



PROTECTION RELAYS & CONTROLS CATALOG

MOTOR & PUMP PROTECTIONGROUND-FAULT PROTECTIONFEEDER PROTECTIONARC-FLASH PROTECTIONSWITCHING RELAYS & CONTROLSGROUND-CONDUCTOR MONITORINGRESISTANCE GROUNDING/NGR MONITORINGAC SYSTEM MONITORS/LOAD SENSORSPUMP CONTROLLERSTOWER AND OBSTRUCTION LIGHTING CONTROLTIMERSFLASHERS

Over 1000 Littelfuse MotorSaver[®], PumpSaver[®], and SSAC parts added!



New Arc-Flash Relays

AF0500 with zone protection and AF0100 with compact, cost-effective design



AF0500 Arc-Flash Relay



AF0100 Arc-Flash Relay

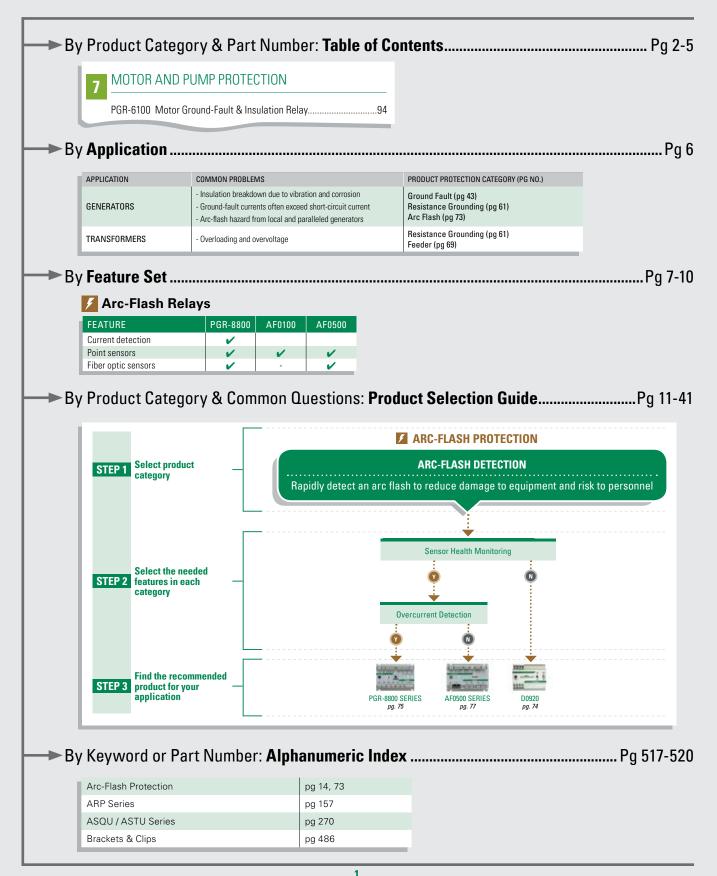
New Smart Motor Protection Relay MP8000 with Bluetooth[®] capabilities



MP8000 Motor Protection Smartphone Application

Your questions answered, any way you ask them.

Choose your preferred product-selection method from the examples below.



Protection Relays & Controls

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FIND THE RIGHT PRODUCT FOR YOUR APPLICATION

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GROUND-FAULT PROTECTION

Unarounded AC Systems

ongrounded no oyotemo		
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PGR-3100 Series	Ground-Fault Indication System	
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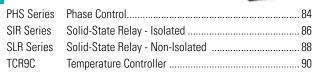


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777-AccuPower	3-Phase Current & Voltage Monitor
77C-KW/HP Series	Single-Phase Current & Voltage Monitor 125
SIO-RTD-02-00	Temperature Input Monitor

www.littelfuse.com/relayscontrols

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Alternating Relays

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FLASHERS & TOWER 13 LIGHTING CONTROLS



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Alphanumeric Index

TYPICAL PRODUCT APPLICATIONS

APPLICATION	COMMON PROBLEMS	PRODUCT PROTECTION CATEGORY (PG NO.)
GENERATORS	 Insulation breakdown due to vibration and corrosion Ground-fault currents often exceed short-circuit current Arc-flash hazard from local and paralleled generators 	Ground Fault (pg 43) Resistance Grounding (pg 61) Arc Flash (pg 73)
TRANSFORMERS	- Overloading and overvoltage	Resistance Grounding (pg 61) Feeder (pg 69)
SWITCHGEAR & MCCs	 Highest average downtime (IEEE 493-1997) Arc-flash risk to personnel maintaining and working on live equipment A fault on one load or feeder trips the entire lineup 	Ground Fault (pg 43) Resistance Grounding (pg 61) Motor (pg 93) Feeder (pg 69) Arc Flash (pg 73) Pump Control (pg 129)
SWITCHBOARDS & PANELBOARDS	- Low-level leakage current undetected by typical OCPDs	Ground Fault (pg 43)
DRIVES	 Switching frequencies cause nuisance tripping Resistance grounded drives require sensitive, wide-frequency ground-fault protection 	Ground Fault (pg 43) Motor (pg 93) Arc Flash (pg 73)
MOTORS & PUMPS	 Winding faults due to overloading, water, dust and vibration Pump damage due to dry running, deadheading, rapid cycling, seal failure (submersible pumps), over heating, plugged intake, jammed impeller, or voltage fault conditions. 	Ground Fault (pg 43) Motor (pg 93) Voltage Monitoring (pg 167) Pump Control (pg 129)
FEEDER CIRCUITS	 Temperature and mechanical stress lead to severe damage Older electromechanical protection is difficult to maintain Uncoordinated feeders causing unnecessary downtime 	Ground Fault (pg 43) Feeder (pg 69)
PORTABLE EQUIPMENT	 Movement causing broken conductors and failed insulation Requirement to keep low ground-fault potential Loss of ground or high ground resistance due to cable faults 	Ground Fault (pg 43) Feeder (pg 69) Arc Flash (pg 73) Ground-Conductor Monitoring (pg 57) Resistance Grounding/NGR Monitoring (pg 61)
GROUNDING RESISTORS	- Open-circuit resistors due to corrosion or loose connections	Resistance Grounding (pg 61)
WATER/WASTEWATER	 Electrocution hazard due to personnel working on submersible pumps or in vicinity of water and electricity Pump damage due to dry running, deadheading, rapid cycling, seal failure (submersible pumps), over heating, plugged intake, jammed impeller, or voltage fault conditions. Higher risk of arc flash and steam blast due to moisture Electrical conductors can cause explosions in explosive methane atmosphere H2S causing premature electronics failure 	Ground Fault (pg 43) Motor (pg 93) Arc Flash (pg 73) Pump Control (pg 129) Time Delay (pg 262) Resistance Grounding (pg 61)
HVACR	 Voltage issues causing premature failure Short cycling increasing wear and tear on compressors Worn contactor causing voltage fault on compressor motor Rapid cycling Low voltage/brownout condition Contactor chatter Reverse phase in a 3-phase system Overload 	Motor (pg 93) Time Delay (pg 262)

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Use the feature tables below and the Product Selection Guide on pages 11-41 to choose the appropriate protection relay or monitor for your application.

圭 📉 🛊 Ground-Fault Protection Relays

FEATURE	SE-601	EL731	PGR-3100	PGR-3200	SE-502	SE-701 SE-703 SE-704	SE-105 SE-107	SE-134C SE-135	SE-325	SE-330 SE-330HV SE-330AU
Detects GF via Voltage			~	~	~				~	~
Detects GF via Current	~	~			~	~	~	~	~	~
Detects DC GF	~	~								
Adjustable GF Pickup	~	~				~	~	~	~	~
Adjustable Time Delay	~	~				~	~	~	~	~
Remote Reset	~	~		~	~	~	~	~	~	~
Analog Output	~	~		~		~				~
Fail-Safe Option	~	~			~	~	~	~	~	~
Harmonic Filtering		~		~		~	~	~	~	~
CT-Loop Monitoring		~				~		~		
Insulation Monitoring				~						
Ground-Check Monitoring							~	~		
Grounding-Resistor Monitoring									~	~
PTC/RTD Overtemperature		~								
Communications		~								~
Conformal Coating	‡	~	~	‡	‡	‡	~	~	~	~

Arc-Flash Relays

FEATURE	PGR-8800	AF0100	AF0500
Current Detection	~		
Point Sensors	~	~	~
Fiber Optic Sensors	~	-	~
Cable Monitoring on Sensor Inputs	~	~	~
USB	~	~	~
DC Supply	~	~	~
AC Supply	~	~	~
Data Logging	~		~
Multi-Zone			~
Communications	~		~

NOTE: Tables are for reference only and include standard and optional configurations. Please see the respective catalog page for exact product specifications.

‡ Optional

🛃 Pump Controllers

	MP8000	777-KW	77C-KW	MPU-32	MPS	
	Single-Phase or 3-Phase 90–690 VAC	3-Phase 200-480 VAC*	Single-Phase 100-240 VAC*	65-265 VAC,	80-275 VDC	
ent	0.5-1,000A (>100A w/external CTs)	2-800A (>90 A w/external CTs)*		Accepts broad range of external CTs		
	Any	871		Ai	ηγ	
npatibility	-	-		-	-	
	~			~	~	
well/Dead-head	V	V	 ✓ 		V	
	-	•		×	~	
	V	V	 ✓ 	V	~	
	-			V	V	
ice,	~	 		v	v	
ige	 ✓ 	 ✓ 	 ✓ 		 ✓ 	
nce	 ✓ 	 ✓ 			 ✓ 	
	Calculated	Calculated	Calculated	 ✓ 	 ✓ 	
е				v	 ✓ 	
al Model				✓	 ✓ 	
uency				 ✓ 	 ✓ 	
erate/Underspeed				✓	 ✓ 	
					 ✓ 	
og	 ✓ 	✓	 ✓ 	 ✓ 	✓	
					 ✓ 	
				 ✓ 	 ✓ 	
Rating	10 A at 240 VAC	10 A at 2	240 VAC*	8 A at 2	50 VAC	
	(up to 100 A)*	🖌 (up 1	to 90 A)*			
g		3 Digit display		4 line x 20 characters		
	Via smartphone	✓	 ✓ 	✓	 ✓ 	
utton		✓	 ✓ 	 ✓ 	 ✓ 	
	Last 1,000 faults	Last fault	Last fault	100 events	64 events	
ations		RS-485	RS-485	RS-232	RS-485	
	~					
Modbus TCP	V	 ✓ 		 ✓ 	 ✓ 	
Modbus RTU	 ✓ 	 ✓ 	 ✓ 	 ✓ 	 ✓ 	
DeviceNet		v		v	 ✓ 	
Profibus		✓			×	
Ethernet/IP		 ✓ 		v	×	
Allen-Bradley DF1					 ✓ 	
				v	 ✓ 	
og.)					~	
og.)				v	×	
ng				✓	~	
Degree C	-40 to 70	-20 to 70	-20 to 70	-40 to 60	-40 to 60	
		5 year		10 y		
	utton ations munication to ** Modbus TCP Modbus RTU DeviceNet Profibus Ethernet/IP Allen-Bradley DF1 og.) og.) ng	Non-Base 90-690 VAC 90-690 VAC 0.5-1,000A (>100A w/external CTs)Non-Base 90-690 VAC 0.5-1,000A (>100A w/external CTs)Non-Base (>100A w/external CTs)Non-Base (>100A w/external CTs)Non-Base (>100A w/external CTs)Non-Base (>100A w/external CTs)Non-Base (>100A w/external CTs)Non-Base 	Single-Phase or 3-Phase $90-690 VAC$ 3-Phase $200-480 VAC*$ ont0.5-1,000A $(>100A w/external CTs)$ 2-800A (>90 A)antAny8apatibilitywell/Dead-head \checkmark \checkmark ywell/Dead-head \checkmark \checkmark ywell/Dead-head \checkmark \checkmark ywell/Dead-head \checkmark \checkmark yrrent Mode \checkmark \checkmark ice, \checkmark \checkmark ice,i \checkmark ice,i \checkmark ice,i \checkmark ice,ii <t< td=""><td>Single-Phase 90-890 VAC3-Phase 200-480 VAC*Single-Phase 100-240 VAC*ont$0.51,000A$ (>100A wetternal CIS)2-800A (>90 A wetternal CIS)*apatibility$Any$$3$-Tapatibility$-$well/Dead-head$-an-$an<td< td=""><td>Single-Phase 90-90 VAC (>100 A w/extemal CTs)3-Phase 200-400 VAC* $0-50 1000A$ (>100 A w/extemal CTs)Single-Phase 100-240 VAC* $100-240 VAC*$65-265 VAC Accepts broad ran Accepts broad ran AnyAny$3-200A (-90 A w/extemal CTs)$Accepts broad ran $3-000A$Accepts broad ran $3-000A$apatibility.<t< td=""></t<></td></td<></td></t<>	Single-Phase 90-890 VAC 3 -Phase 200-480 VAC*Single-Phase 100-240 VAC*ont $0.51,000A$ (>100A wetternal CIS) 2 -800A (>90 A wetternal CIS)*apatibility Any 3 -Tapatibility $ -$ well/Dead-head $ -$ an <td< td=""><td>Single-Phase 90-90 VAC (>100 A w/extemal CTs)3-Phase 200-400 VAC* $0-50 1000A$ (>100 A w/extemal CTs)Single-Phase 100-240 VAC* $100-240 VAC*$65-265 VAC Accepts broad ran Accepts broad ran AnyAny$3-200A (-90 A w/extemal CTs)$Accepts broad ran $3-000A$Accepts broad ran $3-000A$apatibility.<t< td=""></t<></td></td<>	Single-Phase 90-90 VAC (>100 A w/extemal CTs)3-Phase 200-400 VAC* $0-50 1000A$ (>100 A w/extemal CTs)Single-Phase 100-240 VAC* $100-240 VAC*$ 65-265 VAC Accepts broad ran Accepts broad ran AnyAny $3-200A (-90 A w/extemal CTs)$ Accepts broad ran $3-000A$ Accepts broad ran $3-000A$ apatibility. <t< td=""></t<>	

*Other versions exist with different voltage ranges, current monitoring ranges, output contact ratings, and temperature monitoring. Consult specific series datasheets for more details. ** iPhone® and select Android[®] smartphones and tablets are supported via Littelfuse app

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🛃 Pump Controllers

FUNCTION		111P	111-INSIDER-P, 231-INSIDER-P	232-INSIDER	233P	234-P	235P
Supply Voltage		Single-Phase 115 VAC	Single-Phase 115 VAC or 230 VAC	Single-Phase 230 VAC	Single-Phase 230 VAC	Single-Phase 230 VAC	Single-Phase 230 VAC
Monitored Curre	ent	-	-	-	-	-	-
HP Rating		¹/₃ — 1hp	¹ / ₃ – ½hp or ¹ / ₃ – 1hp	¹ /3 — 1hp	¹ /3 — 1.5hp or ¹ /3 — 3hp	¹ /3 — 3hp	5 – 15hp (external CT required
Control Box Compatibility		-	Franklin™, Pentek®, CentriPro™, Flint & Walling™, Grundfos® (mid-2014 or later)	Grundfos® (prior to mid-2014)	-	Grundfos®	-
Overload							
Underload/Dry-v	well/Dead-head	 ✓ 	~	V	 ✓ 	 Image: A set of the set of the	 ✓
Undercurrent/D	ry-well/Dead-head						
Overcurrent/Jan	n	~	~	v	 ✓ 	~	 ✓
Reduced Overcu	rrent Mode						
Current Unbalan							
Phase Loss/ Rev	versal						
Over/Undervolta	age	 ✓ 	 ✓ 	 ✓ 	 ✓ 	 	 ✓
Voltage Unbalar	nce						
Ground Fault							
Overtemperature	e						
Dynamic Therma	al Model						
Over/Underfrequ	uency						
Failure to Accele	erate/Underspeed						
Power Factor							
Rapid Cycling/Jog		~	 ✓ 	 ✓ 	 ✓ 	 Image: A set of the set of the	 ✓
Starter Control							
Differential							
Output Contact I	Rating						
Internal CT's							
On-unit Meterin	g						
Remote Display			Rem	ote display capability w	hen using the Informer v	via IR	
Remote Reset B	utton						
Datalogging			Rem	ote display capability w	hen using the Informer v	via IR	
Local Communic	cations						
Bluetooth® Com							
Smartphone App							
Ś	Modbus TCP						
NETWORK COMS. (Optional)	Modbus RTU						
RK (ion	DeviceNet						
VOI	Profibus						
ЦЦ ТЦ	Ethernet/IP						
	Allen-Bradley DF1						
Analog Output							
Analog Input (Prog.)							
Digital Input (Prog.)							
Conformal Coating							
	Operating Temp Degree C		-40 to 60	-40 to 60	-40 to 60	-40 to 60	-40 to 60
Operating Temp	Degree C	-40 to 60					
	Degree C	cULus	cURus	5 y cCSAus, cURus	ear cULus		

*Other versions exist with different voltage ranges, current monitoring ranges, output contact ratings, and temperature monitoring. Consult specific series datasheets for more details. ** iPhone® and select Android[®] smartphones and tablets are supported via Littelfuse app

🌆 📶 Motor & Feeder Protection Relays

			•				l
FUNCTION/FEATURE (IEEE#)	MP8000	777	77C	MPU-32	MPS	FPU-32	FPS
Supply Voltage	Single or 3-Phase 90-690 VAC	3-Phase 200-480 VAC*	Single-Phase 100-240 VAC*		65-265 VAC, 80-275 VDC		
Monitored Current	0.5-1,000A (>100A w/ external CTs)	2-800A (>90A v	v/external CTs)*		Accepts broad rai	nge of external CTs	
Overload (49, 51)				~	 ✓ 	 ✓ 	 ✓
Underload	~				~		
Overcurrent (50, 51)/Jam	~	 Image: A set of the set of the	 Image: A start of the start of	~	~	V	~
Reduced Overcurrent Mode				~	~	V	~
Undercurrent (37)	 ✓ 	 Image: A start of the start of	 Image: A start of the start of	~	~		
Current Unbalance, Phase Loss/Reversal (37)	~	~		~	~	~	~
Over (59)/Undervoltage (27)	 ✓ 	~	 ✓ 		~		~
/oltage Unbalance (47)	 ✓ 	 ✓ 			~		~
Ground Fault (50G/N, 51G/N)	Calculated	Calculated	Calculated	~	~	 ✓ 	~
Overtemperature (49)		*		~	~	~	~
Dynamic Thermal Model				~	~	~	~
Over/Underfrequency (81)				V	~	V	V
ailure to Accelerate/Underspeed				~	~		
Power Factor (55)					V		~
Rapid Cycling/Jog	~	~	~	~	~		
Starter Control					×		
Breaker Control							~
Differential (87)				V	V		
eeder Protection						~	
Definite-time Overcurrent						~	 ✓
nverse-time Overcurrent		101 0					
Dutput Contact Rating	10A at 240 VAC	10A at 2			8A at 2	250 VAC	1
nternal CT's	 (up to 100 A) 	🖌 (up t					
On-unit Metering) (in an antalana	3 Digit			1	characters	
Remote Display	Via smartphone						
Remote Reset Button Datalogging	Last 1,000 faults	Last fault	Last fault	100 events	64 events	100 events	64 events
Local Communications		RS-485	RS-485	RS-232	RS-485	RS-232	RS-485
Bluetooth [®] Communication to		110 400	110 400	110 202	110 400	110 202	110 400
Smartphone App**	~						
ා Modbus TCP	 ✓ 	 ✓ 		~	~	 ✓ 	~
S _ Modbus RTU	~	~	 ✓ 	~	~	 ✓ 	 ✓
DeviceNet		 ✓ 		~	~	 ✓ 	 ✓
Profibus		 			~		~
WOODUS TUP Modbus RTU DeviceNet Profibus Ethernet/IP Allen-Bradley DE1		 ✓ 		~	~	 ✓ 	 ✓
Allen-Bradley DF1					~		~
Analog Output				~	~	 ✓ 	 ✓
Analog Input (Prog.)					~		~
Digital Input (Prog.)				~	~	~	~
Conformal Coating				~	~	~	~
Operating Temp Deg C	-40 to +70	-20 to +70	-20 to +70	-40 to +60	-40 to +60	-40 to +60	-40 to +60
Warranty	5 year	5 year	5 year	10 year	10 year	10 year	10 year
Certifications		UL, CSA, CE			UL Recognized	I, CSA, CE, RCM	

*Other versions exist with different voltage ranges, current monitoring ranges, output contact ratings, and temperature monitoring. Consult specific series datasheets for more details. ** iPhone® and select Android[®] smartphones and tablets are supported via Littelfuse app

NOTE: IEEE Device Numbers are shown in parenthesis after the applicable features.



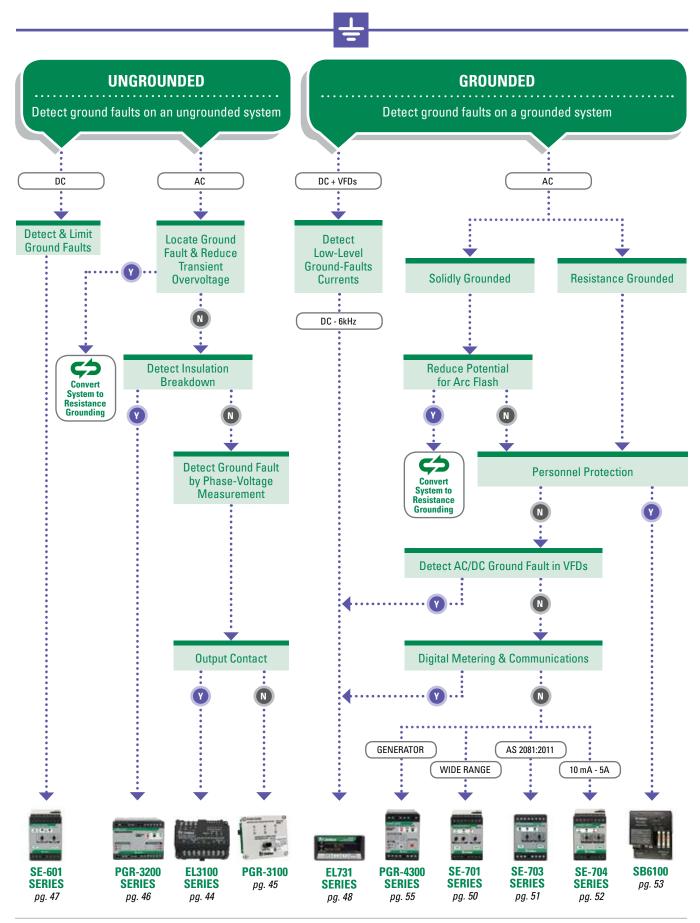
PRODUCT SELECTION GUIDE

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Flashers, Tower and Obstruction Lighting Control	39

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GROUND-FAULT PROTECTION



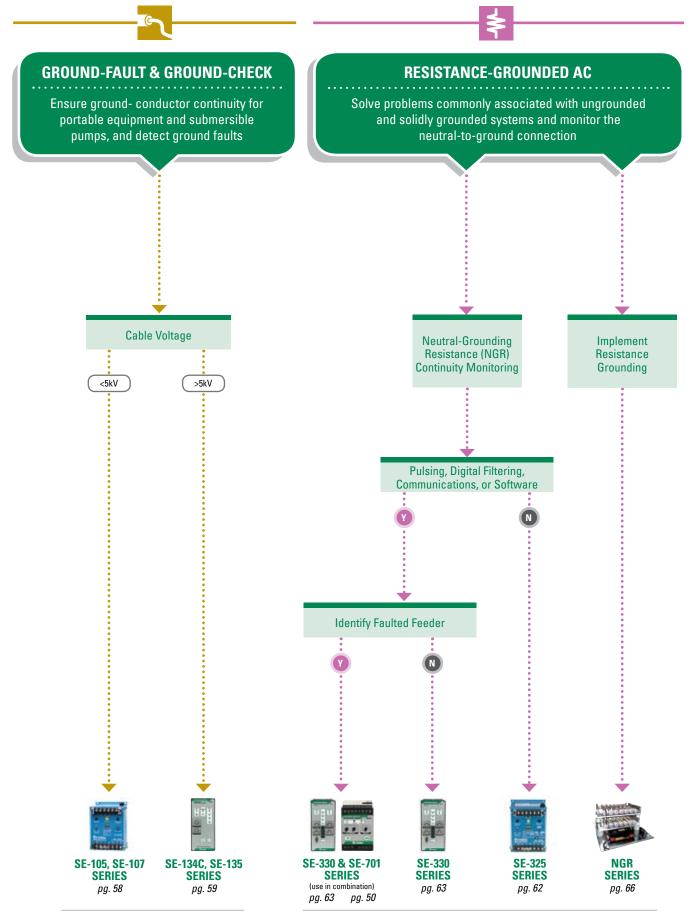
Ground-Fault Protection Relays

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STEP 2 Select the needed features in each category

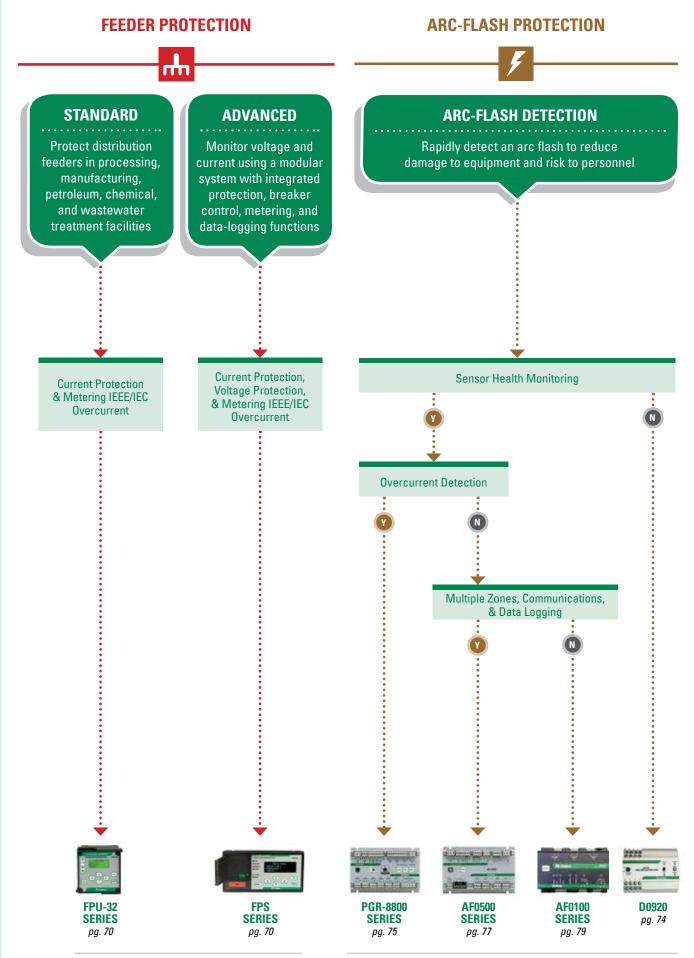
RESISTANCE GROUNDING/NGR MONITORING

GROUND-CONDUCTOR MONITORING



Ground-Conductor Monitoring Relays

Resistance Grounding Systems & NGR Monitors



Feeder Protection Relays

Select product category

STEP 1

Select the needed features in each category

STEP 2

Find the recommended product for your application

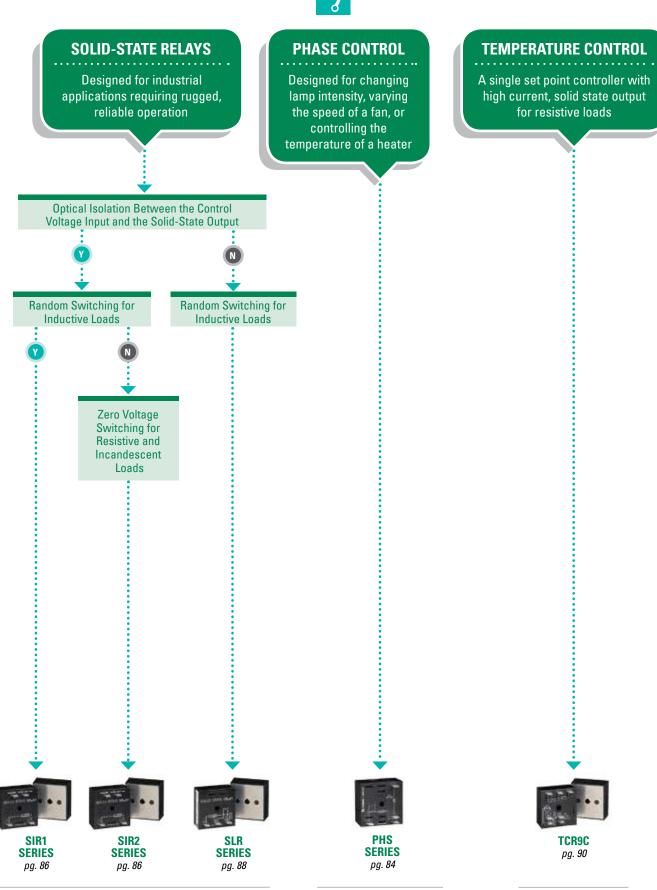
STEP 3

Arc-Flash Relays

14

SWITCHING RELAYS & CONTROLS





Solid-State Switching Relays

Phase Control Switching Relays

Temperature Control Relays

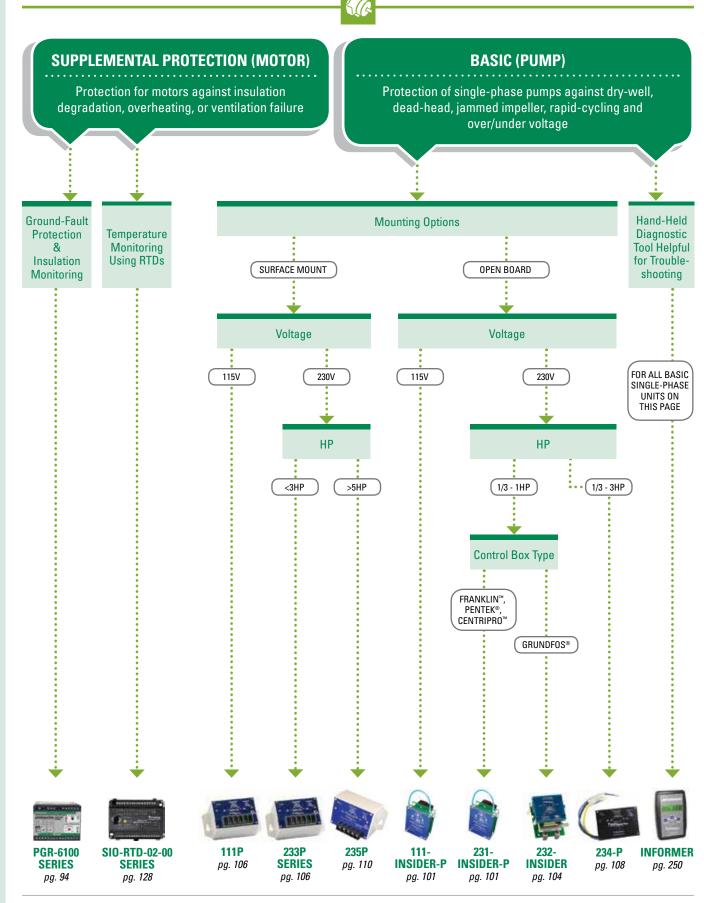
MOTOR & PUMP PROTECTION

Select the needed features in each category

STEP 2

Find the recommended product for your application

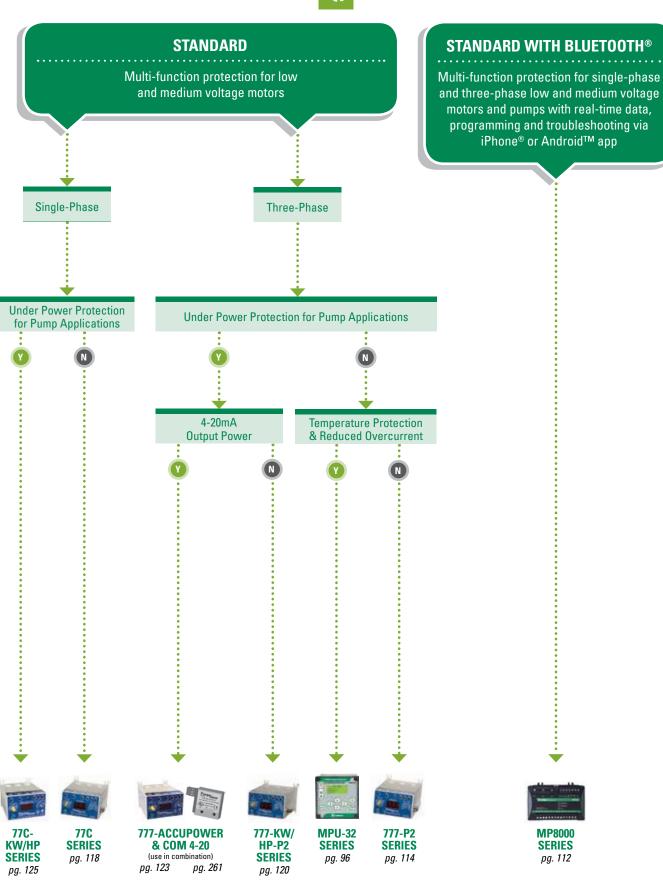
STEP 3



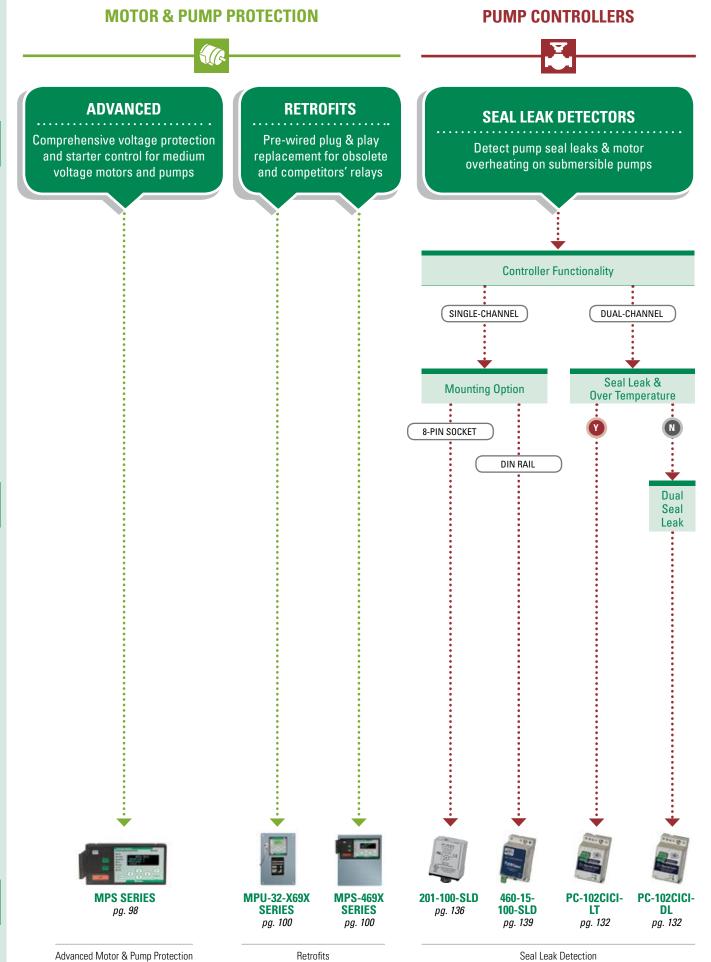
Basic Motor & Pump Protection

MOTOR & PUMP PROTECTION





Standard Motor & Pump Protection with Bluetooth®

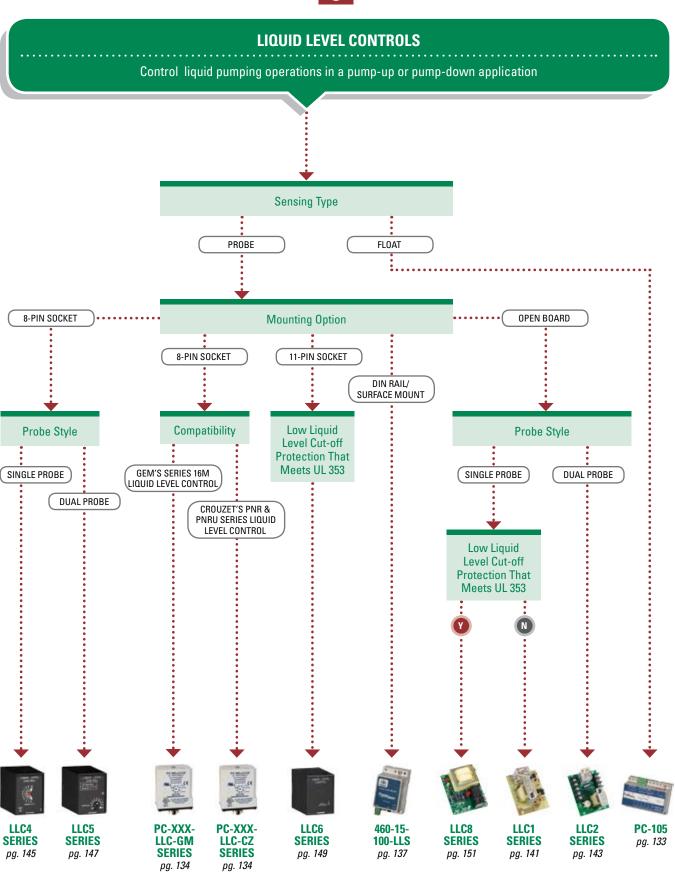


STEP 1 Select product category

18

PUMP CONTROLLERS





Liquid Level Controls

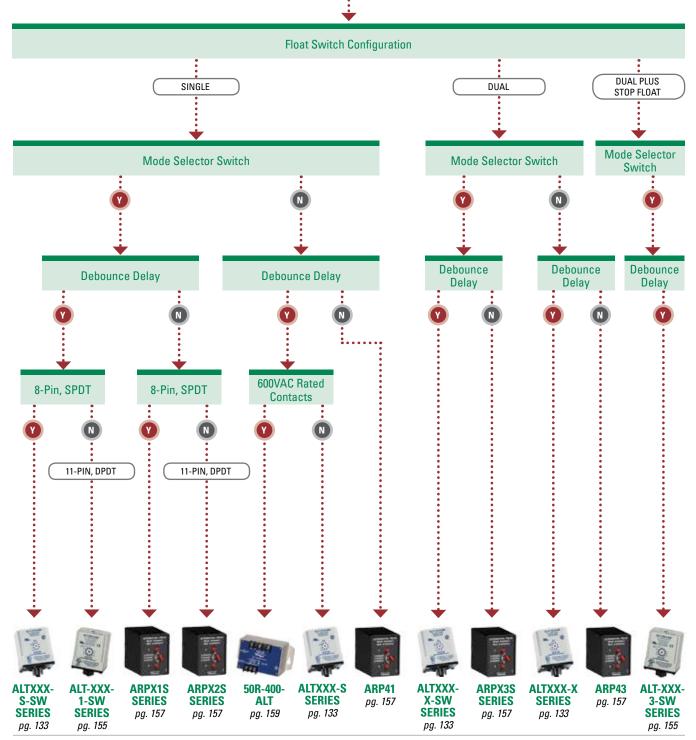
19

PUMP CONTROLLERS



ALTERNATING RELAYS

Used in duplex pumping applications to balance the run time of both pumps



Alternating Relays

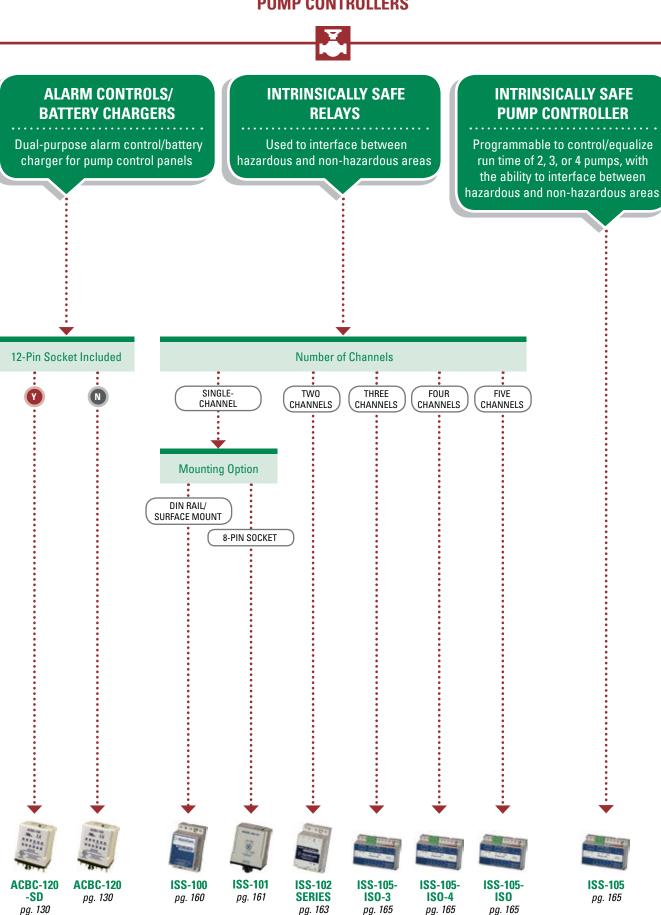
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Select product category

STEP 1

PUMP CONTROLLERS



Alarm Control/Battery Charger

Intrinsically Safe Relays

Intrinsically Safe Pump Controller

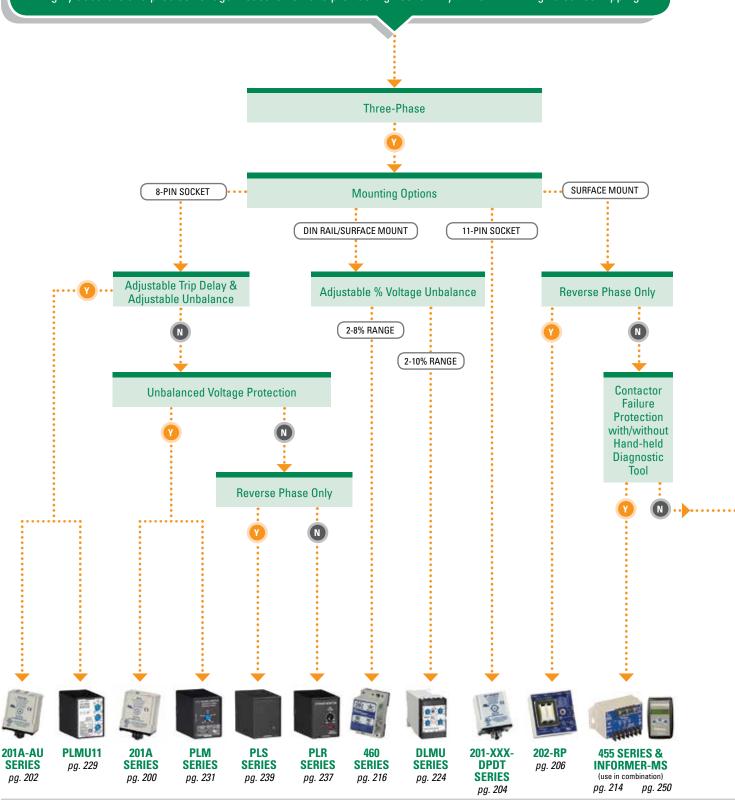
STEP 2 Select the needed features in each category





VOLTAGE MONITORS (1 of 2)

Highly accurate and precise voltage measurements to provide high sensitivity while minimizing nuisance tripping



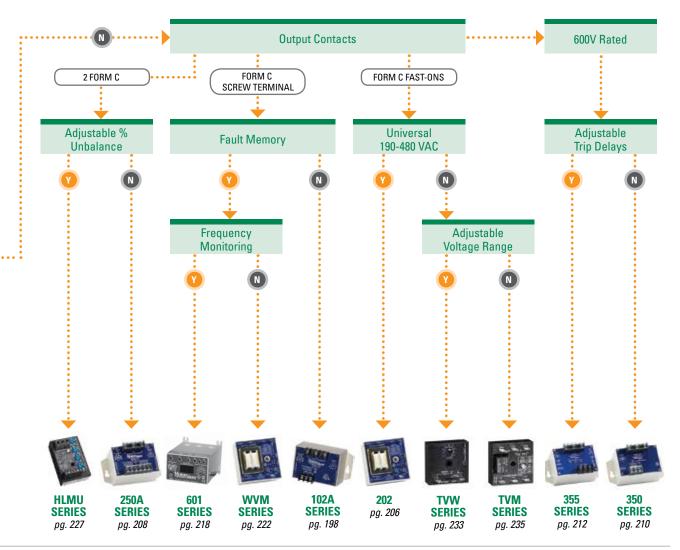
Voltage Monitoring Relays

AC SYSTEM MONITORS/LOAD SENSORS



VOLTAGE MONITORS (1 of 2)

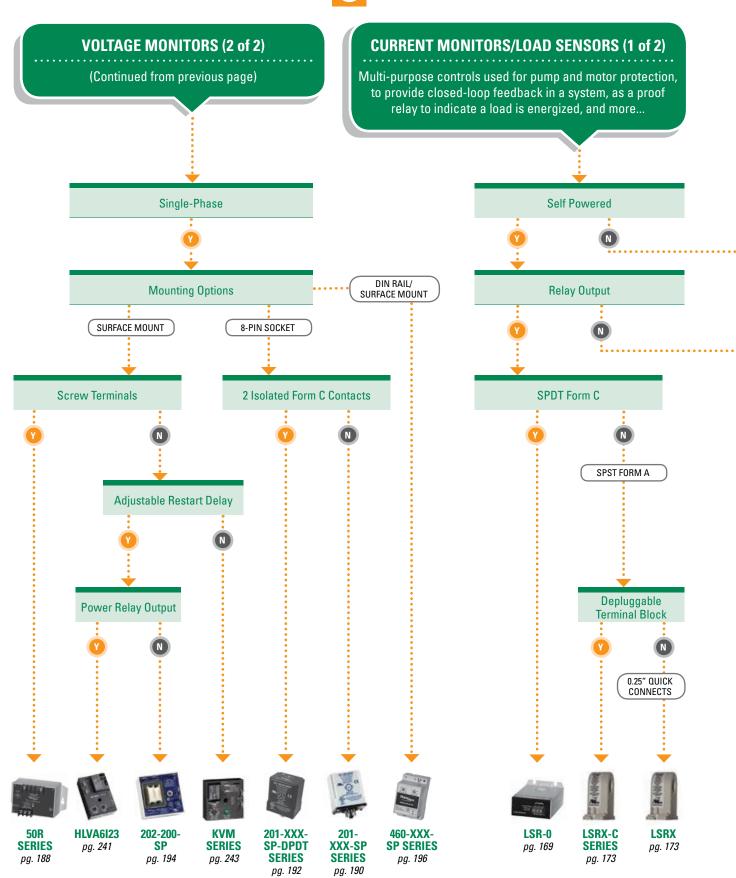
(Continued from previous page)



Voltage Monitoring Relays

AC SYSTEM MONITORS/LOAD SENSORS





Voltage Monitoring Relays

Current Monitoring/Load Sensing Relays

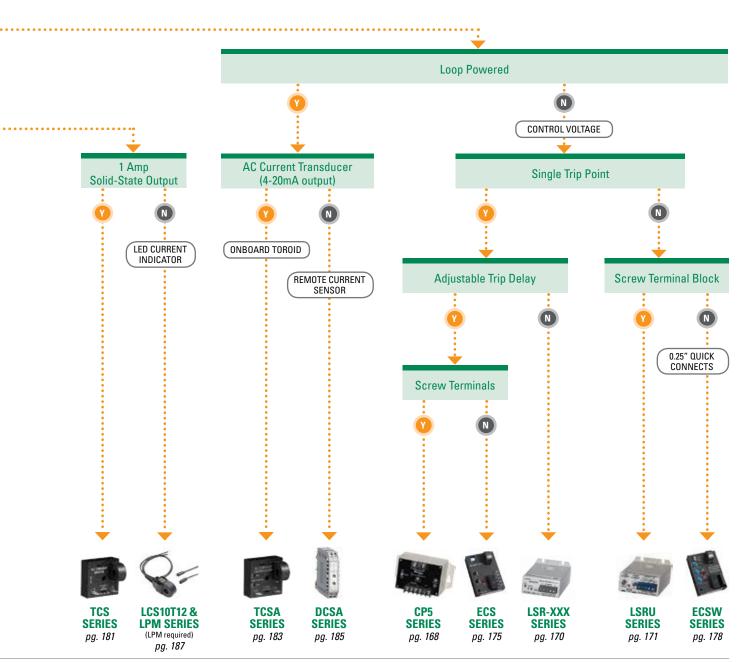
Product Selection Guide

AC SYSTEM MONITORS/LOAD SENSORS



CURRENT MONITORS/LOAD SENSORS (2 of 2)

(Continued from previous page)



Current Monitoring/Load Sensing Relays

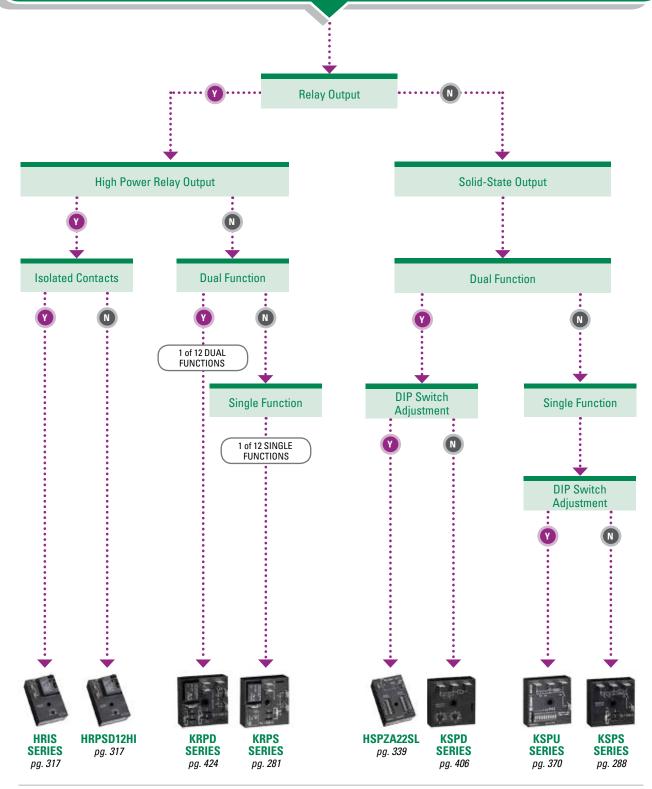
STEP 1 Select product category





FACTORY PROGRAMMABLE

Microprocessor based circuitry provides excellent repeat accuracy and stability

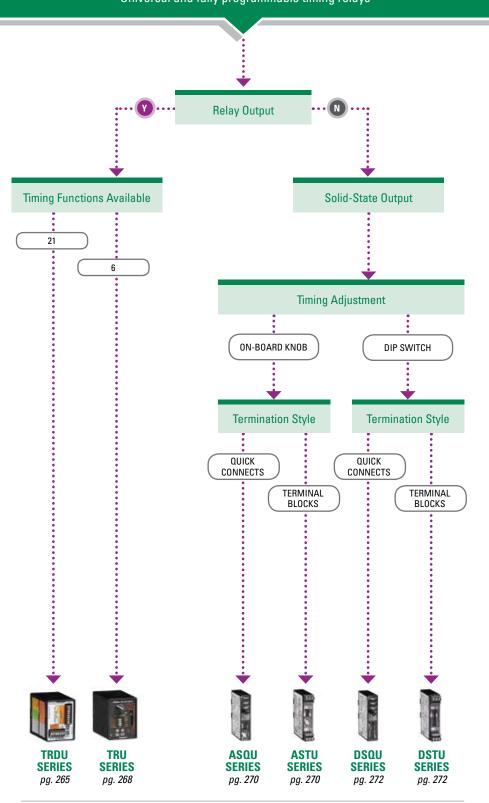


Factory Programmable Timers



MULTIFUNCTION

Universal and fully programmable timing relays



Multifunction Timers



DEDICATED — SINGLE FUNCTION

STEP 1 Select product category

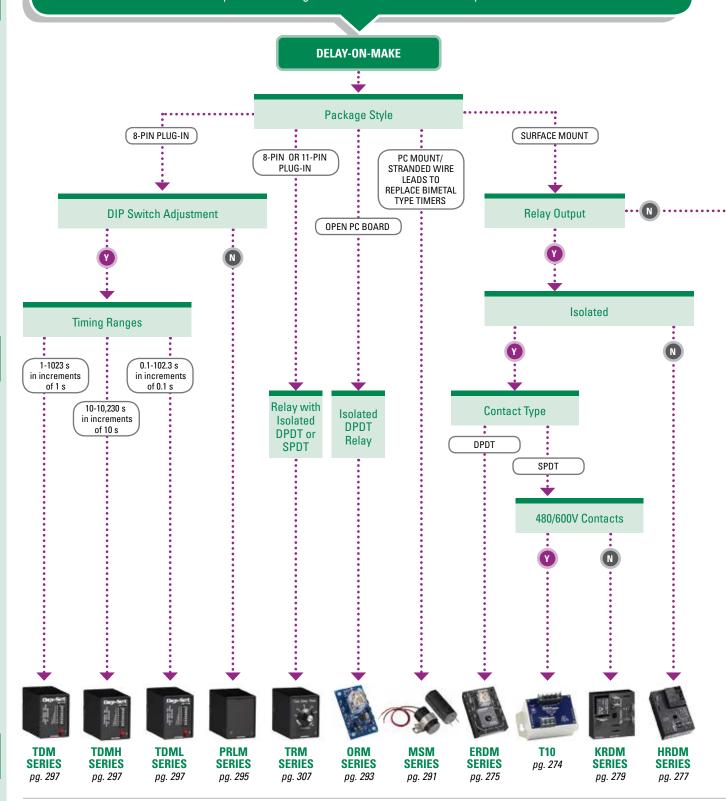
Select the needed features in each category

STEP 2

Find the recommended product for your application

STEP 3

Wide product offering to meet OEM and industrial requirements

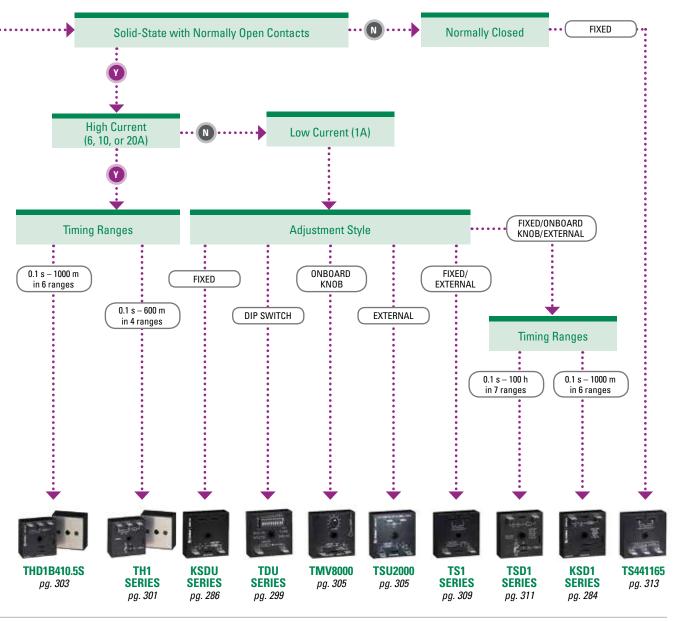


Delay-on-Make Timers



DEDICATED — SINGLE FUNCTION

(Continued from previous page)



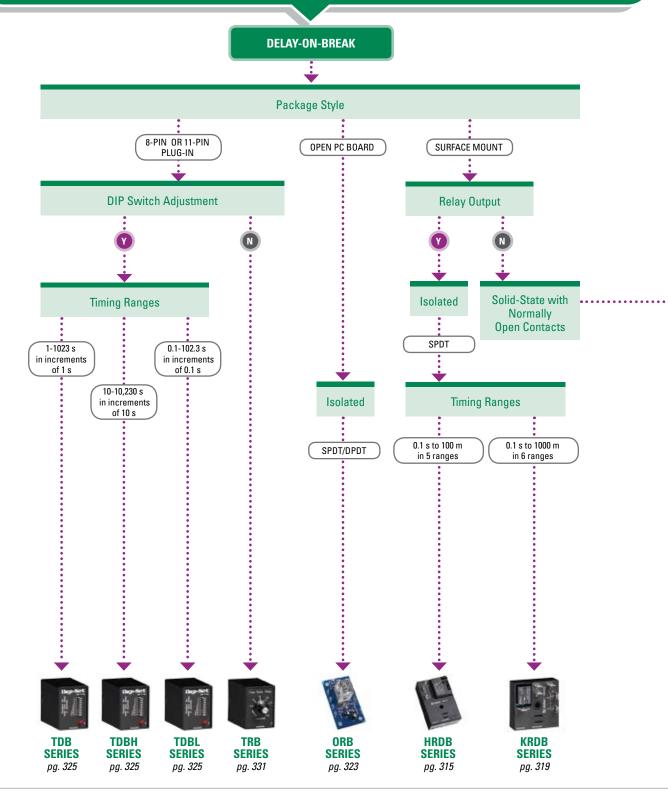
Delay-on-Make Timers

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DEDICATED — SINGLE FUNCTION

Wide product offering to meet OEM and industrial requirements



Delay-on-Break Timers

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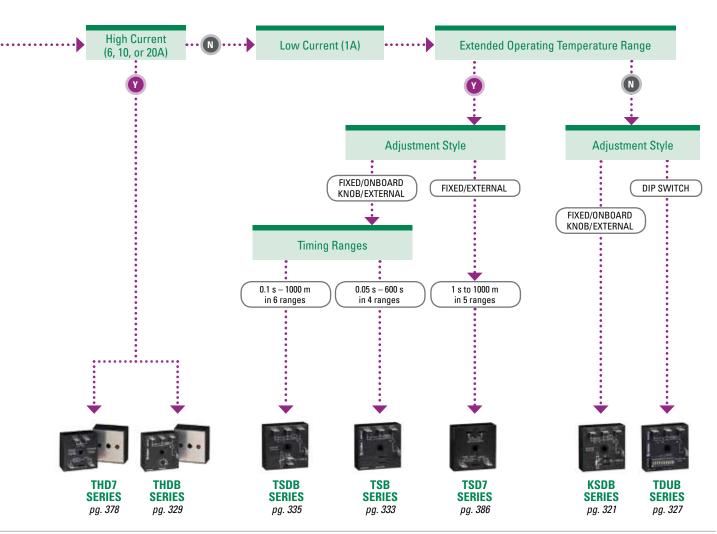
STEP 2 Select the needed features in each category

STEP 1 Select product category



DEDICATED — SINGLE FUNCTION

(Continued from previous page)



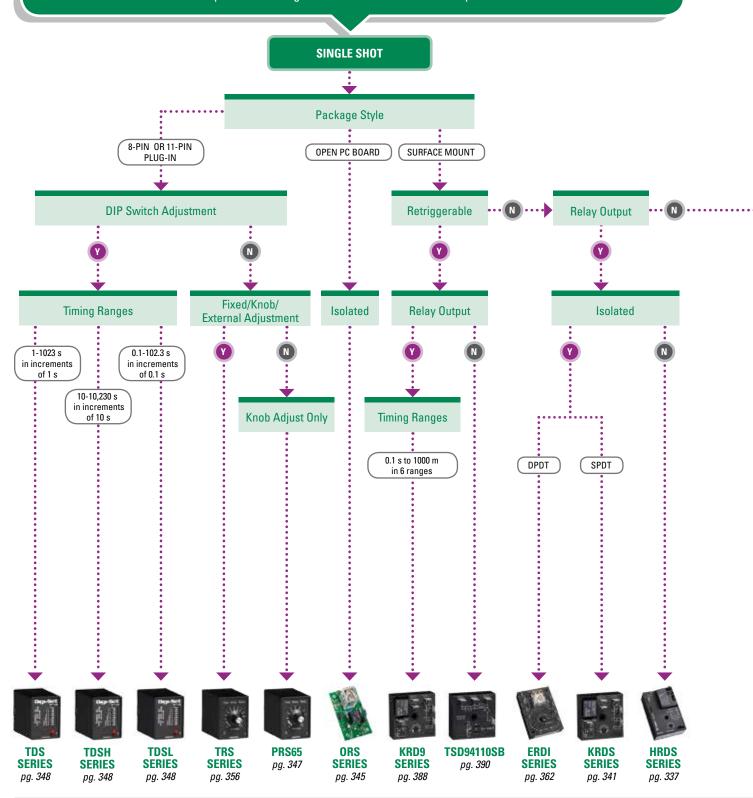
Delay-on-Break Timers

31



DEDICATED — SINGLE FUNCTION

Wide product offering to meet OEM and industrial requirements



Single Shot Timers

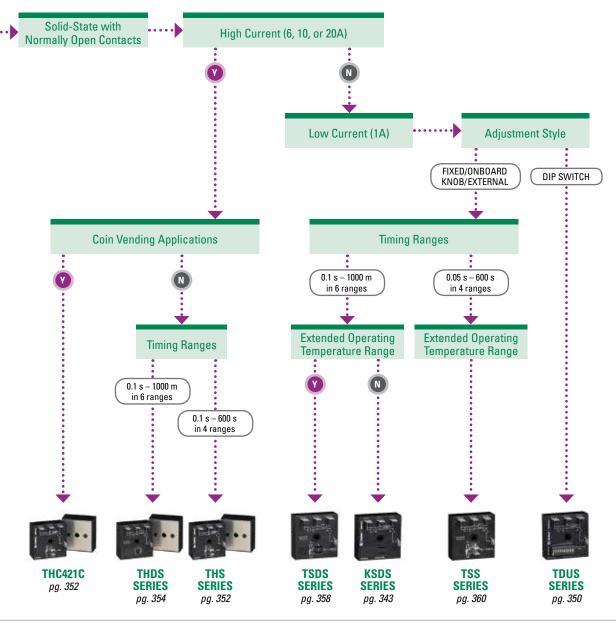
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▼ STEP 2 Select the needed features in each category



DEDICATED — SINGLE FUNCTION

(Continued from previous page)



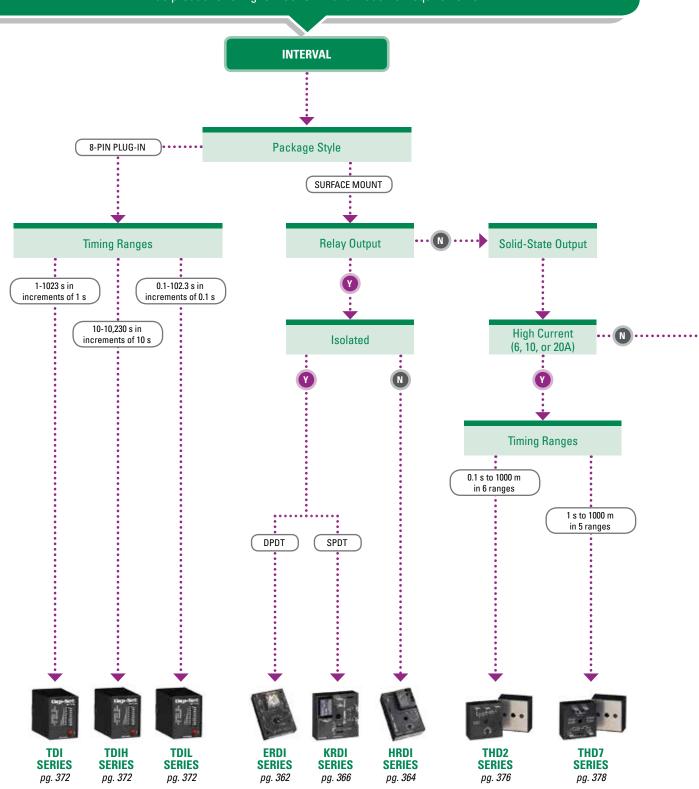
Single Shot Timers

33



DEDICATED — SINGLE FUNCTION

Wide product offering to meet OEM and industrial requirements



Interval Timers

STEP 1 Select product category STEP 2 Select the needed features in each category

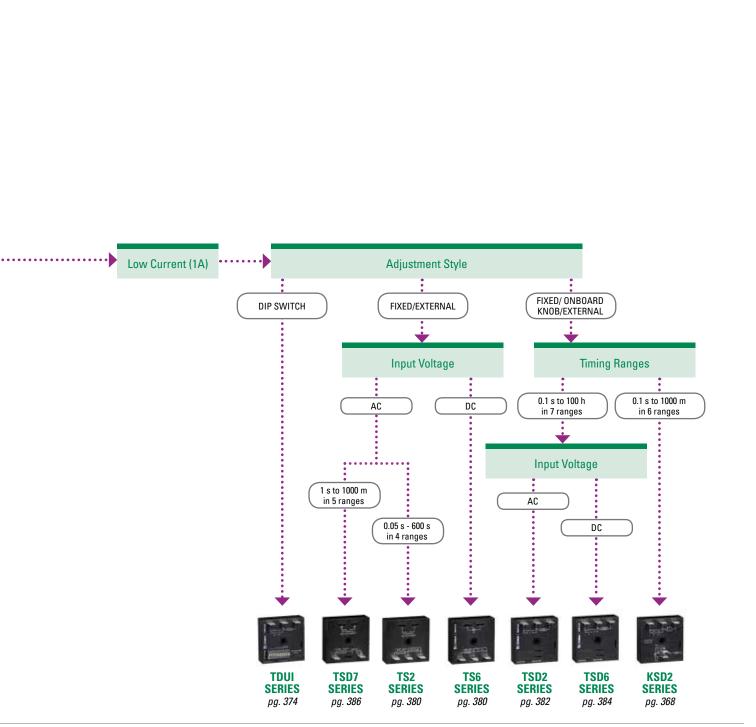
34

TIMERS



DEDICATED — SINGLE FUNCTION

(Continued from previous page)



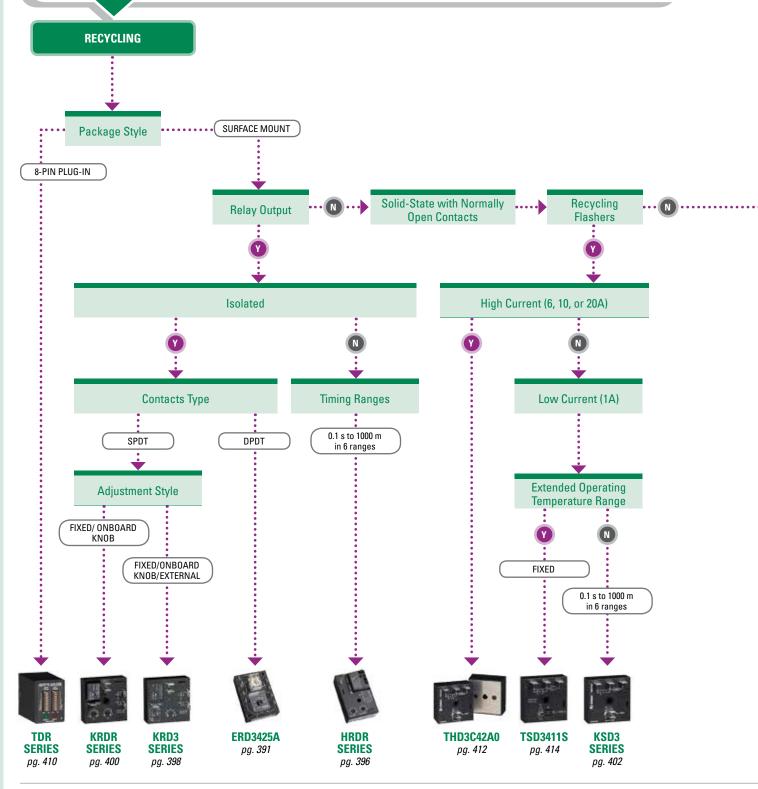
Interval Timers

TIMERS



DEDICATED — SINGLE FUNCTION

Wide product offering to meet OEM and industrial requirements



Recycling Timers

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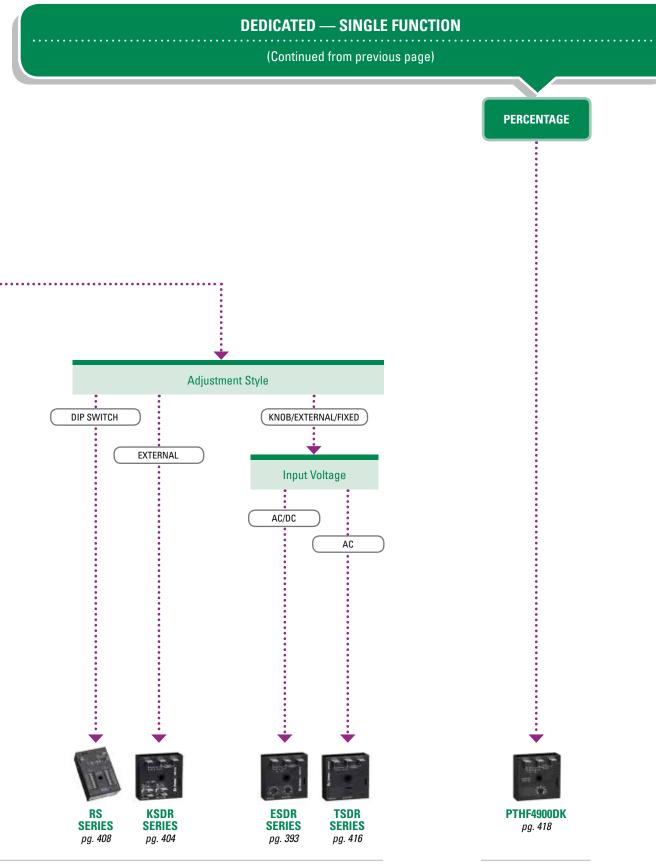
Select the needed features in each category

STEP 1 Select product category

Product Selection Guide

TIMERS



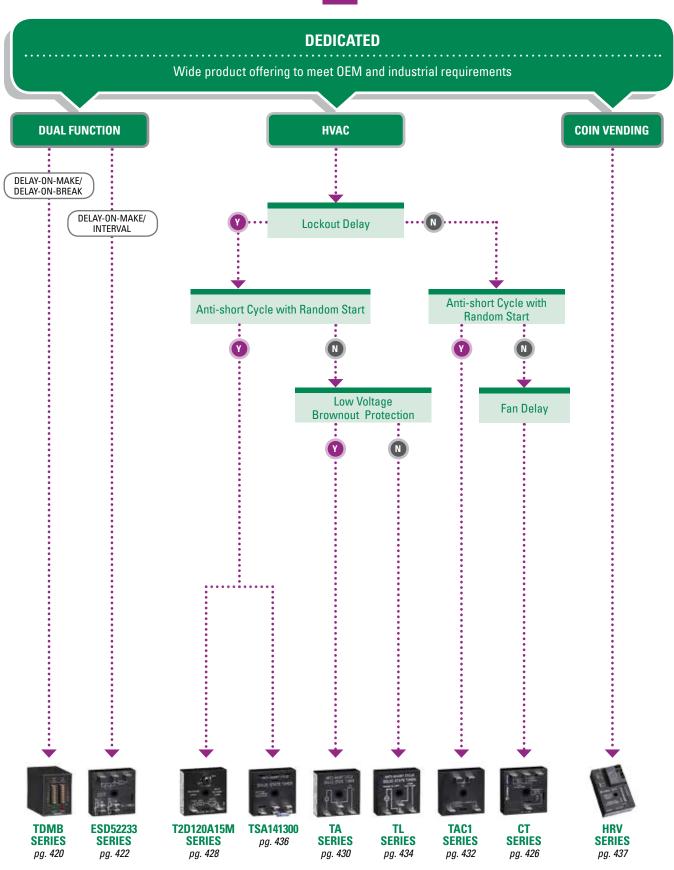


Recycling Timers

Percentage Timers







Dedicated Timers - Dual Function

STEP 1 Select product category

Select the needed features in each category

STEP 2

Find the recommended product for your application

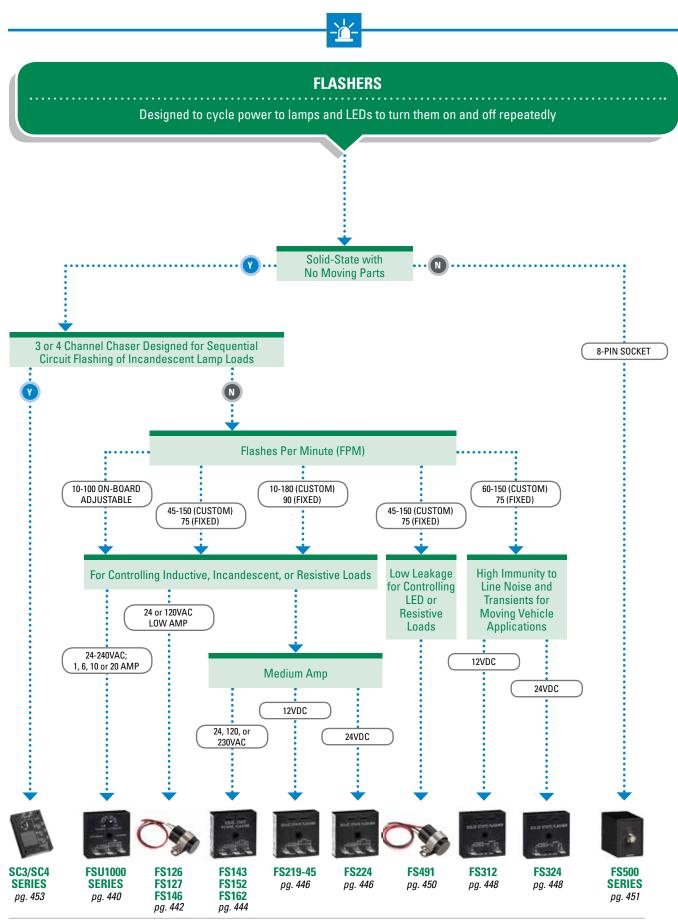
STEP 3

Dedicated Timers – HVAC

Dedicated Timers - Coin Vending

38

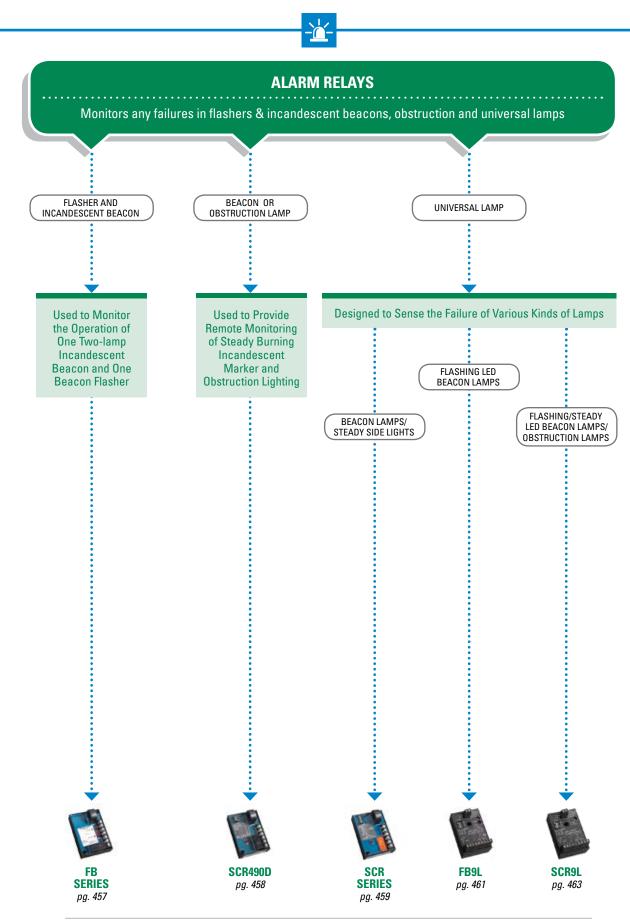
FLASHERS, TOWER AND OBSTRUCTION LIGHTING CONTROL



Flashers

39

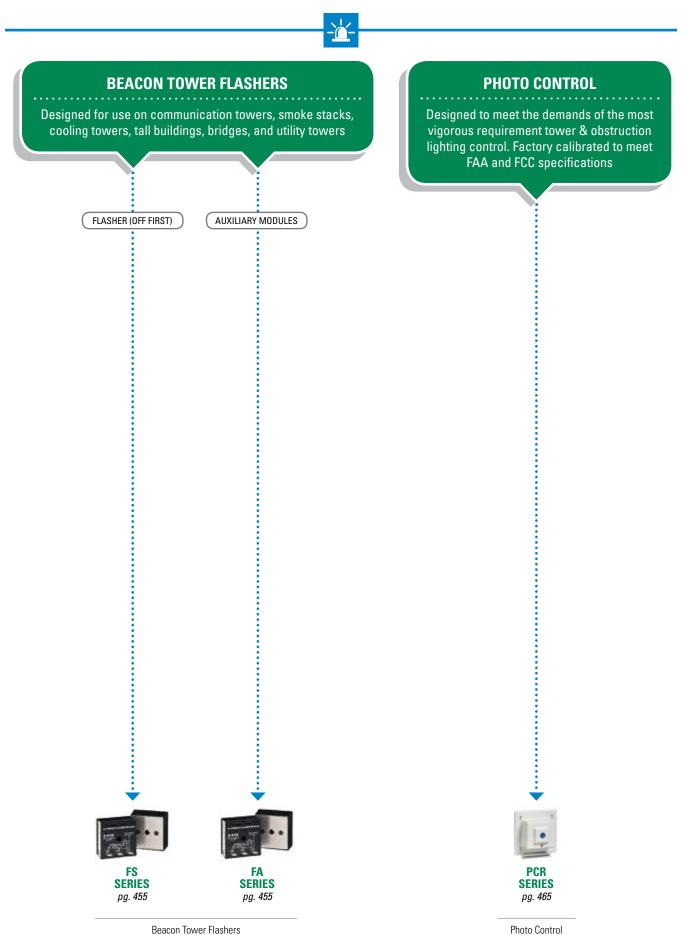
FLASHERS, TOWER AND OBSTRUCTION LIGHTING CONTROL



Alarm Relays

40

FLASHERS, TOWER AND OBSTRUCTION LIGHTING CONTROL





Protection Relays & Controls



GROUND-FAULT PROTECTION

Create safer working environments and reduce incidents of Arc Flash without affecting the uptime of critical operations. Vital in manufacturing and processing environments, sensitive ground-fault relays with advanced filtering will detect breakdown in insulation resistance without nuisance trips. Breakdown in insulation resistance can be caused by moisture, vibration, chemicals and dust.

Ungrounded AC Systems

EL3100 Series	Ground-Fault & Phase-Voltage Indicator	44
PGR-3100 Series	Ground-Fault Indication System	45
PGR-3200 Series	Insulation Monitor	46

Ungrounded DC System

AC/DC Earthed System

EL731 Series	AC/DC Sensitive Earth-Leakage Relay	48
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Solidly Grounded Systems

SE-701 Series	Ground-Fault Monitor	50
SE-703 Series	Earth-Leakage Monitor	51
SE-704 Series	Earth-leakage monitor	52

Ground-Fault Circuit Interrupters – Personnel Protection

SB6000 Series	Industrial Shock-Block	53
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Generator and Single-Function

PGR-4300 Series	Generator	Ground-Fault Relay	′55
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For More Information... and to download our White Paper on Ground-Fault Protection with VFDs, visit Littelfuse.com/TechnicalCenter

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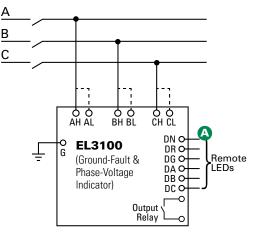
EL3100 SERIES

Ground-Fault & Phase-Voltage Indicator



Image: Second second

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	MOUNTING
EL3100-00	DIN, Surface
ACCESSORIES	REQUIREMENT
RK-310X-0Y	Optional

Note: X=R for red LED and G for green LED Y=0 for no label and 1 for a ground-fault label

Description

The EL3100 is a self-powered ground-fault and phase-voltage indication system for 3-phase systems. The EL3100 meets the National Electrical Code (NEC) and the Canadian Electrical Code (CEC) requirements for ground detectors for ungrounded alternating-current systems. Voltage connections are provided on the EL3100 for 208, 240, 480, and 600-V systems. Three green LED's on the EL3100 indicate the presence of phase-to-ground voltage and one red LED indicates a ground fault. The EL3100 can operate stand-alone or with up to five remote LED indicators. A solid-state relay output provides indication of a ground fault. The output relay is closed when the 3-phase neutral voltage shifts as the result of ground leakage.

Features & Benefits

le Section tems
note
t

Accessories



Remote LEDs

High-intensity 16-mm IP67 LED lamps available in red and green colors.

Specifications

Input Voltage

Dimensions

Approvals

Conformally Coated Warranty Mounting Input L: 208/240 Vac Input H: 480/600 Vac **H** 87.0 mm (3.43"); **W** 112.5 mm (4.43") **D** 56.0 mm (2.2") CSA certified, UL Listed (E340889), RCM (Australia) Standard feature 5 years DIN, Surface

Littelfuse reserves the right to make product changes, without notice. Material in this document is as accurate as known at the time of publication. Visit Littelfuse.com for the most up-to-date information.

www.littelfuse.com/EL3100

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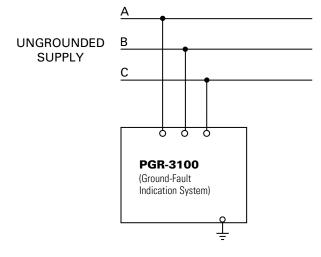
(UL) c (us

PGR-3100 SERIES

Ground-Fault Indication System



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	MOUNTING
PGR-3100	Panel mount

ACCESSORIES						
ORDERING NUMBER		OPTIONS	POWER SUPPLY		ENCLOSURE	INDICATION
PGR-3100-PNL	-	А	В	-	С	D
		0 = No Options, customer supplied 120 V lamp test 1 = Transformer included for 120 V lamp test	0 = Low Voltage (120, 208, 240), c/w fusing 1 = High Voltage (480, 600), c/w fusing		0 = NEMA 4 Enclosure 1 = 316 Stainless Steel	Future Options

Description

The PGR-3100 indicates the presence of voltage on each phase of a three-phase system. The LEDs on the panel illuminate when voltage is present. When a ground-fault occurs, the voltage on the faulted phase reduces to ground potential, causing the LEDs for the faulted phase to dim and the LEDs for the unfaulted phases to become brighter. Ungrounded ac systems are required by the National Electrical Code (NEC®) Article 250.21(B) and the Canadian Electrical Code Part 1, Section 10-106 (2) to have ground detectors, such as the PGR-3100, installed on the system. External potential transformers (PTs) can be used to step down system voltage, allowing the PGR-3100 to be applied to any system voltage. PTs are not required for system voltages up to 600 Vac.

Features & Benefits

FEATURES	BENEFITS
NEC [®] and CEC Code compliant	Meets National Electrical Code (NEC®) Article 250.21(B) and Canadian Electrical Code Part 1, Section 10-106 (2) requirements for ungrounded systems
Phase LEDs	Indicates presence of a ground fault and the faulted phase as well as phase-to-ground voltage on an energized bus
Redundant LEDs	Redundant long-life LEDs (two per phase) to ensure reliability
Lamp test button	Verifies LEDs are operating

Accessories



PGR-3100-PNL Panel-Mount Enclosure

PGR-3100-PNL is the PGR-3100 integrated into compact stainless steel enclosure for ease of installation and retrofits. Options include visual alarm, audible alarm with silence and reset. Dimensions are 8"W x 8"H x 4" D.

Specifications

Input Voltage Indicator Off Voltage Dimensions

Test Button Approvals **Conformally Coated** Warranty Mounting

Up to 600 Vac 50/60 Hz < 30 Vac line to ground H 88.9 mm (3.5"); W 108 mm (4.3"); **D** 54 mm (2.1") Local CSA certified. UL Listed Standard feature 5 years Panel

1 **GROUND-FAULT PROTECTION**

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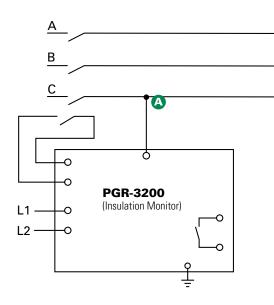
Protection Relays Ground-Fault Protection – Ungrounded AC System

PGR-3200 SERIES **Insulation Monitor**





Simplified Circuit Diagram



Ordering Information

CONTROL POWER	
240 Vac ⁽¹⁾	
120 Vac	
REQUIREMENT	
Required >1,300 V	
Optional	

Note: For optional conformal coating please consult factory. To convert to a resistance grounded system, see neutral-grounding-resistors packages. (1) UL Not Available

Description

The PGR-3200 detects ground faults by continuously monitoring the insulation integrity of ungrounded electrical systems. The relay monitors the insulation for damage and assists with predictive maintenance and troubleshooting of developing ground faults by providing two warning and an alarm level. The PGR-3200 operates on one- or three-phase ungrounded systems up to 6 kV.

The PGR-3200 can also be used on a grounded system to monitor the insulation for damage, while the power system is de-energized. The mode-of-operation terminals (27-28) are connected to the circuit breaker or contactor auxiliary contacts to toggle the relay off when the contactor or breaker is closed.

Features & Benefits

FEATURES	BENEFITS
NEC [®] and CEC Code compliant	Meets National Electrical Code (NEC®) Article 250.21(B) and Canadian Electrical Code Part 1, Section 10-106 (2) requirements for ungrounded systems
Output contact (50 kΩ)	Form C output contact for alarming when the insulation resistance is below 50 $\ensuremath{k\Omega}$
Output contact (10 kΩ)	Form C output contact for tripping when the insulation resistance is below 10 $\ensuremath{k\Omega}$
Analog output (0-1 mA)	Provides means for connecting to an optional meter (PGA-0510) or control system
DIN-rail or surface mount	Flexible options for ease of installation

Accessories



PGH Series High-Tension Coupler

A PGH Series high-tension coupler is required for systems between 1,300 V and 6,000 V.



PGA-0510 Analog Ohm Meter Optional PGA-0510 Analog Meter allows

for metering of insulation resistance.

Specifications

IEEE Device Numbers

Input Voltage Dimensions **Resistance Ratings**

Contact Operating Mode Test Button Reset Button Output Contacts Analog Output Conformally Coated Approvals Warranty Mounting

Undervoltage Relay (27) Ground Detector Relay (64) See ordering information H 75 mm (3"); W 100 mm (3.9"); D 115 mm (4.5") Insulation warning (30 k Ω and 50 k Ω) Insulation alarm (10 k Ω) Non-fail-safe Local Local and remote Two Form C 0-1 mA Consult factory UL Listed (E183688) 5 years DIN, Surface

www.littelfuse.com/pgr-3200

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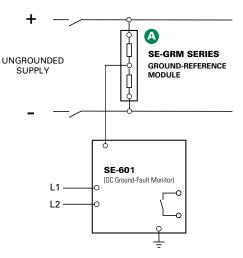


SE-601 SERIES (PGR-2601)

DC Ground-Fault Monitor



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-601-OU	120/240 Vac/Vdc
SE-601-0D	12/24 Vdc
SE-601-OT	48 Vdc
ACCESSORIES	REQUIREMENT
SE-GRM SERIES	Required
PGA-0500	Optional
PMA-55	Optional
PMA-60	Optional



Description

The SE-601 is a microprocessor-based ground-fault relay for ungrounded dc systems. It provides sensitive ground-fault protection without the problems associated with nuisance tripping. Ground-fault current is sensed using an SE-GRM Series Ground-Reference Module—a resistor network that limits ground-fault current to 25 mA. The SE-601 is used on ungrounded dc systems ranging from industrial 24-Vdc control circuits to 1000-Vdc solar and transportation systems.

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (1-20 mA)	Ten settings provide a wide range of low-level protection
Adjustable time delay (50 ms-2.5 s)	Adjustable trip delay allows quick protection or delayed response
Output contacts	Form A and Form B output contacts for operation of separate annunciation and trip circuits
Analog output (0-5 V)	Provides means for connecting to a meter (PGA-0500) or a control system
Non-volatile trip Memory	Retains trip state when de-energized to simplify troubleshooting
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allow connection to shunt or undervoltage breaker coil
Microprocessor based	No calibration required saves on maintenance cost

Accessories



SE-GRM Series Ground-Reference Module Required accessory, used to connect the SE-601 DC Ground-Fault Monitor to the DC bus.



PGA-0500 Analog % Current Meter

Optional panel-mounted analog meter displays ground-fault current as a percentage of 22 mA.

Specifications

IEEE Device Numbers DC Overcurrent Relay (76G) **Input Voltage** See ordering information Dimensions H 75 mm (3.0"); W 55 mm (2.2"); D 115 mm (4.5") **Trip Level Settings** 1-20 mA **Trip Time Settings** 0.05-2.5 s **Output Contacts** Isolated Form A and Form B **Contact Operating Mode** Selectable fail-safe or non-fail-safe **Test Button** Local **Reset Button** Local and remote Analog Output 0-5 V **Conformally Coated** Consult factory CSA certified, UL Listed (E340889), Approvals CE (European Union), C-Tick (Australian) Warranty 5 years Mounting DIN, Surface (standard) Panel (with PMA-55 or PMA-60 adapter)

Note: For optional conformal coating please consult factory.



Protection Relays Ground-Fault Protection – AC/DC Earthed System

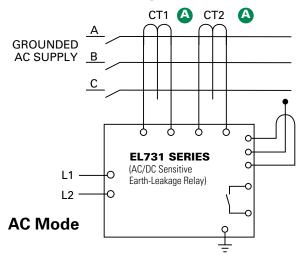
EL731 SERIES

AC/DC Sensitive Earth-Leakage Relay





Simplified Circuit Diagram



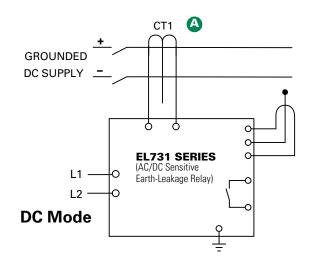
For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER	CONTROL POWER	COMMUNICATIONS
EL731-00-X0	120/240 Vac/Vdc	None
EL731-01-X0	120/240 Vac/Vdc	DeviceNet [™]
EL731-02-X0	120/240 Vac/Vdc	Profibus®
EL731-03-X0	120/240 Vac/Vdc	EtherNet/IP [™]
EL731-04-X0	120/240 Vac/Vdc	Modbus [®] TCP
EL731-10-X0	48 Vdc & 24 Vac	None
EL731-11-X0	48 Vdc & 24 Vac	DeviceNet [™]
EL731-12-X0	48 Vdc & 24 Vac	Profibus®
EL731-13-X0	48 Vdc & 24 Vac	EtherNet/IP™
EL731-14-X0	48 Vdc & 24 Vac	Modbus [®] TCP
EL731-20-X0	24 Vdc	None
EL731-21-X0	24 Vdc	DeviceNet [™]
EL731-22-X0	24 Vdc	Profibus®
EL731-23-X0	24 Vdc	EtherNet/IP [™]
EL731-24-X0	24 Vdc	Modbus [®] TCP

Description

The EL731 is a microprocessor-based AC/DC Sensitive Earth-Leakage Relay that offers complete coverage for all frequencies from 0 to 6,000 Hz. Two CTs are required for the entire frequency range, or one CT can be used for only low- or high-frequency detection. An RTD/PTC sensor input allows over-temperature protection for a motor or drive. The EL731 offers metering, password-protected alarm and trip settings and optional network communications. It is primarily used to add low-level ground-fault protection to variable-speed drives, and to dc circuits.



Accessories



EFCT Series Earth-Fault Current Transformer Required zero-sequence current transformer specifically designed for low level detection.



AC700-CUA Series Communication Adapter Optional network-interface and firmware-upgrade communications adapters field-install in EL731.



AC700-SMK DIN-rail & Surface-mount Adapter EL731 plugs into adapter for back-plane mounting.

ACCESSORIES	REQUIREMENT
EFCT Series CT	One Required
AC700-CUA Series Com. Unit	Optional
AC700-SMK Surface-Mount Kit	Optional
AC700-CVR-00 Watertight Cover (IP66) for Panel-Mount Applications	Optional
PGA-0520 Analog Meter	Optional

Note: When building a part number, replace the "X" with "1" for AS/NZS 2081:2011 Compliant product, "0" otherwise.

www.littelfuse.com/EL731

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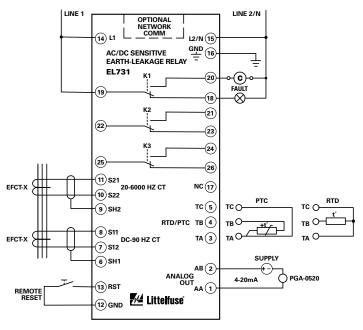
EL731 SERIES

AC/DC Sensitive Earth-Leakage Relay

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (30-5,000 mA)	Adjustable trip setting provides a wide range of low-level protection and system coordination
Frequency range (0-90 Hz, 20-6,000 Hz)	Operate in either AC or DC mode or both. Use single or combined ranges. Separate metering
32-char OLED display	Earth-leakage metering, setup and programming
Local LED indication	Visual Trip, Alarm, CT connection indication
CT-Loop monitoring	Alarms when CT is not connected
Analog output (4-20 mA)	Connect to DCS. Allows connection to an optional meter (PGA-0520) or control system
Adjustable time delay	Adjustable trip delay for quick protection and system coordination
Alarm and trip settings	Detect a deteriorating condition before damage occurs
Temperature-sensor input	Drive or motor temperature protection
Output contacts	3 programmable: Operate 2 alarm and 1 trip circuit
Network communication	Optional connection to plant network
Harmonic filtering	Eliminates nuisance tripping due to harmonic noise
Microprocessor based	No required calibration saves maintenance cost
Universal power supply	Provides flexibility for numerous applications

Wiring Diagram



Specifications

IEEE Device Numbers	AC ground fault (50G/N, 51G/N),
	DC ground fault (79G),
	PTC overtemperature (49),
	RTD temperature (38, 49)
Supply Voltage	120/240 Vac/Vdc, 24 Vdc,
	48 Vdc/24 Vac
Trip Level Settings	30-5,000 mA AC and DC
Alarm Level Settings	30-5,000 mA AC and DC
Trip Delay	0.05-2 s
Output Contacts	3 Form C (programmable)
Contact Operating Mode	Fail-safe & non-fail-safe
Reset	Front panel and remote
Freg. Response, CT1	0-90 Hz
Freg. Response, CT2	20-6,000, 190-6,000, 20-90, 20-3,000 Hz;
• • •	selectable
Current Transformer	EFCT-x series
CT Detection	Open & short detection
Terminals	Plug-in, wire clamping,
	24 to 12 AWG (0.2-2.5 mm ²)
Communications	EtherNet/IP™, DeviceNet™, Profibus®,
	Modbus® TCP (optional)
Analog Output	4-20 mA (selectable 0-5 A or
Analog Catpat	0-100% trip-level setting)
Conformal Coating	Standard feature
Dimensions	H 48 mm (1.9"); W 96 mm (3.8");
Dimensions	D 129 mm (5.0")
Annrovala	
Approvals	UL Listed (E340889), CSA, RCM (Australia), CE
Warranty	5 years
Mounting	Panel; Surface and DIN (with optional
	AC700-SMK)

GROUND-FAULT PROTECTION

1

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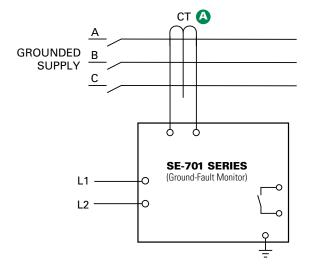
SE-701 SERIES (PGR-5701)

Ground-Fault Monitor

GROUND-FAULT PROTECTION



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-701-0U	120/240 Vac/Vdc
SE-701-0D	12/24 Vdc
SE-701-OT	48 Vdc
SE-701-03	24 Vac
ACCESSORIES	REQUIREMENT
Current Transformer	Required
PGA-0500	Optional
PMA-55, PMA-60	Optional
SE-EFVC Voltage Clamp	Optional

Description

The SE-701 is a microprocessor-based ground-fault relay for resistance- and solidly-grounded systems. In addition to common systems, it is uniquely suited for use on systems with significant harmonic content. The SE-701 can provide main-plant protection, feeder-level protection, or individual-load protection. Proper current transformer selection provides the desired pickup range. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter.

Features & Benefits

FEATURES	BENEFITS
Adjustable pickup (1-99%)	Trip setting based on input CT primary, allows use with any CT. Minimum 50 mA with EFCT Series.
Adjustable time delay (50 ms-2.5 s)	Adjustable trip delay allows quick protection and system coordination
Output contacts	Form A and Form B ground-fault output contacts for operation of separate annunciation and trip circuits
Analog output (0-5V)	Allows for connecting an optional meter (PGA-0500) or a control system
CT-Loop monitoring	Alarms when CT is not connected
Selectable DFT or peak detection filtering	Compatible with variable-speed drives
Harmonic filtering	Eliminates nuisance tripping
Non-volatile trip memory	Retains trip state while de-energized to simplify troubleshooting
Microprocessor based	No calibration required, saves on maintenance cost
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications

Accessories



Ground-Fault Current Transformer

Required current transformer model depends on application. We offer a variety of sensitive CTs with 5- and 30-A primaries.



PGA-0500 Analog % Current Meter

Optional panel-mounted analog meter displays ground-fault current as a percentage of the CT primary rating.

Specifications

IEEE Device Numbers Input Voltage Dimensions **Trip Level Settings Trip Time Settings Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts** Approvals **Analog Output Conformally** coated Warranty Mounting

Ground fault (50G/N, 51G/N) See ordering information H 75 mm (3.0"); W 55 mm (2.2"); D 115 mm (4.5") 1-99% CT-Primary Rating 0.05-2.5 s Contact Operating Mode Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Isolated Form A and Form B CSA certified, UL Listed (E340889), CE (European Union), C-Tick (Australian) 0-5 V Consult factory 5 years DIN, Surface (standard)

Panel (with PMA-55 or PMA-60 adapter)

Note: For optional conformal coating please consult factory.

www.littelfuse.com/se-701

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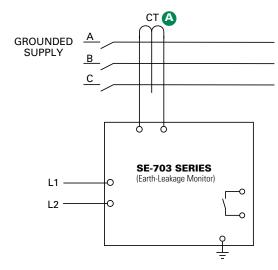


SE-703 SERIES

Earth-Leakage Monitor



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER	
SE-703-0U	120/240 Vac/Vdc	
SE-703-0D	12/24 Vdc	
SE-703-0T	48 Vdc	
SE-703-03	24 Vac	
ACCESSORIES	REQUIREMENT	
EFCT Series	Required	
PGA-0500	Optional	
PMA-55	Optional	
PMA-60	Optional	
SE-EFVC Voltage Clamp	Optional	

Description

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The SE-703 is a microprocessor-based earth-fault relay for resistance- and solidly earthed systems. It offers sensitive earth-fault detection as low as 25 mA and can be used on systems with significant harmonic content. The SE-703 provides feeder-level protection or individual-load protection. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter. The SE-703 is specifically designed to be AS/NZS 2081:2011 compliant.

Features & Benefits

FEATURES	BENEFITS	
Adjustable pickup (25-500 mA)	Adjustable trip setting provides a wide range of low- level protection and system coordination	
Adjustable time delay (INST-500 ms)	Adjustable trip delay allows quick protection and vsystem coordination	
Output contacts	Form A and Form B ground-fault output contacts for operation of separate annunciation and trip circuits	
Analog output (0-5 V)	Allows for connecting an optional meter (PGA-0500) or control system	
CT-Loop monitoring	Alarms when CT is not connected	
Contact operating mode	Fail-safe operating mode for undervoltage applications	
Harmonic filtering	Eliminates nuisance tripping	
Non-volatile trip memory	Retains trip state while de-energized to simplify troubleshooting	
Microprocessor based	No calibration required, saves maintenance cost	
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications	

Accessories



EFCT Series Ground-Fault Current Transformer Required zero-sequence current transformer specifically designed for low-level detection.



PGA-0500 Analog % Current Meter

Optional panel-mounted analog meter displays groundfault current as a percentage of the set-point or 5 A.

PMA-60 Series – Mounting Adapter Required when panel mounting for AS/NZS 2081:2011 compliance

Specifications

IEEE Device Numbers Input Voltage Dimensions **Trip Level Settings Trip Time Settings Contact Operating Mode** Harmonic Filtering **Test Button Reset Button** CT-Loop Monitoring **Output Contacts** Approvals Compliance Analog Output **Conformally Coated** Warranty

Ground fault (50G/N, 51G/N) See ordering information H 75 mm (3.0"); W 55 mm (2.2"); D 115 mm (4.5") 25-500 mA INST-500 ms Fail-safe Standard feature Standard feature Standard feature Standard feature Isolated Form A and Form B CSA certified, UL Listed (E340889), CE (European Union), RCM (Australian) AS/NZS 2081:2011 0-5 V Yes 5 years DIN, Surface (standard), Panel

(with PMA-55 or PMA-60 adapter)

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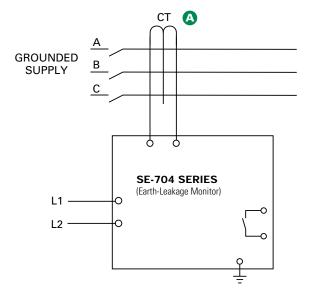
Mounting

SE-704 SERIES (PGR-4704)

Earth-Leakage Monitor



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-704-0U	120/240 Vac/Vdc
SE-704-0D	12/24 Vdc
SE-704-0T	48 Vdc
SE-704-03	24 Vac
ACCESSORIES	REQUIREMENT
SE-CS30 Series	Required
PGA-0500	Optional
PMA-55, PMA-60	Optional

Note: For optional conformal coating please consult factory.

Description



The SE-704 is a microprocessor-based ground-fault relay for resistance- and solidly-grounded systems. It offers very sensitive ground-fault detection as low as 10 mA and can be used on systems with significant harmonic content. The SE-704 provides feeder-level protection or individual-load protection. The output contacts can be connected for use in protective tripping circuits or in alarm indication circuits. The analog output can be used with a PLC or a meter.

Features & Benefits

FEATURES	BENEFITS	
Adjustable pickup (10 mA-5 A)	Adjustable trip setting provides a wide range of low-level protection and system coordination	
Adjustable time delay (30 ms-2.0 s)	Adjustable trip delay allows quick protection and system coordination	
Output contacts	Form A and Form B ground-fault output contacts for operation of separate annunciation and trip circuits	
Analog output (0-5 V & 0-1 mA)	Allows for connecting an optional meter (PGA-0500) or control system	
CT-Loop monitoring	Alarms when CT is not connected	
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil	
Harmonic filtering	Eliminates nuisance tripping	
Non-volatile trip memory	Retains trip state when de-energized to simplify troubleshooting	
Microprocessor based	No calibration required saves maintenance cost	
Universal power supply	Allows operation in application where one side of PT is faulted, provides flexibility for numerous applications	

Accessories



SE-CS30 Series Ground-Fault Transformer

Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.

PGA-0500 Analog % Current Meter Optional panel-mounted analog meter displays groundfault current as a percentage of the set-point or 5 A.

Specifications

IEEE Device Numbers Input Voltage Dimensions **Trip Level Settings Trip Time Settings Contact Operating Mode Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts** Approvals **Analog Output Conformally coated** Warranty Mounting

Ground fault (50G/N, 51G/N) See ordering information H 75 mm (3.0"); W 55 mm (2.2"); D 115 mm (4.5") 10 mA-5.0 A 30-2000 ms Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Isolated Form A and Form B UL Listed (E340889), CSA, CE (European Union) C-Tick (Australian) 0-5 V & 0-1 mA Optional 5 vears DIN, Surface (standard) Panel (with PMA-55 or PMA-60 adapter)

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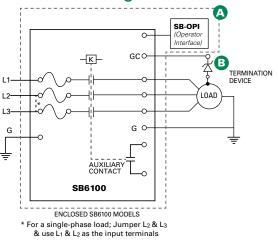


SB6000 SERIES



*Patented

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	VOLTAGE (V)	TRIP LEVEL (mA)	UL CATEGORY/CLASS	
SB6100-00X-0	208	20(Fixed)		
SB6100-10X-0	240		UL 943C Class C special-purpose GFCI	
SB6100-20X-0	480			
SB6100-30X-0	600		UL 943C Class D special-purpose GFCI	
SB6100-01X-0	208	6, 10-100 in increments of 10		
SB6100-11X-0	240		UL 943/UL 1053 Equipment ground-	
SB6100-21X-0	480		fault protective device (EGFPD)	
SB6100-31X-0	600			

Note: x=0 for open-chassis models and 1 for enclosed models

Description

Special-Purpose Ground-Fault Circuit Interrupter (GFCI), Class C and Class D

Industrial Shock Block (ISB) is a personnel protection device designed to meet the new requirements for special-purpose GFCIs defined by UL 943C. ISB is the first and only permanently connected Class C and Class D GFCI on the market. Class C GFCIs are intended to be used on systems where the line-to-line voltage is 480 V or less with a trip level of 20 mA, while Class D GFCIs are intended to be used on 600 V systems. These improvements to the standard Class A GFCI (6 mA trip level used on 240 V systems or less) were made to allow the use of GFCIs in industrial facilities. The ISB includes an automatic self-test feature and is compliant to the UL1998 Software in Programmable Components standard.

Equipment Ground-Fault Protective Device (EGFPD)

ISB is also available with adjustable protection settings as an EGFPD. The EGFPD models can be set to trip at 6 mA or from 10-100 mA in increments of 10 mA. This offers more flexibility since GFCI devices are not allowed to have an adjustable trip level.

Rating and Models

ISB (GFCI & EGFPD) is available for voltages from 208 to 600 V with a maximum full load current of 100 A, and a built-in overcurrent protection supplied by Littelfuse Class T fuses. The load can be 1-phase (line-to-line) or 3-phase, however, cannot have a neutral. The power system can either be solidly-grounded or high-resistance grounded.

Two options for enclosures are available: UL-recognized open-chassis models are available for installation in existing electrical enclosures and UL-listed enclosed models include a NEMA-4X enclosure for standalone installations.

Ground Wire (Load-Ground) Monitor

The ISB also monitors the ground wire (load-ground) connection between the ISB and load. This is a required feature for GFCI devices and is optional for EGFPD devices. If the connection is broken, the ISB will provide an alarm by changing the state of the alarm contacts. This monitoring circuit includes an extra wire (pilot wire) between the ISB and load (since the monitoring current is low, only a small wire is required). At the load, the pilot wire is connected to a termination device. The other end of the termination device is connected to the load ground (typically the enclosure).

Features & Benefits

FEATURES	BENEFITS
UL 943 inverse time trip curve	Detects and interrupts to protect people and reduce the probability of nuisance tripping
Minimum trip time < 20 msec	Reduces the risk of ventricular fibrillation for leakage current of 250 mA and above
UL 943C fixed trip level (GFCI 20 mA)	Personnel protection for systems with leakage current higher than the standard 6 mA required by UL 943 Class A
Selectable trip levels (EGFPD)	Provides extra safety when a customer is able to operate with a setting below 20 mA (GFCI) and the settings above 20 mA can reduce nuisance tripping on systems with high leakage current.
UL 943C ground monitor/ interrupt	Protects from shock by tripping if continuity of ground wire between Industrial Shock-Block and load is broken.
Undervoltage, brownout, chatter detection	Ensures proper operation and prolongs the internal contactor lifetime
3 x Class T, 600 V incoming fuses	The fuses provide overcurrent protection for a 100 A circuit and a higher short-circuit current rating (SCCR) of 50 kA.
Conformal coating	Internal circuits are conformally coated to protect against corrosion and moisture, yet still repairable
Operator Interface	Shows unit status, alarm types, percentage of leakage current, and allows for Test and Reset capabilities
Auxiliary Contact	Provides a normally-open contact for remote indication
Automatic Self-Test	All ISB options (revision 01 or higher) include an automatic self-test feature
Motor Starter	Allows the user to start and stop the motor from the interface

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SB6000 SERIES

Accessories



Operator Interface (AC6000-OPI-00)



1

1N5339B - Termination Device Axial-lead ground-check termination, included with SB6000 series



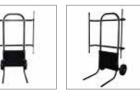
SE-TA6 - Termination Assembly Optional termination assembly with terminals and mounting holes



SE-TA6-SM Stud-Mount **Termination Assembly** Optional ground-check termination for submersible pumps



AC6000-CART-00 Two-wheeled Cart Optional for mounting ISB to allow for moving the unit while power is off



AC6000-MNT-00 **Mounting Frame** Optional for mounting ISB to a cart or other surface. Included with the AC6000-CART-00.

Ordering Information - Accessories

ACCESSORIES	REQUIREMENT	PAGE
AC6000-0PI-00	Included	N/A
1N5339B	Included	477
SE-TA6	Optional	477
SE-TA6-SM	Optional	477
SE-TA6ASF-WL	Optional	477
AC6000-CART-00	Optional	N/A
AC6000-MNT-00	Optional	N/A

Connection Diagram

The SB6100 is installed in-line between incoming power or existing over-current protection device and the load.

The open-chassis SB6100 can be installed in electrical equipment and the enclosed version is typically wall-mounted.



Specifications

Voltage Rating	See ordering information
Current Rating	100 A (continuous)
Load	3-phase, 3-wire (no neutral) or 1-phase (line-to-line), 60 Hz
Short-Circuit Current Rating	50,000 A
Trip Level Settings	Selectable (6, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 mA), or fixed at 20 mA
Trip Time Setting	Inverse time trip curve
Enclosure	NEMA 4X, Polyester, Lockable
Operating Temperature	–35°C (–31°F) to +40°C(104°F), up to +66°C (151°F) with derating
Wiring Requirements	2/0 AWG (maximum)
Approval	GFCI: UL Listed (enclosed models) and UL Recognized component (open-chassis models) EGFPD: cULus Listed (enclosed models) and cURus Recognized Component (open-chassis models); UL1998 Compliant (revision 01 or higher); All models CSA Certified
Dimensions	Enclosed: H 453.8 mm (17.9"); W 406.2 mm (16.0"); D 223.3 mm (8.8")
	Open-chassis: H 455.0 mm (17.9"); W 340.7 mm (13.4"); D 174.9 mm (6.8")
Warranty	1 year

Warranty

1 year

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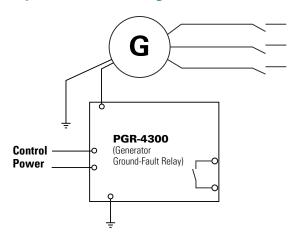
Generator Ground-Fault Relay



pertise Applied Answers Delivered



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
PGR-4300-12	12 Vdc
PGR-4300-24	24 Vdc
PGR-4300-120	120 Vac

ACCESSORIES	REQUIREMENT
PGA-0500	Optional
PMA-55	Optional
PMA-60	Optional

Note: For optional conformal coating please consult factory.

Description

The PGR-4300 Generator Ground-Fault Relay provides a simple method for detecting a ground-fault condition on generators without the need for current transformers (CTs). This greatly simplifies the installation. In addition, it is compatible with both three- and four-pole transfer switches. This relay also monitors the neutral-to-ground path for continuity. The PGR-4300 is ideal for any generator or application where there is not sufficient space to install CTs.

Features & Benefits

FEATURES	BENEFITS	
No CTs required	Saves space and simplifies installation	
Adjustable pickup (100-1200 A)	Adjustable trip setting provides a wide range of protection and allows system coordination	
Adjustable time delay (0 - 1.0 s)	Adjustable trip delay allows quick protection and system coordination	
Output contacts	Form C ground-fault output contacts for alarming or tripping purposes	
Analog output (0-1 mA)	Provides means for connecting to an optional meter (PGA-0500) or control system	
N-G continuity alarm	Monitors neutral-to-ground integrity and alarms if ground path becomes open circuit	
Passive filtering	Eliminates nuisance tripping	

Accessories



PGA-0500 Analog % Current Meter

Optional panel-mounted analog meter displays ground-fault current as a percentage of the set-point.

Specifications

IEEE Device Numbers Input Voltage Dimensions

Trip Level Settings Trip Time Delay Settings Contact Operating Mode Test Button Reset Button Output Contacts Analog Output Conformally Coated Approvals Warranty Mounting Ground Fault (50G/N, 51G/N) See ordering information H 75 mm (3.0"); W 55 mm (2.2"); **D** 115 mm (4.5") 100-1200 A 0-1.0 s Non-fail-safe Local Local and remote Form C 0-1 mA Consult factory UL Listed (E183688) 5 years DIN, Surface (standard) Panel (with PMA-55 or PMA-60 adapter)



Protection Relays

www.littelfuse.com/relayscontrols



GROUND-CONDUCTOR MONITORING

Continuously monitor the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults.

SE-105 / SE-107 Series	Ground-Fault Ground-Check Monitor 58
SE-134C / SE-135 Series	Ground-Fault Ground-Check Monitor 59

For More Information... and to download our technical note on Ground-Fault Ground-Check, visit Littelfuse.com/Ground-faultPaper



SE-105 / SE-107 SERIES

Simplified Circuit Diagram

SE-105 SERIES SE-107 SERIES

Ordering Information

Consult manual online for additional ordering options

ORDERING NUMBER

(Ground-Fault

Ground-Check

GROUNDED

SUPPLY

L1

L2 0 Monitor)

SE-105

SE-105D

SE-105E

SE-107

SE-107D

SE-107E

ACCESSORIES

CT200 Series

SE-TA6, SE-TA6-SM

RK-102, RK-105, RK-105I

SE-TA6A Series

1N5339B

RK-13

PPI-600V

A

в

С GC G

TRAILING

CABLE

CONTROL POWER

120 Vac

240 Vac

120 Vac

240 Vac

Required

Included

Optional

Optional

Optional

Optional

Optional

120 Vac/Vdc

120 Vac/Vdc

REQUIREMENT

М

TERMINATION DEVICE

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Ground-Fault Ground-Check Monitor





The SE-105/SE-107 is a combination ground-wire monitor and ground-fault relay for resistance-grounded systems. It continuously monitors the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults. The SE-105/SE-107 is an excellent choice for trailing cables 5 kV and under in underground mining applications. For higher voltages or long-cable applications, see the SE-134C/SE-135.

Features & Benefits

FEATURES	BENEFITS	
Adjustable pickup (0.5, 2.0, 4.0 A)	Unit can be used on a wide variety of trailing cable applications	
Adjustable time delay (0.1-2.0 s)	Adjustable trip delay for quick protection and system coordination	
Harmonic filter	Prevents false operation	
Zener-characteristic termination assembly	Provides reliable ground-check loop verification	
Fail-safe ground-check circuit	Ensures ground-check circuit remains safe even in the event of equipment failure	
Conformal coating	Additional coating protects circuit boards against harsh environment	
SE-105: selectable UV- or shunt-trip mode	Provides flexibility for different applications	
SE-107: UV-trip mode only	Eliminates chance of unauthorized change to trip circuit	

Accessories



CT200 Series Current Transformer

Required CT detects ground-fault current.



1N5339B Termination Device 5 W axial-lead ground-check termination; included with SE-105/SE-107.



SE-TA6 Termination Assembly Optional termination assembly with convenient terminals and mounting holes

SE-TA6-SM Stud-Mount Termination Assembly Optional 50 W ground-check termination that is robust and compact for submersible pumps.

Wire lead simplifies installation.

Specifications

IEEE Device Numbers

Input Voltage Dimensions

Trip Level Settings Trip Time Settings Contact Operating Mode

Harmonic Filtering **Reset Button Output Contacts** Approvals

Conformally Coated Warranty Mounting

Checking or Interlocking Relay (3GC), Ground Fault (50G/N, 51G/N) See ordering information **H** 150 mm (5.9"); **W** 109 mm (4.3"); **D** 100 mm (4.0") 0.5, 2.0, 4.0 A 0.1-1.0 s Selectable fail-safe or non-fail-safe (SE-105) Fail-safe only (SE-107) Standard feature Local and remote Isolated Form A CSA certified, UL Listed (E340889), C-Tick (Australian) Standard feature 5 years Surface

www.littelfuse.com/se-105_www.littelfuse.com/se-107
www.intenuse.com/se-tub_www.intenuse.com/se-tu/

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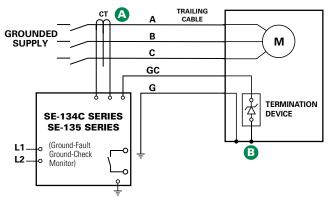


SE-134C / SE-135 SERIES

Ground-Fault Ground-Check Monitor



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	OPTION	POWER SUPPLY	СОММ		
SE-134C	Blank or XGC	0=120/240 Vac/Vdc 1=24/48 Vdc ⁽¹⁾	0=None		
SE-135	SE-135 Blank or XGC	0=120/240 Vac/Vdc	0=None		
0L-100	SE-135 Blank of XGC 1=24/48 Vdc (1)(2)				
ACCESSORIES			REQUIREMENT		
SE-CS10 Series			Required		
SE-CS40 Ser	SE-CS40 Series (for SE-135)				
SE-TA6A Sei	SE-TA6A Series (for SE-134C)				
SE-TA12A/S	E-TA12B Combina	ation (for SE-134C)	Optional		
SE-TA12A Se	eries (for SE-135)		Required		
SE-IP65CVR-	SE-IP65CVR-G				
RK-132			Optional		
PPI-600V			Optional		
(1) CE/C-Tick not available. (2) Not available with Ethernet option 3.					

(2) Not available with Ethernet option

(3) See ordering information.

See Current Transformer Selection Guide and Accessory Information.

Description



The SE-134C/SE-135 is a microprocessor-based, combination ground-wire monitor and ground-fault relay for resistancegrounded or solidly grounded systems. It continuously monitors the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults. The SE-134C/SE-135 is field proven in monitoring trailing cables on large mobile equipment such as drag-lines, mining shovels, shore-to-ship power cables, dock-side cranes, stacker-reclaimers, submersible pumps, and portable conveyors.

Features & Benefits

FEATURES	BENEFITS			
Adjustable pickup (0.5-12.5 A for SE-CS10) (2 - 50 A for SE-CS40)	Unit can be used on a wide variety of trailing cable applications			
Adjustable time delay (0.1-2.5 s)	Adjustable trip delay for quick protection and system coordination			
Output contacts	Separate annunciation of ground-fault and ground- check faults			
Ground-check LED indication	Indication of open or short ground-check wire makes it easier to find faults			
CT-loop monitoring	Alarms when CT is not connected			
High-induced-ac rejection	Makes unit suitable for applications with high voltages and long cables			
DFT (Harmonic) filter	Prevents false operation			
Zener-characteristic termination assembly	Provides reliable ground-check loop verification			
Fail-safe circuits	Ensures ground-check and ground-fault circuits remain safe even in the event of equipment failure			
Conformal coating	Additional coating protects circuit boards against harsh environment			
XGC option	Increases maximum cable length for ground- check monitoring (10 km typical)			

Accessories



SE-CS10 or SE-CS40 Series Ground-Fault Current Transformer

Required zero-sequence current transformer detects ground-fault current.



SE-TA6A Series, SE-TA12A Series Termination Assembly Required termination assembly; temperature compensated.

Specifications

IEEE Device Numbers

Input Voltage Dimensions Trip Level Settings Trip Time Settings Contact Operating Mode Harmonic Filtering Test Button Reset Button Output Contacts Approvals Conformally Coated Warranty Mounting

GC Trip Resistance

Checking or Interlocking Relay (3GC), Ground fault (50G/N, 51G/N) 65-265 Vac; 85-275 Vdc; 18-72 Vdc H 213 mm (8.4"); W 99 mm (3.9"); D 132 mm (5.2") 0.5 -12.5 A for SE-CS10, 2 - 50 A for SE-CS40 0.1-2.5 s Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Isolated Form A and Form B, Two Form C CSA certified, UL Listed (E340889), C-Tick (Australia)⁽³⁾, CE⁽³⁾ Standard feature 5 years Panel, Surface 28Ω (Standard), 45Ω (XGC Option)

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www.littelfuse.com/se-134c, www.littelfuse.com/se-135



Protection Relays

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RESISTANCE GROUNDING/NGR MONITORING

Continuously monitor the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults

Neutral-Grounding-Resistor Sizing Chart					
SE-325 Series	Neutral-Grounding-Resistor Monitor62				
SE-330 / SE-330HV Series	Neutral-Grounding-Resistor Monitor				
SE-330AU Series	Neutral-Earthing-Resistor Monitor65				
NGR Series	Neutral-Grounding-Resistor Packages				
NGRM-ENC Series	Enclosed Neutral-Grounding-Resistor Monitor67				

Neutral-Grounding-Resistor Sizing Chart

System Voltage (Line-to-line)	NGR Let-Through Current and Resistance	Time Rating
208 V	5 A / 24 Ohms	Continuous
480 V	5 A / 55 Ohms	Continuous
600 V	5 A / 69 Ohms	Continuous
2,400 V	5 A/277 Ohms or 10 A/139 Ohms	Continuous or 10 sec
4,160 V	5 A/480 Ohms or 10 A/240 Ohms	Continuous or 10 sec
13,800 V	10 A / 798 Ohms or 200 A / 40 Ohms	10 seconds
25,000 V	200 A/72 Ohms or 400 A/36 Ohms	10 seconds
34,500 V	200 A / 100 Ohms or 400 A / 50 Ohms	10 seconds

Note: The values shown are for any size transformer and are typical.

Note: The above table is for illustrative purposes only. Actual values may differ based on a variety of individual system considerations, such as capacitive charging current and co-ordination study results.



For More Information...

and to download our White Paper Why NGRs Need Contiuous Monitoring, visit Littelfuse.com/TechnicalCenter



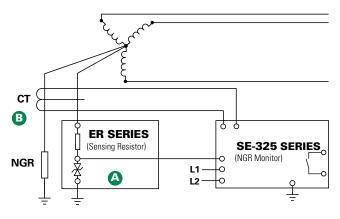
SE-325 SERIES (PGM-8325)

Neutral-Grounding-Resistor Monitor





Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-325	120 Vac
SE-325D	120 Vac/Vdc
SE-325E	240 Vac

 $\label{eq:consult} \mbox{Consult manual online for additional ordering options.}$

ACCESSORIES	REQUIREMENT
CT200 Series	Required
ER Series	Required
SE-MRE-600	Optional
RK-325, RK-325I, RK-302	Optional
RK-13	Optional
NGRM-ENC	Optional

Description

The SE-325 Neutral-Grounding-Resistor Monitor is used on resistance-grounded systems up to 25 kV to monitor the integrity of the neutral-to-ground path and to detect ground faults. It measures current and voltage in a transformer or generator neutral-to-ground connection and continuity of the neutral-grounding resistor (NGR). The SE-325 coordinates these three measurements to detect a loose connection, corrosion, ground fault, or NGR failure, and provides one alarm or trip output contact.

Features & Benefits

FEATURES	BENEFITS
Continuous NGR monitoring	Detects resistor failure within seconds, reduces transient-overvoltage risk, removes risk of ground- fault-detection failure
Ground-fault Detection	Main or backup protection to detect a ground fault anywhere on the monitored system
Adjustable pickup (0.5-4 A)	Select greatest sensitivity without false operation
Adjustable time delay (0.1-2 s)	Adjustable trip delay allows system coordination
Output contacts	Form A output contact
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil or alarm system

Accessories



ER Series Sensing Resistor

Required interface between the power system and the SE-325. Eliminates hazardous voltage levels at the monitor.



CT200 Series Current Transformer

Required CT detects ground-fault current.



RK Series Remote Indication and Reset Optional panel-mounted remote indication

and reset assemblies. Available in NEMA 1 or NEMA 4 configurations.

Specifications

IEEE Device Numbers

Input Voltage Dimensions GF Trip Level Settings GF Trip Time Settings RF Trip-Level Settings Contact Operating Mode Reset Button Output Contacts Approvals

Conformally coated Warranty Mounting Ground Fault (50G/N, 51G/N), Overvoltage (59N), Lockout Relay (86), Checking Relay (3) See ordering information H 150 mm (5.9"); W 109 mm (4.3"); D 100 mm (4.0") 0.5-4.0 A 0.1-2.0 s 20-400 Vac (≤5 kV systems) 100-2,000 Vac (>5 kV systems) Selectable fail-safe or non-fail-safe Standard feature Form A CSA certified, UL Listed (E340889), C-Tick (Australian) Standard feature 5 years Surface

www.littelfuse.com/se-325

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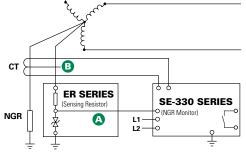


SE-330, SE-330HV SERIES

Neutral-Grounding-Resistor Monitor



Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER		POWER SUPPLY	СОММ			K4 UNIT HEALTHY CONTACT
SE-330	-	Х	Х	-	0	Х
SE-330 for all apps. 35 kV or less SE-330HV for 72 kV apps.		0=120/240 Vac/Vdc 2=48 Vdc	0=USB Only 1=DeviceNet 3=EtherNet (Dual RJ45) 4=EtherNet (SC Fiber & RJ45) 5=EtherNet (Dual SC Fiber) 6=IEC61850 Dual RJ45) 7=IEC61850 (SC Fiber & RJ45) 8=IEC61850 (Dual SC Fiber)			0=Normally Open 1=Normally Closed

NOTE: For Australian applications, see the SE-330AU.

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional
NGRM-ENC	Optional
PGA-0520	Optional
SE-330-SMA	Optional

Littelfuse reserves the right to make product changes, without notice. Material in this document is as accurate as known at the time of publication. Visit Littelfuse.com for the most up-to-date information.

Description

The SE-330 Series is an advanced ground-fault and neutralgrounding-resistor monitoring relay. It measures neutral current, neutral-to-ground voltage, and neutral-to-ground resistance. It provides continuous monitoring of the neutral-to-ground path to verify that the neutral-grounding resistor (NGR) is intact. This is of utmost importance—an open NGR renders current-sensing ground-fault protection inoperative and could result in a false belief that the system is functioning properly. The SE-330 can be used with low- and medium-voltage transformers and generators with low- or high-resistance grounding used in processing, manufacturing, chemical, pulp and paper, petroleum, and watertreatment facilities. For high-voltage applications, use the SE-330HV Series. For applications that require conformance to Australian standard AS/NZS 2081.3:2002, see the SE-330AU Series.

Resistor Monitoring

The SE-330 combines the measured values of resistance, current, and voltage to continuously determine that an NGR is intact. It is able to detect a resistor failure with or without a ground fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 72 kV.

Ground-Fault Monitoring

The SE-330 uses an application-appropriate current transformer to reliably detect ground-fault currents as small as 100 mA. DFT filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Should the resistor open and a ground fault subsequently occur, the SE-330 will detect the fault through voltage measurement, while other current-only sensing relays would be ineffective.

Pulsing Ground-Fault Location

The SE-330 is capable of controlling a pulsing contactor, which is used to switch the NGR resistance in a pulsing-compatible NGR package. The resulting ground-fault current is distinguishable from charging currents and noise and will only appear upstream of the ground fault, making fault location fast and easy, even without isolating feeders or interrupting loads.

Accessories



ER Series Sensing Resistor

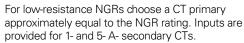
Required interface between the power system and the SE-330/SE-330HV. Eliminates hazardous voltage levels at the relay.



EFCT Series Ground-Fault Current Transformer Sensitive ground-fault current detection (5 A primary).

SE-CS30 Series Ground-Fault Current Transformer Sensitive ground-fault current detection (30 A primary).

Other Current Transformer





SE-IP65CVR-G Hinged Transparent Cover Watertight cover, tamper resistant, IP65 protection.

Watertight cover, tamp

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www.littelfuse.com/se-330, www.littelfuse.com/se-330hv

SE-330, SE-330HV SERIES

Features & Benefits

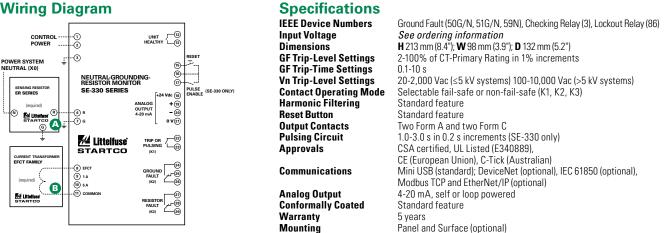
FEATURES	IEEE #	BENEFITS
Continuous NGR monitoring	3	Detects resistor failure within seconds, reduces transient-overvoltage risk, removes risk of ground-fault-detection failure
Ground-fault detection	50G/N, 51G/N, 59N	Main or backup protection to detect a ground fault anywhere on the monitored system
Adjustable pickup (2-100%)		Select greatest sensitivity without false operation, adjustable in 1% increments (MEM setting)
Adjustable time delay (0.1-10 s)		Adjustable trip delay allows quick protection and system coordination
Universal CT compatibility		Allows the use of a CT that gives required ground-fault settings
Output contacts		Two Form C (Ground Fault, Resistor Fault), Two Form A (Trip/Pulse, Healthy)
Analog output (4-20 mA)		Connect an optional PGA-0520 meter or control system
Pulsing output (SE-330 only)		Control the operation of a pulsing ground-fault-location circuit
Trip records		On-board 100-event (with date and time) recorder helps with system diagnostics
Harmonic filtering (DFT)		Eliminate false trips due to harmonic noise from ASDs
Local communications		Mini USB port to view measured values, configure settings, and check event records
Data Logging		On-board microSD card (included) can be used for long-term data logging
Network communications		Remotely view measured values and event records, reset trips, and cause a remote trip Available Protocol Options: IEC 61850 - with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface Modbus TCP and Ethernet/IP - with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface DeviceNet - with CAN interface
Software		PC-interface software (SE-MON330) is available at Littelfuse.com/RelaySoftware
Selectable contact operating mode		Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil or alarm circuit (Trip, Ground Fault, Resistor Fault relays)
Selectable reset mode		Selectable latching or auto-reset operation
Calibrate push button		Ensures resistor-failure sensitivity is correct
Unit-healthy output		Verifies SE-330 is operating correctly
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Typical Values

SYSTEM VOLTAGE	NEUTRAL-GROUN	IDING RESISTOR	SEN	ISING RESISTOR	GROUND-FAULT	V., PICKUP LEVEL	
(VOLTS)	CURRENT (AMPERES)	RESISTANCE (OHMS)	MODEL	RESISTANCE (SWITCH S5 SETTING)	PICKUP LEVEL (AMPERES)	(VOLTS)	
480	5	55	ER-600VC	20 kΩ	2.5	170	
600	5	69	ER-600VC	20 kΩ	2.5	200	
2,400	5	277	ER-5KV	20 kΩ	2.5	800	
4,160	5	480	ER-5KV	20 kΩ	3	1,700	
7,200	10	416	ER-15KV	100 kΩ	2	170 x 5 = 850	
14,400	15	554	ER-15KV	100 kΩ	3	340 x 5 = 1,700	

DISCLAIMER: The above table is for illustrative purposes only. Actual values may differ based on a variety of individual system considerations, such as capacitive charging current and coordination study results.

Wiring Diagram



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www.littelfuse.com/se-330, www.littelfuse.com/se-330hv

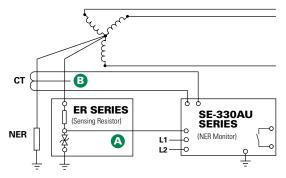


 $(\in \mathbf{C})$

SE-330AU SERIES

Neutral-Earthing-Resistor Monitor

Simplified Circuit Diagram



Ordering Information

0							
ORDERING NUMBER		POWER SUPPLY	COMN	Л			K4 UNIT HEALTHY CONTACT
SE-330AU	-	Х	X		-	0	Х
			0=USB	Only			
			1=Devi	ceNet			
			3=Ethe (Dual F				
SE-330AU for all apps. 35		0=120/240	4=Ethe (SC Fib	rNet er & RJ45)			0=Normally Open
kV or less SE-330HV		Vac/Vdc 2=48 Vdc	5=Ethe (Dual S	rNet SC Fiber)			1=Normally Closed
for 72 kV apps.		2-40 Vut	6=IEC6 (Dual F				Glosed
			7=IEC6 (SC Fib	1850 er & RJ45)			
			8=IEC6 (Dual S	1850 SC Fiber)			
				DEGUNDEN		-	

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional

Description

The SE-330AU Series is an advanced earth-fault and earthingresistor monitoring relay for low- and medium-voltage transformers and generators. It monitors neutral current, neutral-to-earth voltage, and neutral-to-earth resistance. It provides continuous monitoring of the neutral-to-earth path to verify that the neutral-earthing resistor (NER) is intact. This is of utmost importance—an open NER renders current-sensing earth-fault protection inoperative and could result in a false belief that the system is functioning properly. The SE-330AU earth-fault function complies with AS/NZS 2081.3:2002. Outputs include four relay outputs, and an analog output. A mini USB port is included to view measured values, configure settings, and check event records. An on-board micro SD card can be used for long-term data logging. Network communications options are available. For non-AS/NZS 2081 applications, see the SE-330 or SE-330HV Series.

Resistor Monitoring

The SE-330AU combines the measured values of resistance, current, and voltage to continuously determine that the NER is intact. It is able to detect a resistor failure with or without an earth fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 35 kV.

Earth-Fault Monitoring

The SE-330AU uses a 5- or 30-A-primary current transformer to provide a pickup-setting range of 0.125 to 5 A or 0.75 to 30 A to comply with AS/NZS 2081.3:2002. DFT filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Open-CT detection is provided.

Accessories



ER Series Sensing Resistor

Required interface between the power system and the SE-330AU. Eliminates hazardous voltage levels at the relay.

Warranty

Mounting

EFCT Series Earth-Fault Current Transformer Sensitive earth-fault current detection (5 A primary).

SE-CS30 Series Earth-Fault Current Transformer Sensitive earth-fault current detection (30 A primary).

Specifications

Input Voltage	See ordering info
Dimensions	H 213 mm (8.4"); \
GF Trip-Level Settings	0.125 to 30 A
GF Trip-Time Settings	0.1 to 0.5 s
Vn Trip-Level Settings	20-2,000 Vac (≤5 k
	100-10,000 Vac (>!
Output Contacts	Two Form A, Two
Operating Mode	Fail-Safe
Harmonic Filtering	Standard feature
Reset	Front panel push l
Approvals	C-Tick (Australian
Communications	Mini USB (standard
	(optional), Modbus
Analog Output	4-20 mA, self or l
Conformal Coating	Standard feature

ormation **W** 98 mm (3.9"); **D** 132 mm (5.2") kV systems) •5 kV systems) o Form C button and remote input n), CE d); DeviceNet (optional), IEC 61850 TCP and EtherNet/IP (optional) loop powered 5 years Panel, Surface (optional)

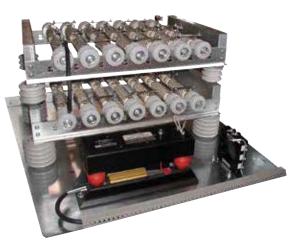
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NGR SERIES

Neutral-Grounding-Resistor System





For information about the NGRM-ENC NGR Monitor Control Panel, see Accessories.

Ordering Information

For information regarding a tailored NGR package, please fill out and submit the form at www.littelfuse.com/NGR-Quote

Description

Neutral-Grounding Resistors (NGRs) are used to ground power systems by inserting a resistor between the system neutral and ground. This reduces the prospective ground-fault current to a predetermined value.

A properly designed resistance-grounded system provides benefits over both ungrounded and solidly grounded systems. Because the system is grounded, transient overvoltages do not occur and ground-fault current can flow allowing it to be detected and measured. They also significantly reduce damage caused by ground faults on solidly grounded systems. Limiting ground-fault current eliminates the arcflash hazards associated with the first ground fault. The hazards associated with phase-to-phase electrical faults must still be mitigated by using arc-flash relays, feeder-protection relays, current-limiting fuses, and other methods. Groundfault relays (such as the SE-701) can be used on feeders to provide selective coordination and the ability to quickly locate or isolate the fault. Pulsing systems are also available as they are another popular fault-location method.

Applications

Resistance grounding is typically applied on transformers and generators where safety and continuity of service are paramount. A faulted feeder may remain in operation until it is safe to repair the fault, where allowed by the local electrical code.

Benefits

- Eliminate phase-to-ground arc-flash incidents
- Eliminate transient overvoltages
- Reduced point-of-fault damage
- Can provide continuity of service during a ground fault
- Optional pulsing ground-fault current to aid in fault location

Features

- ER-series Sensing Resistor and Current Transformer required for NGR monitoring come pre-installed inside the enclosure
- Can be packaged with a zigzag transformer to resistance ground an ungrounded delta system, a system bus fed by generators, or a system with an inaccessible neutral
- SE-325 or SE-330 NGR Monitor can provide continuous NGR monitoring and ground-fault protection; NGR failure will render all downstream current-sensing ground-fault protection inoperative
- Stainless steel resistor elements prevent corrosion
- Short-time and continuous-rated duty resistors are available

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Protection Relays Neutral-Grounding-Resistor Monitoring



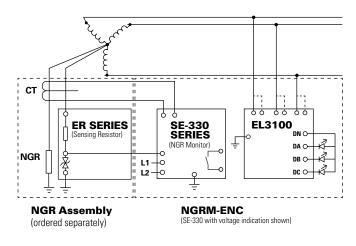
NGRM-ENC SERIES

NGRM-ENC





Simplified Circuit Diagram



Ordering Information

The following options are available with a faster shipping time:



Description

The NGRM-ENC Enclosed Neutral-Grounding-Resistor (NGR) Monitor series is a Type 4X enclosure housing a Littelfuse Startco SE-325 or SE-330 Neutral-Grounding-Resistor Monitor and optional accessories that include a 480/600-V control power transformer (CPT), faulted-phase indication (FPI; implemented with an EL3100 Ground-Fault & Phase-Voltage Indicator), earth-leakage panel meter, pulse-enable control, and mounting options. Appropriate fusing is included and field wiring is to terminal blocks.

Options



SE-325 Neutral-Grounding-Resistor Monitor Measures current and voltage in a transformer or generator neutral-to-ground connection and continuity of the neutral-grounding resistor.



SE-330 Neutral-Grounding-Resistor Monitor Advanced ground-fault and neutral-grounding resistor monitoring relay that measures neutral current, neutral-to-ground voltage, and neutral-toground resistance.



EL3100 Ground-Fault & Phase-Voltage Indicator Three panel-mounted LEDs indicate the ground-faulted phase.



Panel Meter

Panel-mounted meter displays earth leakage current as a percentage of the ground-fault-CT-primary rating.



RK-332/RK-302 Remote Indication and Reset Panel-mounted remote indication and reset assemblies are included with SE-325 and surface-mounted SE-330 configurations.

ORDERING NUMBER	PROTECTION RELAY OPTION	NGR MONITOR MOUNTING OPTION	AMMETER & PULSE CONTROL OPTION	COMMS	CONTROL-POWER TRANSFORMER OPTION
NGRM-ENC-000-01	SE-325	Surface mounted	None	None	CPT
NGRM-ENC-200-01	SE-330 (K4=N0)	Surface mounted	None	None	CPT
NGRM-ENC-201-01	SE-330 (K4=N0)	Panel mounted	None	None	CPT
NGRM-ENC-201-11	SE-330 (K4=N0)	Panel mounted	Ammeter	None	CPT
NGRM-ENC-230-01	SE-330 (K4=N0)	Surface mounted	None	Ethernet/2 RJ45 ports	CPT
NGRM-ENC-231-01	SE-330 (K4=N0)	Panel mounted	None	Ethernet/2 RJ45 ports	CPT

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Ordering Information

NGRM-ENC SERIES

	PROTECTION RELAY OPTION	NETWORK COMMUNICATIONS OPTION	NGR MONITOR MOUNTING OPTION		AMMETER & PULSE CONTROL OPTION	CONTROL-POWER TRANSFORMER OPTION
NGRM-ENC-	Х	Х	Х	_	Х	Х
	0=SE-325 1=SE-325 & voltage indication ⁽¹⁾ 2=SE-330 (N.O. K4) 3=SE-330 (N.O. K4) & voltage indication ⁽¹⁾ 4=SE-330 (N.C. K4) & voltage indication ⁽¹⁾ 6=SE-330HV (N.O. K4) & voltage indication ⁽¹⁾ 8=SE-330HV (N.C. K4) 9=SE-330HV (N.C. K4) & voltage indication ⁽¹⁾	0=No network communications 1=DeviceNet ⁽²⁾ 3=Ethernet, dual RJ45 ⁽²⁾ 4=Ethernet, 1 RJ45 & 1 fiber ⁽²⁾ 5=Ethernet, dual fiber ⁽²⁾ 6=IEC 61850, dual RJ45 ⁽²⁾ 7=IEC 61850, 1 RJ45 & 1 fiber ⁽²⁾ 8=IEC 61850, dual fiber ⁽²⁾	0=Surface-mounted NGR monitor ⁽⁴⁾ 1=Panel-mounted NGR monitor ⁽⁵⁾		0=No ammeter 1=Earth-leakage panel meter ⁽²⁾ 2=Earth-leakage panel meter & pulse-enable switch ⁽³⁾	0=No CPT 1=480/600-V CPT ⁽¹⁾

Note (1) - Includes fuses, (2) - SE-330 models only, (3) - SE-330 models only, excluding SE-330HV models, (4) - Includes panel-mounted indication & reset, and USB connector for SE-330 models, (5) - SE-330 models only; includes IP65 hinged transparent cover

Specifications

Enclosure	Polyester, Lockable. SE-330 panel-mount options are rated to IP65. All other options are rated to
	Type 4X.
Dimensions	H 454 mm (17.9"); W 406 mm (16");
	D 264 mm (10.4")
	Clearance required to open
	SE-IP65CVR-G 112 mm (4.4")
Approvals	cCSAus
Warranty	1 year

www.littelfuse.com/ngrm-enc

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FEEDER PROTECTION

Protect feeder circuits from overcurrents, earth faults, phase loss and other detrimental conditions in critical applications and processes. They provide essential data for predictive and preventive maintenance, extending the life of equipment, enhancing safety and maximizing efficiency.

FPU-32 Series	Feeder Protection Unit70
FPS Series	Feeder Protection System

For More Information... and to download datasheets and manuals on our Feeder Protection Relays, click Technical Resources at Littelfuse.com/FeederProtection

FPU-32 SERIES (PGR-7200)

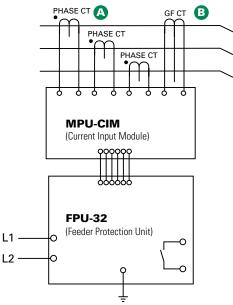
Feeder Protection Unit



LITTELFUSE STARTCO FEEDER PROTECTION UNIT FEE

NOTE: The FPU-32 consists of the Feeder Protection Unit (pictured above) and the MPU-CIM Current Input Module (not pictured).

Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATIONS
FPU-32-00-00	TIA-232
FPU-32-01-00	TIA-232 & RS-485
FPU-32-02-00	TIA-232 & DeviceNet™
FPU-32-04-00	TIA-232 & Ethernet

NOTE: One of the following is required: MPU-CIM-00-00 Current Input Module, or MPU-CTI-RT-00 Current Input Module with ring-tonque terminals.

ACCESSORIES	REQUIREMENT
Phase CTs	Recommended
Ground-Fault CT	Optional
MPU-16A-Y92A-96N	Optional
	•



The FPU-32 Feeder Protection Unit provides integrated protection, metering, and data-logging functions. It is an excellent choice for retrofitting and upgrading older relays because of its compact size and ability to use existing CTs. The FPU-32 is used to protect distribution feeders in processing, manufacturing, petroleum, chemical, and wastewater treatment facilities.

Features & Benefits

Description

FEATURES	BENEFITS
IEC & IEEE overcurrent protection curves	Definite and inverse time settings for system coordination; prevents catastrophic failures
Two setpoint groups	Create distinctive settings for maintenance or for two different loads
Reduced overcurrent mode	Maintenance mode setting to reduce the risk of arc-flash hazards
Data logging	On-board 100-event recorder and remote data logging helps with system diagnostics
Overload	Thermal protection for connected load
Phase loss/Phase reverse (current)	Detects unhealthy supply conditions
Unbalance (current)	Prevents overheating due to unbalanced phases
Communications	Remotely view measured values, event records & reset trips

Accessories



Phase Current Transformers

Phase CTs are required to detect phase currents.



Ground-Fault Transformer

Overload (49, 51)

Zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.

Specifications

Protective Functions (IEEE #)

Input Voltage Power-Up Time Ride-Through Time 24-Vdc Source AC Measurements

Frequency Output Contacts Approvals Communications Analog Output Conformally Coated Warranty Mounting (Control Unit) Phase sequence (46) Inverse-time overcurrent (50, 51) Unbalance (46) Ground fault (50G/N, 51G/N) Phase loss (46) RTD/PTC temperature (49) 65-265 Vac, 30 VA; 80-275 Vdc, 25 W 800 ms at 120 vac 100 ms minimum 400 mA maximum True RMS and DFT, Peak 32 samples/cycle and positive and negative sequence of fundamental 50, 60 Hz Three Form C CSA certified, CE, C-Tick (Australian), UL Recognized TIA-232 (standard); TIA-485, DeviceNet[™], Ethernet (optional) 4-20 mA, programmable Standard feature 10 years Panel (standard)

Definite-time overcurrent (50, 51)

(Current Input Module) DIN, Surface

RFEEDER PROTECTION

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FPS SERIES

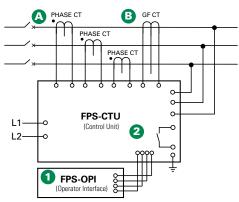
Feeder Protection System







Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATIONS
FPS-CTU-01-00	RS-485
FPS-CTU-02-00	RS-485 & DeviceNet [™]
FPS-CTU-03-00	RS-485 & Profibus®
FPS-CTU-04-00	RS-485 & Ethernet

ACCESSORIES	REQUIREMENT
FPS-0PI-01-00	Recommended
SE-IP65CVR-M	Optional
Phase CTs	Required
Ground-Fault CT	Recommended
MPS-RTD-01-00	Optional

Description

The FPS Feeder Protection System monitors voltage and current to provide a comprehensive package of 17 protective functions. The FPS is a modular system with integrated protection, breaker control, metering, and data-logging functions.

Operator Interface (FPS-OPI)

- Large, bright, 4 x 20 vacuum-fluorescent display
- Display metered values
- Access set points
- Powered by Control Unit
- Panel mount or attach directly to Control Unit
- Remote mounting (1.2 km or 4000 ft maximum loop length)
 1/2 DIN size
- Hazardous-location certified

2 Control Unit (FPS-CTU)

- Current inputs—5-A or 1-A secondary phase current transformers
- Voltage inputs—up to 600 V without PTs
- Earth-leakage input—5-A or 1-A secondary or sensitive transformer
- 8 digital inputs, 5 relay outputs, 1 analog input and output
- 24-Vdc supply for OPI and RTD modules, and for digital inputs
- IRIG-B time-code input
- 1/2 DIN size, surface mount
- RS-485 network communications (Standard)
- DeviceNet[™], Profibus[®], or Ethernet communications available

Accessories



Phase Current Transformers

Phase CTs are required to detect phase currents.



Ground-Fault Current Transformer

Zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.



MPS-RTD Temperature Input Module Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.



SE-IP65CVR-M Cover

Optional gasketed, transparent cover for limited access and IP65 protection for an Operator Interface Module.

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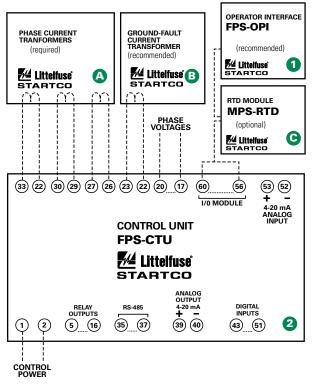
FPS SERIES

Feeder Protection System

Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Long-time overcurrent provides thermal protection for feeder or load
Inverse-time overcurrent	50, 51	Coordination using IEEE and IEC Curves
Definite-time overcurrent	50, 51	Instantaneous overcurrent to detect catastrophic failure
Current unbalance/ Phase loss/Phase reverse	46	Detects an open or high-impedance phase
Ground fault	50G/N, 51G/N	Inverse and definite time. Early insulation-failure detection.
RTD temperature	38, 49	Optional protection (MPS-RTD module) for load-temperature monitoring
Overvoltage	59	Limits stress to insulation
Undervoltage	27	Detects a damaging brown-out condition
Voltage unbalance	47	Detects unhealthy supply voltage
Two setting groups		Minimizes Arc-Flash hazards during maintenance
Breaker control		Allows local and remote operation; reduces component count
Metering		Displays the measured and calculated parameters
Data logging		On-board 64-event recorder helps with system diagnosis
Communications		Remotely view measured values, event records, & reset trips
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



Specifications

Protective Functions	Overload (49, 51)	Unbalance (current) (46)
(IEEE Device Numbers)	Phase reverse (current) (46)	Phase loss (voltage) (47)
	Overfrequency (81)	Overvoltage (59)
	Overcurrent (50, 51)	Phase loss (current) (46)
	Underfrequency (81)	Undervoltage (27)
	Ground fault (50G/N, 51G/N)	Phase reverse (voltage) (47
	Unbalance (voltage) (47)	Power factor (55)
	RTD temperature (38, 49)	
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 25 W	
Power-Up Time	800 ms at 120 Vac	
Ride-Through Time	100 ms minimum	
24-Vdc Source	100 mA maximum	
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and	
	positive and negative seque	ence of fundamental
Frequency	50 or 60 Hz	
Inputs	Phase current, Earth-leakage	current, Phase voltage,
	7 digital, 1 analog	
Output Contacts	5 contacts — See Product Ma	anual
Approvals	CSA certified, C-Tick (Australian)	
Communications	Allen-Bradley® DFI and Mo	dbus® RTU (Standard);
	DeviceNet™, Profibus®, Eth	ernet (Optional)
Conformal Coating	Standard feature	
Warranty	10 years	
Mounting:	,	
Control Unit	Surface	
Operator Interface	Panel, Control-Unit mounted	

4



ARC-FLASH PROTECTION

Rapidly detects developing Arc-Flash incidents and sends a trip signal to interrupt power before significant damage occurs.

D0920	Arc Detection Unit	74
PGR-8800 Series	Arc-Flash Relay	75
AF0500 Series	Arc-Flash Relay	77
AF0100 Series	Arc-Flash Relay	79
A0220 Series	Light Sensor	80
PGA-1100	Diode Logic	81



For More Information... and to download our White Paper on Key Considerations for Selecting an Arc-Flash Relay or our Arc-Flash Energy Reduction Workbook, visit Littelfuse.com/ArcFlash

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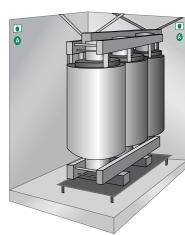
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D0920 ARC DETECTION UNIT

Arc Detection Unit



Installation Diagram



Install sensors in line of sight to possible arc faults.

Ordering Information

ORDERING NUMBER	DESCRIPTION
D0920.0060	230 V AC +15, -30%, remains powered on after trip, slide switch instead of key switch, electronic reset button instead of mechanical reset button, CCC approved

ACCESSORIES	REQUIREMENT
A0033.0010 Detector cable 2 x 0.25 mm ² w/screen. 100 m	Optional
A0220.0010 Arc Detector V-Type; 10 m cable	Required: At least one sensor per monitored zone
A0220.0020 Arc Detector V-Type; 15 m cable	per monitored zone
PGA-1100/D1100 Diode Logic Unit	Optional

Description

The D0920 Arc-Flash relay provides a simple and cost effective solution for Arc-Flash monitoring. Two light sensors can be connected directly to one relay.

C ∈ (@)

Light Sensors react to light and have a 180° detection zone. Sensors are supplied with 10 or 15 m of cable. 1-2 sensors are recommended per cubicle or drawer.

Features & Benefits

FEATURES	BENEFITS	
Compact module	Fits into wide range of Arc-Flash applications	
Trip time <1 ms	Limits Arc-Flash damage and risk of injury	
Two optical sensor cable lengths	Point sensors with 10 or 15 m of cable	
Inputs for two sensors	Single Arc-Flash relay can monitor 2 sensors	
Adjustable light sensitivity	Allows operation in bright environments and maximum sensitivity in dark environments	
Service mode	Allows relay and sensor test without tripping system	

Accessories



A0220 Light Sensors

Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Available with 10 or 15 m cable.



PGA-1100/D1100 Diode Logic Unit For tripping one circuit breaker with multiple D0920 Relays

Specifications

Supply Voltage Thyristor Output

Sensitivity Number of Sensors Response Time Power Consumption Ambient Temperature Dimensions Certification 230 V AC +15,-30% 325 V DC from charged capacitor, nominal energy 3.5 J Adjustable 2 - 24 klux Max. 2 Less than 1 ms 3.5 VA -25° C to 70^{\circ}C H 90 mm (3.5"); W 105 mm (4.1"); D 61 mm (2.4") CE, CCC

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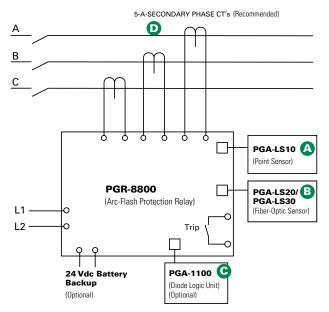
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PGR-8800 SERIES (D1000)

Arc-Flash Relay



Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER	DESCRIPTION
PGR-8800-00 (UL, CE, CSA, RCM)	Arc-Flash Relay
PGR-8800-00-CC (UL, CE, CSA, RCM)	Arc-Flash Relay, Conformally Coated
ACCESSORIES	REQUIREMENT
PGA-LS10	Required*
PGA-LS20, PGA-LS30	Required*
PGA-1100	Optional
Current Transformer	Recommended

*At least one sensor is required. However, the exact number of sensors for proper coverage depends on the application.



Description

The PGR-8800 Series is a microprocessor-based relay that limits arc-fault damage by detecting the light from an arc flash and rapidly tripping. Phase-current-transformer inputs are provided for current-constrained arc-flash protection and, when so equipped, a programmable definite-time overcurrent function can be enabled. An optical sensor on the PGR-8800 and adjustable trip level reduce the chance of nuisance tripping by setting a threshold for ambient light. Sensors, inputs, and connections are monitored to ensure fail-safe operation. A secondary solid-state trip circuit provides a redundant trip path. A USB port is used for configuration and access to event logs and graphs.

Optical Sensors

The PGR-8800 accepts both PGA-LS10 and PGA-LS20/ PGA-LS30 optical sensors, designed to collect light over a wide angle and with high sensitivity. For fast fault location, front-panel and sensor LED's indicate sensor health and which sensor detected an arc fault.

Sensor Placement

The PGR-8800 Arc-Flash Relay and sensors are easily installed in retrofit projects and new switchgear with little or no re-configuration. Even elaborate systems with multiple power sources take minutes to configure using the relay's built-in USB interface software.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical bus bars, breaker compartments, drawers, and anywhere that there is potential for an arc-fault. Threading a fiber-optic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy. Even if policy is to only work on de-energized systems, all maintenance areas should be monitored to prevent potential damage and additional cost. At least one sensor should have visibility of an arc fault if a person blocks the other sensor(s).

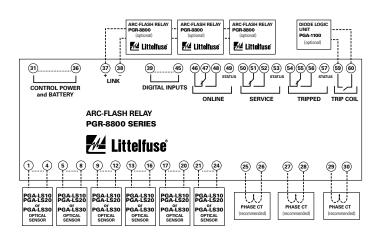


PGR-8800 SERIES (D1000)

Features & Benefits

FEATURES	BENEFITS
Arc-Flash trip time <1 ms	Limits arc-flash damage and risk of injury
Multiple sensors (up to 24)	Single module can monitor 6 sensors. Up to 4 PGR-8800 units can be linked into one system
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
Redundant trip circuit	Solid-state backup arc-detection circuit adds a second layer of safety
Adjustable light sensitivity	Allows for operation in bright environments and maximum sensitivity in dark environments
LED indication (on unit and each sensor)	18 LEDs provide at-a glance status for module and I/O state
Current detection	Phase-CT inputs provide overcurrent protection and prevent nuisance trips
Optical detection	Point and fiber-optic sensors provide wide detection area with sensor health trip indication
Digital inputs (6)	Two each: remote trip, inhibit, and reset inputs
Service mode	Allows for system test without tripping
Trip coil contact	Solid-state 24-300 Vdc/24-300 Vac IGBT
Indication contacts	Form C and status outputs
USB interface	Data logging and configuration software uses a USB interface with no drivers or software installation
Built-in sensor	Can be used in single-sensor systems, as a seventh sensor, and for calibration
Universal power supply/Battery backup	100-240 Vac, 14-48 Vdc, or 110-250 Vdc supply accepted. Ability to charge and run off an external, user-supplied 24 Vdc battery
Data logging	On-board event recorder helps with system diagnostics
Modbus	Remotely view measured values, event records & reset trips
Upstream Tripping	Ability to trip upstream device if the local breaker fails to clear the fault

ARC-FLASH PROTECTION



Accessories



PGA-LS10 Point Sensor

Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Sensor health and trip indication. Dimensions: See PGR-8800 Manual



PGA-LS20/PGA-LS30 Fiber-Optic Sensor

360° light sensor for tricky installations with many shadows or to run along bus bars. Sensor health and trip indication. Dimensions: See PGR-8800 Manual



PGA-1100 Diode Logic Unit

This module allows multiple PGR-8800 relays to trip the same breaker, for example an upstream or a tie-breaker. Dimensions: **H** 80mm (3.15"); **W** 20mm (0.79"); **D** 70mm (2.76")



Current Transformers

Eliminate nuisance arc-flash trips and use for overcurrent protection.

Specifications

IEEE Device Numbers Input Voltage Dimensions **Optical Trip Settings Current Trip Setting (A) Indication Contact Mode** Trip Coil Voltage⁽¹⁾ **Trip Coil Contact Mode Redundant Trip Circuit** Input Monitoring **USB** Interface **Trip, Reset, Service Buttons Expandable System** Warranty Mounting Approvals

Overcurrent (50), Arc Flash (AFD) 100-240 Vac, 14-48 Vdc, and 110-250 Vdc H 130 mm (5.1"); W 200 mm (7.9"); D 54 mm (2.1") 9-25 klux, 800 µs-20 s Programmable Fail-safe 24-300 Vdc, 24-300 Vac Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Link up to 4 PGR-8800 units 5 years Surface, DIN (with D0050 adapter clips) UL, CE, CSA, RCM, FCC, DNV type approval, ABS type approval

NOTE (1) - Contact Littelfuse for trip coil voltages higher than 300 Vdc/Vac.

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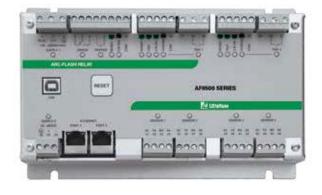
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AF0500 SERIES

Arc-Flash Relay





Features & Benefits

FEATURES	BENEFITS
4 arc sensor inputs	Supports both point and fiber sensors
Arc-Flash trip time <1ms	Limits arc-flash damage and risk of injury
2 IGBT high speed trip outputs	Supports applications such as upstream breaker tripping or tie breaker tripping
Universal Power Supply	100-240 Vac, 24-48 Vdc, or 110-250 Vdc supply
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
LED indication (on unit and each sensor)	Trip and sensor status indicated both on relay and sensors
Discrete wire networking	Multiple AF0500 units can be interconnected to form a system
USB interface	Data logging and configuration software uses a USB interface with no drivers or software installation
Data logging	On-board event recorder for system diagnostics (2048 log lines)
Ethernet interface	Modbus® TCP communication

Ordering Information

•	
ORDERING NUMBER	DESCRIPTION
AF0500-00	Arc-Flash Relay
AF0500-00-CC	Arc-Flash Relay, Conformally Coated
ACCESSORIES	REQUIREMENT
PGA-LS10	Required*
PGA-LS20, PGA-LS30	Required*
PGA-1100	Optional

Description

The AF0500 is a microprocessor-based arc-flash relay that limits arc-fault damage by detecting the light from an arc flash and rapidly tripping the feeder breaker. The unit is well suited for switchgear, transformer and power converter applications.

Sensors, inputs, and connections are health monitored to ensure fail-safe operation. A secondary solid-state trip circuit provides a redundant trip path. A USB port is used for configuration and access to event logs.

AF0500 includes an Ethernet interface and supports Modbus[®] TCP communication. Zone tripping, upstream breaker tripping and tie breaker tripping applications can be easily configured.

A number of control inputs allows interconnection of multiple AF0500 units to form a system.

Optical Sensors

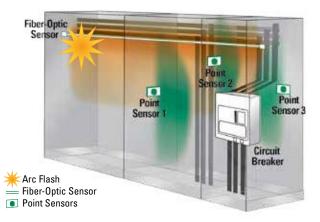
The AF0500 accepts both PGA-LS10 point sensors and PGA-LS20/PGA-LS30 fiber-optical sensors. Thus any combination of fiber or point sensors is supported.

For fast fault location, front-panel and sensor LEDs indicate sensor health and which sensor detected an arc fault.

Sensor Placement

The AF0500 Arc-Flash Relay and sensors are easily installed in retrofit projects and new switchgear with little or no re-configuration. Simple applications work straight out of the box with no need of PC configuration. More complex systems with multiple power sources are configured using the relay's built-in USB interface software.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical bus bars, breaker compartments, drawers, and anywhere that there is a risk for an arc fault. Threading a fiber-optic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy. Even if policy is to only work on de-energized systems, all maintenance areas should be monitored to prevent potential damage and additional cost.



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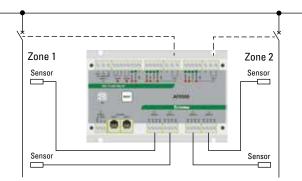


AF0500 SERIES

Applications

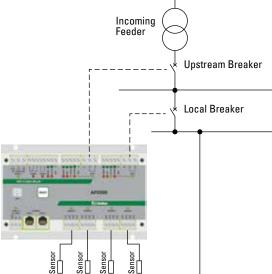
Zone Tripping

AF0500 can trip 2 separate zones. Sensors can be assigned to the zones individually through PC configuration.



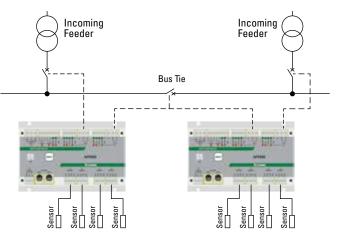
Upstream Breaker Tripping

In case of failure of the local circuit breaker to open, another trip command is sent after a short delay to an upstream breaker to clear the fault.



Tie Breaker Tripping

In case of an arc in one section of the switchboard, the AF0500 can trip both the incoming feeder and the tie breaker simultaneously. Thus the affected part of the switchboard is isolated from the non-affected part.



Accessories



PGA-LS10 Point Sensor

Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Includes Sensor health and trip indication.



PGA-LS20/PGA-LS30 Fiber-Optic Sensor 360° light sensor to run along bus bars. Sensor health and trip indication.

PGA-1100 Diode Logic Unit This module allows multiple arc-flash relays to trip a common breaker, for example a tie-breaker.

Specifications

Power Supply		Communication	Ethernet, 2 ports with internal Ethernet switch,
Universal	100 to 240 Vac (+10%, -15%) 50/60 Hz, 20 VA,		Modbus [®] TCP
	110 to 250 Vdc (+10%, -20%) 8 W	Dimensions	H 130 mm (5.1"); W 200 mm (7.9"); D 54 mm (2.1")
Low Voltage	24 to 48 Vdc (+10%, -20%), 4 W	Shipping Weight	0.9 kg (2 lb)
Sensor Inputs	4 light sensor inputs for PGA-LS10, PGA-LS20	Operating Temp.	-40°C to +70°C (-40°F to 158°F)
	and PGA-LS30 sensors	Approvals	UL Listed (UL508), CE, RCM, FCC, CSA
Trip Outputs	2 IGBT switches	Warranty	5 years
UL Rating	120/240 Vac, 1800 VA, 0.75 A maximum continuous,	Mounting	Surface, DIN (with optional D0050 adapter clips)
	125/250 Vdc, 138 VA, 0.75 A maximum continuous		
Supplemental Rating			
Make/Carry	30 A for 0.2s		
Voltage Rating	24 to 300 Vac, 24 to 300 Vdc		
Current Rating	20 A for 2 s, 10 A for 5 s		

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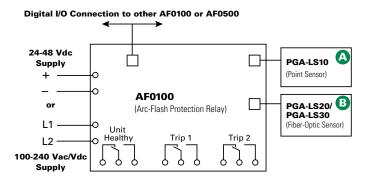


AF0100 SERIES

Arc-Flash Relay



Simplified Circuit Diagram



For dimensional drawing see: Appendix page 510, Figure 11.

Ordering Information

ORDERING NUMBER	DESCRIPTION
AF0100-00	Arc-Flash Relay, Universal Supply
AF0100-10	Arc-Flash Relay, 24-48 Vdc

Specifications

Input Voltage AF0100-00 100-240 Vac/Vdc, 24-48 Vdc AF0100-10 24-48 Vdc Dimensions **H** 90 mm (3.5"); **W** 128 mm (5.0"); **D** 60 mm (2.4") **Trip, Error Relays** Form C, 250 Vac/30 Vdc, 6 A resistive Sensitivity 10-25 klux programmable Mounting Surface, DIN rail **Operating Temperature** -40°C to +70°C (-40°F to 158°F) **Shipping Weight** 1.0 kg (2.2 lb) Certifications Contact factory Warranty 2 years

Description

The AF0100 Series arc-flash relay is a cost-effective solution that reduces arc-fault damage by detecting the light from an arc flash and rapidly tripping. Two remote light sensors can be connected to one relay and multiple AF0100 and/or AF0500 relays can be connected to monitor additional sensors, providing complete coverage for a wide range of applications. The compact, DIN-rail or surface-mountable body makes this an ideal solution for equipment manufacturers.

Two isolated Form-C contacts are provided for applications with multiple devices that must be tripped. This is especially useful for generator applications where the generator and breaker need to be tripped in case of an arc flash.

The AF0100 accepts PGA-LS10 point sensors and PGA-LS20/ PGA-LS30 fiber-optic sensors in any combination. Sensor health is continuously monitored to ensure fail-safe operation. A solid-state redundant trip circuit provides an internal fail-safe mechanism and fast arc-flash response during power up.

Front-panel and sensor LEDs indicate sensor health and fault location.

Features & Benefits

FEATURES	BENEFITS
Compact	Fits into a wide range of arc-flash applications
Two optical sensor types	Point sensors or fiber-optic sensors can be used in any combination for coverage flexibility
Dual sensor inputs	One relay can monitor two arc-flash sensors
Adjustable light sensitivity	Allows for operation in bright environments and maximum sensitivity in dark environments
Discrete wire networking	Multiple AF0100 or AF0500 units can be interconnected to form a system
Fail-safe system	Continuous monitoring of optical sensors and inputs ensures protection
USB interface	Configuration software is easy to use with no drivers or software installation
Unit health	Ensures continuous protection with self diagnostic and remote unit-healthy indication
LED Indication	Trip and sensor status indication both on relay and sensors

Accessories



PGA-LS10 Point Sensor

Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Includes sensor health and trip indication.



PGA-LS20/PGA-LS30 Fiber-Optic Sensor 360° light sensor to run along bus bars. Includes sensor health and trip indication.

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Protection Relays Arc Detectors

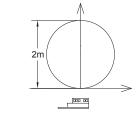
A0220 SERIES

Arc Detecting Point Sensor



Detection range for a 3kA fault

2m 2m 2m-2m-



Ordering Information

ORDERING NUMBER	CONTROL POWER
A0220.0010	Arc Detector type V, 10 m
A0220.0020	Arc Detector type V, 15 m
A0220.0030	Arc Detector type V, 10 m, CCC approved
A0220.0040	Arc Detector type V, 15 m, CCC approved

Connection to D0920 relay

SENSOR WIRE	TERMINAL
Red	1
Green	2
Screen	3

Description

The A0220 Arc Detector is a photo electric sensor. It has a sensitive area of 180°. Sensor signal is a mA current signal of 0.5 mA/klux. The sensor includes 10 m of shielded two-wire electrical cable which can easily be shortened or extended to a maximum of 50 m. Use Belden 85240 or equivalent cable $(2 \times 0.50 \text{ mm}^2)$.

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A0220 Drill

guide

4 x ø3.5

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The sensor is compatible with the D0920, D1000 and PGR-8800 Littelfuse Arc Flash Relays.

A0220 Sensor Installation

The sensors include an adhesivebacked drill template for easy surface or panel-mount installation. All dimensions are shown in millimetres.

Affix the drill template where the sensor is to be mounted. Either M4 or M5 screws or pop rivets (4 mm or 5 mm) can be used.

Mounting screws are M4 for the top holes. This template matches the mounting dimensions for the A1000 or PGA-LS10 sensor.

The bottom mounting holes are either for 5mm self-drilling screws (3.5mm drill) or for M5 (4.2 mm drill). This template matches the mounting dimensions for the A0200 and A0300 sensors.

For placement of sensors please refer to the relay manual.

Specifications

Sensitivity Range for D0920 Range for PGR-8800 Ambient temperature Degree of protection 0.5 mA/ klux 2 klux to 30 klux 10 klux to 30 klux -25°C to +70°C IP65

Type Selection Table:

A0220 Arc Detector includes 10m cable



SENSOR WIRE	SENSOR 1 TERMINAL	SENSOR 2 TERMINAL	SENSOR 3 TERMINAL	SENSOR 4 TERMINAL	SENSOR 5 TERMINAL	SENSOR 6 TERMINAL
Green	4	8	12	16	20	24
Red	3	7	11	15	19	23
Screen	Chassis	Chassis	Chassis	Chassis	Chassis	Chassis

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Protection Relays

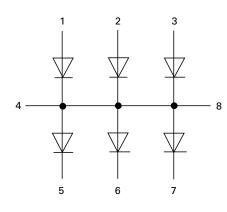
Accessory for Arc-Flash Relays

PGA-1100 (D1100)

Diode Logic



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	DESCRIPTION
PGA-1100.0010	Diode logic unit

Description

The PGA-1100 Diode Logic module is an optional accessory for the Littelfuse Arc-Flash Relays.

It is used in installations with more than one breaker and more than one Arc-Flash Relay. Purpose of the unit is to separate the trip paths, so the breakers can be tripped independently from each other.

Typical applications are a switchboards with two incoming feeders and one tie breaker or switchboards with several protected zones and tripping of a common upstream circuit breaker.

The unit has three input diodes to handle the outputs of three Arc-Flash relays and three output diodes to handle the trip coils of three circuit breakers. If more than three relays/ circuit breakers are needed, more units can be added by connecting terminal 8 of one box to terminal 4 of the next one, thus increasing the number of inputs and outputs with multiples of three.

For more application information please refer to the arc-flash relay manuals.

Specifications

Diodes	1000V reverse voltage, 3A continuous, 25A for 1 second
Certification	CE
Dimensions	H 70 mm (2.76"); W 20 mm (0.79"); D 80 mm (3.15")



CE



Protection Relays

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SWITCHING RELAYS & CONTROLS

Simple controls perform a specific function such as changing lamp intensity; vary the speed of a motor; or manage temperature of a heater.

PHS Series	Phase Control	4
SIR Series	Solid-State Relay - Isolated8	6
SLR Series	Solid-State Relay - Non-Isolated8	8
TCR9C	Temperature Controller9	0

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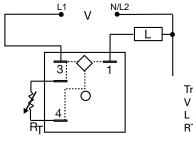
Phase Control

PHS SERIES





Wiring Diagram



Triac Output Device V = Voltage L = Load RT = External Adjustment

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

MODEL	INPUT VOLTAGE	RATING
PHS120A10	120VAC	10A
PHS120A20	120VAC	20A
PHS120A6	120VAC	6A
PHS230A10	230VAC	10A
PHS230A20	230VAC	20A
PHS230A6	230VAC	6A

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The PHS Series is an ideal method of changing lamp intensity, varying the speed of a fan/motor, or controlling the temperature of a heater. The effective output voltage is adjusted with an accessory external potentiometer suitable for line voltage applications.

Operation

Upon application of input voltage, effective output voltage can be varied by changing the external resistance value. As the external resistance increases, the effective output voltage decreases. The inverse is also true.

Features & Benefits

FEATURES	BENEFITS
External adjustment - 230VAC rated potentiometer	Allows control of heavy loads directly, solid state design will provide long life
Up to 20A steady state - 200A inrush	Allows control of heavy loads directly, solid state design will provide long life
Single hole surface mounting	Provides quick and easy installation

Accessories



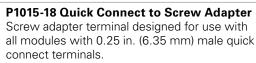
P1004-174 (100kΩ 1W), **P1004-175** (200kΩ 2W) **Versa-Pot**

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



6

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Specifications

PHS SERIES

Output Type Rating

Variable voltage phase angle control **Steady State (at 100% On)** 1A 1A 10A 6A 10A 100A 20A 200A

Minimum Load Current Voltage Drop Input Voltage Tolerance AC Line Frequency Protection Dielectric Breakdown Insulation Resistance Mechanical Mounting * Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

External Adjustment Potentiometer 120VAC 230VAC 20A 100mA ≅ 2.0V at rated current 120 or 230VAC

±20% 50/60Hz

 \geq 2000V RMS terminals to mounting surface ${\geq}100M\Omega$

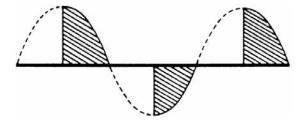
Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing 1A: ≅ 2.4 oz (68 g) 6, 10, & 20A: ≅ 3.9 oz (111 g)

 $100 K\Omega$ rated at 1W $200 K\Omega$ rated at 2W Must have insulation resistance suitable for line voltage applications.

*Units rated ≥ 6A must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

Typical Output Waveform



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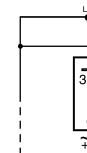
SIR SERIES

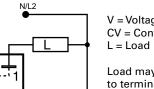
Solid-State Relay - Isolated

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Wiring Diagram





V = Voltage CV = Control Voltage

Load may be connected to terminal 3 or 1.

Note: Normally open output is shown. Normally closed output is also available.

For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The SIR Series is designed for industrial applications requiring rugged reliable operation. Provides an optically isolated, high capacity, solid-state output, with power switching capability up to 20A steady state, 200A inrush. Zero voltage switching SIR2 extends the life of an incandescent lamp up to 10 times. Random switching SIR1 is ideal for inductive loads. When fully insulated female terminals are used on the connection wires, the system meets the requirements for touch-proof connections.

Operation

The solid-state output is located between terminals 1 and 3, and is normally open or normally closed without control voltage applied to terminals 4 and 5. When control voltage is applied to terminals 4 and 5, the solid-state output opens or closes respectively.

Reset: Removing control voltage resets the output. The unit is also reset if output voltage is removed.

Features & Benefits

FEATURES	BENEFITS
Compact design measures 2 in. (50.8mm) square	Perfect for OEM applications where space is limited
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration and humidity
Up to 20A, 200A inrush output rating	Provides direct control of heavy inductive, incandescent or resistive loads
Switching output is optically isolated from the control input	Provides the ability to interface between 2 different electrical circuits
SIR1 models provide random switching	Designed for use with resistive and incandescent loads, extending lamp life up to 10 times
SIR2 models provide zero voltage switching	Perfect for resistive and incandescent loads
Metalized mounting surface	Facilitates heat transfer in high current applications

Ordering Information

SWITCHING	CONTROL VOLTAGE	RATING	OUTPUT FORM	OUTPUT VOLTAGE
Random	9 to 30VAC or DC	3A	Normally open	120VAC
Random	9 to 30VAC or DC	20A	Normally open	120VAC
Random	90 to 150VAC or DC	6A	Normally closed	120VAC
Random	190 to 290VAC or DC	20A	Normally closed	230VAC
Zero voltage	9 to 30VAC or DC	20A	Normally open	120VAC
Zero voltage	90 to 150VAC or DC	20A	Normally open	120VAC
Zero voltage	90 to 150VAC or DC	20A	Normally closed	120VAC
	Random Random Random Random Zero voltage Zero voltage	Random9 to 30VAC or DCRandom9 to 30VAC or DCRandom90 to 150VAC or DCRandom190 to 290VAC or DCZero voltage9 to 30VAC or DCZero voltage90 to 150VAC or DC	Random9 to 30VAC or DC3ARandom9 to 30VAC or DC20ARandom90 to 150VAC or DC6ARandom190 to 290VAC or DC20AZero voltage9 to 30VAC or DC20AZero voltage90 to 150VAC or DC20A	Random9 to 30VAC or DC3ANormally openRandom9 to 30VAC or DC20ANormally openRandom90 to 150VAC or DC6ANormally closedRandom190 to 290VAC or DC20ANormally closedZero voltage9 to 30VAC or DC20ANormally openZero voltage90 to 150VAC or DC20ANormally open

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Accessories

SIR SERIES

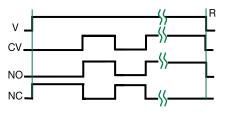


P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Function Diagram



Specifications

Output Type Form Voltage Tolerance	Optical isolation SPST, NO or NC 24, 120, or 230V ±20%		d state
Ratings	Steady State	Inrush*	Output Device
	ЗA	30A	Triac
	6A	60A	Triac
	10A	100A	Triac
-	20A	200A	Triac
Minimum Load Current	≅ 50mA		
Voltage Drop	≅ 2.0V at rated current		
Leakage Current (Open State)	≅6mA		
Input			
Туре	Optical isolation		transistor
Control Voltage	9 to 290VAC/DC	C in 3 ranges	
Power Consumption	≤ 0.5W		
Protection	F 1		
Circuitry	Encapsulated		
Dielectric Breakdown		erminals to m	nounting surface
Insulation Resistance	≥ 100 MΩ		
Mechanical	0		
Mounting* Dimensions			(M5 x 0.8) screw
Dimensions	H 50.8 mm (2.0" D 38.4 mm (1.51		m (2.0);
Termination			connect terminals
Environmental	0.20 111. (0.00 1111	n male quick	
Operating/Storage			
operating/storage		_	

Temperature Humidity Weight -40° to 60°C / -55° to 85°C 95% relative, non-condensing ≅ 3.9 oz (111 g)

*Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

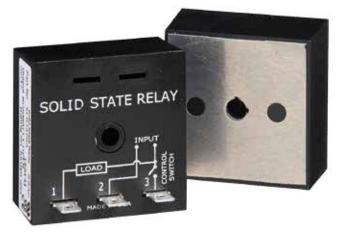
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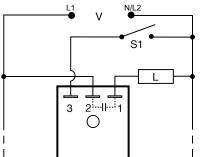
SLR SERIES

Solid-State Relay - Non-Isolated

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Wiring Diagram



V = Voltage S1 = Initiate Switch L = Load

Note: Normally open output is shown. Normally closed output is also available.

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

MODEL	SWITCHING	INPUT VOLTAGE	OUTPUT RATING	OUTPUT FORM
SLR1420A	Random	120VAC	20A	Normally open
SLR1610A	Random	230VAC	10A	Normally open

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Description

The SLR Series has no isolation between the control switch input and the solid-state output. Select the SLR for applications where the control switch is the same voltage source as the load. Provides the noiseless, reliability and long life of a solid-state relay, without the cost of isolation circuitry. The SLR Series offers random switching and is normally used for inductive loads. When fully insulated female terminals are used on the connection wires, the system meets the requirements for touch-proof connections.

Operation

The solid-state output is located between terminals 1 and 2 and can be ordered as either normally open or normally closed, when voltage is applied and S1 is open. When S1 is closed, the solid-state output between terminals 1 and 2 closes (or opens). If S1 is opened, the solid-state output will open (or close).

Reset: Opening S1 resets the output to its original state. Reset is also accomplished by removing input voltage.

Features & Benefits

FEATURES	BENEFITS
Compact design measures 2 in. (50.8mm) square	Perfect for OEM applications where space is limited
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Up to 20A steady, 200A inrush output rating	Provides direct control of heavy inductive, resistive, or incandescent loads
Metalized mounting surface	Facilitates heat transfer in high current applications

Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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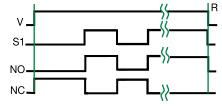
Specifications

SLR SERIES

Output (Contact) Type	Non-isolated sol	id state		,
Form	SPST, NO or NC	SPST, NO or NC		
Voltage	24, 120, or 230V/	AC		S
Tolerance	±20%			N 1.
Ratings	Steady State	Inrush*	Output Device	N
	1A	10A	SCR & Bridge Rectifier	N
	6 A	60A	Triac	
	10A	100A	Triac	
	20A	200A	Triac	
Minimum Load Current	≅ 50mA			
Voltage Drop				
(at Rated Current)	≅ 2.0V - 6, 10, & 20A units; ≅ 2.5V - 1A units			
Leakage Current (Open State)	≤5mA			
Initiate Switch Voltage	Same as the out	put voltage		
Power Consumption	≤ 0.5W			
Protection				
Circuitry	Encapsulated			
Dielectric Breakdown	\ge 2000V RMS terminals to mounting surface			
Insulation Resistance	≥ 100MΩ			
Mechanical				
Mounting*			(M5 x 0.8) screw	
Dimensions	H 50.8 mm (2.0"		n (2.0");	
	D 38.4 mm (1.51'	,		
Termination	0.25 in. (6.35 mm) male quick connect			
	terminals			
Environmental				
Operating/Storage				
Temperature	-20° to 60°C / -4			
Humidity	95% relative, non-condensing			
Weight	1A units: ≅ 2.4 0	-		
	6, 10, 20A units:	≅ 3.9 oz (111	g)	

*Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact R = Reset $-\frac{1}{2} = Undefined$ Time

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TCR9C

Temperature Controller

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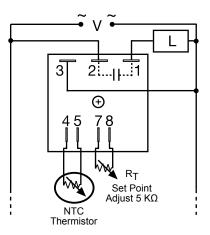


V = Voltage

Caution: NTC Thermistor must

be electrically insulated, 1500 volts BMS minimum

L = Load



For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The TCR9C of solid-state temperature control is a low cost modular approach to accurate control of temperature. The high power output is available in 20 amperes and provides setpoint temperature control. The efficient mounting surface allows for utilization of equipment as the heat sink. Designed for use with resistive loads.

Operation

Setpoint Control: TCR9C is a single setpoint temperature controller. When the thermistor resistance is high (above the setpoint), the solid-state output is ON. When the thermistor resistance decreases (temperature increases) to setpoint or below, the output turns OFF. It must be recognized that temperature differential (under and overshoot) is largely due to the system as a whole. The mass of the system, size of the heaters and sensor all play an important part. Single setpoint control is best when there is little or no lag time between heater and sensor, and when the heater is not oversized.

Features & Benefits

- NTC thermistor sensing for low cost setpoint control
- Solid-state output to control resistive heaters
- External adjustment of the setpoint
- Small package, encapsulated, single-screw mounting
- Metal mounting surface utilizes equipment as heat sink

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

Specifications

Control Туре Single setpoint, negative temperature coefficient resistance sensing Sensor Type Thermistor, negative temperature coefficient (customer supplied) Electrically insulated for 1500V RMS min. Adjustment Temperature setpoint selected by means of an external resistance $\leq \pm 5\%$ of the setpoint resistance Accuracy Add the tolerance of the NTC thermistor and the drift of the adj. pot over temp. range Setpoint vs. Ambient **Temperature and Operating Voltage** ±5% of setpoint resistance **Reset Time** ≤ 150ms Input Voltage 120 - 240VAC Tolerance ±15%

50/60 Hz

www.littelfuse.com/tcr9c

90

AC Line Frequency



Output

TCR9C

Туре Form Rating

Minimum Load Current Voltage Drop Off State Leakage Current Protection **Dielectric Breakdown Isolation Voltage** Circuitry Mechanical Mounting Dimensions

Termination **Environmental**

Operating/Storage Temperature Humidity Weight

Solid state Non-isolated, single pole, zero voltage switching Model **Steady State** Inrush* С 20A 200A* 100mA ≈ 2V at rated current ≈ 5mA @ 230VAC ≥2000 volts terminals to mounting surface ≥100mΩ Encapsulated Surface mount with one #10 (M5 x 0 .8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0");

0.25 in. (6.35mm) male quick connect terminals

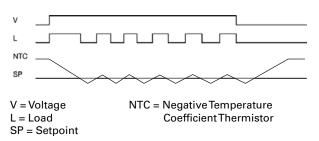
-40° to 60°C / -40° to 85°C 95% relative, non-condensing

≅ 2 .7 oz (77 g)

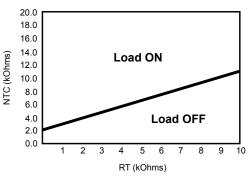
D 38.4 mm (1.51")

* Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: non-repetitive for 16ms.

Function Diagram



Adjustment vs. Thermistor Resistance



Note: If R_T value exceeds 13kOhms, the output will not energize.



Protection Relays

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MOTOR & PUMP PROTECTION

Prevent damage to motors caused by overloads, jams, phase loss or unbalance, heat from non-electric sources, heavy start-ups and excessive operational cycles. Dynamic thermal curves, as well as integrated protection, metering, and data-logging functions extend motor life and maximize process efficiency.

PGR-6100 Series	Motor Cround Foult & Insulation Poloy 04
	Motor Ground-Fault & Insulation Relay 94
PGR-6101-120	Motor Ground-Fault & Insulation Relay 95
MPU-32 Series	Motor Protection Unit
MPS Series	Motor Protection System98
MPU-32-X69X Series	Motor Protection Relay Retrofit Kit 100
MPS-469X Series	Motor Protection Relay Retrofit Kit100
111-Insider-P /	
231-Insider-P	Single-Phase Pump Monitor101
232-Insider	Single-Phase Pump Monitor104
111P / 233P /	
233P-1.5 Series	Single-Phase Pump Monitor106
234-P	Single-Phase Pump Monitor108
235P	Single-Phase Pump Monitor110
MP8000 Series	Bluetooth® Current & Voltage Monitor 112
777 Series	3-Phase Current & Voltage Monitor 114
777 / 77C Series	Single-Phase Current & Voltage Monitor 118
777-KW/HP-P2 Series	3-Phase Current & Voltage Monitor 120
777-AccuPower	3-Phase Current & Voltage Monitor 123
77C-KW/HP Series	Single-Phase Current & Voltage Monitor 125
SIO-RTD-02-00	Temperature Input Monitor



For More Information...

and to download our Motor Protection Brochure or White Paper, click on Technical Resources at Littelfuse.com/MotorProtection

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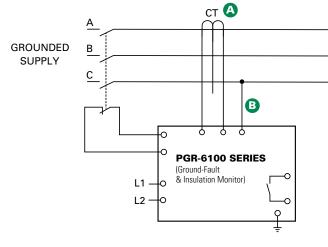
PGR-6100 SERIES (GFR4000)

Ground-Fault & Insulation Monitor





Simplified Circuit Diagram



Ordering Information

•		
ORDERING NUMBER	CONTROL POWER	
PGR-6100-120	120 Vac	
PGR-6100-240 ⁽¹⁾	240 Vac (1)	
ACCESSORIES	REQUIREMENT	
SE-CS30 Series	Required	
PGH Family	Required >1300 V	
PGA-0500	Optional	
PGA-0510	Optional	
Nata (1) BCB 6100 240 ordering aption is not III Listed		

Note (1) - PGR-6100-240 ordering option is not UL Listed. For optional conformal coating please consult factory.

Description

The PGR-6100 combines the features of a ground-fault protection relay and insulation monitor into one unit. It protects against ground faults by monitoring insulation resistance when the motor is de-energized and by monitoring ground-fault current when the motor is energized. The PGR-6100 features two separate analog outputs for optional current and ohm meters, and two separate alarm relays. It operates on one- or three-phase solidly grounded, resistance-grounded and ungrounded systems up to 6 kV.

Features & Benefits

FEATURES	BENEFITS
Adjustable GF pickup (10 mA-3 A)	Trip setting provides a wide range of low-level protection and system coordination
Adjustable insulation pickup (250 kΩ - 2 MΩ)	Customizable insulation resistance setpoints for maximum protection
Adjustable time delay (50 ms-1.0 s)	Adjustable trip delay for quick protection and system coordination
Output contacts	Two Form C output contacts for ground fault and insulation-resistance fault
Analog outputs (0-1 mA)	Two analog outputs indicate insulation resistance and ground-fault current
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil

Accessories



SE-CS30 Series Ground-Fault CTs

Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.



PGH Family High Tension Couplers Required (for systems >1,300 V) PGH Family hightension coupler must be connected between the phase conductor and the PGR-6100.



PGA-0500 Analog % Current Meter PGA-0510 Analog Ohm Meter Optional panel-mounted meters display ground-fault current as a percentage of the set-point and insulation resistance.

Specifications

IEEE Device Numbers

Input Voltage Dimensions Response delay Contact Operating Mode Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts Analog Output Approvals Warranty Mounting Ground Fault (50G/N, 51G/N), Ground detector (64), Alarm Relay (74) *See ordering information* **H** 75 mm (3"); **W** 100 mm (3.9"); **D** 115 mm (4.5") < 50 ms Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Two Form C 0-1 mA UL Listed (E183688) ⁽¹⁾ 5 years DIN, Surface

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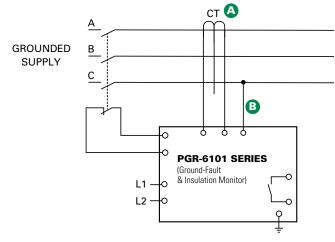
US

PGR-6101-120 (GFR4001)

Ground-Fault & Insulation Monitor



Simplified Circuit Diagram



Ordering Information

ACCESSORIES	REQUIREMENT
SE-CS30 Series	Required
PGH Family	Required >1300 V
PGA-0500	Optional
PGA-0510	Optional

For optional conformal coating please consult factory.

Description

The PGR-6101-120 combines the features of a ground-fault protection relay and insulation monitor into one unit. It protects against ground faults by monitoring insulation resistance when the motor is de-energized and by monitoring ground-fault current when the motor is energized. The PGR-6101-120 features two separate analog outputs for optional current and ohm meters, and two separate alarm relays. It operates on one- or three-phase solidly grounded, resistance grounded and ungrounded systems up to 6 kV.

Features & Benefits

FEATURES	BENEFITS
Adjustable GF pickup (30-200 mA)	Trip setting provides a wide range of low-level protection and system coordination
Adjustable insulation pickup (60-600 kΩ)	Customizable insulation resistance setpoints for maximum protection
Adjustable time delay (50-250 ms)	Adjustable trip delay for quick protection and system coordination
Output contacts	Two Form C output contacts for ground fault and insulation-resistance fault
Analog outputs (0-1 mA)	Two analog outputs indicate insulation resistance and ground-fault current
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil

Accessories



SE-CS30 Series Ground-Fault Transformers

Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.



PGH Family High Tension Couplers Required (for systems >1,300 V) PGH Family hightension coupler must be connected between the



PGA-0500 Analog % Current Meter PGA-0510 Analog Ohm Meter Optional panel-mounted meters display ground-fault current as a percentage of the

phase conductor and the PGR-6101-120.

set-point and insulation resistance.

Specifications

IEEE Device Numbers

Input Voltage Dimensions Response delay Contact Operating Mode Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts Analog Output Approvals Warranty Mounting Ground Fault (50G/N, 51G/N), Ground detector (64), Alarm Relay (74) 120 Vac H 75 mm (3"); W 100 mm (3.9"); D 115 mm (4.5") < 50 ms Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Two Form C 0-1 mA UL Listed (E183688) 5 years DIN, Surface

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www.littelfuse.com/pgr-6101-120

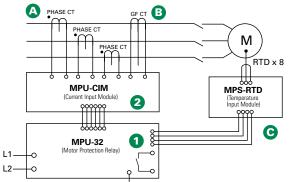
MPU-32 SERIES (PGR-6200)

Motor Protection Unit





Simplified Circuit Diagram



Ordering Information

MOTOR & PUMP PROTECTION

ORDERING NUMBER	COMMUNICATION
MPU-32-00-00	TIA-232
MPU-32-01-00	TIA-232 & TIA-485
MPU-32-02-00	TIA-232 & DeviceNet™
MPU-32-04-00	TIA-232 & EtherNet/IP™ & Modbus® TCP

NOTE: One of the following is required: MPU-CIM-00-00 Current Input Module, or MPU-CTI-RT-00 Current Input Module with ring-tonque terminals.

ACCESSORIES	REQUIREMENT
Phase CTs	Required
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
MPU-32-SMK	Optional
CA-945	Optional
MPU-16A-Y92A-96N	Optional

Description

The MPU-32 Motor Protection Unit is used to provide currentand temperature-based protection, metering, and data logging for three-phase low-voltage medium-horsepower induction motors. This relay is ideal for retrofitting and upgrading obsolete or aging motor protection using existing CTs. See the PMA Family of Panel Mount Adapter Kits to replace common obsolete relays.

Motor Protection Unit

- Three ac-current inputs
- Earth-leakage-CT input
- Programmable digital input
- 24-Vdc source for digital input
- Programmable 4-20-mA analog output
- On-board temperature-sensor input,
- 100-Ω-Platinum RTD or PTC
- Three programmable output relays
- Local RS-232 communications, optional Network Communications
- PC-interface software (SE-Comm-RIS)
- 4 line x 20 character backlit LCD display
- Keypad for programming and display selection
- 4 LEDs; 1 user programmable

2 Current Input Module (MPU-CIM)

The MPU-CIM Current Input Module is the interface between the MPU-32 relay and the 5-A-secondary, 1-A-secondary, and sensitive current transformers. The MPU-CIM is ordered separately from the MPU-32 and can be surface or DIN-rail mounted. Wire-clamping terminals are standard, but the MPU-CTI is available for those who require ring-tongue terminals.

Accessories

Phase Current Transformers

Phase CTs are required to detect phase currents. For upgrade applications, existing CTs can be used.



Ground-Fault Current Transformer

Optional zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.



MPS-RTD Temperature Input Module Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.



MPS-DIF Differential Current Module Optional motor differential protection, compatible with core balance and summation current transformer connections.

www.littelfuse.com/mpu-32

96

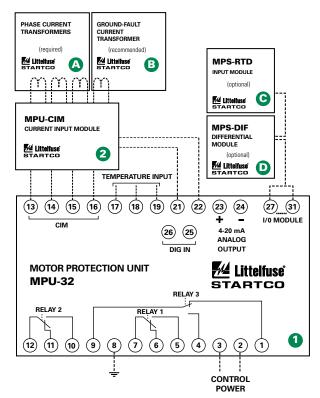
MPU-32 SERIES (PGR-6200)



Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Dynamic thermal model		Provides protection through starting, running, and cooling cycles
Communications		Remotely view measured values and event records, reset trips, and access setpoints
Ground fault	50G/N, 51G/N	Prevents catastrophic failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating due to unbalanced phases
RTD temperature	38, 49	RTD temperature protection (MPS-RTD module) for high-ambient or loss-of-ventilation protection
Phase loss/Phase reverse (current)	46	Detects unhealthy supply conditions
Overcurrent	50, 51	Prevents catastrophic failures and fires; extends motor life
Jam		Prevents motor damage by detecting mechanical jams or excessive loading
Undercurrent	37	Detects low level or no-load conditions
PTC overtemperature	49	Overtemperature (PTC) protection for high-ambient or loss-of-ventilation detection
Starts per hour	66	Limits the motor starts per hour to prevent overheating
Differential	87	Optional MPS-DIF module for sensitive winding-fault protection
Reduced overcurrent mode		Minimizes arc-flash hazards during maintenance
Metering		View measured and calculated parameters with on-board display
MPU-CIM		Separate current input module to reduce risk of open-CT hazard and for convenient installation
Analog output		Provides means for metering selectable parameters
Data logging		On-board 100-event recorder for data logging
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



Specifications Protective Functions

Protective Functions (IEEE Device Numbers)	Overload (49, 51) Phase reverse (current) (46) Overcurrent (50, 51)	RTD temperature (38, 49) Unbalance (current) (46) Starts per hour (66)		
	Jam	Differential (87)		
	Ground fault (50G/N, 51G/N) PTC overtemperature (49	Phase loss (current) (46) Undercurrent (37)		
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 2	25 W		
Power-Up Time	800 ms at 120 Vac			
Ride-Through Time	100 ms minimum			
24-Vdc Source	100 mA maximum			
AC Measurements	True RMS and DFT, Peak, 16 sa			
	positive and negative sequenc	e of fundamental		
Frequency	50, 60 Hz or ASD			
Output Contacts	Three Form C programmables			
Communications	TIA-232 (standard); TIA-485, Devic	eNet™,		
	Ethernet (optional)			
Analog Output	4-20 mA, programmable			
Conformally Coated	Standard feature			
Warranty	10 years			
Mounting				
(Control Unit)	Panel (standard)			
	Surface (with MPU-32-SMK co	onverter kit)		
(Current Input Module)	DIN, Surface			
Approvals	CSA certified, CE (European Union), UL Recognized,			
	C-Tick (Australian)			

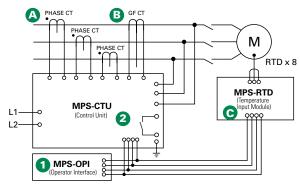
MPS SERIES (PGR-6300)

Motor Protection System





Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	COMMUNICATIONS
MPS-CTU-01-00	RS-485
MPS-CTU-02-00	RS-485 & DeviceNet [™]
MPS-CTU-03-00	RS-485 & Profibus®
MPS-CTU-04-00	RS-485 & EtherNet/IP™ & Modbus® TCP

ACCESSORIES	REQUIREMENT
MPS-0PI-01-00	Recommended
Phase CTs	Required
Ground-Fault CT	Recommended
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
SE-IP65CVR-M	Optional

Description

The MPS Motor Protection System monitors voltage, current, and temperature to provide a comprehensive package of 22 protective functions. The MPS is a modular system with integrated protection, motor control, metering, and data-logging functions. This system is typically used to provide protection for three-phase low- and medium-voltage, medium- to highhorsepower induction motors.

Operator Interface (MPS-OPI)

- Large, bright, 4 x 20 vacuum-fluorescent display
- Display metered values
- Access set points
- Powered by Control Unit
- Panel mount or attach directly to Control Unit
- Remote mounting (1.2 km or 4000 ft maximum loop length)
- 1/2 DIN size
- Hazardous-location certified

2 Control Unit (MPS-CTU)

- Current inputs—5-A or 1-A secondary phase current transformers
- Voltage inputs—up to 600 V without PTs
- Earth-leakage input—5-A or 1-A secondary or sensitive transformer
- Tachometer (high-speed pulse) input
- 8 digital inputs, 5 relay outputs, 1 analog input and output
- 24-Vdc supply for OPI and RTD modules, and for digital inputs
- IRIG-B time-code input
- 1/2 DIN size, surface mount
- RS-485 network communications (Standard)
- DeviceNet[™], Profibus[®], or Ethernet communications available

Accessories



Phase Current Transformers Phase CTs are required to deter

Phase CTs are required to detect phase currents.



Ground-Fault Current Transformer Required zero-sequence current transformer detects ground-fault current. Available with 5

detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.



MPS-RTD Temperature Input Module Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.



MPS-DIF Differential Current Module Optional motor differential protection, compatible with core balance and summatic

compatible with core balance and summation current transformer connections.

www.littelfuse.com/mps

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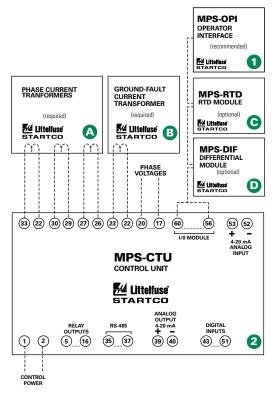
MPS SERIES (PGR-6300)



Features & Benefits

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating and extends motor life
Overcurrent/Jam	50, 51	Prevents catastrophic failures and fires and extends motor life
Undercurrent	37	Detects low-level or no-load conditions
Ground fault	50g/N, 51G/N	Prevents catastrophic failures and fires
RTD temperature	38, 49	Optional RTD temperature protection (MPS-RTD module) for high ambient or loss of ventilation protection
Overvoltage	59	Prevents stress to insulation
Undervoltage	27	Prevents a start attempt when it will damage the motor
Voltage unbalance	47	Detects unhealthy supply voltage
Phase differential	87	Provides sensitive protection for high-resistance winding faults
Dynamic thermal mode		Provides protection through starting, running, overload, and cooling cycles
Reduced overcurrent mode		Minimizes Arc-Flash hazards during maintenance
Starter control		Simplifies the installation by reducing component count
Metering		Displays the measured and calculated motor parameters
Data logging		On-board 64-event recorder helps with system diagnosis
Communications		Remotely view measured values, event records & reset trips
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Wiring Diagram



Specifications Protective Functions

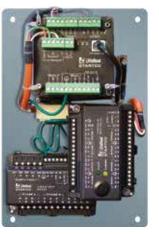
Protective Functions (IEEE Device Numbers)	Overload (49, 51) Phase reverse (current) (46) Overfrequency (81)	Unbalance (current) (46) Underspeed (14) Starts per hour (66)	
	Overcurrent (50, 51)	Phase loss (voltage) (47)	
	Jam (21)	Overvoltage (59)	
	Underfrequency (81)	Differential (87)	
	Ground fault (50G/N, 51G/N)	Phase loss (current) (46)	
	Undercurrent (37)	Undervoltage (27)	
	Unbalance (voltage) (47)	Phase reverse	
	Failure to accelerate	(voltage) (47)	
	RTD temperature (38, 49)	Power factor (55)	
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 2	5 W	
Power-Up Time	800 ms at 120 Vac		
Ride-Through Time	100 ms minimum		
24-Vdc Source	100 mA maximum		
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and		
	positive and negative sequence	e of fundamental	
Frequency	50, 60 Hz or ASD		
Inputs	Phase current, Earth-leakage curr	ent, Phase voltage,	
	7 digital, tachometer, 1 analog		
Output Contacts	5 contacts — See Product Manua		
Approvals	CSA Certified, RCM (Australian		
Communications	Allen-Bradley [®] DFI and Modbus [®] RTU (Standard);		
	DeviceNet [™] , Profibus [®] , Ethern	et (Optional)	
Conformally Coated	Standard feature		
Warranty	10 years		
Mounting			
(Control Unit)	Surface		
(Operator Interface)	Panel, Control-Unit mounted		

MPU-32-X69X (PGR-6210) SERIES / MPS-469X (PGR-6310) SERIES

Motor Protection Retrofit Kits

1 MPU-32-X69X





Front

Back

2 MPS-469X



Front



Description

Littelfuse Startco retrofit kits are an excellent choice for upgrading motor protection, providing current- and temperature-based protection, metering, and data logging.

1 MPU-32-X69X

The MPU-32-X69X Motor Protection Retrofit Kit is designed to replace GE Multilin 169, 269, and 369 relays. It includes the MPU-32 Motor Protection Relay, MPU-CIM Current Input Module, and optional MPS-RTD Temperature Input Modules, which are pre-wired on a panel. The kit fits in the existing space and typically can utilize existing current transformers and wiring to simplify the upgrade procedure.

2 MPS-469X

The MPS-469X Motor Protection Retrofit Kit replaces the GE Multilin 469 relay. It includes the MPS Motor Protection System and optional RTD and differential modules mounted on a panel that can be installed in the existing 469 cutout. Existing current transformer and wiring can be utilized, simplifying the upgrade procedure.

Features & Benefits

FEATURES	BENEFITS
Mounting	Fits in existing mounting holes and panel openings
Quick installation	Existing CTs and RTDs can be used to reduce installation time
Factory tested	100% factory-tested, pre-assembled components ensure reliability
Communications	Add communications capability to older switchgear and improve system performance
Microprocessor based	No calibration required saves on maintenance cost
Reduced overcurrent mode	Maintenance mode setting to reduce the risk of Arc-Flash Hazards
Conformal coating	Protects circuit boards against corrosion and moisture
Additional protection	Additional protective functions, including dynamic thermal model and ability to match existing overcurrent curves

MPU-32-X69X Ordering Information

		RTD INPUTS	MPU-32 COMMUNICATIONS	GROUND-FAULT CT	FUTURE OPTIONS
MPU-32-X69X	-	Х	Х	X	00
		$0 = One Platinum 100 \Omega$	0 = TIA232	0 = Wired for Sensitive Ground-Fault CT (50 mA Secondary)	
		1 = One Platinum 100 Ω and 8-input MPS-RTD Module	1 = TIA232 & TIA485	1 = Wired for 1- or 5-A Secondary Ground-Fault CT	
			2 = TIA232 & DeviceNet		
			4 = TIA232 & Ethernet		
MADC ACO	V	Ordering Inform	attan.		

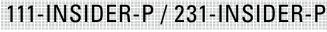
MPS-469X Ordering Information

		MODULE CONFIGURATION	MPS COMMUNICATIONS	FUTURE OPTIONS
MPS-469X	-	X	Х	000
		0 = None	1 = RS485	
		1 = One MPS-RTD Module	2 = RS485 & DeviceNet	
		2 = Two MPS-RTD Modules	3 = RS485 & Profibus	
		3 = One MPS-DIF Module	4 = RS485 & Ethernet	
		4 = One MPS-RTD Module and One MPS-DIF Module		

www.littelfuse.com/mpu-32-X69X, www.littelfuse.com/mps-469X

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Single-Phase Pump Monitor



Answers Delivered



Wiring Diagrams

See next page.

Accessories



Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12

(h)

Informer IR Kit-12

12" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without opening the panel. Included with the Informer

Ordering Information

MODEL	VOLTAGE	DESCRIPTION
111-Insider-P	115VAC	⅓ - ½ hp, includes IR Kit-12
231-Insider-P	230VAC	⅓ - 1 hp, includes IR Kit-12

Description

The Littelfuse 111-Insider-P single-phase products fit inside $\frac{1}{3}$ and $\frac{1}{2}$, 115V control boxes and the 231-Insider-P fits inside $\frac{1}{3}\frac{1}{2}$, $\frac{3}{4}$, and 1 hp, 230V control boxes. Both models are designed to protect single-phase pumps from dry-well, dead-head, jammed impeller, rapid-cycle, overvoltage, and undervoltage conditions.

A calibration adjustment allows the Insider to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontroller-based voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the product deactivates its output relay and directly disconnects the pump motor. The unit then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the unit will operate in manual reset mode.

The Insider communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. An IR Kit-12 (12" fiber optic kit) is included with each Insider, allowing the Informer to access these parameters even when the Insider is enclosed in a control box. This is valuable for troubleshooting the pump while it is running.

NOTE: The 111/231-Insider-P models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

Features & Benefits

BENEFITS
Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
Provides status and diagnostics for troubleshooting

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111-INSIDER-P / 231-INSIDER-P

Specifications

Functional Specifications Adjustments/Settings

Overcurrent Underload (dry-well) **Overvoltage** 111-Insider-P 231-Insider-P Undervoltage 111-Insider-P 231-Insider-P Number of restarts allowed in a 60-sec. period (rapid-cycling) **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times Over/Undervoltage** All other faults

125% of calibration point Adjustable (70 to 90% of calibrated run power)

132.5VAC 265VAC

95VAC 190VAC

4

5 seconds 4 seconds

2 seconds Manual, 2-225 minutes

Input Characteristics Supply Voltage

111-Insider-P	115VAC
231-Insider-P	230VAC
Load Range	
111-Insider-P	1∕3 — 1⁄2 h
231-Insider-P	1∕3−1 hp
Frequency	50*/60H
Output Characteristics	
Output Contact Rating-SPST	
111-Insider-P	½hp@12
231-Insider-P	1hp@ 24
General Characteristics	
Operating Temperature	-40° to 6
Maximum Input Power	5 W
Safety Marks	
cUR**	UL508, (
Weight	10 oz.
Mounting Methods	Inside a

۱p D Ηz

20VAC (17 amps max.) 40VAC (17 amps max.)

60° C (-40° to 140° F)

C22.2 No. 14 Pentek[®], Franklin[™], CentriPro[™], Flint and Walling™, and Grundfos®*** control box

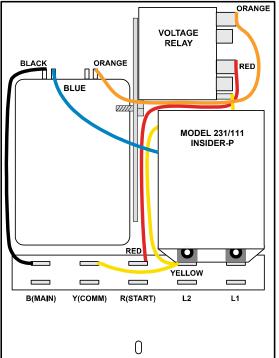
*Note: 50Hz will increase all delay timers by 20%

**The 111-Insider-P and 231-Insider-P are approved by UL for use in the Franklin™, Pentek®, and CentriPro[™] type 3R control boxes when installed as described in the installation instructions. The 111-Insider-P and 231-Insider-P are not intended to provide overload protection, and should be used with thermally or impedance protected motors only.

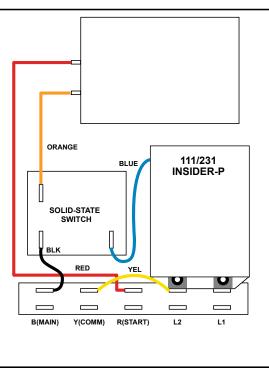
***Grundfos control boxes manufactured after mid 2014.

Wiring Diagrams

PENTEK® CONTROL BOX WIRING DIAGRAM



FRANKLIN™ CONTROL BOX WIRING DIAGRAM



www.littelfuse.com/111insiderp-231insiderp

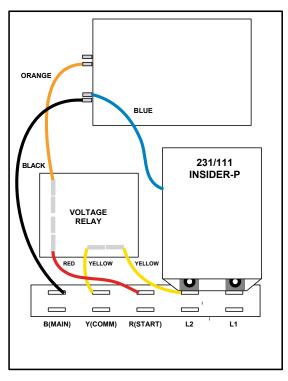
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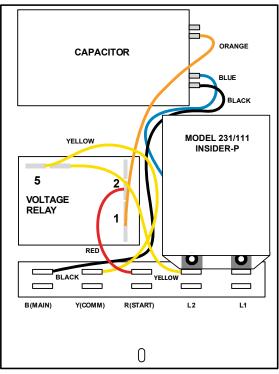


111-INSIDER-P / 231-INSIDER-P

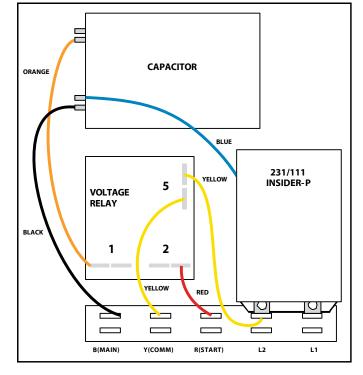
CENTRIPRO[™] CONTROL BOX WIRING DIAGRAM



GRUNDFOS® CONTROL BOX* WIRING DIAGRAM



* For boxes manufactured in mid 2014 or later. See 232-INSIDER on next page for boxes manufactured prior to mid 2014.



For installation instructions see the Fresh Water Pumping Catalog at www.Littelfuse.com/PumpProtection

FLINT AND WALLING[™] CONTROL BOX WIRING DIAGRAM

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232-INSIDER

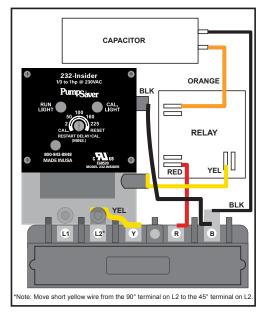
Single-Phase Pump Monitor





Wiring Diagram

232-INSIDER CONNECTIONS IN GRUNDFOS® CONTROL BOX



For installation instructions see the Install Bulletin.

Description

The Model 232-Insider single-phase PumpSaver® fits inside 1/3, 1/2, 3/4, and 1hp, 230V Grundfos control boxes manufactured prior to mid 2014. The PumpSaver® Model 232-Insider is a pump monitor designed to protect single-phase pumps from dry-well, deadhead, jammed impeller, overvoltage and undervoltage conditions. Typical applications include residential water wells, commercial water wells, irrigation wells, and golf course systems.

A calibration adjustment allows the 232-Insider to be calibrated to your specific pumping application, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the 232-Insider deactivates its output relay and directly disconnects the pump motor. The 232-Insider then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the 232-Insider reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the 232-Insider will operate in manual reset mode.

The Insider communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. This is valuable for troubleshooting the pump while it is running.

Note: The use of flow restrictors or unusually high head pressures at the time of calibration may interfere with the detection of dead-head conditions. Contact Littelfuse for information on a product to fit these applications.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, and voltage faults
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting

Accessories

Informer A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system.

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232-INSIDER



Specifications

Functional Adjustments/Settings Overcurrent Underload (dry-well) Underload (dry well) with high sensitivity jumper removed Overvoltage Undervoltage **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times** Over/undervoltage All other faults (dry-well recovery timer) **Input Characteristics** Supply Voltage Load Range Frequency **Output Characteristics Output Contact Rating-SPST General Characteristics Operating Temperature** Maximum Input Power **Safety Marks** UL CSA Weight **Mounting Methods**

125% of calibration point Approx. 80% of calibration point Approx. 87% of calibration point 265VAC 190VAC 5 seconds 4 seconds 2 seconds Manual, 2-225 minutes 230VAC ¹∕₃ – 1 hp 50*/60Hz 1hp@240VAC (17 amps max.) -40° to 60° C (-40° to 140° F) 5 W UL508 C22.2 No. 14 10 oz.

Grundfos® Control Box manufactured

prior to mid 2014

*Note: 50 Hz will increase all delay timers by 20%



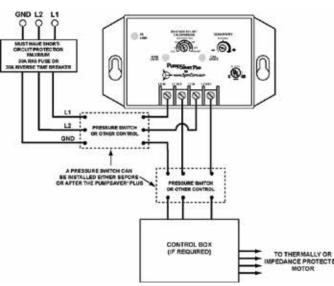
111P / 233P / 233P-1.5 SERIES

Single-Phase PumpSaver®



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Wiring Diagram



For dimensional drawing see: Appendix page 511, Figure 15.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
111P	115VAC	Load Range: 1⁄3 - 1hp
111P-ENCL	115VAC	111P with NEMA3R enclosure
233P	230VAC	Load Range: ½ - 3hp
233P-ENCL	230VAC	233P with NEMA3R enclosure
233P-1.5	230VAC	Load Range: ½ - 1.5hp
233P-1.5-ENCL	230VAC	233P-1.5 with NEMA3R enclosure

Description

The Littlefuse Models 111P (115 volt, $\frac{1}{3}$ to 1hp); 233P-1.5 (230 volt, $\frac{1}{3}$ to 1.5hp); and 233P (230 volt, $\frac{1}{3}$ to 3hp) protect pumps from dry-well, dead-head, jammed impeller, overvoltage/ undervoltage conditions and now rapid-cycle protection whether the pressure switch is mounted before or after our unit.

A calibration adjustment allows the unit to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontroller-based voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the unit deactivates its output relay and directly disconnects the pump motor. The unit then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on.

The infrared LED communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults.

Special considerations for pump cables larger than #10 AWG: In some cases where larger motors are installed with deep set pumps, pump cables are used that exceed the relay's terminal size. In these conditions, a short splice of #10 AWG or #12 AWG may be a solution at the control box. Note: All local, state and national electric codes should be followed when applying this solution.

NOTE: The 111P/233P/233P-1.5 models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage, power factor, current for reliable pump protection
Onboard calibration process	Calibrates unit to your specific individual pumping application and reduces nuisance tripping
Onboard sensitivity adjustment	User adjustable sensitivity knob makes the unit more adaptable to varying pumping applications

Accessories



Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system.

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111P / 233P / 233P-1.5 SERIES



Specifications

Functional Specifications Adjustments/Settings Overcurrent Underload (dry-well) Overvoltage 111P 233P, 233P-1.5 Undervoltage 111P 233P. 233P-1.5 Number of restarts allowed in a 60-sec. period (rapid-cycling) 4 **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times** Over/undervoltage All other faults **Input Characteristics Supply Voltage** 111P 233P-1.5, 233P Load Range: 111P 233P-1.5 233P Frequency

125% of calibration point Adjustable (70 to 90% of calibrated run power)

132.5VAC 265VAC

95VAC 190VAC

5 seconds 4 seconds

2 seconds Manual, 2-225 Minutes

115VAC 230VAC

⅓–1hp ⅓–1.5 hp 1/3 – 3 hp 50*/60Hz

Output Characteristics Output Contact Rating-SPST

111P 233P-1.5 233P **General Characteristics Operating Temperature Maximum Input Power** Wire Gauge **Terminal Torque** Safety Marks cUL Listed

Weight **Mounting Methods**

Dimensions

1hp@120VAC (16 amps max.) 1.5hp@240VAC (10 amps max.) 3hp@240VAC (17 amps max.)

-40° to 60° C (-40° to 140° F) 5 W Solid or Stranded 10 - 22AWG 13 in.-lbs.

UL508, C22.2 No. 14 H 73.66 mm (2.9"); W 133.35 mm (5.25"); **D** 73.99 mm (2.913") 14 oz. #8 screws

*Note: 50Hz will increase all delay timers by 20%

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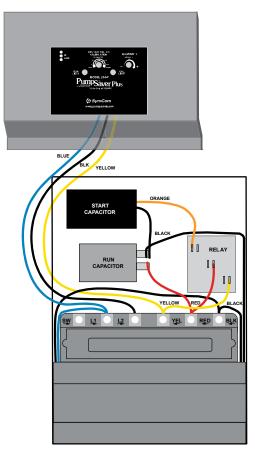
234-P

Single-Phase Pump Monitor



Wiring Diagram

234-P CONNECTIONS IN GRUNDFOS® CONTROL BOX



For installation instructions see the Install Bulletin.

Description

The PumpSaver® Model 234-P is designed to be mounted inside a Grundfos® control box to protect $1/_3$ – 3hp, 2- or 3-wire, 230V pumps.

The Model 234-P protects single-phase pumps from dry-well, dead-head, rapid-cycle, jammed-impeller, and over/undervoltage conditions. Typical applications include residential waterwells, commercial waterwells, irrigation wells, and golf course and other sprinkler systems.

A calibration adjustment allows the 234-P to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the 234-P deactivates its output relay and directly disconnects the pump motor. The 234-P then begins its userselectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the 234-P reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the 234-P will operate in manual reset mode.

The 234-P communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. An IR Kit-12 (12" fiber optic kit) allows the Informer to access these parameters even when the 234-P is enclosed in a control box. This is valuable for troubleshooting the pump while it is running.

NOTE: The PumpSaver® models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

The Model 234-P is not recommended for use with the Grundfos® Deluxe Control Box.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Onboard sensitivity adjustment	Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting



Accessories

234-P



Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12



Informer IR Kit-12

12" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without opening the panel. Included with the Informer

Specifications

Specifications	
Functional Specifications	
Adjustments/Settings	
Overcurrent	125% of calibration point
Underload (dry-well)	Adjustable (70 - 90% of calibrated run power)
Overvoltage	265VAC
Undervoltage	190VAC
Number of restarts allowed	
in a 60-second period	
(rapid-cycling)	4
Trip Delay Times	
Overcurrent	5 seconds
Dry-well	4 seconds
Restart Delay Times	
Over/undervoltage	2 seconds
All other faults (dry-well	
recovery timer)	Manual, 2-225 Minutes
Input Characteristics	
Supply Voltage	230VAC
Load Range	1∕₃ – 3 hp
Frequency	50*/60Hz
Output Characteristics	
Output Contact Rating (SPST)	3 hp @ 240VAC (17 amps max.)
General Characteristics	
Operating Temperature	-40° to 60° C (-40° to 140° F)
Maximum Input Power	5W
Dimensions	Fitted to Grundfos [®] Control Box
Weight	14 oz.
Mounting Methods	Grundfos [®] Control Box
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 2, 4kV contact, 6kV air

*Note: 50 Hz will increase all delay timers by 20%

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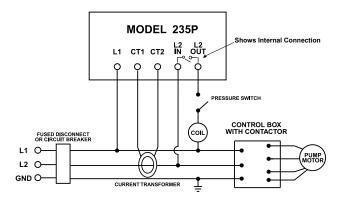


235P

Single-Phase Pump Monitor



Wiring Diagram



For dimensional drawing see: Appendix page 511, Figure 15.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
235P	230VAC	5 - 15hp
235P-ENCL	230VAC	233P with NEMA3R enclosure

PART*	SIZE	CURRENT (A)	CT CURRENT RATIO
CT-0050-D10	5 - 7.5hp	27.5 - 42.1	50:5
CT-0075-D10	10hp	51	75:5
CT-0100-D10	15hp	75	100:5

Description

The Littelfuse 235P is designed to protect 5-15hp, 230V, single-phase pumps from dry-well, dead-head, jammed impeller and overvoltage and undervoltage conditions.

A calibration adjustment allows the 235P to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations causing overcurrent and undercurrent. When an abnormality, such as loss of suction is detected, the 235P deactivates its output relay and directly disconnects the pump motor. The unit then begins its userselectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on.

The 235P communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults.

An external current transformer is required for operation (sold separately).

Special considerations for pump cables larger than #10 AWG: In some cases where larger motors are installed with deep set pumps, pump cables are used that exceed the relay's terminal size. In these conditions, a short splice of #10 AWG or #12 AWG may be a solution at the control box. Note: All local, state and national electric codes should be followed when applying this solution.

NOTE: The 235P model has a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Onboard sensitivity adjustment	Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting

* Current transformer sold separately

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Accessories

235P



Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12

Specifications

Functional Specifications

Adjustments/Settings Overcurrent Underload (dry-well) Overvoltage Undervoltage Number of restarts allowed in a 60-sec. period (rapid-cycling) Trip Delay Times Overcurrent Dry-well Restart Delay Times Over/undervoltage All other faults

125% of calibration point Adjustable (70 to 90% of calibrated run power) 265VAC 190VAC

5 seconds 4 seconds

4

2 seconds Manual, 2-225 Minutes

Input Characteristics

Supply Voltage Load Range Frequency Output Characteristics Output Contact Rating-SPST General Characteristics

Operating Temperature Maximum Input Power Wire Gauge Terminal Torque Safety Marks cUL Listed Dimensions

Weight Mounting Methods 230VAC 5 - 15 hp 50*/60Hz

Output Contact Rating-SPST A300, 720A @240VAC (10 amps max.)

-40° to 60° C (-40° to 140° F) 5 W Solid or Stranded 10 - 22AWG 13 in.-lbs.

UL508, C22.2 No. 14 H 73.66 mm (2.9"); W 133.35 mm (5.25"); D 73.99 mm (2.913") 14 oz. #8 screws

*Note: 50Hz will increase all delay timers by 20%)

Dimensions Weight Mounting Methods H 73.66 mm (2.9"); W 133.35 mm (5.25"); D 73.99 mm (2.913") 14 oz. #8 screws

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Protection Relays Motor and Pump Protection – 3-Phase Motor Protection

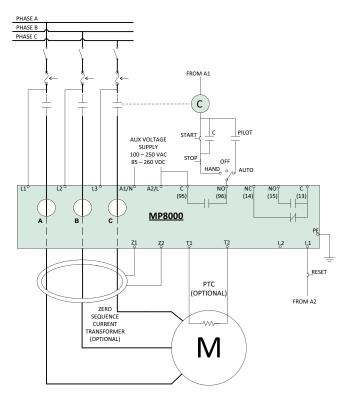
MP8000 SERIES

Bluetooth® 3-Phase Current & Voltage Monitor





Wiring Diagram



For dimensional drawing see: Appendix page 516, Figure 50.

Description

The MP8000/MP8100 are advanced motor protection electronic overload relays, fully programmable via Bluetooth[®] using an iPhone[®] or Android[™] smartphone or tablet with the Littelfuse App. It is easy to use and arc-flash safety is increased because the app allows settings to be modified and real-time operational information viewed. Viewing operational information and faults on the app does not require the user to open the control panel.

The MP8000 protects any motor drawing 0.5-1,000 full load Amps (external CTs are required above 100 Amps). It is designed for single or 3-phase systems with operating voltages of 90-690 VAC (use of external potential transformers can extend upper voltage range above 690 VAC). Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application.

Protection is unsurpassed by combining overload, voltage, phase loss and reversal, voltage and current unbalance, power monitoring, and underload in one package. For standalone applications, the Bluetooth[®] interface can be used when paired with a smartphone or tablet. The units also feature an Ethernet communications port that can be used to form an Ethernet Modbus TCP/IP network. Units can be remotely monitored and controlled from a PC, or SCADA system, and data logging through a PC with the optional Solutions software or other software program using the MP8000 memory map. This capability allows for a simple cost-effective way to further enhance arc-flash safety.

Features & Benefits

FEATURES	BENEFITS
Bluetooth® interface	Visual indication for programming, viewing real-time voltage or current, and last fault information (date and time stamped)
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
4 programmable delay timers	Program separate delay times for power up, rapid cycle protection, motor cool down, and underload restarting
Flexible reset	Reset can be done through pushbutton on panel, remotely via the network
Network communications capability	Compatible with Ethernet Modbus TCP/IP

Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
MP8000	90-690VAC (use of external potential transformers can extend upper voltage range above 690VAC)	0.5-1,000A (external CTs required above 100A)	Provides remote wired communication via Ethernet Modbus TCP/IP
MP8100	90-690VAC (use of external potential transformers can extend upper voltage range above 690VAC)	0.5-1,000A (external CTs required above 100A)	Provides remote wired communication via Ethernet Modbus TCP/IP, RS485, and CAN bus

www.littelfuse.com/mp8000

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MP8000 SERIES



Advanced Features

- Overload (Overpower)
- Underload (Underpower)
- Overcurrent/Jam
- Undercurrent
- Current Unbalance
- Phase Loss
- Phase Reversal
- Overvoltage
- Undervoltage
- Voltage Unbalance
- Rapid Cycling/Jog
- Contactor Failure
- Zero-Sequence Ground Fault
- PTC Motor Overtemperature

Littelfuse Mobile App





MP8000 Littelfuse App icon





Specifications

Functional Characteristics Frequency **TC- Overcurrent Trip Class Output Characteristics Output Contact Rating Control relay Auxiliary relay Pilot Duty Rating General Purpose General Characteristics**

Ambient Temperature Range

Operating Storage Accuracy Voltage Current Timing

-40° to 70°C (-40° to 158°F) -55° to 80°C (-67° to 176°F)

50/60Hz

SPST - Form A

SPDT - Form C

5A @ 240VAC

B300

Trip class 02-60 or linear

±1% ±2% (2 to 100 amps direct) 2% ±0.5 seconds ±5%

GF Current Repeatability

Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque (depluggable** terminal blocks) **Terminal Torque** (Earth Ground) **Standards Passed Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst** Surge

FCC Rating

Short Circuit Withstand Rating **Hi-Potential Test Safety Marks** cULus CF **Maximum Conductor Size** (with insulation)

Weight **Mounting Method**

Dimensions

±0.5% ±1% (2 to 100 amps direct) 3 (conformal coating standard)

IP20 10-95%, non-condensing per IEC 68-2-3

5.5 in.-lbs.

5 W

7.9 in.-lbs.

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power IEC 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground Part 15.107 for emissions, Part 15.247 for intentional radiators

100kA symmetrical at 690VAC Meets UL508 (2 x rated V +1000V for 1 minute)

UL60947, UL1053, C22.2 (File #E68520) IEC 60947 Edition 5.2, IEC 60947-8

0.63" H 73.91 mm (2.91"); W 103.63 mm (4.08"); D 121.67 mm (4.79") 0.85 lbs (13.6 oz, 385.6 g) Surface mount (4 - #8 screws) or DIN-rail mount

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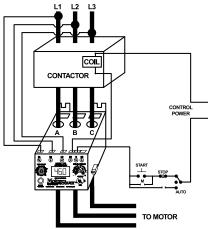
777 SERIES

3-Phase Current & Voltage Monitor

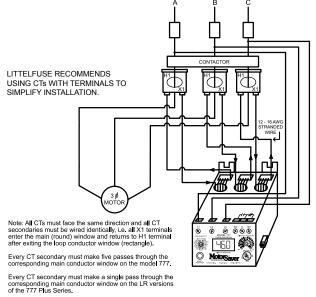


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 777 (2 to 90 amps)



CURRENT TRANSFORMER WIRING DIAGRAM FOR MODEL 777 (80 to 800 amps)



Description

The 777 is a fully programmable electronic overload relay designed to protect any motor drawing 2-800 full load amps (external CTs are required above 90 amps). The 777 (family of products) is for 3-phase 200-480VAC applications, with several specialized units for other voltage ranges and unique applications. Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application. Some unique applications include use with a Subtrol® equipped Franklin submersible motor to detect high motor temperatures and applications where a fast linear trip is required.

All of the overload relays provide unsurpassed protection by combining overload, voltage, phase loss and reversal, voltage and current unbalance, power monitoring, and underload based on current in one package. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition. The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet[™], Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software. This capability allows for a simple, cost-effective way to meet new requirements for arc-flash safety.

Features & Benefits

FEATURES	BENEFITS
Built-in display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Flexible reset	Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET remote reset kit
Network communications capability	Compatible with Modbus, DeviceNet™, Profibus, or Ethernet using optional communications module

Ordering Information

See next page.

For dimensional drawing see: Appendix page 507, Figure 1.

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Ordering Information

777 SERIES

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
777-P2	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts
777-LR-P2	200-480VAC	1-800A (external CTs required above 9A)	Protects low range motors when wired directly or with 10-800 FLA with use of external CTs
777-HVR-P2	340-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 470VA @ 600VAC output SPDT relay contacts. Required when a control power transformer (CPT) is not used with a 480V system
777-HVR-LR-P2	340-480VAC	1-800A (external CTs required above 9A)	Provides low and high power trip*, linear overcurrent trip, and 470VA @ 600VAC output SPDT relay contacts. Required when a control power transformer (CPT) is not used with a 480V system
777-575-P2	500-600VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-575-LR-P2	500-600VAC	1-800A (external CTs required above 9A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-MV-P2	100-240VAC	10-800A with external CTs	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Designed for Medium Voltage applications where both PTs and CTs are used. Has built in multipliers for 25.5, 50.5, 100.5 CTs. The voltage unbalance, single-phase and reverse phase protection can be disabled for applications where only the PTs are used
777-HRG-P2	200-480VAC	2-90A only	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-LR-HRG-P2	200-480VAC	10-800A (external CTs required, external	Overload relays designed for high resistance grounding systems that incorporate an external zero-sequence CTs that correspond with the built in multipliers to detect ground faults
777-575-HRG-P2	500-600VAC	2-90A only	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-575-LR-HRG-P2	500-600VAC	10-800A with external CTs	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-FT	200-480VAC	2-800A (external CTs required above 90A)	Provides linear overcurrent trip and 480VA @ 240VAC output SPDT relay contacts. Also known as shock relay, it is designed for fast linear trip applications. Overcurrent trip delay can be set ranging from less than 500ms - 70 seconds. Low trip delay is ideal in chain drive and drive linkage applications to prevent breaking in overload or jam situations. Other applications include sewage clarifiers, mixers, augers, and conveyors. Longer trip delay is ideal for motor test panels in rewind shops. Also includes adjustable motor acceleration time and overcurrent trip delay time when the faster linear trip mode is used
777-TS	200-480VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol® equipped Franklin submersible motors to detect high motor temperatures
777-LR-TS	200-480VAC	1-9A only	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol® equipped Franklin submersible motors to detect high motor temperatures
777-575-TS	500-600VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol [®] equipped Franklin submersible motors with nominal 500-600VAC range to detect high motor temperatures
777VA-02	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Has restart delay 1 setpoints of 2-500 minutes and undercurrent trip delay setpoints of 2-60 minutes.
777VA-03 * Network programmable o	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. For use with static and rotary single to 3-phase converters. High and low voltage trip feature only applies to the utility supplied power. Works well with unloaded phase converters because the relay ignores severely unbalanced voltages

* Network programmable only

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777 SERIES

Accessories



RS485MS-2W Communication Module Required to enable the Modbus communications function on Model 77X-type products.

CIO-MB/CIO-120-MB Communication Module Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network.



CIO-DN-P/CIO-120-DN-P **Communication Module**

DeviceNet[™] interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet[™] network.



CIO-777-PR Communication Module Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network.

CIO-EN (non-POE) Communication Module Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network.

Communication Adapters

 RS485-RS232–Converter with cable & plug RS485-USB-Converter with cable & plug RS232-USB-Converter Specifications match industry standard. **RM1000 Remote Monitor**

The RM1000/777 motor management system



The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



OL-RESET Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

Specifications

Functional Characteristics Frequency **TC- Overcurrent Trip Class** (777 Plus Series units) **TC- Overcurrent Trip Class** (77C, 777 non-Plus

Output Characteristics

Series units)

Output Contact Rating (SPDT - Form C) **Pilot duty rating General purpose** Pilot duty rating for HVR models **General Characteristics Ambient Temperature Range** Operating Storage Accuracy Voltage Current **GF** Current Timing (777 Plus Series units) ±0.5 second Timing (77C, 777 non-Plus Series units) Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst Short Circuit** Surge IEC

50/60Hz 02-60, J02-J60, L00-L60 or Off

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3%(<100 amps direct) ±15%

5% +1 second

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-lbs.

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power 100kA

61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration,

half-sine pulse

MOTOR & PUMP PROTECTION

combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices. **RM2000 Remote Monitor**







777 SERIES



Safety Marks

Weight

Mounting Method

UL CE CSA Maximum Conductor Size (with insulation) through 777/77C Dimensions UL508, UL1053 (File #E68520) IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

0.65" **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.56 lbs. (24.96 oz., 707.6 g) Surface mount (4 - #8 screws) or DIN rail mount

777 / 77C SERIES

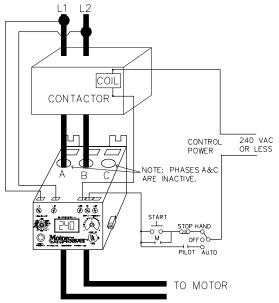
Single-Phase Current & Voltage Monitor



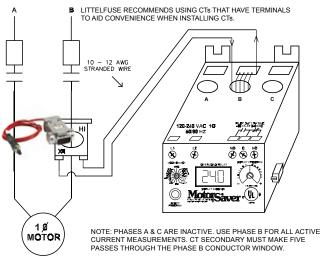


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 77C WITH MOTOR CONTROL



TYPICAL WIRING DIAGRAM FOR MODEL 77C WITH EXTERNAL CT



For dimensional drawing see: Appendix page 507, Figure 1.

The 777/ 77C Series is a fully programmable electronic overload relay designed to protect any motor drawing 2-800 full load amps (external CTs are required above 90 amps). Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application.

All of the overload relays provide unsurpassed protection by combining overload, underload, and voltage in one package. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition. The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet[™], Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software. This capability allows for a simple, cost-effective way to meet new requirements for arc-flash safety.

Features & Benefits

FEATURES	BENEFITS
Built-in display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Flexible reset	Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET remote reset kit
Network communications capability	Compatible with Modbus, DeviceNet™, Profibus, or Ethernet using optional communications module

Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
77C	100-240VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts
77C-LR	100-240VAC	1-9A only	Provides 480VA @ 240VAC output SPDT relay contacts
777- HVR-SP	340-480VAC	2-800A (external CTs required above 90A)	Provides 470VA @ 600VAC output SPDT relay contacts. For systems with no control power transformer

777 / 77C SERIES

Accessories



RS485MS-2W Communication Module Required to enable the Modbus communications function on Model 77X-type products.



Communication Adapters

• RS485-RS232-Converter with cable & plug

- RS485-USB-Converter with cable & plug
- RS232-USB-Converter Specifications match industry standard.



RM1000 Remote Monitor The RM1000/777 motor management system

combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



RM2000 Remote Monitor The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor

monitoring with event storage and real-time clock for date and time stamp.



Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



OL-RESET Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

Specifications

Frequency **Functional Characteristics TC- Overcurrent Trip Class** (77C, 777 non-Plus Series units)

Output Characteristics

Output Contact Rating (SPDT - Form C) Pilot duty rating General purpose **Pilot duty rating for HVR** models **General Characteristics** Ambient Temperature Range Operating Storage Accuracy Voltage Current **GF** Current Timing (77C, 777 non-Plus Series units) Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated

50/60Hz

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

Answers Delivered

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3%(<100 amps direct) ±15%

5% +1 second

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-lbs.

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m IEC 61000-4-3, Level 3 10V/m **Fast Transient Burst** IEC 61000-4-4, Level 3, 3.5kV input power 100kA

IEC

ANSI/IEEE

Short Circuit

Surge

Hi-potential Test Vibration

Shock

Safety Marks

UL CE CSA **Maximum Conductor Size** (with insulation) through 777/77C Dimensions

Weight **Mounting Method** 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak,

2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

UL508, UL1053 (File #E68520) IEC 60947-1, IEC 60947-5-1 C22.2

0.65" H 77.47 mm (3.05"); W 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.56 lbs. (24.96 oz., 707.6 g) Surface mount (4 - #8 screws) or DIN rail mount



Protection Relays Motor and Pump Protection – 3-Phase Pump Protection

777-KW/HP-P2 SERIES

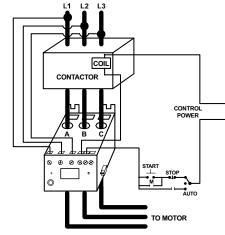
3-Phase Current & Voltage Monitor



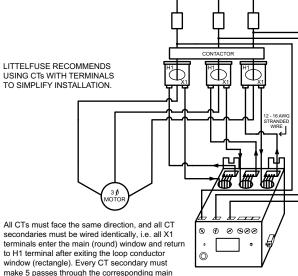


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR 777-KW/HP-P2 SERIES



CURRENT TRANSFORMER WIRING DIAGRAM FOR 777-KW/HP-P2 SERIES

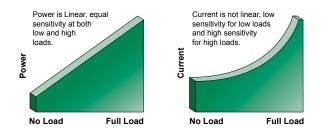


make 5 passes through the corresponding main conductor window.

For dimensional drawing see: Appendix page 507, Figure 1.

Description

The 777-KW/HP-P2 Series has the overload, voltage, phase loss and reversal, voltage and current unbalance, current and power monitoring*, and underload trip based on power in one package. The underpower trip feature is desirable anytime the current vs. load characteristic is non-linear or has little change. In general terms, smaller motors and slow-speed motors have little change in current over the normal load range. Larger motors that are running light loads will also show small current changes over the operating load range. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition.



The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet[™], Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software.

* Low current trip and high power trip are network programmable only

Features & Benefits

FEATURES	BENEFITS
Low and High Power Protection	Increases reliability for non-linear motors where the load characteristic has little change
Built-in Display	Visual indication for programming, viewing real-time voltage, current, kilowatts, or horsepower, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
	data and fault history, without the need to open the
compatibility	data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET

www.littelfuse.com/777kwhpp2

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777-KW/HP-P2 SERIES



Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
777-KW/HP-P2	200-480VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts
777-LR-KW/HP-P2	200-480VAC (3-phase)	1-800A (external CTs required above 9A)	Provides 480VA @ 240VAC output SPDT relay contacts
777-HVR-KW/HP-P2	340-480VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 470VA @ 600VAC output SPDT relay contacts. Required when a CPT (control power transformer) is not used on a 480V system. Commonly used in pumping applications to save the cost and extra wiring associated with a CPT
777-575-KW/HP-P2	500-600VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-MLR-KW/HP-P2	200-480VAC (3-phase)	0.5-21A and 40-740A with external CTs	Provides 480VA @ 240VAC output SPDT relay contacts. It is wired directly without the need to loop conductors for 5-21 amps (under 5 amps requires looping of conductors), and can be used with external CTs for 40-740 amps

Accessories



RS485MS-2W Communication Module

Required to enable the Modbus communications function on Model 77X-type products.



CIO-MB/CIO-120-MB Communication Module Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network.



CIO-DN-P/CIO-120-DN-P Communication Module

DeviceNet[™] interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet[™] network.



CIO-777-PR Communication Module Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network.



CIO-EN (non-POE) Communication Module Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network.



Communication Adapters

- RS485-RS232-Converter with cable & plug
- RS485-USB-Converter with cable & plug
- **RS232-USB**–Converter Specifications match industry standard.



RM1000 Remote Monitor

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



RM2000 Remote Monitor The RM2000/777 motor management system

combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.

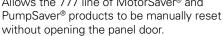


Solutions Software: Solutions-M Software features include data logging, real-time

data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver[®] and





OL-RESET Manual Remote Reset Kit Allows the 777 line of MotorSaver[®] and PumpSaver[®] products to be manually reset without opening the panel door.



777-KW/HP-P2 SERIES

Specifications

Frequency **Functional Characteristics TC-Overcurrent Trip Class Output Characteristics Output Contact Rating** (SPDT - Form C) Pilot duty rating **General purpose Pilot duty rating for HVR** model **General Characteristics Ambient Temperature Range** Operating Storage Accuracy Voltage Current Power **GF** Current Timing Repeatability Voltage Current Power **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed**

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI), Conducted Radio Frequency Immunity (RFI), Radiated Fast Transient Burst Short Circuit Rating 50/60Hz

02-60, J02-J60, L00-L60 or OFF

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3% (<100 amps direct) ±4% (<100 amps direct) ±15% ±0.5 second

±0.5% of nominal voltage ±1% (<100 amps direct) ±2% 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-Ibs.

IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5 kV input power 100kA Surge IEC

ANSI/IEEE

Hi-potential Test

Vibration

Shock

Safety Marks UL CE CSA Maximum Conductor Size (with insulation) through 777 Dimensions

Weight Mounting Method 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

UL508, UL1053 (File #E68520) IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

0.65" **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.56 lbs. (24.96 oz., 707.6 g) Surface mount (4 - #8 screws) or DIN rail mount

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777-ACCUPOWER

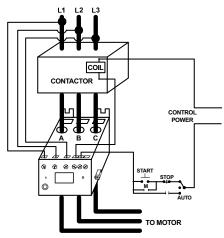
3-Phase Current & Voltage Monitor



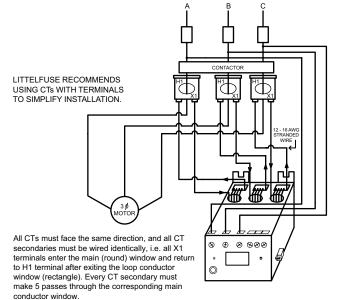


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 777-ACCUPOWER



CURRENT TRANSFORMER WIRING DIAGRAM OR MODEL 777-ACCUPOWER



For dimensional drawing see: Appendix page 507, Figure 1.

The 777-AccuPower is a fully-programmable 3-phase motor and pump protection relay. It allows motor hp rating, full load amps, efficiency and power factor to be entered and will accurately calculate motor output power. This is most useful with mag-drive pumps or process applications where the process power is desired over the utility power. Voltage, current and power measurements can be displayed as well as fault information and setpoints. The built-in display simplifies troubleshooting and allows the user to easily and precisely configure setpoints. The 777-AccuPower can be used with the optional COM 4-20 output module to give an analog signal proportional to output shaft power, the RS485MS-2W (for limited Modbus capabilities, and for use with the RM1000/RM2000) remote displays listed in the 777 accessories section.

Features & Benefits

FEATURES	BENEFITS
Motor output power measurement	Allows use of process power over utility power
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Built-in Display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Remote display compatibility	Increases safety through remote display of run-hour meter, last four fault codes, without the need to open the cabinet. Aids with arc flash safety regulations
Network communications capability	Limited Modbus capabilities using RS485MS-2W communication module

Accessories



RS485MS-2W Communication Module

Required to enable the Modbus communications function on Model 77X-type products.



COM 4-20 Output Communication Module This module allows communication to a PLC

with an analog input and no Modbus input.

The RM1000/777 motor management system combines unsurpassed electronic motor

RM1000 Remote Monitor



protection and critical, user-friendly, motor monitoring for up to 16 devices. RM2000 Remote Monitor The RM2000/777 motor management sys



The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.

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777-ACCUPOWER

Protection Relays Motor and Pump Protection – 3-Phase Pump Protection

Specifications

Input Characteristics Line Voltage Frequency Motor Full Load Amp Range Functional Characteristics TC- Overcurrent Trip Class

Output Characteristics

Output Contact Rating (SPDT - Form C) Pilot duty General Purpose

General Characteristics Ambient Temperature Range

Operating Storage Accuracy **Measured Horsepower/ Kilowatt** Typical Voltage Current **GF** Current Timing Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque**

200-480VAC 50/60Hz 2-800A (external CTs required over 90A)

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

480VA @ 240VAC 10A @ 240VAC

-40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F)

±3%* ±1% ±3%(<100 amps direct) ±15% 5% ±1 second

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3 7 in.-Ibs.

Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI), Conducted Radio Frequency Immunity (RFI), Radiated Fast Transient Burst Short Circuit Rating Surge IEC

ANSI/IEEE

Hi-Potential Test

Vibration

Shock

Safety Marks UL CE CSA Max. Conductor Size through 777 Dimensions

Weight Mounting Method IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5 kV input power 100kA

61000-4-5 Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V + 1000V for 1 min.) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hrs, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

UL508, UL1053 IEC 60947-1, IEC 60947-5-1 C22.2

0.65" with insulation **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.3 lbs. (20.8 oz., 589.67 g) Surface mount (4 - #8 screws) or DIN rail mount

*On a well balanced system within recommended current range.

www.littelfuse.com/777accupower

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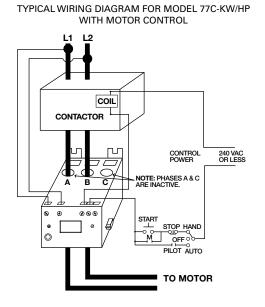


77C-KW/HP SERIES

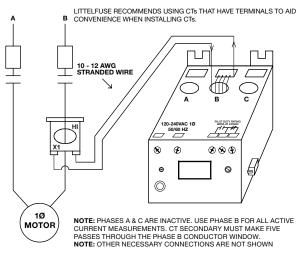
Single-Phase Current & Voltage Monitor



Wiring Diagram



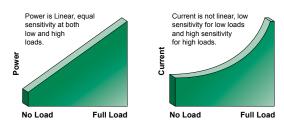
TYPICAL WIRING DIAGRAM FOR MODEL 77C-KW/HP WITH EXTERNAL CT



For dimensional drawing see: Appendix page 507, Figure 1.

Description

The 77C-KW/HP and 77C-LR-KW/HP are fully programmable pump protection relays which will monitor the voltage and current for high or low voltage, overload and underload conditions based on power, in one package. The underpower trip feature is desirable anytime the current vs.load characteristic is non-linear or has little change. In general terms, smaller motors and slow-speed motors have little change in current over the normal load range. Larger motors that are running light loads will also show small current changes over the operating load range. Common uses include pumping applications where motors run slower than around 3400 rpm and usually have small current vs load changes; such as slow speed mixer or agitator motors up to 50 hp, and magdrive or can pumps.



The Littelfuse PumpSaver relay provides the high sensivity of a power monitor to protect pump motors from dry run and dead-head conditions.

Features & Benefits

FEATURES	BENEFITS
Underload protection	Increases reliability for non-linear motors where the load characteristic has little change
Built-in display	Visual indication for programming, viewing real-time voltage, current, kilowatts or horsepower, and last fault code
15 programmable criteria settings	Allows user flexibility to fine-tune the relay for maximum protection in any application.
Last fault memory	Provides instant troubleshooting diagnostics
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations.
Flexible reset	Reset options: automatic, manual using pushbutton on relay, or remotely with optional 777-MRSW or OL-RESET remote reset kit.
Network communications capability	Compatible with Modbus using optional communications module (RS485MS-2W)

Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
77C-KW/HP	100-240VAC	2-90A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT (Form C) relay contacts
77C-LR-KW/HP	100-240VAC	1-9A (external CTs required above 9A)	Provides 480VA @ 240VAC output SPDT (Form C) relay contacts



77C-KW/HP SERIES

Accessories



RS485MS-2W Communication Module

Required to enable the Modbus communications function on Model 77X-type products.

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Communication Adapters • RS485-RS232-Converter with cable & plug

• RS485-USB-Converter with cable & plug RS232-USB-Converter Specifications match industry standard.



RM1000 Remote Monitor

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



RM2000 Remote Monitor

The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.

Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



OL-RESET Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

Specifications

Input Characteristics

Supplt Voltage Frequency **Motor Full Load Amp Range** 77C-KW/HP

77C-LR-KW/HP

Short Circuit Withstand Rating **Power Consumption Output Contact Rating SPDT** (Form C)

Expected Life Mechanical Electrical Accuracy at 25° C (77° F) Voltage Current Timing Repeatability Voltage Current **Safety Marks** UL CE CSA

Standards Passed

Radio Frequency Immunity (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst** Surge IEC

ANSI/IEEE

Hi-potential Test Vibration

Shock

Mechanical Dimensions

Maximum conductor size through holes **Terminal Torque Enclosure Material** Weight **Mounting Methods**

100-240 VAC, 1Ø 50-60 Hz

2-25 Amps (Loops Required) 26-90 Amps (Direct) 91-800 Amps (External CT's) 1.0 Amps - 2.0 Amps (additional Loop) 2.0 Amps - 9.0 Amps (Direct)

100kA per UL and CSA 5W (Maximum)

Pilot duty rating: 480 VA @ 240 VAC General purpose: 10A @ 240 VAC

1 x 10⁶ operations 1 x 10⁵ operations at rated load

±1% ±3% (Direct, No External CTs) 5% ± 1 second

± 0.5% of nominal voltage ± 1% (Direct, No External CTs)

UL508, UL1053 IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power

IEC 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 min.) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

H 77.47 mm (3.05"); W 97.79 mm (3.85"); D 128.27 mm (5.05")

0.65" (with insulation) 7 in.-lbs. polycarbonate 1.2 lbs 35mm DIN rail or surface mount

77C-KW/HP SERIES



Environmental

Temperature Range		
Ambient Operating	-20° - 70° C (-4° - 158	3°F)
Ambient Storage	-40° - 80° C (-40° - 17	76°F)
Pollution Degree	3	
Class of Protection	IP20, NEMA 1	
Relative Humidity	10-95%, non-condens	sing per IEC 68-2-3
Programmable		
Operating Points	Range	
LV- Low Voltage Threshold	85V - HV Setting	
HV- High Voltage Threshold	LV Setting - 264V	
MULT- # of Conductors or		
CT Ratio (XXX:5)		
77C:	1-10 Conductors or 10	10-800 Ratio
77C-LR:	1 or 2	
OC- Overcurrent Threshold	(20-100A) ÷ MULT or	80-120% of CT Primary
TC- Overcurrent Trip Class *	5, J5, 10, J10, 15, J15	, 20, J20, 30, J30, or
	Lln (linear)	
RD1- Rapid Cycle Timer	0, 2 - 500 Seconds	
RD2- Restart Delay After All		
Faults Except Undercurrent		
(motor cool down timer)**	2 - 500 Minutes/Seconds	
RD3- Restart Delay		
After Undercurrent		
(dry well recovery timer)	2 - 500 Minutes/Seco	onds
#RU- Number of Restarts		
After Undercurrent	0, 1, 2, 3, 4, A (Autom	atic)
ADDR- RS485 Address	A01- A99	
#RO-Number of Restarts		
After Overcurrent	0, 1, 2, 3, 4, A (Autom	atic)
LP/PWS (PWS = LP Range)	1 = 0.01 - 0.99 KW	5 = 0.01 - 1.30 HP
•	2 = 1.00 - 9.95 KW	6 = 1.34 - 13.3 HP
	3 = 10.0 - 99.5 KW	8 = 13.4 - 133 HP
	4 = 100 - 650 KW	9 = 134 - 871 HP

* If J Prefix is displayed in trip class setting, jam protection is enabled. If programmed to LIn position, overcurrent trip delays are fixed linear-type delays set in OPT1 position.

** RD2 & RD3 can be changed from minutes to seconds under program position OPT2.

SETTING	RD2	RD3	SETTING	RD2	RD3
0	Minutes	Minutes	2	Seconds	Minutes
1	Minutes	Seconds	3	Seconds	Seconds



Protection Relays Motor and Pump Protection – Temperature Monitoring

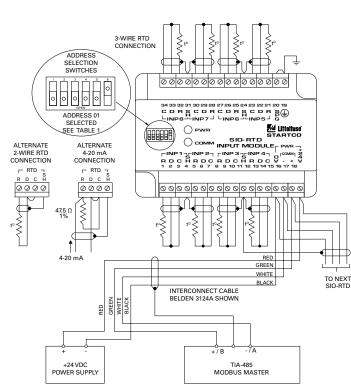
SIO-RTD-02-00







Wiring Diagram



Description

The SIO-RTD is a microprocessor-based data-acquisition system for measuring temperatures accurately with resistance temperature detectors (RTDs) and for monitoring 4-20 mA analog-output devices in industrial environments. RTD inputs are noise-filtered and automatically calibrated for lead-length compensation, ambient temperature, and other factors providing accurate readings through the specified temperature range for several types of RTD devices.

Features & Benefits

FEATURES	BENEFITS
8 inputs	Single module can collect multiple data points
CSA Class 1 Zone 2 Hazardous-location Certified	Can be mounted in hazardous areas
Individually-selectable input type	Flexible; can be used with Pt100, Ni100, Ni120, Cu10 RTD or 4-20 mA inputs
Conformal coating	Protects circuit boards against corrosion and moisture
Remote monitoring	Up to 1.2 km away from network master
Notch filter	Rejects noise from motor monitoring applications

Specifications

Input Voltage RTD Types RTD Range Analog Range Accuracy (Pt100, Ni100, Ni120) (Cu10) (4-20 mA) Lead Compensation Communications Conformally Coated Approvals Dimensions

Warranty Mounting 18 to 32 Vdc, 2W Pt100 (default), Ni100, Ni120, Cu10 -40 to 200° C with open and short detection 4-20 mA

1° C 3° C 0.1 mA Up to 20 Ω Modbus RTU® Standard feature cCSAus H 87 mm (3.43"); W 112.5 mm (4.43"); D 56 mm (2.2") 5 years DIN, Surface

For dimensional drawing see: Appendix page 515, Figure 49.

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PUMP CONTROLS & LIQUID LEVEL CONTROLS

Protect and disable a pump if a hazardous condition arises. PumpSaver® offers a wide variety of controls for both single phase and three phase applications. Intrinsically safe relays are specifically designed to interface between hazardous and non-hazardous areas.

ACBC-120 Series	Alarm Controller/Battery Charging Unit 130
PC-102 Series	Dual Channel Switch132
PC-105	5-Channel Pump Controller 133
PC-XXX-LLC-CZ Series	Liquid Level Control Relays 134
PC-XXX-LLC-GM Series	Liquid Level Control Relays134
201-100-SLD	Single-Channel Seal-Leak Detector 136
460-15-100-LLS	Single-Channel Liquid Level Sensor
460-15-100-SLD	Single-Channel Seal-Leak Detector 139
LLC1 Series	Open Board Liquid Level Control 141
LLC2 Series	Open Board Liquid Level Control 143
LLC4 Series	Octal Plug-In Liquid Level Control145
LLC5 Series	Liquid Level Control147
LLC6 Series	Low Level Cutoff Liquid Level Control 149
LLC8 Series	Low Level Cutoff Liquid Level Control 151

Alternating Relays

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For More Information...

and to download our Fresh Water Pumping Catalog, visit Littelfuse.com/PumpProtection 8

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Protection Relays Pump Controls and Liquid Level Controls

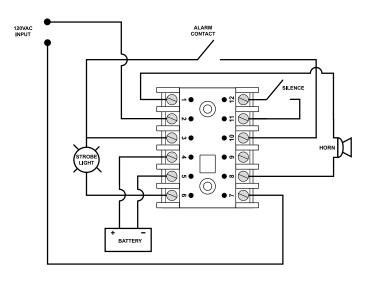
ACBC-120 SERIES

Alarm Controller and Battery Charger for pump control panels

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Wiring Diagram



For dimensional drawing see: Appendix, page 509, Figure 8.

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
ACBC-120	120VAC	Does not include SD12-PC socket for mounting
ACBC-120-SD	120VAC	Includes SD12-PC socket for mounting

Description

The ACBC-120 Series is a dual purpose alarm controller/battery charging unit. When there is a loss of 120VAC power, the ACBC-120's primary function as an alarm controller activates. When this power loss occurs, input power is switched to a 12VDC, lead-acid, rechargeable backup battery and a 12VDC alarm consisting of a strobe light and/or a horn is activated. The horn follows a 2 second on/2 second off pattern with a "horn silence" option to turn the sound off. An LED indicator on the unit also signals that the device has entered the alarm mode.

When 120VAC input is present the alarm circuit can be tested and the unit's secondary function as a 12VDC backup battery charger is activated. In fast charge mode, the unit has the capability to source up to 100mA of charging current. However, the device normally charges at a current of 14mA in maintenance mode. The alarm circuit can be tested by pressing the "test" button located on the front of the unit or by activating an external switch via the "alarm contact" pin.

The device has the ability to signal low battery voltage if the voltage drops below 10.5VDC. The device can also detect if no battery is present or if the battery is connected backwards. In either of these cases, the ACBC-120 will signal a battery error and will not attempt to charge.

Must use Model SD12-PC socket for UL Rating!

*Note: Manufacturer's recommended screw terminal torque for the SD Series Sockets is 12 in.-Ibs.

Features & Benefits

FEATURES	BENEFITS		
Controls 12VDC alarm circuit	Activates strobe and/or horn when power loss occurs		
Selectable fast charge mode	Unit sources higher charging current up to 100mA (normal mode is 14mA)		
Trip delay timer	Prevents nuisance tripping		
Battery fault detection and reverse polarity protection	Signals if battery voltage drops below 10.5VDC and can detect if no battery is present or if the battery is connected backwards		
LED indication	Visual indication of unit status or trip		
Test button	Preventative maintenance check of the alarm circuit by pressing the test button on the unit or externally through alarm contact connection		

Accessories



SD12-PC 12-pin Rectangle Socket

Rectangle Socket for the ACBC-120. 12-pin surface mountable.

ACBC-120 SERIES



Specifications

Input Characteristics Supply Voltage AC Input Voltage Frequency **AC Input Current AC Input Power**

Functional Characteristics

Battery Charging Characteristics Acceptable Battery Type Fast Charge Current Maintenance Charge Current Low Battery Alert Level **Output Characteristics** Strobe Light Alarm Output Horn Alarm Output **General Characteristics Temperature Range**

120V +/-10% 50/60Hz 0.018A (max.) 0.003 (typical) 2.4W (max.) fast charge current 0.4W (typical) maint. charge current

12V lead-acid rechargeable 100mA +/-10% 14mA +/-50% 10.5V

12VDC@1A (max.) 12VDC@1A (max.)

-40° to 60°C (-40° to 140°F)

Standards Passed

Radio Frequency, Radiated Fast Transient Burst

Safety Marks UL (SD12-PC socket required) Dimensions

Weight **Mounting Method**

Socket Available

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air 150MHz, 10V/m IEC 61000-4-4, Level 4, 4kV input lines; 4kV signal lines

> UL508 (File #E68520) H 44.45 mm (1.75"); W 60.325 mm (2.375"); **D** 104.775 mm (4.125") (with socket) 0.7 lb. (11.2 oz., 317.51 g) Surface mount with #8 or #10 screws (plug into SD12-PC socket) Model SD12-PC (UL Rating 600V) The 600V socket can be surface mounted



Protection Relays Pump Controls and Liquid Level Controls

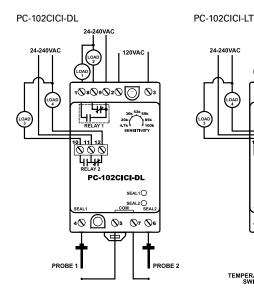
PC-102 SERIES

Dual Seal-Leak Detector or Seal-Leak & **Over-Temperature Detector**

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Wiring Diagram



For dimensional drawing see: Appendix, page 510, Figure 10.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION	
PC-102CICI-DL	120VAC nominal	Dual seal-leak detector uses inputs to sense seal failures and energize the output relay. Input logic direct or inverted is DIP switch selectable	
PC-102CICI-LT	120VAC nominal	Seal-leak and over-temperature detector uses one input to sense seal failures and the temperature input to detect motor overheating. Configurable to suit various probes. Seal input logic direct or inverted, plus over-temperature trip reset automatic or manual, is DIP switch selectable	

Description

The PC-102 is a dual-channel switch that provides dual protection against seal failures and over-temperature in submersible pumping applications.

Both units have two form-C isolated output relays and two LEDs, which illuminate when each associated output relay is energized.

The sensitivity adjustment (4.7k-100kOhms) allows you to define the input impedance at which the output relays will change state. The sensitivity for the over-temperature detector can be set to 4k Ohms with use of the DIP switches.

This unit may not be compatible with Flygt pumps.

Features & Benefits

FEATURES	BENEFITS		
Finger-safe terminals	Meets IEC 61000 safety requirements		
Compact design for DIN rail or surface mount	Allows flexiblility in panel installation		
LED Status Indicator	Visual indication of relay engagement		
Two input channels	Flexibility for pump-up/pump-down or two-channel switch applications		

Specifications

20VA0

20k 851

TEMP

SEALO

PROBE

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10809020

Lu

PC-102CICI-LT

10 (0) 05 07 00

Input Characteristics Frequency **Functional Characteristics Probe Sense Voltage** Sensitivity Sensitivity (for temp) Input Logic **Debounce Time Delay Output Characteristics Relay Output Rating** (2 Form C isolated) **Pilot Duty General Purpose General Characteristics Temperature Range Maximum Input Power Depluggable Connector Output Relay Status Indicators Terminal Torque** Wire range **Standards Passed**

Radio Frequency Immunity (RFI) IEC 61000-4-3, Level 3, 10V/m **Fast Transients**

Safety Marks ш Dimensions

Weight **Mounting Method** 50/60Hz

5vdc pulsed 4.7k-100k0 Selectable 4kΩ with DIP switches Direct or inverted 0.5 or 2 seconds

180VA @ 120VAC, C150 5A @ 240VAC

-20° to 55°C (-4° to 131°F) 2 W Phoenix Contact-Series MSTB plugs

LEDs 4.5 in.-lbs. 12-20 AWG

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air. IEC 61000-4-4, Level 3, 4kV input power 2kV inputs/outputs

> UL508 (File #E68520) H 88.9 mm (3.5"); W 52.93 mm (2.08"); **D** 59.69 mm (2.35") 0.9 lb. (14.4 oz., 408.23 g) 35mm DIN rail or Surface Mount (#6 or #8 screws)

www.littelfuse.com/pc102

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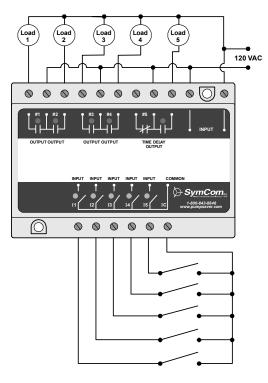
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PC-105

Pump controller with duplex, triplex or quadplex functionality or 5-channel relay



Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 12.

Description

The PC-105 is a 5-channel pump controller designed to handle multiple pump applications. Alternatively, it can operate as a 5-channel switch.

The PC-105's control functions support all of the popular industrystandard multi-pump, pump-up and pump-down configurations.

It can indicate low, high and out-of-sequence alarms and use alternating and non-alternating pump control. The non-alternating pump can be used as a jockey pump or emergency pump.

Using the built-in DIP switches, individual pumps can be disabled when taken out of service for repair or maintenance.

Features

- Compact design
- Low, high and out-of-sequence alarms
- Variable time delay/lag pump delay from 2-255 seconds
- Duplex SPS (separate pump stop) pump control
- Duplex, triplex or quadplex pump control
- Pump-up or pump-down functions
- External silence, reset and alternation configuration
- Five-channel relay configuration
- DIN rail or surface mountable

Specifications

Input Characteristics Supply Voltage Frequency **Functional Characteristics Probe Sense Voltage Output Characteristics Relay Output Rating: Pilot Duty General Purpose General Characteristics Temperature Range Maximum Input Power** Wire range **Terminal Torque** Pump In-rush delay **Standards Passed Radio Frequency** Immunity (RFI) **Fast Transients Safety Marks**

UL Dimensions

Weight Mounting Method 120VAC 50*/60Hz

5vdc continuous

480VA @ 240VAC, B300 7A @ 240VAC

/A @ 240VAC -20° to 55°C (-4° to 131°F)

4 W 12 to 20 AWG 4.5 in.-lbs. (max.)

2 seconds

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air.

IEC 61000-4-3, Level 3, 10V/m IEC 61000-4-4, Level 3, 4kV input power 2kV inputs/outputs

UL508 (File #E68520) H 94.06 mm (3.703"); W 127.64 mm (5.025"); D 59.69 mm (2.35") 1.2 lbs. (19.2 oz., 544.31 g) 35 mm DIN rail or Surface Mount (#6 or #8 screws)

*Note: 50Hz will increase all delay timers by 20%.

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PC-XXX-LLC-CZ / PC-XXX-LLC-GM SERIES

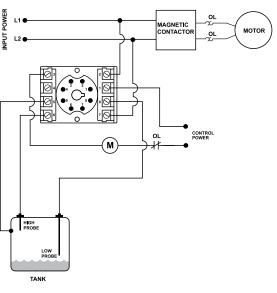
Liquid Level Control

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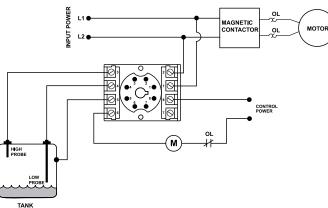


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR PC-XXX-LLC-CZ



TYPICAL WIRING DIAGRAM FOR PC-XXX-LLC-GM



Description

The PC-xxx-LLC-CZ and PC-xxx-LLC-GM Series are liquid level control relays used to control conductive liquid pumping operations in a pump-up or pump-down application. The units come in two different voltage ranges (see specs below).

The units have an adjustable sensitivity knob (4.7k to 100k ohms) that is set according to the resistance level at which you want the probes (sold separately) to sense the conductive liquid. The units have a built-in debounce time delay that prevents the relay from energizing if the probe resistance momentarily goes above or below the sensitivity setpoint (due to liquid splashing in the tank).

The units operate their internal relay based on inputs from a high and low probe and a common reference (when a conductive tank is used) or common probe (when a non-conductive tank is used).

PC-xxx-LLC-CZ

 Compatible with Crouzet's PNR & PNRU series liquid level control

PC-xxx-LLC-GM

Compatible with Gems' Series 16M general purpose control

Must use Model OT08PC or P1011-6 socket for UL Rating!

Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-lbs.

Features & Benefits

FEATURES	BENEFITS		
Debounce time delay (2 seconds)	Prevents rapid cycling of the pump due to turbulance in the tank		
Adjustable sensitivity (4.7 to 100Kohms)	Allows user to fine tune the sensing resistance to prevent false tripping due to foam or debris		
Dual probe design (plus a common)	Allows user the ability to set the level differential required		

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION		
PC-100-LLC-CZ	95-120VAC	Compatible with Crouzet's PNR & PNRU Series liquid level control		
PC-200-LLC-CZ	190-240VAC	Compatible with Crouzet's PNR & PNRU Series liquid level control		
PC-100-LLC-GM	95-120VAC	Compatible with Gems' Series 16M liquid level control		
PC-200-LLC-GM	190-240VAC	Compatible with Gems' Series 16M liquid level control		

For dimensional drawing see: Appendix, page 509, Figure 8.

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PC-XXX-LLC-CZ / PC-XXX-LLC-GM SERIES

Accessories



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.

Specifications

Input Characteristics

Supply Voltage PC-100-LLC-CZ PC-100-LLC-GM PC-200-LLC-CZ PC-200-LLC-GM Frequency

Functional Characteristics

Probe Sense Voltage Debounce Time Delay Probe Sensitivity Output Characteristics

Output Contact Rating

Pilot Duty General Purpose 95-120VAC 95-120VAC 190-240VAC 190-240VAC 50/60Hz

5VDC pulsed 2 seconds 4.7k to 100k Adjustable

480VA @ 240VAC 10A @240VAC

General Characteristics

Temperature Range Maximum Input Power Sandards Passed Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI) Fast Transients

Safety Marks

UL (OT08PC octal socket required) CE Dimensions (when installed

in socket base)

Weight Mounting Method

Socket Available

IEC 61000-4-2, Level 3, 6kV contact, 8kV air. 150MHz, 10V/m

-40° to 70°C (-40° to 158°F)

5 W

IEC 61000-4-4, Level 3, 2kV input power and controls

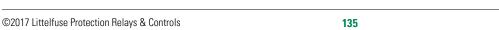
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Expertise Applied | Answers Delivered

UL508 (File #E68520) IEC60947-6-2

H 44.45 mm (1.75"); W 60.33 mm (2.375"); D 104.78 mm (4.125") 0.65 lb. (10.4 oz., 294.84 g) DIN rail or surface mount (plug into OT08PC socket) Model OT08PC (UL Rating 600V)

The 600V socket can be surface mounted or installed on DIN Rail.



www.littelfuse.com/pcxxxllccz-pcxxxllcgm



201-100-SLD

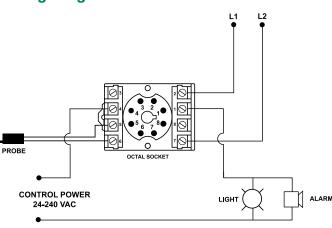
Single-Channel Seal-Leak Detector

CE® UL listed when used in combination with OT08PC socket only.



8 PUMP CONTROLS & LIQUID LEVEL CONTROLS

Wiring Diagram



For dimensional drawing see: Appendix, page 509, Figure 8.

Note: Manufacturer's recommended screw terminal torque for the RB Series and OT Series

Description

The model 201-100-SLD is an 8-pin plug-in style seal-leak detector to sense seal failures on submersible pumps. A microcontroller-based relay that monitors the shaft seal of a submersible pump motor. A resistive probe is installed in the seal cavity. If water leaks into the pump, the resistance measured by the probe decreases. When the resistance drops below the sensitivity setpoint, the unit will trip and the relay contacts will change state. The unit will automatically reset when a fault is cleared.

Features & Benefits

- LED status indicator
- Compact plug-in design
- DIN rail or surface mountable via octal base

Accessories



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.

Specifications

Control Voltage Frequency 50/60Hz Sensitivity **Probe Sense Voltage Output contact Rating** SPDT **Pilot Duty General Purpose Operating Temperature** Storage **Maximum Input Power** 5 W **Relative Humidity** Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency Immunity,** Radiated **Fast Transient Burst**

IEC

ANSI/IEEE

Hi-Potential Test UL* CE Enclosure Dimensions

Weight **Mounting Method**

Socket Available Approvals

110/120VAC nominal 4.7k-100kΩ 5vdc pulsed 480VA @ 240VAC 10A @ 240VAC -40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F) 10-95%, non-condensing per IEC 68-2-3

150MHz, 10V/m IEC 61000-4-4, Level 3, 3.5kV input power and controls IEC 61000-4-5, Level 3, 4kV line-to-line; level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V + 1000V for 1 min.) UL508 (File #E68520) IEC 60947-6-2 Polycarbonate **H** 44.45 mm (1.75"); **W** 60.325 mm (2.375"); **D** (with socket) 104.78 mm (4.125") 0.7 lb. (11.2 oz., 317.51 g) DIN rail or surface mount (plug into OT08PC socket) Model OT08PC (UL Rating 600V) UL, CE

*Must use Model OT08PC socket for UL Rating! The 600V socket can be surface mounted or installed on DIN Rail.

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Octal Sockets is 12 in.-Ibs.

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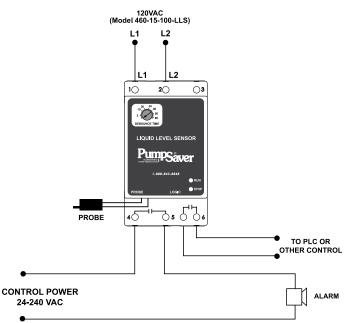
460-15-100-LLS

Single-Channel Liquid Level Sensor





Wiring Diagram



For dimensional drawing see: Appendix, page 510, Figure 10.

Description

The 460-15-100-LLS is a liquid level sensor to detect the presence of conductive liquids. A probe is mounted at the desired tank level and connected to the PumpSaver[®]. When the probe is submersed, the relay's output contacts will change state as soon as the debounce time expires. The adjustable debounce timer is intended to prevent nuisance actuating due to waves or splashing in the tank.

Relay logic can be inverted so the relay's output contacts change state when the probe is no longer submersed. This makes the unit versatile for use in pump-up and pump-down applications.

Features & Benefits

FEATURES	BENEFITS		
Unique Probe Protection	Probes are protected from scale build up through pulsed DC signal between the probes		
Invertible relay logic	Allows flexibility to be used in pump-up and pump-down applications		
Adjustable debounce timer	Prevents nuisance actuating caused by waves or splashing in the tank		
LED status indicators	Provides visual indication of the relay status		

Specifications

Input Characteristics Control Voltage Frequency

Sensitivity

Functional Characteristics Probe Sense Voltage Debounce Time Delay Output Characteristics Output contact Rating - (Two Form A - SPST) Pilot Duty **General Purpose General Characteristics Ambient Temperature Range** Operating Storage **Maximum Input Power Class of Protection Relative Humidity Terminal Torque** Wire

Standards Passed

Fast Transient Burst

Electrostatic Discharge (ES Radio Frequency Immunity, Radiated 110/120VAC nominal
50/60Hz (*Note: 50Hz will increase all delay timers by 20%*)
100kΩ
5vdc pulsed
2-60 seconds

360VA @ 240VAC 8A @ 240VAC

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F) 2 W IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3 4.5 in.-Ibs. 12-20 AWG

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

150MHz, 10 V/m IEC 61000-4-4, Level 3, 3.5kV input power and controls

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Protection Relays Pump Controls and Liquid Level Controls

460-15-100-LLS

Surge IEC

ANSI/IEEE

Hi-Potential Test Safety Marks UL CE Enclosure Dimensions

Weight Mounting Method IEC 61000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V + 1000 V for 1 min.)

UL508 (File #E68520) IEC 60947 Polycarbonate H 88.9 mm (3.5"); W 52.93 mm (2.08"); D 59.69mm (2.35") 1 lb. (16 oz., 453.59 g) 35mm DIN rail or Surface Mount (#6 or #8 screws)

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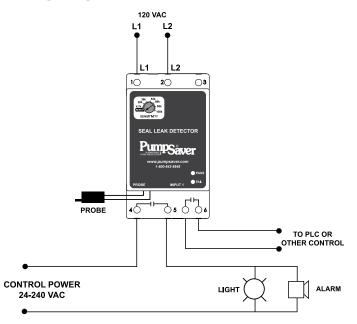
460-15-100-SLD

Single-Channel Seal-Leak Detector





Wiring Diagram



For dimensional drawing see: Appendix, page 510, Figure 10.

Description

The 460-15-100-SLD is a seal-leak detector to sense seal failures on submersible pumps. A microcontroller-based relay monitors the shaft seal of a submersible pump motor. A resistive probe is installed in the seal cavity. If water leaks into the pump, the resistance measured by the probe decreases. When the resistance drops below the sensitivity setpoint, the unit will trip and the relay contacts will change state. Output relay logic can be reversed by removing an external jumper. The unit will automatically reset when a fault is cleared.

Features & Benefits

FEATURES	BENEFITS		
Unique probe protection logic	Probes are protected from scale build up through pulsed DC signal between the probes		
Invertible relay logic	Allows flexibility to be used in pump-up and pump-down applications		
LED status indicators	Provides visual indication of the relay status		
2 relay contacts	Control independent loads on different circuits		

110/120VAC nominal

timers by 20%)

4.7k-100kΩ

5vdc pulsed

360VA @ 240VAC

-40° to 70°C (-40° to 158°F)

-40° to 80°C (-40° to 176°F)

IP20, NEMA 1 (finger safe)

8A @ 240VAC

50/60Hz (Note: 50Hz will increase all delay

Specifications

Input Characteristics Control Voltage Frequency

Functional Characteristics

Sensitivity **Probe Sense Voltage Output Characteristics Output contact Rating** - (Two Form A - SPST) **Pilot Duty General Purpose General Characteristics Ambient Temperature Range** Operating Storage **Maximum Input Power Class of Protection Relative Humidity Terminal Torque** Wire

Standards Passed

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency** Immunity, Radiated 150MHz, 10 V/m **Fast Transient Burst**

2 W

4.5 in.-lbs.

AWG 12-20 AWG

IEC 61000-4-4, Level 3, 3.5kV input power and controls

10-95%, non-condensing per IEC 68-2-3



Protection Relays Pump Controls and Liquid Level Controls

460-15-100-SLD

Surge IEC

ANSI/IEEE

Hi-Potential Test Safety Marks

UL CE Enclosure Dimensions

Weight Mounting Method IEC 61000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V + 1000 V for 1 min.)

UL508 (File #E68520) IEC 60947 Polycarbonate **H** 88.9 mm (3.5"); **W** 52.93 mm (2.08"); **D** 59.69 mm (2.35") 1 lb. (16 oz., 453.59 g) 35mm DIN rail or Surface Mount (#6 or #8 screws)

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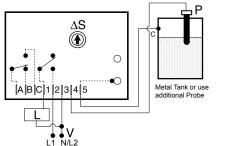
LLC1 SERIES

Open Board Liquid Level Controls





Wiring Diagram



 $\begin{array}{l} \mathsf{P} = \mathsf{Probe} \\ \mathsf{L} = \mathsf{Load} \\ \mathsf{V} = \mathsf{Voltage} \\ \Delta \mathsf{S} = \mathsf{Sensitivity} \\ \mathsf{Adjustment} \end{array}$

Contacts A, B & C are isolated.

Connect common to conductive tank or an additional probe as required.

For dimensional drawing see: Appendix, page 514, Figure 40.

Description

The LLC1 Series is a single probe conductive liquid level control designed for OEM equipment and commercial appliances. This unit may be ordered with fixed fill or fixed drain operation. A time delay (1-60s) prevents rapid cycling of the output relay. On adjustable units, the sensitivity adjustment allows accurate level sensing while ignoring foaming agents and floating debris. Isolated AC voltage is provided at the probe to prevent electrolysis. A trickle current of less than 1mA determines the presence or absence of liquid between the probe and common. The LLC1 Series printed circuit board is conformal coated to resist moisture and corrosion.

Operation

Drain (Pump-Down Mode): When the liquid level rises and touches the probe, a fixed time delay begins. This time delay prevents rapid cycling of the output relay and its load. At the end of the time delay, the output relay energizes and remains energized until the liquid level falls below the probe. The output relay then de-energizes and remains de-energized until the liquid again touches the probe.

Fill (Pump-Up Mode): When the liquid level falls below the probe, a fixed time delay begins. This time delay prevents rapid cycling of the output relay and its load. At the end of the time delay, the output relay energizes and remains energized until the liquid level rises and touches the probe. The output relay then de-energizes and remains de-energized until the liquid level again falls below the probe.

Features & Benefits

FEATURES	BENEFITS		
Isolated AC voltage on probe	Prevents scale buildup on the probe		
Open PCB design	Cost effective design for OEM equipment and commercial appliances		
Conformally coated PCB	Protects against moisture and corrosion		
Sensitivity adjustment	Provides accurate level sensing while ignoring foan or floating debris		

Ordering Information

MODEL	INPUT VOLTAGE	OPERATION	TIME DELAY	SENSE RESISTANCE	MOUNTING
LLC14A1AX	120VAC	Drain	1s	Adjustable	0.5 in nylon standoffs (3)
LLC14A5AX	120VAC	Drain	5s	Adjustable	0.5 in nylon standoffs (3)
LLC14B15AX	120VAC	Fill	15s	Adjustable	0.5 in nylon standoffs (3)
LLC14B1AX	120VAC	Fill	1s	Adjustable	0.5 in nylon standoffs (3)
LLC14B60AX	120VAC	Fill	60s	Adjustable	0.5 in nylon standoffs (3)
LLC16A25AX	230VAC	Drain	25s	Adjustable	0.5 in nylon standoffs (3)
LLC16A3AX	230VAC	Drain	3s	Adjustable	0.5 in nylon standoffs (3)

If you don't find the part you need, call us for a custom product 800-843-8848

PUMP CONTROLS & LIQUID LEVEL CONTROLS

8

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LLC1 SERIES

Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



PHST-38QTN Electrode Designed for a maximum steam pressure of 240 PSI; 400° F. UL353 Recognized.



LLP-24 Threaded Probe (24") Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid level control electrodes.

Specifications

Control Type

Sense Voltage

Sense Resistance Sense Resistance Tolerance

Time Delay

Range Input Voltage Tolerance 24VAC 120 & 230VAC AC Line Frequency Output Type Form Rating

Life Protection Surge Isolation Voltage Mechanical Mounting

Termination Dimensions (Open Board)

Environmental

Operating/Storage Temperature Coating

Weight

ON/OFF (single level) resistance sensor with built-in time delay to prevent rapid cycling Low voltage AC between probe & common. Isolated from input & output. Fixed or adjustable to $250K\Omega$ Adjustable - guaranteed range Factory fixed ±10%

Fixed 1 - 60s in 1s increments

24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

Electromechanical relay Non-isolated, SPST & Isolated, SPDT contacts 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁵

IEEE C62.41-1991 Level A \geq 1500V RMS between input, output & probe

Surface mount to probe common with two #6 (M3.5 x 0.6) screws or 0.50 in. (12.7 mm) nylon standoffs with three #6 (M3.5 x 0.6) screws (use Terminal 5 for probe common) 0.25 in. (6.35 mm) male quick connect terminals H 88.9 mm (3.5°); W 69.9 mm (2.75°); D 50.8 mm (2.0°)

-20° to 55°C/-40° to 80°C Printed circuit board is conformal coated to resist moisture and corrosion ≈ 8.7 oz (247 g)

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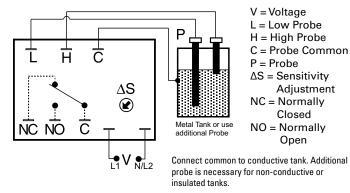


LLC2 SERIES

Open Board Liquid Level Controls



Wiring Diagram



For dimensional drawing see: Appendix, page 514, Figure 41.

Ordering Information

-				
MODEL	INPUT VOLTAGE	OPERATION	TERMINATION	SENSE RESISTANCE
LLC24A2AN	120VAC	Drain	Terminal block	Adjustable to 100kΩ
LLC24A2F50N	120VAC	Drain	Terminal block	Fixed 50kΩ
LLC24B1AC	120VAC	Fill	0.25" Quick connect	Adjustable to 100kΩ
LLC24B1F26C	120VAC	Fill	0.25" Quick connect	Fixed 26kΩ
LLC24B2F50N	120VAC	Fill	Terminal block	Fixed 50kΩ
LLC26A1F25C	230VAC	Drain	0.25" Quick connect	Fixed 25kΩ

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Description

The LLC2 Series is a dual-probe conductive liquid level control designed for OEM equipment and commercial appliance applications. Models are available for fill or drain operation. Transformer isolated 12VAC is provided at the probes to prevent electrolysis. A trickle current of less than 1mA determines the presence or absence of liquid between the probes and common. On adjustable units, the sensitivity adjustment allows accurate level sensing while ignoring foaming agents and floating debris. The LLC2 Series printed circuit board is conformal coated to resist moisture and corrosion.

Operation

Drain (Pump-Down Mode): When the liquid level rises and touches the high probe, the output relay energizes and remains energized until the liquid level falls below the low probe. The output relay then de-energizes and remains de-energized until the liquid again touches the high probe.

Fill (Pump-Up Mode): When the liquid level falls below the low probe, the output relay energizes and remains energized until the liquid level rises and touches the high probe. The output relay then de-energizes and remains de-energized until the liquid level again falls below the low probe.

Features & Benefits

FEATURES	BENEFITS
Isolated 12VAC probes	Prevents scale buildup on the probes
Open PCB design	Cost effective design for OEM equipment and commercial appliances
Conformally coated PCB	Protects against moisture and corrosion
Sensitivity adjustment	Provides accurate level sensing while ignoring foam or floating debris

Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.







all modules with 0.25 in. (6.35 mm) male quick connect terminals.
PHST-38QTN Electrode

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

Designed for a maximum steam pressure of 240 PSI; 400° F. UL353 Recognized.

LLP-24 Threaded Probe (24")

Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid level control electrodes.



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LLC2 SERIES

Protection Relays Pump Controls and Liquid Level Controls

Specifications

Control Type

Sense Voltage Sense Resistance Sense Resistance Tolerance

Input

Voltage Tolerance 24VAC 120 & 230VAC AC Line Frequency Output Type Form Rating

Life

Protection Isolation Voltage Mechanical Mounting

Termination

Dimensions (Open Board)

Environmental

Operating/Storage Temperature Coating

Weight

Resistance sensing for high & low level detection of conductive liquids 12VAC at probe terminals Fixed or adjustable to $100K\Omega$ Adjustable: guaranteed range Fixed: $\pm 10\%$

24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

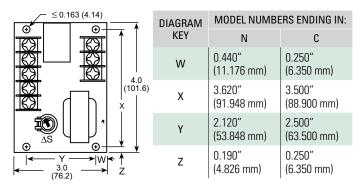
Electromechanical relay Isolated, SPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁵

≥ 1500V RMS between input, output, & probe

Surface mount with two or four #6 (M3.5 x 0.6) screws 0.25 in. (6.35 mm) duplex male quick connect terminals. Terminal blocks for up to #14 AWG 2.5 mm²) wire H 101.6 mm (4.0"); W 76.2 mm (3.0"); D 50.8 mm (2.0")

-20° to 55°C / -40° to 80°C Printed circuit board is conformal coated to resist moisture and corrosion \approx 9 oz (255 g)

Mounting Dimensions



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11C4 SERIES

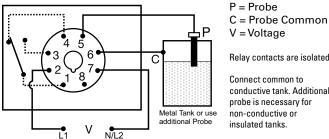
Octal Plug-In Liquid Level Controls







Wiring Diagram



Description

The LLC4 combines resistance sensing circuitry with solid-state timing to provide single probe level maintenance. On adjustable units, the sensitivity adjustment allows accurate level sensing while ignoring foaming agents and floating debris. Isolated 12VAC is provided at the probe to prevent electrolysis. A trickle current of less than 1mA determines the presence or absence of conductive liquid between the probe and common. The LLC4 Series can be used with many types of low voltage (resistance changing) transducers to perform other control functions like temperature limit control, photo limit control, condensation sensing, and ice sensing.

Operation

Drain (Pump-Down Mode): When the liquid level rises and touches the probe, the time delay begins. This time delay prevents rapid cycling of the output relay and its load. At the end of the time delay, the output relay energize and remain energized until the liquid level falls below the probe level. The output relay de-energize and remain de-energized until the liquid rises and touches the probe.

Fill (Pump-Up Mode): When the liquid level falls below the probe, the time delay begins. This time delay prevents rapid cycling of the output relay and its load. At the end of the time delay, the output relay energize and remain energized until the liquid level rises and touches the probe. The output relay then de-energize and remain de-energized until the liquid level again falls below the probe level.

Features & Benefits

FEATURES	BENEFITS
Isolated 12VAC probes	Prevents scale buildup on probe
Industry standard 8-pin octal plug connection	Eliminates need for special connectors
Sensitivity adjustment	Provides accurate level sensing while ignoring foam or floating debris

e buildup on probe				
ed for special connectors				
rate level sensing while ignoring foam oris				
'IME Delay	SENSE RESISTANCE			
	Adjustable 1 - 250kΩ			
60s	Adjustable 1 - 250kΩ			
20s	Adjustable 1 - 250kΩ			
2s	Adjustable 1 - 250kΩ			

INPUT TIME INPUT MODEL **OPERATION** SENSE RESISTANCE MODEL **OPERATION** VOLTAGE DELAY VOLTAGE LLC42A10A 24VAC 10s LLC44B1A 24VAC Drain Adjustable 1 - 250kΩ Fill LLC42A1A 24VAC Drain 1s Adjustable 1 - 250kΩ LLC44A60A 120VAC Drain 6 LLC42B15A 24VAC Fill LLC44B20A 120VAC Fill 2 15s Adjustable 1 - 250kΩ 120VAC 23 LLC44A10A Drain 10s Adjustable 1 - 250kΩ LLC44B2A 120VAC Fill LLC44A15A 120VAC LLC44B30A 120VAC Fill 30s Drain 15s Adjustable 1 - 250kΩ Adjustable 1 - 250kΩ LLC44A1A 120VAC Drain Adjustable 1 - 250kΩ LLC44B4A 120VAC Fill 4s Adjustable 1 - 250kΩ 1s 120VAC Fill LLC44A2A Drain 2s Adjustable 1 - 250kΩ LLC44B5A 120VAC 5s Adjustable 1 - 250kΩ Fill 5s LLC44A4A 120VAC Drain 4s Adjustable 1 - 250kΩ LLC44B5F100 120VAC Fixed 100kΩ LLC44A5A 120VAC Drain 5s Adjustable 1 - 250kΩ

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V = Voltage Relay contacts are isolated. Connect common to

conductive tank Additional probe is necessary for non-conductive or insulated tanks.

For dimensional drawing see: Appendix, page 513, Figure 33.

Ordering Information

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LLC4 SERIES

Accessories



BZ1 Front Panel Mount Kit Provides an easy method of through-the-panel

mounting of 8- or 11-pin plug-in timers, flashers, and other controls. NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 (M 3.5×0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



PSC8 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.





LLP-24 Threaded Probe (24")

Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid level control electrodes.

Specifications

Control Type

Sensing Voltage Sensing Resistance Sensing Resistance Tolerance

Input

Voltage Tolerance 24VAC 120 & 230VAC AC Line Frequency Output Type Form Rating

Protection

Surge Isolation Voltage Mechanical Mounting Termination Dimensions

Environmental

Operating/Storage Temperature Weight ON/OFF (single level) resistance sensor with built-in time delay to prevent rapid cycling 12VAC Fixed or adjustable to $250 \text{K}\Omega$

Adjustable: 1K ±500Ω at low end; 250K ±25% at high end Factory fixed: ±10% or 500Ω, whichever is greater

24, 120, or 230VAC

-15%, +20% -20%, +10% 50/60 Hz

Electromechanical relay Isolated, SPDT 4A resistive @ 240VAC; 1/10 hp @ 240VAC

IEEE C62.41-1991 Level A \geq 1500V RMS between input, output & probe

Plug-in socket Octal 8-pin plug-in **H** 73.9 mm (2.91"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78")

-20° to 60°C/-40° to 80°C ≅ 6 oz (170 g)

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LLC5 SERIES

Liquid Level Controls

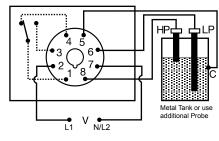
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8-PIN

Wiring Diagram



HP = HIGH LEVEL PROBE LP = LOW LEVEL PROBE C = PROBE COMMON V = VOLTAGE

Relay contacts are isolated. Connect common to conductive tank. Additional probe is necessary for nonconductive or insulated tanks.

For dimensional drawing see: Appendix, page 514, Figure 43.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
LLC52AA	24VAC	For Drain (pump-down) operation with adjustable sense resistance
LLC52BA	24VAC	For Fill (pump-up) operation with adjustable sense resistance
LLC54AA	120VAC	For Drain (pump-down) operation with adjustable sense resistance
LLC54AAS	120VAC	For Drain (pump-down) operation with adjustable sense resistance and reverse connection (#8 low, #6 high)
LLC54AF10	120VAC	For Drain (pump-down) operation with fixed sense resistance of 10 $\ensuremath{k\Omega}$
LLC54BA	120VAC	For Fill (pump-up) operation with adjustable sense resistance
LLC54BAS	120VAC	For Fill (pump-up) operation with adjustable sense resistance and reverse connection (#8 low, #6 high)
LLC56AA	230 VAC	For Drain (pump-down) operation with adjustable sense resistance

Description

The LLC5 provides dual probe conductive liquid level control in a convenient octal plug-in package. Models are available for fixed fill or drain operation. Isolated, pulsed DC voltage on the probes prevents electrolytic plating. Less than 1 mA of current is used to sense the presence of conductive liquid between the probes and common. On adjustable units, the sensitivity adjustment eliminates false tripping caused by floating debris and foaming agents.

Operation

Drain (Pump-Down Mode): When the liquid level rises and touches the high level probe, the output relay and LED energize and remain energized until the liquid level falls below the low level probe. The output relay and LED de-energize and remain de-energized until the liquid rises and touches the high level probe.

Fill (Pump-Up Mode): When the liquid level falls below the low level probe, the output relay and LED energize and remain energized until the liquid level rises and touches the high level probe. The output relay and LED de-energize and remain de-energized until the liquid level again falls below the low level probe.

Features & Benefits

FEATURES	BENEFITS
Unique Probe Protection logic	Probes are protected from scale build up through pulsed DC signal between the probes.
LED status indicatior	Visual indication of relay engagement in pump-up or pump-down activity
Isolated 5A SPDT contacts	Allows control of loads for AC voltage

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.

N 8 at

NDS-8 Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm

DIN rail. Uses PSC8 hold-down clips.



PSC8 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.

Note: use of the PSC8 clips partley covers the LED window of the LLC5 unit. Use of alternative socket base P1011-6 with its corresponding hold down clips PSCRB8 do not cover up the LED window, but the socket base is not DIN rail mountable.

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LLC5 SERIES

Protection Relays Pump Controls and Liquid Level Controls

Accessories



PHST-38QTN Electrode Designed for a maximum steam pressure of 240

level control electrodes.

PSI; 400° F. UL353 Recognized. LLP-24 Threaded Probe (24") Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid

Specifications Control Type

Sensing Voltage Sensing Resistance Sensing Resistance Tolerance

Response Time Input Tolerance 24VAC 120 & 230VAC **AC Line Frequency** Output Туре Form Rating Protection **Isolation Voltage** Mechanical Mounting Dimensions

Termination Environmental **Operating/Storage** Temperature Weight

Resistance sensing for high & low level detection of conductive liquids Pulsed DC at probe terminals Factory fixed or adjustable to $100K\Omega$

Adjustable: 1K ±500Ω at low end; $100K\Omega \pm 25\%$, 0% at high end Factory fixed: $\pm 10\%$ or 500Ω whichever is greater Debounce time delay <1s

-15%, +20% -20%, +10% 50/60 Hz

Electromechanical relay Isolated, SPDT 5A resistive @ 240VAC, 1/10 hp @ 240VAC

≥ 1500V RMS between input, output, & probe

Plug-in socket H 60.7 mm (2.39"); W 45.2 mm (1.78"); **D** 76.5 mm (3.01")

Octal 8-pin plug-in

-20° to 60°C / -40° to 80°C 6 oz (170 g) approx.



LLC6 SERIES

Low Level Cutoff Liquid Level Controls

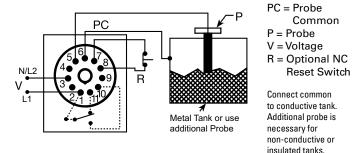






Common

Wiring Diagram



For dimensional drawing see: Appendix, page 513, Figure 33.

Description

The LLC6 Series is a plug-in, single-probe conductive liquid level control designed for low liquid level cutoff protection. It offers a factory fixed time delay of 1 - 60s and is available in input voltages of 24, 120, or 230VAC. LED indicator illuminates whenever the LLC6's 10A, SPDT output relay is energized. Available with automatic/manual reset or a special manual reset with power outage feature, which auto resets the unit when power is restored and the water level is acceptable. 24VAC and 120VAC units are recognized as limit switches under UL353 (230VAC units are UL508) and CSA certified under Standard 14.

Operation

Automatic Reset (Reset terminals not connected): When liquid rises to the low level cutoff probe, the output relay and the LED indicator energize. When the liquid falls below low level cutoff probe, the output relay and the LED indicator de-energize after a fixed time delay.

Manual Reset (Reset switch connected): When the liquid level falls below the low level probe, the output relay and LED de-energize after a fixed time delay. When the liquid level rises to the low level probe, the output relay and LED indicator remain de-energized until the manual reset switch is opened; then they energize immediately.

Power Outage Manual Reset (Reset switch connected): A power outage causes the output relay and LED indicator to de-energize. Upon restoration of power, if the liquid level is above the low level probe, the output relay and LED indicator will re-energize. If the liquid level is below the low level probe, the output relay and LED indicator remain de-energized until the Normally Closed (NC) reset switch is opened.

Features & Benefits

FEATURES	BENEFITS
Isolated 12VAC on probe	Prevents electrolysis
Industry standard 11-pin octal plug connection	Eliminates need for special connectors
LED indication	Visual indication output relay is energized
Power outage protection (see ordering table for models)	Automatically resets the unit when power is restored and the water level is acceptable

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY (FIXED)	SENSE RESISTANCE	RESET
LLC6210F10M	24VAC	10s	10kΩ	Manual/Automatic
LLC6410F10M	120VAC	10s	10kΩ	Manual/Automatic
LLC643F26M	120VAC	3s	26kΩ	Manual/Automatic
LLC6610F5P	230VAC	10s	5kΩ	Power Outage Manual Reset

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LLC6 SERIES

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel



mounting of 8- or 11-pin plug-in timers, flashers,

and other controls. NDS-11 11-pin Socket 11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 (M 3.5 x 0.6) screws or



snaps onto a 35 mm DIN rail. Uses PSC11 holddown clips.

PSC11 Hold-down Clips Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-11 Socket. Sold in pairs.

Designed for a maximum steam pressure of





240 PSI; 400° F UL353 Recognized.

PHST-38QTN Electrode

LLP-24 Threaded Probe (24") Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid level control electrodes.

Specifications

Control Type

Sense Voltage **Sense Resistance Sense Resistance Tolerance Time Delay** Range Tolerance **Repeat Accuracy** Time Delay vs Temp. & Voltage **Power Outage Reset Delay** Input Voltage Tolerance 24VAC 120 or 230VAC **AC Line Frequency** Output Туре Form Rating

Protection Surge **Isolation Voltage**

Mechanical

Mounting Termination Dimensions

Environmental

Operating/Storage Temperature Humidity Weight

ON/OFF (single level) resistance sensor with built-in time delay to prevent rapid cycling 12VAC nominal at probe terminals Fixed 5K - 250KΩ Fixed ±10%

1 - 60s in 1s increments ±20% ±10%

±10% ≤ 1s

24, 120, or 230VAC

+20% to -15% +10% to -20% 50/60 Hz

Electromechanical relay Non-isolated, SPDT 10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC

IEEE C62.41-1991 Level A \geq 2500V RMS between input & output terminals

Plug-in socket 11-pin relay type H 73.9 mm (2.91"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78")

-40° to 60°C / -40° to 80°C 95% relative, non-condensing ≈ 7.3 oz (207 g)

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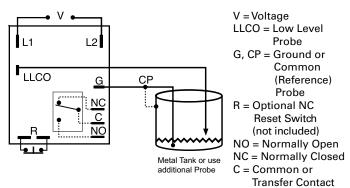
LLC8 SERIES

Low Level Cutoff Liquid Level Controls

$C \in \mathbf{A}$



Wiring Diagram



Relay contacts are isolated. Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

For dimensional drawing see: Appendix, page 514, Figure 42.

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY (FIXED)	SENSE RESISTANCE	RESET
LLC825F5M	24VAC	5s	5kΩ	Manual/automatic
LLC842F103M	120VAC	2s	10kΩ	Manual/automatic
LLC843F10M	120VAC	3s	10kΩ	Manual/automatic
LLC843F10P	120VAC	3s	10kΩ	Power outage manual reset
LLC843F26M	120VAC	3s	26kΩ	Manual/automatic
LLC843F26P	120VAC	3s	26kΩ	Power outage manual reset
LLC845F25P	120VAC	5s	25kΩ	Power outage manual reset
LLC8430F250P	120VAC	30s	250kΩ	Power outage manual reset
LLC8430F26P	120VAC	30s	26kΩ	Power outage manual reset
LLC8610F12M	230VAC	10s	12kΩ	Manual/automatic
LLC863F26P	230VAC	3s	26kΩ	Power outage manual reset

Description

The LLC8 Series is a low cost, single-probe conductive liquid level control designed for low liquid level cutoff protection. It offers a factory fixed time delay of 1 - 60s and is available for input voltages of 24, 120, or 230VAC. LED indicator illuminates whenever the LLC8's isolated, 10A, SPDT output relay is energized. Sense resistance is fixed from 5K - 250KΩ. Available with manual/automatic reset or a special manual reset with a power outage feature that auto resets the unit when power is restored and the water level is acceptable. 24 and 120VAC units are UL recognized as limit switches under UL353 (230VAC units are UL 508) and CSA certified under Standard 14.

Operation

Automatic Reset (Reset switch not connected): When liquid rises to low level cutoff probe, output relay and LED indicator energize. When liquid falls below the low level cutoff probe, the output relay and LED indicator de-energize after a fixed time delay.

Manual Reset (Reset switch connected): When the liquid level falls below low level probe, the output relay and LED de-energize after a fixed time delay. When the liquid level rises to low level probe, the output relay and LED indicator remain de-energized until the NC manual reset switch is opened; then they energize immediately.

Power Outage Manual Reset (Reset switch connected): A power outage causes the output relay and LED indicator to de-energize. Upon restoration of power, if the liquid is touching the low level probe, the output relay and LED indicator will re-energize. If the liquid level is below the low level probe, the output relay and LED indicator remain de-energized until the NC reset switch is opened.

Features & Benefits

FEATURES	BENEFITS
Isolated 12VAC probes	Prevents scale buildup on probe
Open PCB design	Cost effective design for OEM low liquid level cutoff protection
Conformally coated PCB	Protects against moisture and corrosion
LED indication	Visual indication output relay is energized
Power outage protection (see ordering table for models)	Automatically resets the unit when power is restored and the water level is acceptable
24VAC & 120VAC models meet UL353	Required for use as a low level limit switch

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LLC8 SERIES

Protection Relays Pump Controls and Liquid Level Controls

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



strain relief. **P1015-18 Quick Connect to Screw Adapter** Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick

connect terminals.



PHST-38QTN Electrode Designed for a maximum steam pressure of

240 PSI; 400° F. UL353 Recognized.



LLP-24 Threaded Probe (24") Threaded stainless steel probe measuring 24" (61 cm) long. For use with PHST-38QTN liquid level control electrodes.

Specifications

Control Type

Rating

Surae

Protection

Mechanical Mounting

Termination Dimensions

Electrical

Isolation Voltage

Sense Voltage **Sense Resistance** Sense Resistance Tolerance **Time Delay** Tolerance **Repeat Accuracy** Time Delay vs Temp. & Voltage **Power Outage Reset Delay** Input Voltage Tolerance 24VAC 120 or 230VAC **AC Line Frequency** Output Туре Form

Fixed 5K - 250KΩ ±10% ±20% ±10% ±10% ≤1s

time delav

Resistance sensing for conductive liquids with

12VAC nominal at probe terminals

24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

Electromechanical relay Isolated SPDT 10A resistive @ 120/240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC

IEEE C62.41-1991 Level A $\geq 2500V$ RMS input to output terminals

0.5 in. (12.7 mm) x .187 (4.76 mm) dia. nylon standoffs (3)

H 63.5 mm (2.5"); W 55.6 mm (2.19"); D 47.8 mm (1.88") 0.25 in. (6.35 mm) male quick connect terminals 0.187 x 0.03 in. (4.75 x 0.76 mm) male quick connect terminals

Operating/Storage

Temperature Coating

Environmental

Reset Switch & Probe(s)

Humidity Weight -40° to 60° C / -40° to 80° C Printed circuit board is conformal coated to resist moisture & corrosion 95% relative, non-condensing \approx 5 oz (141.7 g)

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ALT SERIES

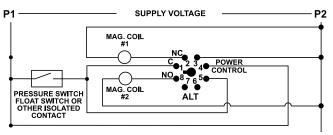




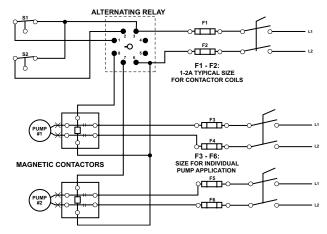
ALT-115-S-SW "Balance Marked SME Control of the second SME Control of th

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR THE ALT-S



TYPICAL WIRING DIAGRAM FOR THE ALT-X (CROSS CONNECTED)



For dimensional drawing see: Appendix, page 509, Figure 8.

Accessories



OT08PC Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.

Description

The ALT alternating relays are used to alternate between two loads. The ALT is commonly used in duplex pumping applications to balance the runtime of both pumps.

The **ALT-S** is used in single high-level float applications. When the float switch opens, the alternating relay changes state, forcing the other pump to run the next time the float closes. All ALT relays have a built-in debounce feature that prevents the relay from changing state if the switch or float contact bounces momentarily.

The **ALT-X** has an internal cross-connected relay and is used in dual high-level float applications. These floats are commonly referred to as lead and lag floats.

The pumps alternate as in the ALT-S version but the crossconnected relay configuration allows both pumps to run simultaneously when both the lead and lag floats are closed.

These relays are also available with a built-in switch (SW option) that is used to manually force one of the pumps to run every time the float switch is closed. This is helpful when a pump has been removed for repair or for test purposes. In the case of the **ALT-X-SW**, the switch essentially forces one pump to be the lead pump, while still allowing the second to run when both floats are closed.

Must use the OT08PC socket for UL Rating!

*Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-Ibs.

Features & Benefits

FEATURES	BENEFITS
Debounce time delay	Prevents nuisance actuating causes by waves or spashing in the tank
Built-in manual/ auto switch	Force lead pump operation when a pump is removed for repair or testing (on select models)

Ordering Information

-		
MODEL	LINE VOLTAGE	DESCRIPTION
ALT024-S	20-26VAC or VDC	For single high-level float applications
ALT024-S-SW	20-26VAC or VDC	For single high-level float applications with built in manual switch
ALT115-S	95-125VAC	For single high-level float applications
ALT115-S-SW	95-125VAC	For single high-level float applications with built in manual switch
ALT115-X	95-125VAC	For dual high-level (lead and lag) float applications
ALT115-X-SW	95-125VAC	For dual high-level (lead and lag) float applications with built in manual switch
ALT230-S	195-250VAC	For single high-level float applications
ALT230-S-SW	195-250VAC	For single high-level float applications with built in manual switch
ALT230-X	195-250VAC	For dual high-level (lead and lag) float applications
ALT230-X-SW	195-250VAC	For dual high-level (lead and lag) float applications with built in manual switch

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ALT SERIES

Specifications

Input Characteristics Supply Current Functional Characteristics Debounce Time Delay Control Input Impedance (min) 24 115 230 **Output Characteristics Output Contact Rating**

40mA

0.5 second

10kΩ 56kΩ 100kΩ

480VA @ 240VAC

General Characteristics

Temperature Range Maximum Input Power Safety Marks UL (OT08PC octal socket required) CSA **Dimensions (with socket)**

Weight **Mounting Method**

Socket Available

-40° to 50°C (-40° to 122°F) 5 W

UL508 (File #E68520) C22.2 No. 14 (File #46510) H 44.45 mm (1.75"); W 60.33 mm (2.375"); **D** 104.78 mm (4.125") 0.38 lb. (6.08 oz., 172.67 g) DIN rail or surface mount (plug into OT08PC socket) OT08PC (UL Rating 600V)

The 600V socket can be surface mounted or installed on DIN Rail.

ALT-XXX-1-SW / ALT-XXX-3-SW SERIES

Alternating Relay

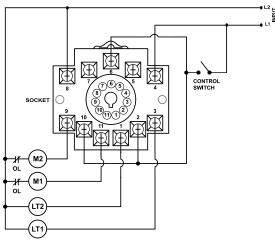


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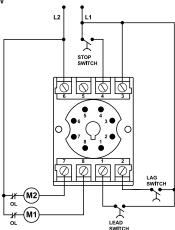


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR ALT-XXX-1-SW



TYPICAL WIRING DIAGRAM FOR ALT-XXX-3-SW



INPUT POWER and the

Description

The ALT-xxx-1-SW/ALT-xxx-3-SW Series are used to alternate between two loads and are commonly used in duplex pump-up and pump-down applications to balance the runtime of both pumps.

The ALT relays have a built-in debounce time delay that prevents the relay from changing state if the float momentarily bounces, and they have a built-in switch to manually force a specific load (pump) to operate each time the input float closes. This is helpful when performing periodic maintenance or pump repair.

Must use the OT08PC socket for the 8-pin models, and the OT11PC socket for the 11-pin models, for UL Rating!

*Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-Ibs.

Features & Benefits

FEATURES	BENEFITS
Debounce time delay	Prevents rapid cycling caused by waves or splashing in the tank
LED indicators	Visual indication of load operation in duplex application
Built-in manual switch to force load operation	Helpful to control load operation when performing periodic maintenance or pump repair
ALT-xxx-3-SW offers duplexing	Allows lag pump to energize if lead pump can't handle current demand

Accessories



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.



OT11PC 11-pin Magnal Socket 11-pin surface & DIN rail mountable. Rated for 10A @ 300VAC

Ordering Information

MODEL	LINE VOTAGE	MOUNTING	DESCRIPTION
ALT-100-1-SW	95-120VAC	11-pin magnal	Single float input, two isolated Form C relays (DPDT), 2 LEDs for load indication
ALT-100-3-SW	95-120VAC	8-pin octal	Three float inputs (lead, lag, stop floats), actuating latching relays on lead/lag floats, 2 LEDs for load indication
ALT-200-3-SW	190-240VAC	8-pin octal	Three float inputs (lead, lag, stop floats), actuating latching relays on lead/lag floats, 2 LEDs for load indication

PUMP CONTROLS & LIQUID LEVEL CONTROLS

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For dimensional drawing see: Appendix, page 509, Figure 8.

www.littelfuse.com/altxxx1sw-altxxx3sw



ALT-XXX-1-SW / ALT-XXX-3-SW SERIES

Specifications

Input Characteristics Supply Voltage ALT-100-1-SW, ALT-100-3-SW ALT-200-3-SW Frequency **Functional Characteristics Debounce Time Delay** ALT-100-1-SW, ALT-100-3-SW, ALT-200-3-SW **Output Characteristics Output Relay (DPDT) Pilot Duty General Purpose General Characteristics Temperature Range Maximum Input Power**

95-120VAC 190-240VAC 50/60Hz

1 second

5 seconds

480VA @ 240VAC 10A @ 240VAC

-40° to 70°C (-40° to 158°F) 5 W

Standards Passed

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency, Radiated Fast Transient Burst**

Safety Marks UL (OT08PC or OT11PC octal socket required) CE Dimensions

Weight **Mounting Method**

Sockets Available Model OT08PC Model OT11PC

input power and controls UL508 (File #E68520) IEC 60947-6-2

H 44.45 mm (1.75"); W 60.33 mm (2.375"); D 104.78 mm (4.125") (with socket) 0.65 lb. (10.4 oz., 294.84 g) DIN rail or surface mount (plug into OT08PC or OT11PC socket)

UL Rating 600V UL Rating 300V

150MHz, 10V/m

IEC 61000-4-4, Level 3, 3,5kV

The sockets can be surface mounted or installed on DIN Rail.

Pump Controls and Liquid Level Controls – Alternating Relays



ARP SERIES Alternating Relay

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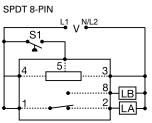


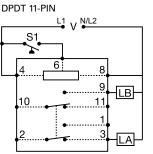




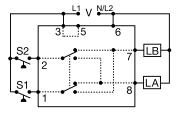
11-PIN

Wiring Diagram

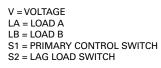




DPDT 8-PIN CROSS WIRED



Relay contacts in above are isolated.



For dimensional drawing see: Appendix, page 514, Figure 46.

Ordering Information

Description

The ARP Series is used in systems where equal run time for two motors is desirable. The selector switch allows selection of alternation or for continuous operation of either load. LED's indicate the status of the output relay. This versatile series may be front panel mounted (BZ1 accessory required) or 35 mm DIN rail mounted with an accessory socket.

Operation

Alternating: When the rotary switch is in the "alternate" position, alternating operation of Load A and Load B occurs upon the opening of the control switch S1. To terminate alternating operation and cause only the selected load to operate, rotate the switch to position "A" to lock Load A or position "B" to lock Load B. The LEDs indicate the status of the internal relay and which load is selected to operate.

Note: Input voltage must be applied at all times for proper alternation. The use of a solid-state control switch for S1 may not initiate alternation correctly. S1 voltage must be from the same supply as the unit's input voltage (see connection diagrams). Loss of input voltage resets the unit; Load A becomes the lead load for the next operation.

Duplexing (Cross Wired): Duplexing models operate the same as alternating relays and when both the Control (S1) and Lag Load (S2) Switches are closed, Load A and Load B energize simultaneously.

The DPDT 8-pin, cross-wired option, allows extra system load capacity through simultaneous operation of both motors when needed. Relay contacts are not isolated.

Features & Benefits

FEATURES	BENEFITS	
Alternating or electrically locked operation	Flexibility to run unit alternating between the two loads as normal or lock the relay to one specific load.	
Low profile selector switch	Prevents accidental actuation	
LED status indication	Visual indication of which load is engaged	
Industry standard base connection	Flexibility to use in many applications	

MODEL	LINE VOLTAGE	OUTPUT FORM	DESCRIPTION
AR120A-3095	120VAC	SPDT	8 pin for alternating applications. Rotary switch allows user to lock internal relay to one specific load.
ARP23S	24VAC	DPDT	8 pin cross wired for duplexing applications. Rotary switch allows user to lock internal relay to one specific load.
ARP41	120VAC	SPDT	8 pin for alternating applications.
ARP41S	120VAC	SPDT	8 pin for alternating applications. Rotary switch allows user to lock internal relay to one specific load.
ARP42S	120VAC	DPDT	11 pin for alternating applications. Rotary switch allows user to lock internal relay to one specific load.
ARP43	120VAC	DPDT	8 pin cross wired for duplexing applications.
ARP43S	120VAC	DPDT	8 pin cross wired for duplexing applications. Rotary switch allows user to lock internal relay to one specific load.
ARP61S	230VAC	SPDT	8 pin for alternating applications. Rotary switch allows user to lock internal relay to one specific load.
ARP62S	230VAC	DPDT	8 pin cross wired for duplexing applications. Rotary switch allows user to lock internal relay to one specific load.
ARP63S	230VAC	DPDT	8 pin cross wired for duplexing applications. Rotary switch allows user to lock internal relay to one specific load.

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ARP SERIES

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5×0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.

NDS-11 11-pin Socket 1-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.



PSC8 or PSC11 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in pairs.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Specifications

Input Tolerance 24VAC 120 & 230VAC AC Line Frequency Output Type Form Rating

Maximum Voltage Life Protection Isolation Voltage Mechanical

Mounting Dimensions

Termination Environmental Operating/Storage Temperature Weight

-15% to 20% -20% to 10% 50/60Hz

Electromechanical relay SPDT, DPDT, or cross wired DPDT 10A resistive @ 120/240VAC & 28 VDC; 1/3 hp @ 120/240VAC 250VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁶

≥ 1500V RMS input to output

Plug-in socket H 81.3 mm (3.2"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Octal 8-pin or magnal 11-pin

-20° to 60°C / -30° to 85°C 5.6 oz (159 g) approx.

NOTE: Unit does not have debounce time delay.

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50R-400-ALT

480VAC Application, Panel Mount





Description

The 50R-400-ALT alternating relays are used to alternate between two loads, most commonly in duplex pumping and compressor applications to balance the runtime of both loads.

When used in single float applications, the alternating relay changes state after the float switch opens*, forcing the other pump to run the next time the float closes. When used in dual float applications, the alternating relay will allow both pumps to run simultaneously when the lead and lag floats are both closed.

An adjustment knob provides the option to force one pump to run every time the float switch is closed. This is helpful when one pump has been removed for repair or for test purposes.

A built-in debounce feature prevents the alternating relay from changing state if the float contact bounces momentarily.

*The alternating relay will not switch states while current is flowing. Switching will only occur after current has been sensed, followed by loss of current for the duration of the debounce time delay.

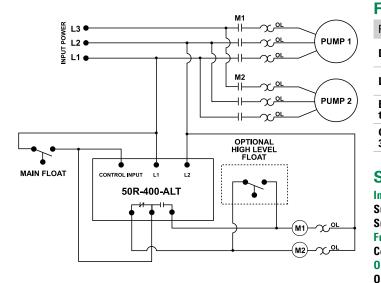
Features & Benefits

FEATURES	BENEFITS	
Debounce time delay	Prevents rapid cycling caused by waves or splashing in the tank	
LED indicators	Visual indication of load operation in duplex application	
Built-in manual switch to force load operation	Helpful to control load operation when performing periodic maintenance or pump repair	
Operates from 380 - 480VAC	No transformer required to provide 120 - 240V for control circuit	

Specifications

Input Characteristics	
Supply Voltage	380-480VAC
Supply Current	40mA
Functional Characteristics	
Control Input Impedance (min)	1ΜΩ
Output Characteristics	
Output Contact Rating	
Pilot Duty	470VA @ 600VAC
General Purpose	10A
Debounce Time Delay	1 second
General Characteristics	
Maximum Input Power	5 W
Terminal	
Torque	7 inlbs.
Wire Size	12-18AWG
Safety Marks	
UL	UL508 (File #E68520)
CE	IEC 60947
Dimensions	H 74.4 mm (2.93"); W 133.9 mm (5.27");
	D 74.9 mm (2.95")
Weight	0.98 lb. (15.68 oz., 444.52 g)
Mounting Method	#8 screws

Wiring Diagram



For dimensional drawing see: Appendix, page 509, Figure 6.

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ISS-100

Single-Channel Intrinsically Safe Switch





Wiring Diagram

115 VAC INPUT

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- 1. Maximum distance between unit and switch contact is 10,000 feet.
- 2. All non-intrinsically safe wiring shall be separated from intrinsically safe wiring. Description of special wiring methods can be found in the National Electrical Code ANSI/NFPA 70, Article 504 Intrinsically Safe Systems. Check your state and local codes for additional requirements.
- 3. All switch contacts shall be non-energy storing, containing no inductance or capacitance.

Description

The ISS-100 switches are UL 913 listed as an associated apparatus for interfacing between hazardous and non-hazardous areas. These units must be installed in a non-hazardous area.

Features & Benefits

FEATURES	BENEFITS
Finger-safe terminals	Meets IEC 61000 safety requirements
Compact design for DIN rail or surface mount	Allows flexiblility in panel installation
LED Status Indicator	Visual indication of relay engagement
Isolated output relay	Allows connection to PLC or control voltage

Specifications

Input Characteristics Supply Voltage Functional Characteristics Probe Sense Voltage Output Characteristics Output Contact Rating Pilot Duty General Purpose Relay Contact Life (Electrical) Relay Contact Life (Mechanical) **General Characteristics Temperature Range Maximum Input Power** Wire range **Terminal Torque Provides Intrinsically-Safe Circuits in the** following locations:

Entity Parameters

Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI) Fast Transients Safety Mark UL Dimensions

Weight **Mounting Method** 90-120VAC

5vdc continuous

180VA @120VAC, C300 8A @120VAC 100,000 cycles min. @ rated load 10,000,000 cycles

-20° to 55°C (-4° to 131°F) 1.5 W 12 to 20 AWG 3.5 to 4.5 in.-lbs. (max. 4.5 in.-lbs.)

Division 1 and 2 Class I, Groups A, B, C, D; Class II, Groups E,F,G; and Class III $V_{00} = 16.8V$ Po=Voc*Isc $I_{sc} = 1.2 \text{mA}$ 4 $L_{a} = 100 \text{mH}$ $C_a = 0.39 uF$

IEC 61000-4-2, Level 3, 6kV contact, 8kV air IEC 61000-4-3, Level 3, 10V/m IEC 61000-4-4, Level 3, 4kV input power

UL913 Sixth Edition (File #E233355) **H** 88.9 mm (3.5"); **W** 52.93 mm (2.08"); **D** 59.69 mm (2.35") 0.5 lb. (8 oz., 226.8 g) 35mm DIN rail or Surface Mount (#6 or #8 screws)

For dimensional drawing see: Appendix, page 510, Figure 10.

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See Note 3

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ISS-101

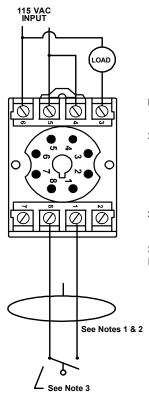
Single-Channel Intrinsically Safe Switch





Wiring Diagram

CONTROL DRAWING ISS-101



NOTES:

1. Maximum distance between unit and switch contact is 10,000 feet.

- 2. All non-intrinsically safe wiring shall be separated from intrinsically safe wiring. Description of special wiring methods can be found in the National Electrical Code ANSI/NFPA 70, Article 504 Intrinsically Safe Systems. Check your state and local codes for additional requirements.
- 3. All switch contacts shall be non-energy storing, containing no inductance or capacitance.

See Install Bulletin for full instructions and Hazardous Location information.

Description

The ISS-101 switches are UL 913 listed as an associated apparatus for interfacing between hazardous and non-hazardous areas. These units must be installed in a non-hazardous area.

Must use Model OT08PC socket for UL Rating!

Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-Ibs.

Features & Benefits

FEATURES	BENEFITS	
Compact design for DIN rail or surface mount via octal base	Allows flexibility in panel installation	
LED status indicator	Visual indication of relay engagement	
Isolated output relay	Allows connection to PLC or control voltage	
Standard 8-pin socket	Pop-in replacement for other manufacturers' parts	

Accessories (included)



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.

Specifications **Input Characteristics**

90-120VAC **Supply Voltage Functional Characteristics Probe Sense Voltage Output Characteristics Output Contact Rating Pilot Duty General Purpose Relay Contact Life** (Mechanical) **General Characteristics Temperature Range Maximum Input Power** Wire range **Terminal Torque Provides Intrinsically-Safe Circuits in the** following locations:

Entity Parameters

5VDC continuous

180VA @120VAC, C300 8A @120VAC Relay Contact Life (Electrical) 100,000 cycles min. @ rated load

10,000,000 cycles

-20° to 55°C (-4° to 131°F) 1.5 W 12 to 20 AWG 3.5 to 4.5 in.-lbs. (max. 4.5 in.-lbs.)

Division 1 and 2 Class I, Groups A, B, C, D; Class II, Groups E,F,G; and Class III $V_{0C} = 16.8V$ Po=Voc*Isc $I_{SC} = 1.2 \text{mA}$ 4 $L_a = 100 \text{mH}$ $C_a = 0.39 \mu F$

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For dimensional drawing see: Appendix, page 509, Figure 8.

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Standards Passed

ISS-101

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency** Immunity (RFI) IEC 61000-4-3, Level 3, 10V/m Fast Transients IEC 61000-4-4, Level 3, 4kV input power Safety Mark UL UL913 Sixth Edition (File #E233355) Dimensions H 44.45 mm (1.75"); W 60.33 mm (2.375"); **D** 104.78 mm (4.125") Weight

Mounting Method

0.5 lb. (8 oz., 226.8 g) DIN rail or surface mount

(plug into OT08PC socket)

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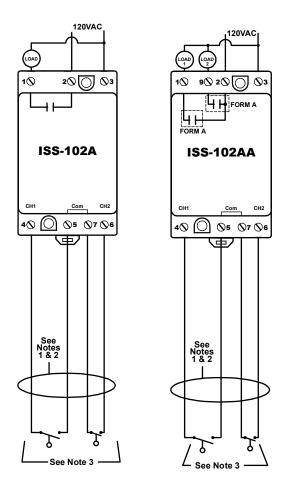
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ISS-102 SERIES

Two-Channel Intrinsically Safe Switch



Wiring Diagrams



For more wiring diagrams and notes, see next page. For dimensional drawing see: Appendix, page 510, Figure 10.

Description

The ISS-102 is a two-channel, intrinsically-safe switch designed for multiple uses including a pump-up/pump-down (latching) controller or two-channel switch. LEDs indicate the state of the intrinsically-safe inputs and output relays and user-selectable options are available including a variable resistance threshold for float inputs. The ISS-102 enclosure is surface or DIN rail mountable.

-LC Each input channel is active when the corresponding switch is closed. When the lag input (CH2) is activated, the output closes. Applying latching logic, the output contact remains closed until the lead (CH1) and the lag (CH2) inputs are deactivated. Sensitivity is fixed at 100kOhms with a debounce time delay of 2 seconds.

-DCS This dual-channel switch has two Form A output relays. Two LEDs illuminate the output state of their respective Form A relay. Resistance probes or switches can be used on its inputs. Sensitivity is fixed at 100kOhms with a debounce time delay of 0.5 seconds.

-MC By selecting the proper functionality through the DIP switches, you can define a pump-up or pump-down, single or dual channel non-latching switch. The sensitivity adjustment (4.7k-100kOhms) allows you to define the input impedance at which the output relays (one Form A & one Form C) will change state, with a debounce time delay of 0.5 or 2 seconds.

Features & Benefits

FEATURES	BENEFITS
Finger-safe terminals	Meets IEC 61000 safety requirements
Compact design for DIN rail or surface mount	Allows flexiblility in panel installation
LED status indicator	Visual indication of relay engagement
Two input channels	Flexibility for pump up/pump down latching controller or two-channel switch applications

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
ISS-102A-LC	120VAC	Latching Controller
ISS-102AA-DCS	120VAC	Dual Channel Switch
ISS-102ACI-MC	120VAC	Multi-function Controller
ISS-102C-M-LC	120VAC	MSHA* evaluated
ISS-102CCI-M-MC	120VAC	MSHA* evaluated

* Mine Safety and Health Administration

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ISS-102 SERIES

120VAC

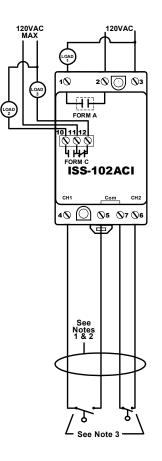
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ISS-102CCI-M

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Wiring Diagrams (continued)



Specifications

Functional Characteristics

Debounce Time Probe Sense Voltage Output Characteristics

Output Contact Rating Pilot Duty General Purpose Relay Contact Life (Electrical) Relay Contact Life (Mechanical) Output Relay Type ISS-102A-LC ISS-102AA-DCS ISS-102ACI-MC ISS-102CCI-M-LC ISS-102CCI-M-MC General Characteristics Temperature Range

Maximum Input Power Wire Range Terminal Torque 0.5 or 2 seconds 5vdc pulsed

> 180VA @120VAC, C150 5A @120VAC 100,000 cycles min. @ rated load 10,000,000 cycles

20VAC

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FORM C

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Notes

See Note 3

ISS-102C-M

120 VA C

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Notes

- See Note

One Form A Two Form A One Form A & One isolated Form C One Form C Two Form C (one isolated)

-20° to 55°C (-4° to 131°F) 2 W 12 to 20 AWG 3.5 to 4.5 in.-Ibs. (max. 4.5 in.-Ibs.)



Entity Parameters

Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI) Fast Transients Safety Mark UL

Dimensions

Weight Mounting Method

NOTES:

- 1. Maximum distance between unit and switch contact is 10,000 feet.
- All non-intrinsically-safe wiring shall be separated from intrinsically-safe wiring. Description of special wiring methods can be found in the National Electrical Code ANSI/NFPA 70, Article 504 Intrinsically-Safe Systems. Check your state and local codes for additional requirements.
- 3. All switch contacts shall be non-energy storing, containing no inductance or capacitance.

 $\begin{array}{l} \text{Division 1 and 2} \\ \text{Class I, Groups A,B,C,D;} \\ \text{Class II, Groups E,F,G;} \\ \text{Class III} \\ \text{V}_{\text{oc}} = 16.8\text{V} \\ \text{Po} = & \underbrace{\text{Voc*Isc}}_{\text{Isc}} = 1.2\text{mA} \\ \text{L}_{a} = & 100\text{mH} \\ \text{C}_{a} = & 0.39\text{uF} \end{array}$

IEC 61000-4-2, Level 3, 6kV contact, 8kV air. IEC 61000-4-3, Level 3, 10V/m IEC 61000-4-4, Level 3, 4kV input power

UL913 Sixth Edition (File #E233355) (except Models ISS-102C-M-LC & ISS-102CCI-M-MC which have been evaluated by MSHA) H 88.9 mm (3.5"); W 52.93 mm (2.08"); D 59.69 mm (2.35") 0.7 lb. (11.2 oz., 317.51 g) 35mm DIN rail or Surface Mount (#6 or #8 screws)

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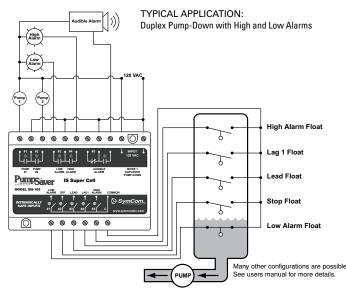
ISS-105 SERIES

Five-Channel Intrinsically Safe Switch





Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 12.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
ISS-105	120VAC	Intrinsically-Safe & Pump Controller
ISS-105-ISO	120VAC	Intrinsically-Safe Only
ISS-105-ISO-3	120VAC	3-Channel Intrinsically-Safe Only
ISS-105-ISO-4	120VAC	4-Channel Intrinsically-Safe Only
ISS-105-ISO-F	120VAC	ISO with Fast Trip Relays

Description

The ISS-105 is a "smart" five-channel intrinsically safe relay and pump controller. The ISS-105 can be configured for pump-up or pump-down applications or as a five-channel relay covering a wide variety of applications.

The ISS-105 has a long list of features that are needed for multiple pump applications and can indicate low, high and out-of-sequence alarms. If an out-of-sequence alarm occurs, the skipped pump(s) will be started as intended.

The Model ISS-105 can be set-up to do non-alternating control, alternating control and alternating control with one non-alternating pump. The non-alternating pump is intended for use with an emergency or jockey pump. The ISS-105 can start an emergency pump once every 50 cycles to keep it working freely. Using the built-in DIP switches, individual pumps can be disabled when taken out of service for repair or maintenance.

Features & Benefits

- 5 intrinsically-safe input channels meeting UL913 Sixth Edition
- 4 normally open output relays and 1 SPDT output relay
- Field selectable pump control options
- Monitors float sequencing and sends signal to alarm if out-of-sequence condition occurs
- High and/or low alarm options depending on the number of pumps and settings
- Output contacts for audible alarm
- Meets IEC EMC standards for Electrical Fast Transients (EFT), Electrostatic Discharge (ESD) and Radio Frequency Immunity (RFI)
- DIN rail or surface mountable allows flexibility in panel installation
- User-selectable alternator/non-alternator option
- Non-alternating pump option for emergency or jockey applications
- Pump disable switches make it easy to disable individual pumps when they are out for service or repair
- Adjustable lag pump delay for all pumping modes
- Adjustable delay-on-make/break timer in five-channel relay mode
- Finger-safe terminals meet IEC 61000 safety requirements

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Specifications

ISS-105

Input Characteristics Supply Voltage Frequency Functional Characteristics Probe Sense Voltage Output Characteristics Relay Output Rating Pilot Duty General Purpose Relay Contact Life (Electrical) Relay Contact Life (Mechanical) General Characteristics Temperature Range Maximum Input Power Wire range

Recommended Terminal Torque Provides Intrinsically-Safe Circuits in the following locations:

Entity Parameters

120VAC 50*/60Hz

5vdc continuous

12 to 20 AWG

480VA @ 240VAC, B300 7A @ 240VAC 100,000 cycles min. @ rated load 10,000,000 cycles -40° to 55°C (-40° to 131°F) 5 W

3.5 to 4.5 in.-lbs. (max. 4.5 in.-lbs.)

 $\begin{array}{l} \mbox{Division 1 and 2} \\ \mbox{Class I, Groups A,B,C,D;} \\ \mbox{Class II, Groups E,F,G;} \\ \mbox{and Class III} \\ \mbox{V}_{oc} = 16.8V \\ \mbox{I}_{sc} = 1.2mA \\ \mbox{L}_{a} = 100mH \\ \mbox{C}_{a} = 0.39uF \end{array}$

Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI) Fast Transients

Safety Marks

UL Dimensions

Weight Mounting Method IEC 61000-4-2, Level 3, 6kV contact, 8kV air. IEC 61000-4-3, Level 3, 10V/m IEC 61000-4-4, Level 3, 4kV input power 2kV inputs/outputs

UL913 Sixth Edition (File #E233355) H 59.69 mm (2.35"); W 94.06 mm (3.703"); D 27.64 mm (5.025") 1.2 lbs. (19.2 oz., 544.31 g) 35 mm DIN rail or Surface Mount (#6 or #8 screws)

*Note: 50Hz will increase all delay timers by 20%.

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AC SYSTEM MONITORS/LOAD SENSORS

Current monitors provide protection against both supply line and load side faults when the motor is running. They protect against single-phasing and current unbalance problems that can be caused by voltage supply problems, bad contactors, loose wiring, bad wires, or damaged motors. They also provide very reliable overload and underload protection.

Littelfuse voltage monitors are microcontroller based and factory calibrated for highly accurate and precise voltage measurements providing high sensitivity while minimizing nuisance tripping. This precise operation can detect a single-phase condition or voltage unbalance even with regenerated voltages present.

Current Monitoring Relays and Transducers

CP5 Series	Single-Phase Current Monitor168
LSR-0	Load Sensor, Low Cost Relay169
LSR-XXX Series	Load Sensors 170
LSRU Series	Load Sensors 171
LSRX / LSRX-C Series	Load Sensors, Low Cost Relays 173
ECS Series	Current Sensors175
ECSW Series	Current Sensors178
TCS Series	Current Sensors181
TCSA Series	Current Transducers
DCSA Series	Current Transducers185
LCS10T12 / LPM Series	Current Indicators

Voltage Monitoring Relays

5 5 ,
50R Series
201-XXX-SP Series
201-XXX-SP-DPDT Series
202-200-SP Series
460-XXX-SP Series
102A Series
201A Series
201A-AU Series
201-XXX-DPDT Series
202 Series
250A Series
350 Series
355 Series
455 Series
460 Series
601 Series
601-CS-D-P1
WVM Series222
DLMU Series
HLMU Series
PLMU11
PLM Series
TVW Series
TVM Series
PLR Series
PLS Series
HLVA6I23
KVM Series

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For More Information... on common faults and how to fix them, visit Littelfuse.com/MotorProtection



CP5 SERIES

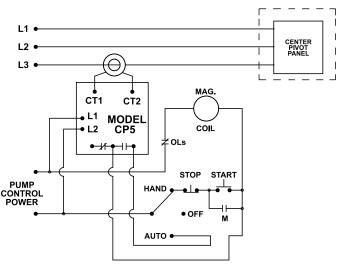
Protection Relays Current Monitoring Relays and Transducers

Single-Phase Current Monitor





Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Ordering Information

MODEL	LINE VOLTAGE
CP5115	115VAC
CP5460	460VAC

Description

The CP5 Series are undercurrent monitors designed to monitor one leg of a 3-phase system. It is commonly used as a tower monitor on center pivot irrigation systems to detect stalled or jammed towers to prevent over watering.

The CP5 Series has both an adjustable trip level and an adjustable trip delay timer. When the current is sensed, the CP5 Series activates its output relay, thus starting the motor/pump. When the current in the monitored power line falls below the user-selectable trip point, the unit goes through a trip delay timer and then deactivates the output relay if the monitored current does not recover first.

Features & Benefits

FEATURES	BENEFITS
Adjustable trip level (0-5A)	Provides ability to precisely set the current trip point for any application
Adjustable trip delay (0-10m)	Prevents nuisance tripping due to power line fluctuations
600V rated relay contacts available on CP5-460 model	Eliminates the need for a control transformer to step voltage down to 120 - 240V for a control circuit

Specifications

Input Characteristics Nominal Input Voltage CP5115 115VAC CP5460 460VAC Frequency 50*/60Hz **Functional Characteristics Operating Points Trip Level** 0-5 Amps 0-10 minutes **Trip Delay** Restart 1 second **Output Characteristics Output Contact Rating (SPDT) Pilot Duty** CP5115 480VA @ 240VAC CP5460 470VA @ 600VAC **General Characteristics** Terminal Torque 7 in.-lbs. Wire Size 12-18AWG Safety Marks UL UL508 (File #E68520) Dimensions **H** 74.4 mm (2.93"); **W** 133.9 mm (5.27"); **D** 74.9 mm (2.95")

1 lb. (16 oz., 453.59 q)

#8 screws

*Note: 50Hz will increase all delay timers by 20%

www.littelfuse.com/cp5

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

Weight

Mounting Method



LSR-0

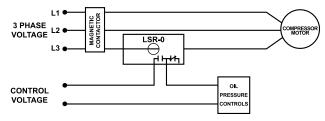
Self-Powered Load Sensor/Low-Cost **Proof Relay**



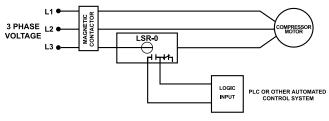


Wiring Diagram

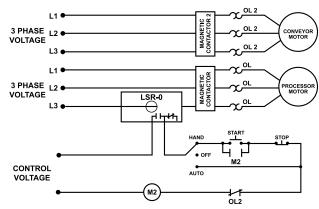
TYPICAL WIRING DIAGRAM FOR REFRIGERATION AND **OIL FAILURE CONTROL**



TYPICAL WIRING DIAGRAM FOR BUILDING AUTOMATION



TYPICAL WIRING DIAGRAM FOR BUILDING AUTOMATION



For dimensional drawing see: Appendix, page 511, Figure 14.

Description

The LSR-0 is a self-powered load sensor intended for use as a proof relay. It is used to verify that current is flowing as intended. It has a guaranteed 15A pull-in current and 2.5A drop-out current. Proof relays are typically used to interlock fans, compressors, motors, heating elements and other devices. The LSR-0 is self-powered, that is, it draws its power from the wire being monitored so it does not require separate control power wiring.

Features

- Self-powered
- Low cost proof relay
- Can monitor up to 135A loads

Specifications

Max Current Ratings 135A continuous **Functional Characteristics** Turn-on Threshold Turn-off Threshold Power Isolation **Output Characteristics Relay Output Rating: Pilot Duty General Purpose General Characteristics Temperature Range** Wire Size **Hole Size Terminal Torque Safety Marks** CSA, CSA-NRTL/C (File #46510) CE Dimensions Weight

Mounting Method

Fixed, 15A (max.)* 2.5A (min.) Induced from conductor 600VAC rms 480VA @ 240VAC

10A

-20° to 70°C (-4° to 158°F) #12-24AWG 0.725" diameter 7 in.-Ibs.

H 42.42 mm (1.67"); W 58.42 mm (2.3"); **D** 90.43 mm (3.56") 0.35 lb. (5.6 oz., 158.76 g) Four #6 screws 3/4" in length

*Conductors may be looped for smaller motor applications.

Caution: This product should not be relied upon solely for safety of life or safety applications

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www.littelfuse.com/lsr0



Protection Relays Current Monitoring Relays and Transducers

LSR-XXX SERIES

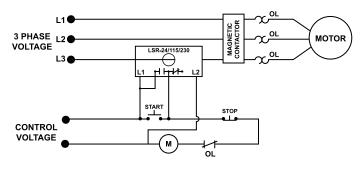
Load Sensor



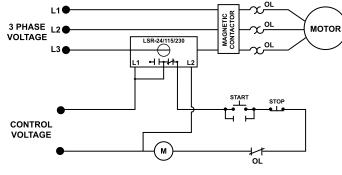


Wiring Diagram

TYPICAL WIRING DIAGRAM FOR LOAD LOSS DETECTION



TYPICAL WIRING DIAGRAM FOR OVERLOAD DETECTION



For dimensional drawing see: Appendix, page 511, Figure 14.

Ordering Information

MODEL	LINE VOTAGE
LSR-24	24VAC
LSR-115	115VAC
LSR-230	230VAC

Description

The LSR-xxx Series load sensors use current levels to determine feed rates, tool wear, loss of prime on pumps, mixer viscosity and all types of overload and underload conditions. They may also be used to stage pump motors, chillers and other machinery. These devices combine a current transformer (CT) with Form C (SPDT) relay contacts to switch alarm circuits, contactors or any resistive or inductive load. One simple screwdriver adjustment will calibrate the sensor for all singlephase or 3-phase applications up to 100hp.

Features

- Can monitor current of motors up to 100Hp
- Fine adjustment with 20-turn pot
- Status LEDs

Specifications

Functional Characteristics	
Isolation	600VAC rms
Current Adjustment Range	
(Typical)	2-100A
Current Adjustment Range	
(Min-Max)	0.5-135A
Trip Setpoint	Adjustable to ±1% range
Input Characteristics	
Control Power:	
LSR-24	24VAC
LSR-115	115VAC
LSR-230	230VAC
Max Current Ratings	135A max. continuous
Output Characteristics	
Output Contact Rating (SPDT):	:
Pilot Duty	480VA @ 240VAC
General Purpose	10A
General Characteristics	
Temperature Range	-20° to 70°C (-4° to 158°F)
Wire Size	#12-24AWG
Hole Size	0.725" diameter
Terminal Torque	7 inlbs.
Safety Marks	
CSA, CSA-NRTL/C	(File #46510)
CE	IEC 60947
Dimensions	H 42.42 mm (1.67"); W 58.42 mm (2.3");
	D 90.43 mm (3.56")
Weight	0.4 lb. (6.4 oz., 181.44 g)
Mounting Method	Four #6 screws 3/4" in length

Caution: This product should not be relied upon solely for safety of life or safety applications.

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LSRU SERIES

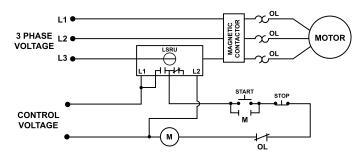
Load Sensor







Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 14.

Ordering Information

See next page.

Description

The LSRU Series is a microcontroller-based family of load sensors. The LSRU family of products employ three basic types of control logic: motor control logic, alarm logic and feed control logic.

Motor Control Logic

Several combinations of functions are available in the LSRU, including overcurrent and undercurrent or either overcurrent or undercurrent with variable trip, restart or extended restart delay settings. These various versions of the LSRU trip on the respective fault and then automatically reset after the restart delay expires, in preparation for the next motor start. LSRUs do not trip on undercurrent when the load turns off, this is recognized as a normal condition.

Alarm Logic

The LSRU-AL simply indicates whether the current is between the setpoints or outside of the setpoints. This product is best used with a PLC or other controller where status indication is desired.

Feed Control

The LSRU-FC is a load monitor intended to control feeder mechanisms in a variety of applications. It stops the feeder when the grinder, chipper, saw, auger, etc. nears overload. When the load is reduced to a preset level, the feeder is restarted.

Features & Benefits

FEATURES	BENEFITS
LED indicator	Visual indication of relay status
Built in current sensor	Eliminates the need for a stand alone current transformer and also provides isolation between the monitored and control circuits
Adjustable current sensing range	Provides ability to precisely set the current trip point for any application

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LSRU SERIES

Protection Relays Current Monitoring Relays and Transducers

Ordering Information

MODEL	LINE VOTAGE	CURRENT RANGE	DESCRIPTION
LSRU-024-AL-2	24VAC	5-25A	Alarm logic
LSRU-024-AL-3	24VAC	25-100A	Alarm logic
LSRU-115-AL-1.5	115VAC	0-10A	Alarm logic
LSRU-115-AL-2	115VAC	5-25A	Alarm logic
LSRU-115-AL-3	115VAC	25-100A	Alarm logic
LSRU-115-FC-1.5	115VAC	0-10A	Feed control logic
LSRU-115-0T-1.5	115VAC	0-10A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-0T-2	115VAC	5-25A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-0T-3	115VAC	25-100A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-0R-1.5	115VAC	0-10A	Motor control logic with overcurrent trip, adj restart delay (0.5-300s, manual)
LSRU-115-0R-2	115VAC	5-25A	Motor control logic with overcurrent trip, adj restart delay (0.5-300s, manual)
LSRU-115-UE-2	115VAC	5-25A	Motor control logic with undercurrent trip, adj ext restart delay (2-300m, manual)
LSRU-115-UT-2	115VAC	5-25A	Motor control logic with undercurrent trip, adj trip delay (0.5-60s)
LSRU-115-UT-3	115VAC	25-100A	Motor control logic with undercurrent trip, adj trip delay (0.5-60s)
LSRU-115-UR-2	115VAC	5-25A	Motor control logic with undercurrent trip, adj restart delay (0.5-300s, manual)
LSRU-115-0U-1.5	115VAC	0-10A	Motor control logic with overcurrent and undercurrent trip
LSRU-115-0U-2	115VAC	5-25A	Motor control logic with overcurrent and undercurrent trip
LSRU-115-0U-3	115VAC	25-100A	Motor control logic with overcurrent and undercurrent trip

AC SYSTEM MONITORS/LOAD SENSORS

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PART # KEY 0 = Overcurrent Trip U = Undercurrent Trip T = Adj. Trip Delay (0.5-60 seconds)

1.5 = 0-10 Amps 2 = 5-25 Amps 3 = 25-100 Amps

R = Adj. Restart Delay (0.5-300 seconds, Manual)

E = Adj. Extended Restart Delay (2-300 minutes, Manual)

Specifications Functional Characteristics

Isolation Power Motor Acceleration Time When not selected as an option: **Fixed Trip Delay** (-AL, -FC) **Fixed Restart Delay** (-AL only) (-FC only) **Input Characteristics Control Power Output Characteristics Output Contact Rating (SPDT) Pilot Duty General Purpose**

600VAC rms 2 Watts 2 seconds 0.5 second 1 second 1 second as soon as current is within limits

24VAC or 115VAC

0.5 second

480VA @ 240VAC 10A @ 240VAC

General Characteristics

Temperature Range Wire Size Hole Size Terminal Torque Safety Marks CSA, CSA-NRTL/C CE Dimensions

Weight Mounting Method -40° to 70°C (-40° to 158°F) #12-24AWG 0.725" diameter 7 in.-lbs.

(File #46510)

H 42.42 mm (1.67"); W 58.42 mm (2.3"); D 90.43 mm (3.56") 0.5 lb. (8 oz., 226.8 g) Four #6 screws 3/4" in length

Caution: This product should not be relied upon solely for safety of life or safety applications.

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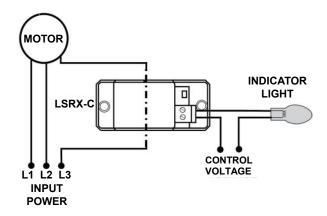
LSRX / LSRX-C SERIES

Self-Powered Load Sensor, Low-Cost Proof Relay



ACCOMEL LSARX RELAY OUTPAUT BADYAC BADY CHARBAC BADY CHARAC CHARAC

Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 13.

Ordering Information

MODEL	DESCRIPTION
LSRX	Fast-on terminal
LSRX-C	Depluggable screw terminals
LSRX-OEM	Fast-on terminals, 10 pack

Description

The LSRX/LSRX-C Series are AC current sensors designed to energize the output contact whenever 4.5 Amps or greater is present. The LSRX/LSRX-C Series is used commonly as an AC current proof relay to indicate if a motor is operating. It can also be used to interlock fans, compressors and motors; to indicate equipment status such as feed rates, tool wear, loss of prime on pumps, mixer viscosity and all types of current sensing conditions or to stage pump motors, chillers, or other machinery.

This device combines a current transformer (CT), transducer and high current output relay together to switch alarm circuits, contactors and most resistive or inductive loads. The LSRX/ LSRX-C Series can perform the function of an auxiliary contact, yet has the advantages of universal application and isolation.

Features & Benefits

FEATURES	BENEFITS
Self-powered	Eliminates need for separate control voltage. Draws power from wire being monitored
Quick-connect terminals	Saves time at installation
LED indication	Visual indication of relay status
Built in current sensor will monitor up to 200A loads	Eliminates the need for a stand alone current transformer and also provides isolation between the monitored and control circuits

Accessories



Informer IR Kit-36 (36" infrared adapter cable) Attaches to the face of the unit to provide remote diagnostics without opening the panel.

Specifications

Input Characteristics Operating Current Minimum Pull-in Current Power

Output Characteristics

Relay Output Rating (SPST - Form A) Pilot Duty General Purpose Electrical Life Mechanical Life Maximum Conductor Diameter Output Terminals LSRX LSRX-C Torque Rating 5-200A Continuous 4.5A (typical), 7.0A (max)* Induced from AC conductor

480VA @ 240VAC, B300 5A @ 240VAC 1x10⁵ 1x10⁷

0.7 in.

0.25" quick-connect fast-ons depluggable screw terminals 3.0 in.-lbs.



4kV air

LSRX / LSRX-C SERIES

General Characteristics	
Temperature Range:	
Operating	-20° to 70°C (-4° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Hole Size	0.72" diameter
Wire Size	12-26 AWG
Output Relay Status Indicator	LED
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 2, 4kV contact, 4kV
Fast Transient Burst	IEC 61000-4-4, Level 3, 2kV power,
	1kV input/output
Surge	
IEC	61000-4-5, Level 3, 2kV line-to-line;
	2kV line-to-ground
Safety Marks	
UL	UL508 Recognized (File #E68520)
CE	IEC 60947
Dimensions	H 68.58 mm (2.7"); W 28.7 mm (1.13");
	D 63.5 mm (2.5")
Weight	0.3 lb. (4.8 oz., 136.08 g)
Mounting Method	Surface Mount

*Conductors may be looped for smaller motor applications.

ECS SERIES

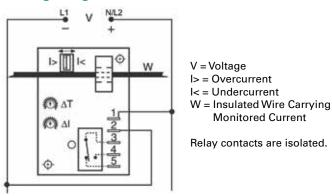
Current Sensors







Wiring Diagram



For dimensional drawing see: Appendix, page 513, Figure 34.

Ordering Information

See next page.

Description

The ECS Series of single-phase AC current sensors is a universal, overcurrent or undercurrent sensing control. Its built-in toroidal sensor eliminates the inconvenience of installing a stand-alone current transformer. Includes onboard adjustments for current sensing mode, trip point, and trip delay. Detects over or undercurrent events like locked rotor, loss of load, an open heater or lamp load, or proves an operation is taking place or has ended.

Operation

Input voltage must be supplied at all times for proper operation. When a fault is sensed throughout the trip delay, the output relay is energized. When the current returns to the normal run condition or zero, the output and the delay are reset. If a fault is sensed and then corrected before the trip delay is completed, the relay will not energize and the trip delay is reset to zero.

Adjustment

Select the desired function, over or under current sensing. Set the trip point and trip delay to approximate settings. Apply power to the ECS and the monitored load. Turn adjustment and watch the LED. LED will light; turn slightly in opposite direction until LED is off. Adjustment can be done while connected to the control circuitry if the trip delay is set at maximum. To increase sensitivity, multiple turns may be made through the ECS's toroidal sensor. The trip point range is divided by the number of turns through the toroidal sensor to create a new range. When using an external CT, select a 2VA, 0-5A output CT rated for the current to be monitored. Select ECS adjustment range 0. Pass one secondary wire lead through the ECS toroid and connect the secondary leads together.

Features & Benefits

FEATURES	BENEFITS
Built-in toroidal current sensing	Eliminates need to install stand alone current transformer and provides isolation from monitored circuit
Encapsulated	Protects against shock, vibration, and humidity
Adjustable mode, trip point and trip delay	Provides flexibility for use in many applications
10A, SPDT isolated relay output	Allows control of loads for AC or DC voltages

Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

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ECS SERIES

Ordering Information

MODEL	SENSING	INPUT VOLTAGE	TRIP POINT ADJUSTABLE	TRIP DELAY	SENSING DELAY ON STARTUP
ECS20BC	Selectable, over or undercurrent	24VAC	0.5 - 5A	0.5 - 50s	1s
ECS21BC	Selectable, over or undercurrent	24VAC	2 - 20A	0.5 - 50s	1s
ECS2HBC	Selectable, over or undercurrent	24VAC	5 - 50A	0.5 - 50s	1s
ECS30AC	Selectable, over or undercurrent	24VDC	0.5 - 5A	0.150 - 7s	1s
ECS40A	Selectable, over or undercurrent	120VAC	0.5 - 5A	0.150 - 7s	Os
ECS40AC	Selectable, over or undercurrent	120VAC	0.5 - 5A	0.150 - 7s	1s
ECS40BC	Selectable, over or undercurrent	120VAC	0.5 - 5A	0.5 - 50s	1s
ECS41A	Selectable, over or undercurrent	120VAC	2 - 20A	0.150 - 7s	Os
ECS41AC	Selectable, over or undercurrent	120VAC	2 - 20A	0.150 - 7s	1s
ECS41BC	Selectable, over or undercurrent	120VAC	2 - 20A	0.5 - 50s	1s
ECS41BD	Selectable, over or undercurrent	120VAC	2 - 20A	0.5 - 50s	2s
ECS41BH	Selectable, over or undercurrent	120VAC	2 - 20A	0.5 - 50s	6s
ECS4HBC	Selectable, over or undercurrent	120VAC	5 - 50A	0.5 - 50s	1s
ECS4HBH	Selectable, over or undercurrent	120VAC	5 - 50A	0.5 - 50s	6s
ECS60AH	Selectable, over or undercurrent	230VAC	0.5 - 5A	0.150 - 7s	6s
ECS60BC	Selectable, over or undercurrent	230VAC	0.5 - 5A	0.5 - 50s	1s
ECS61BC	Selectable, over or undercurrent	230VAC	2 - 20A	0.5 - 50s	1s
ECS6HAH	Selectable, over or undercurrent	230VAC	5 - 50A	0.150 - 7s	6s
ECSH21F2.5C	Overcurrent	24VDC	2 - 20A	2.5s	1s
ECSH30AC	Overcurrent	24VDC	0.5 - 5A	0.150 - 7s	1s
ECSH31AD	Overcurrent	24VDC	2 - 20A	0.150 - 7s	2s
ECSH31F.08D	Overcurrent	24VDC	2 - 20A	0.08s	2s
ECSH3HF0.08D	Overcurrent	24VDC	5 - 50A	0.08s	2s
ECSH34F.08C	Overcurrent	24VDC	4A non-adjustable	0.08s	1s
ECSH40A	Overcurrent	120VAC	0.5 - 5A	0.150 - 7s	Os
ECSH40AC	Overcurrent	120VAC	0.5 - 5A	0.150 - 7s	1s
ECSH40AD	Overcurrent	120VAC	0.5 - 5A	0.150 - 7s	2s
ECSH41AC	Overcurrent	120VAC	2 - 20A	0.150 - 7s	1s
ECSH41AD	Overcurrent	120VAC	2 - 20A	0.150 - 7s	2s
ECSH41BC	Overcurrent	120VAC	2 - 20A	0.5 - 50s	1s
ECSH41F.08D	Overcurrent	120VAC	2 - 20A	0.08s	2s
ECSH4HAD	Overcurrent	120VAC	5 - 50A	0.150 - 7s	2s
ECSH4HF.08D	Overcurrent	120VAC	5 - 50A	0.08s	2s
ECSH61AD	Overcurrent	230VAC	2 - 20A	0.150 - 7s	2s
ECSL31A	Undercurrent	24VDC	2 - 20A	0.150 - 7s	Os
ECSL40AC	Undercurrent	120VAC	0.5 - 5A	0.150 - 7s	1s
ECSL40B	Undercurrent	120VAC	0.5 - 5A	0.5 - 50s	Os
ECSL40BH	Undercurrent	120VAC	0.5 - 5A	0.5 - 50s	6s
ECSL41A	Undercurrent	120VAC	2 - 20A	0.150 - 7s	Os
ECSL41AD	Undercurrent	120VAC	2 - 20A	0.150 - 7s	2s
ECSH4HAD	Overcurrent	120VAC	5 - 50A	0.150 - 7s	2s
ECSL41AH	Undercurrent	120VAC	2 - 20A	0.150 - 7s	6s
ECSL4HAC	Undercurrent	120VAC	5 - 50A	0.150 - 7s	1s
ECSL4HBH	Undercurrent	120VAC	5 - 50A	0.5 - 50s	65
ECSL61AH	Undercurrent	230VAC	2 - 20A	0.150 - 7s	65
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Specifications

Sensor

Type Mode

Trip Point Range Tolerance Adjustable Fixed

Maximum Allowable Current

Trip Point Hysteresis Trip Point vs. Temperature Response Time Frequency Type of Detection Trip Delay Type

Range Adjustable Factory Fixed Delay vs. Temperature Sensing Delay on Startup Input Voltage Tolerance 12VDC & 24VDC/AC 120 & 230VAC

AC Line Frequency Output

Type Form Rating

Life

Protection

Circuitry Isolation Voltage Insulation Resistance Mechanical Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

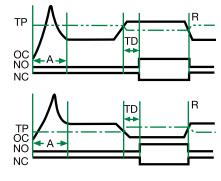
Toroidal through hole wiring Over or undercurrent, switch selectable on the unit or factory fixed 0.5 - 50A in 3 adjustable ranges or fixed Guaranteed range 0.5 - 25A: 0.5A or ±5% whichever is less; 26 - 50A: ±2.5% Steady - 50A turns; Inrush - 300A turns for 10s ≅ ±5% ±5% ≤ 75ms 45/500 Hz Peak detection Analog 0.150 - 7s; 0.5 - 50s (guaranteed ranges) +/- 10% ±15% Factory fixed 0 - 6s: +40%, -0% 24 . 120, or 230VAC; 12 or 24VDC -15 - 20% -20 - 10% 50/60 Hz Electromechanical relay Isolated, SPDT 10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC Mechanical - 1 x 10⁶; Electrical - 1 x 10⁵ Encapsulated

 \geq 2500V RMS input to output \geq 100 M Ω

Surface mount with two #6 (M3.5 x 0.6) screws **H** 88.9 mm (3.5"); **W** 63.5 mm (2.5"); **D** 44.5 mm (1.75") 0.25 in. (6.35 mm) male quick connect terminals (5)

-40° to 60°C / -40° to 85°C 95% relative, non-condensing \approx 6.4 oz (181 g)

Function Diagram



- NO = Normally Open Contact NC = Normally Closed
- Contact A = Sensing Delay On
- Start Up
- TD = Trip Delay
- TP = Trip Point
- R = Reset
- OC = Monitored Current



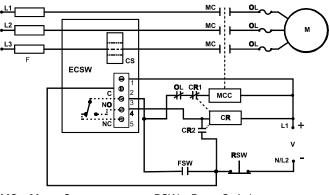
Protection Relays Current Monitoring Relays and Transducers

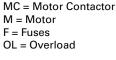
ECSW SERIES

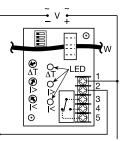
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Wiring Diagram







RSW = Reset Switch FSW = Fan or Float Contacts CR = Control Relay CS = Current Sensor MCC = Motor Contactor Coil

V = Voltage I> = Adjustable Overcurrent I< = Adjustable Undercurrent W = Monitored Wire ΔT - Adjustable Trip Delay

For dimensional drawing see: Appendix, page 513, Figure 34.

Ordering Information



Description

The ECSW Series of single-phase, AC window, current sensors includes adjustable overcurrent and undercurrent trip points. Detects locked rotor, jam, loss of load, an open heater or lamp load, a broken belt, or loss of suction. LED's aid in trip point adjustment and provide fault indication. The built-in toroidal sensor eliminates the need for an external current transformer. The output can be electrically latched after a fault, or automatically reset. Remote resetting of a latched output by removing input voltage. The unit includes switch selectable zero current detection and normally de-energized or energized output operation. Time delays are included to improve operation and eliminate nuisance tripping.

Features & Benefits

FEATURES	BENEFITS	
Built-in toroidal current sensing	Eliminates need to install stand alone current transformer and provides isolation from monitored circuit	
Encapsulated	Protects against shock, vibration, and humidity	
LED indication	Visual indication for trip point adjustment and fault indication	
Multiple switch selectable features	User selectable zero current detection, latched, normally de-energized, or energized output adds application flexibility	
Adjustable trip delay	Eliminates nuisance tripping and prevents rapid cycling	
Isolated 10A, SPDT output contacts	Allows control of loads for AC or DC voltages	

Operation

When the input voltage is applied, sensing delay on startup begins and the output transfers (if normally energized is selected). Upon completion of the startup delay, sensing of the monitored current begins. As long as current is above undercurrent trip point and below the overcurrent trip point (inside the window), the output relay remains in its normal operating condition and both red LED's are OFF. The green LED glows when the output is energized. If current varies outside the window, the associated red LED glows, and the trip delay begins. If the current remains outside the window for the full

-					
MODEL	INPUT VOLTAGE	TRIP POINT ADJUST.	TRIP DELAY	SENSING DELAY ON STARTUP	CONNECT.
ECSW3LABT	24VDC	0.5 - 5A	0.150 - 7s	0.1s	Terminal blocks
ECSW4HBHT	120VAC	5 - 50A	0.5 - 50s	6s	Terminal blocks
ECSW4LADT	120VAC	0.5 - 5A	0.150 - 7s	2s	Terminal blocks
ECSW4LBHT	120VAC	0.5 - 5A	0.5 - 50s	6s	Terminal blocks
ECSW4MACT	120VAC	2 - 20A	0.150 - 7s	1s	Terminal blocks
ECSW4MBHT	120VAC	2 - 20A	0.5 - 50s	6s	Terminal blocks
ECSW4MBGT	120VAC	2 - 20A	0.5 - 50s	5s	Terminal blocks
ECSW6MBHT	230VAC	2 - 20A	0.5 - 50s	6s	Terminal blocks
		•	•		

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ECSW SERIES



trip delay, the relay transfers to fault condition state. If the current returns to normal levels (inside the window) during the trip delay, the red LED goes OFF, the trip delay is reset, and the output remains in the normal condition.

Reset: Remove input voltage or open latch switch. If zero current detection is selected, the unit will reset as soon as zero current is detected.

Operation With Zero Current Detection Enabled: If the current decreases to zero within the trip delay period, then zero current is viewed as an acceptable current level. The unit's output remains in its normal operating state. This allows the monitored load to cycle ON and OFF without nuisance tripping the ECSW. Zero current is defined as current flow of less than 250 milliamp-turns.

Note: When zero current detect is selected, the latching operation of switch SW2 is canceled; the output will not latch after a fault trip.

Notes on Operation

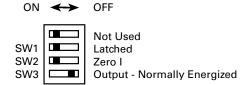
- **1.** There is no hysteresis on the trip points. The overcurrent and undercurrent trip points should be adjusted to provide adequate protection against short cycling.
- **2.** If the upper setpoint is set below the lower setpoint, both red LED's will glow indicating a setting error.
- **3.** If zero current detection is selected (SW2 ON), and the system is wired to disconnect the monitored load, the system may short cycle. After the unit trips, the load deenergizes, and zero current is detected. The ECSW resets, and the load energizes again immediately and may be short cycled.
- 4. The sensing delay on start up only occurs when input voltage is applied. When zero current detection is selected, the trip delay must be longer than the duration of the inrush current or the unit will trip on the inrush current.

Typical Pump or Fan Protection Circuit Operation

Window Current Sensing: With the ECSW connected as shown in the diagram, a load may be monitored and controlled for over and undercurrent. The ECSW Series' on board CT (CS) may be placed on the line or load side of the contactor. The ECSW selection switches are set for zero current sensing (see Selector Switch SW2) and the output selection is normally deenergized (see Selector Switch SW3). The input voltage (V) is applied to the ECSW continually. As the control switch (FSW) is closed, the input voltage (V) is applied to the motor contactor coil (MCC), and the motor (M) energizes. As long as the current remains below the overcurrent and above the undercurrent trip points, the ECSW's output contacts remain de-energized. If the load current should rise above or fall below a trip point, for the full trip delay, the normally open (NO) contact will close, energizing the control relay (CR) coil. The CR normally closed contact (CR1) opens and the MCC de-energizes and CR latches on through its normally open contacts (CR2). Reset is accomplished by momentarily opening the normally closed reset switch (RSW).

Note: If the current falls to zero within the trip delay, the ECSW remains de-energized. The sensing delay on startup occurs when input voltage is applied therefore trip delay must be longer than the duration of the motor's inrush current. The external latching relay CR2 is required in this system to prevent rapid cycling. A timer can be added to provide an automatic reset.

Selector Switch



Mode Selection Switches

- SW1 = Latched or Auto reset selector OFF - Automatic reset after a fault ON - Output relay latches after a fault trips the unit
- SW2 = Zero current detection (below 250 mA) OFF - Zero current detection disabled ON - Zero current detection enabled
- SW3 = Output during normal operation OFF - Output relay de-energized
 - ON Output relay energized



ECSW SERIES

Protection Relays Current Monitoring Relays and Transducers

Specifications

Sensor Туре

Mode

Trip Point Range Tolerance Time Point vs Temp. & Voltage **Response Time** Frequency **Type of Detection Zero Current Detection Time Delay** Range

Tolerance Sensing Delay On Start Up Tolerance Delay vs. Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 120 & 230VAC **AC Line Frequency** Output Type **Mode: Switch Selectable 0N** OFF Form Rating Life

Toroid, through hole wiring for up to #4 AWG (21.1 mm²) THHN wire Over & undercurrent trip points (window current sensing) 0.5 - 50A in 3 adjustable ranges Guaranteed range Maximum Allowable Current Steady - 50A turns; Inrush - 300A turns for 10s

> ±5% ≤ 75ms 45/500 Hz Peak detection < 250mA turns typical

0.15 - 50s in 2 adjustable ranges or 0.1 - 50s fixed Adjustable: guaranteed range; Fixed: ±10% Fixed ≈ 0.1 - 6s in 1s increments +40% -0% ±15%

24, 120, or 230VAC; 12 or 24VDC

-15% - 20% -20% - 10% 50/60 Hz

Electromechanical relay

Energized during normal operation, de-energized after a fault De-energized during normal operation, energizes during a fault Isolated, SPDT 10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC Mechanical - 1 x 106; Electrical - 1 x 105 Electrical Remove input voltage

Switch selectable latching function

Protection Surge Circuitry **Isolation Voltage**

Insulation Resistance Mechanical Mounting Dimensions

Termination

Environmental **Operating/Storage** Temperature Humidity Weight

IEEE C62.41-1991 Level A Encapsulated ≥ 2500V RMS input to output \geq 100 M Ω

Surface mount with two #6 (M3.5 x 0.6) screws H 88.9 mm (3.5"); W 63.5 mm (2.5"); **D** 44.5 mm (1.75") 0.197 in. (5 mm) terminal blocks for up to #12 (3.2 mm²) AWG wire

-40° to 60° C/-40° to 85° C 95% relative, non-condensing ≈ 6.4 oz (181 g)

Latch

Туре Reset

Function

9

TCS SERIES

Current Sensor

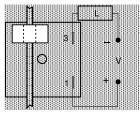


 $C \in \mathbf{A}$

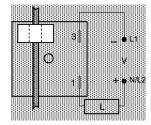


Wiring Diagram

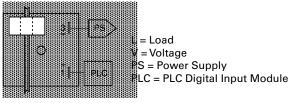
POSITIVE SWITCHING



NEGATIVE SWITCHING



SINKING



SOURCING



Nonitored AC conductor ust be insulated.

= Load

For dimensional drawing see: Appendix, page 513, Figure 35.

Description

The TCS Series is a low cost method of go/no go current detection. It includes a solid-state output to sink or source current when connected directly to a standard PLC digital input module. Its normally open or normally closed output can also be used to control relays, lamps, valves, and small heaters rated up to 1A steady, 10A inrush. The TCS is self-powered (no external power required to operate the unit) and available with an adjustable actuation range of 2 - 20A or factory fixed actuation points from 2 - 45A.

Operation

Normally Open: When a current equal to or greater than the actuate current is passed through the toroidal sensor, the output closes. When the current is reduced to 95% of the actuate current or less, the output opens.

Normally Closed: When the current through the toroid is equal to or greater than the actuate current, the output opens. When the current is reduced below 95% of the actuate current, the output closes. To increase sensitivity, multiple turns may be made through the TCS's toroidal sensor. The trip point range is divided by the number of turns through the toroidal sensor to create a new range. When using an external CT, select a 2VA, 0-20A output CT rated for the current to be monitored. Select TCS adjustment range 0. Pass one secondary wire lead through the TCS' toroid and connect the secondary leads together.

Features & Benefits

FEATURES	BENEFITS
Self powered	No control voltage is required to operate the unit
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Can connect directly to PLC	Solid state output to sink or source current can be connected directly to a standard PLC digital input module
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Complete isolation between sensed current and control circuit	Allows you to monitor a load in a separate lectrical system

Ordering Information

MODEL	OUTPUT VOLTAGE	ACTUATE CURRENT	OUTPUT FORM	MODEL	OUTPUT VOLTAGE	ACTUATE CURRENT	OUTPUT FORM
TCSG2A	3 to 50VDC	Fixed, 2A	Normally open	TCSH2B	24 to 240VAC	Fixed, 2A	Normally closed
TCSGAA	3 to 50VDC	2-20A adjustable	Normally open	TCSH5B	24 to 240VAC	Fixed, 5A	Normally closed
TCSGAB	3 to 50VDC	2-20A adjustable	Normally closed	TCSHAA	24 to 240VAC	2-20A adjustable	Normally open
TCSH2A	24 to 240VAC	Fixed, 2A	Normally open	TCSHAB	24 to 240VAC	2-20A adjustable	Normally closed

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TCS SERIES

Sensor

Type

Specifications

Current to Actuate

Actuate Current vs. Temp.

Reset Current

& Voltage

Burden

Output

Туре

Form

Rating

Voltage

Voltage Drop

Dielectric Breakdown

Insulation Resistance

Protection Circuitry

Mechanical Mounting

Dimensions

Termination

Response Times

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes

installation/removal of modules quick and easy. P1015-64 (AVVG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.



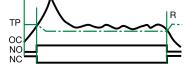
P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Function Diagram



TP = Trip Point OC = Monitored Current NO = Normally Open Output NC = Normally Closed Output R = Reset

Sensor Hole

Environmental Operating/Storage Temperature Humidity Weight

Toroid, through hole wiring, alternating current, monitored wire must be properly insulated Adjustable: - 2 - 20A, guaranteed range Fixed: - 2 - 45A, +0/-20% ≤ 95% of the actuate current Maximum Allowable Current Steady - 50A turns Inrush - 300A turns for 10s

> ≤ ±5% Overcurrent - ≤ 200 ms Undercurrent - \leq 1s < 0.5VA

Solid state NO or NC 1A steady, 10A inrush AC - 24 to 240VAC +10/-20% DC - 3 to 50VDC AC NO & NC - ≈ 2.5V DC NO & NC - ≅ 1.2V

Encapsulated ≥ 2000V RMS terminals to mounting surface ≥ 100 MΩ

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 44.5 mm (1.75") 0.25 in. (6.35 mm) male quick connect terminals (2) 0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm2) THHN wire

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 g)

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TCSA SERIES

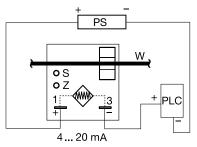
CurrentTransducers



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Wiring Diagram



PS = Power Supply Z = Zero Adjust S = Span Adjust W = Insulated Wire Carrying Monitored Current PLC = PLC Analog Input or Meter Input

For dimensional drawing see: Appendix, page 513, Figure 35.

Ordering Information

MODEL	CURRENT RANGE
TCSA5	0-5A
TCSA10	0-10A
TCSA20	0-20A
TCSA50	0-50A

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Description

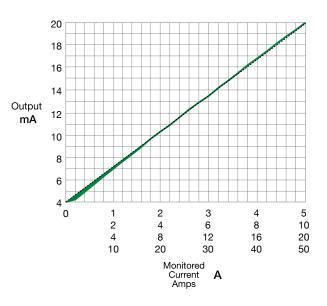
The TCSA Series is a loop-powered, linear output current transducer that provides an output that is directly proportional to the RMS AC current passing through the onboard toroid. The TCSA provides a 4 - 20mA output over a power supply range of 10 - 30VDC. Each unit is factory calibrated for monitoring in one of four ranges; 0-5, 0-10, 0-20, or 0-50A. The 0 - 5A range allows the use of external current transformers so loads up to 1200AC amps can be monitored.

Operation

The TCSA varies the effective resistance of its output in direct proportion to the current flowing in the monitored conductor. The unit is factory calibrated so that 0 amps provides a 4mA output and full span provides a 20mA output. Zero and span adjustments are provided for minor calibration adjustments in the field (if required).

Using an External Current Transformer (CT)

Select a 2VA, 0 to 5A output CT, rated for the current to be monitored. Select TCSA5. Pass one of the CT's secondary wire leads through the TCSA's toroid. Connect the CT's secondary leads together.



Features

- Monitors 0 50A in 4 ranges
- Loop powered from 10 to 30VDC
- Linear output from 4 20mA
- Zero & span adjustments
- Complete isolation between sensed current & control circuit

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TCSA SERIES

Protection Relays Current Monitoring Relays and Transducers

Accessories



P1023-6 Mounting bracket

installation/removal of modules quick and easy. P1015-64 (AWG 14/16)

The 90° orientation of mounting slots makes

Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male guick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Specifications

Sensor Type

Monitored AC Current Ranges 4 Factory Calibrated Ranges **Factory Calibration** Maximum Allowable Current Steady - 50A turns;

Repeat Accuracy Response Time

Burden **AC Line Frequency** 0 - 20A / 21 - 50A **Temperature Coefficient** Output **Type: Series Connection**

Range

Sensor Supply Voltage* **Momentary Voltage** Zero Adjust Span Adjust Adjustment Protection **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions Termination

Sensor Hole

Environmental

Operating/Storage Temperature Humidity Weight

Toroid, through hole wiring, alternating current, monitored conductor must be properly insulated 0 - 50A

0 - 5A, 0 - 10A, 0 - 20A, or 0 - 50A ≤±2% of full scale Inrush - 300A turns for 10s $\leq \pm 0.25\%$ of full scale under fixed conditions ≅ 300ms $\leq 0.5 VA$

20 - 100Hz / 30 - 100Hz ±0.05%/°C

Current directly proportional to monitored current 4 - 20mA 10 to 30VDC 40VDC for 1m ≅ 3.75 - 4.25mA 18mA - 22mA Mini-screw, 25-turn potentiometer

≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$ Units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 44.5 mm (1.75") 0.25 in. (6.35 mm) male guick connect terminals 0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm²) THHN wire

-30° to 60°C/-40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

*Minimum loop-power supply voltage equals the minimum sensor voltage 10VDC plus the voltage drop developed across all the other loop devices at 20mA.

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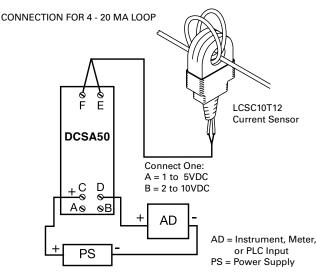


CurrentTransducers

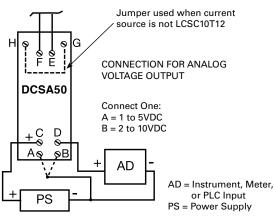


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Wiring Diagram



To LCSC10T12 Current Sensor



For dimensional drawing see: Appendix, page 513, Figure 36.

Description

The DCSA Series is a loop-powered, linear output current transducer that provides an output that is directly proportional to the RMS AC current passing through the LCSC10T12 sensor. The DCSA Series provides either an analog current or voltage: 4-20 mA, 1 to 5VDC, or 2 to 10VDC. Each unit is factory calibrated for monitoring (with the LCSC10T12 connected) in one of four ranges; 0-5, 0-10, 0-20, or 0-50A. Zero and span adjustments allow field calibration if needed. The DCSA Series mounts on both DIN 1 and DIN 3 rails.

Operation

The DCSA Series varies the effective resistance of its output in direct proportion to the current flowing in the conductor monitored by the LCSC10T12. Connecting the power supply to terminals C & D provides a 4 to 20mA DC current. Connect the power supply to terminals C & A to get 1 to 5VDC at terminal D. Connect the power supply to terminals C & B to get 2 to 10VDC at terminal D.

Features

- Mounts on DIN 1 or DIN 3 rail
- 0-50A in 4 ranges using LCSC10T12 sensor
- Loop powered from 10 to 30VDC
- Linear output from 4-20mA, 1-10VDC
- Zero & span adjustments
- Separate sensor & control unit

Accessories



LCSC10T12 Toroidal Current Sensor

Remote monitoring of currents up to 50A.

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Ordering Information

MODEL	CURRENT RANGE WITH LCSC10T12	INPUT RANGE (F TO E)
DCSA5	0-5A	0-5mA AC
DCSA20	0-20A	0-20mA AC
DCSA50	0-50A	0-50mA AC

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DCSA SERIES

Protection Relays Current Monitoring Relays and Transducers

Specifications

Input

Ranges (without LCSC10T12 connected) 4 factory calibrated ranges in mA AC **Factory calibration Repeat Accuracy Response Time Temperature Coefficient** Input to Output Output Туре Analog

Range Supply Voltage* **Momentary Voltage** Zero Adjust Span Adjust Adjustment

Protection

Dielectric Breakdown Insulation Resistance Polarity **Mechanical** Mounting Termination Wire clamp **Environmental Operating/Storage** Temperature Humidity Weight

0 - 5mA, 0 - 10mA, 0 - 20mA, or 0 - 50mA AC ±0.5% of full scale ±0.25% of full scale under fixed conditions ≅ 300ms ±0.05%/°C Not isolated

Current directly proportional to input current 4 - 20mA, or 1 to 5VDC or 2 to 10VDC

Mini-screw, multi-turn potentiometer

Units are reverse polarity protected

For 22 - 14AWG (.336 mm² ... 2.5 mm²)

DIN 1 & DIN 3 rail mounting

 -30° to 60° C / -40° to 85° C

≅ 1.6 oz (45.4 g)

95% relative, non-condensing

≥ 2500V RMS terminals to mounting surface

10 to 30VDC

40VDC for 1m

18mA - 22mA

≥ 100 MΩ

≅ 3.75 - 4.25mA

Accessory - LCSC10T12 Toroidal Sensor 1000

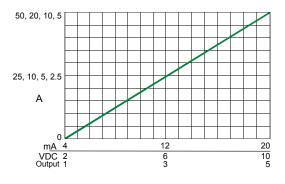
Number of Turns **Nominal Output Current Full Range** Burden Frequency 0 - 20A / 21 - 50A Sensor Hole Weight

0 - 50 mA Maximum Allowable Current Steady 50A turns: Inrush 300A turns for 10s ≤ 0.5 VA

> 20/100 Hz / 30/100 Hz 0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm²) THHN wire ≈ 1 oz (28.3 g)

*Minimum loop-power supply voltage equals the minimum sensor voltage 10VDC plus the voltage drop developed across all the other loop devices at 20mA.

Monitored Current Amps Diagram





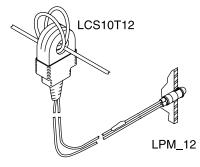
Current Indicators



Answers Delivered



Wiring Diagram



Wire Length: 500 ft. (152.4m) max. (Customer Supplied)

CAUTION: The LCS10T12 must be connected to the LPM12 or LPMG12 before current flows to prevent damage or shock hazard. Monitored wires must be properly insulated.

For dimensional drawing see: Appendix, page 513, Figure 37 and 38.

Ordering Information

MODEL	DESCRIPTION
LCS10T12	AC Current Sensor
LPM12	Red LED Indicator
LPMG12	Green LED Indicator

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The LCS10T12 connected to the LPM12 or LPMG12 indicator is a low cost, easy to use, go/no-go indication system for the remote monitoring of current flow. The LCS10T12 is installed on an adequately insulated wire of the monitored load. Its 12in. (30.4cm) leads are connected to the LPM12 or LPMG12 panel mount indicator directly or via customer supplied wires up to 500 feet (152.4m) long.

Operation

When the monitored current is 5A turns, the panel mount LPM indicator will glow. The LCS10T12 is designed to maximize the light output of the panel mount indicator. It can be used to monitor current flow of less than 5A by passing the monitored conductor 2 or more times through the sensor.

CAUTION: The LCS10T12 must be connected to the LPM12 or LPMG12 before current flows to prevent damage or a shock hazard. Monitored wires must be properly insulated.

Panel mount indicator designed to match the output of the LCS10T12. The LPM12 and LPMG12 come with 12 in. (30.4 cm) wires and a one piece mounting clip. Both devices install quickly in a 0.25 in. (6.35 mm) hole in panels from 0.031 - 0.062 in. (0.79 - 1.6 mm) thick.

Features

- Low cost go/no go indication
- May be connected to wires up to 500 feet (152.4 m) long
- Remote monitoring of currents up to 50A
- Green or red LED indicator available

Specifications

Monitored Current

WOIIIIOICU GI	IIIGIIL					
Current Rang	e	2 - 50A AC				
Wire Passes	Min. Current	Max. Current	Max. Inrush	Max. Wire Dia.		
1	5A	50A	120A	0.355 in. (9.0 mm)		
2	2.5A	25A	60A	0.187 in. (4.7 mm)		
3	1.7A	16.6A	40A	0.15 in. (3.8 mm)		
4	1.3A	12.5A	30A	0.125 in. (3.2 mm)		
5	5/X	50/X	120/X			
Maximum Cu	rrent	50A turns co	ntinuous			
AC Line Freq	uency	50/60Hz				
DC Resistanc	e of					
Current Limi	iter	65 Ω				
Mechanical						
Sensor Hole		0.36 in. (9.14	mm) for up to #	¥4 AWG (21.1 mm²)		
		THHN wire				
Termination		12 in. (30.4 cm) wire leads				
Environmenta	al					
Operating/St	orage					
Temperatur		-40° to 60°C	/-40° to 85°C			
Weight		LCS: ≅ 0.8 oz	: (23 g)			
-		LPM: ≃ 0.2 0	z (6 g)			

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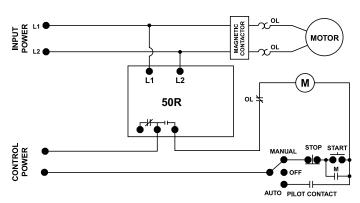
50R SERIES

Single-Phase Voltage Monitor

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Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Description

The 50R Series single-phase voltage monitor has a voltagesensing circuit which constantly monitors the single-phase power for a low voltage condition. Single-phase motors on fans, compressors, air conditioners, heat pumps, well pumps, sump pumps and small conveyor motors are all applicable to the 50R Series.

When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

Features & Benefits

FEATURES	BENEFITS
Proprietary voltage sensing circuitry	Constant monitoring of single-phase power for a low voltage condition
Adjustable trip delay (-3 models) and restart delay (-2 models) settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions and allows staggered start up of multiple motors, after a fault, to prevent a low voltage condition
High voltage detection (-9 models)	Trips and resets at a fixed percentage of the setpoint: trip 110%, reset 107%.
600V rated relay contacts available on some models	Eliminates the need for a control transformer to step voltage down to 120 - 240V for a control circuit

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
50R-100	95-120VAC	Fixed trip and restart delay
50R-100-2	95-120VAC	Fixed trip and variable restart delay (manual, 2-300s)
50R200	190-240VAC	Fixed trip and restart delay
50R2002	190-240VAC	Fixed trip and variable restart delay (manual, 2-300s)
50R2003	190-240VAC	Fixed restart and variable trip delay (2-30s)
50R20029	190-240VAC	Fixed trip and variable restart delay (manual, 2-300s) plus high voltage detection
50R400	380-480VAC	Fixed trip and restart delay
50R4002	380-480VAC	Fixed trip and variable restart delay (manual, 2-300s)
50R4003	380-480VAC	Fixed restart and variable trip delay (2-30s)
50R40029	380-480VAC	Fixed trip and variable restart delay (manual, 2-300s) plus high voltage detection

www.littelfuse.com/50r

50R SERIES



2-300 seconds

Specifications

Input Characteristics Line Voltage 50R-100 95-120VAC 50R200 190-240VAC 50R400 380-480VAC Frequency 50*/60Hz **Functional Characteristics** Low Voltage: Trip (% of setpoint) 90% **Reset (% of setpoint)** 93% **Delay Time (Nominal)** Trip 4 seconds Restart (low voltage) 2 seconds Restart (complete power loss) 2 seconds **Output Characteristics Output Contact Rating** (SPDT - 1 Form C) 50R-100, 50R200 **Pilot Duty** 480VA @ 240VAC **General Purpose** 10A @ 240VAC 50R400 **Pilot Duty** 470VA @ 600VAC **General Characteristics Ambient Temperature Range** Operating -20° to 70°C (-4° to 158°F) Storage -40° to 80°C (-40° to 176°F) **Maximum Input Power** 5 W **Relative Humidity** 10-95%, non-condensing per IEC 68-2-3 Terminal Torque 7 in.-lbs. Wire Size 12-18AWG Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Fast Transient Burst** IEC 61000-4-4, Level 3, 3.5kV input power and controls **Transient Protection** (Internal) IEC 61000-4-5; 1995 ±6kV **Safety Marks** UL UL508 (File #E68520) CE IEC 60947-6-2 Dimensions H 74.4 mm (2.93"); W 133.9 mm (5.27"); **D** 74.9 mm (2.95") Weight 0.98 lb. (15.68 oz., 444.52 g) **Mounting Method** #8 screws

Special Options

Opt. 2: Variable Restart Delay	Manual, 2-300
Opt. 3: Variable Trip Delay	2-30 seconds
Opt. 9: High Voltage	
Detection Operating Points	
Trip (% of Setpoint)	110%
Reset (% of Setpoint)	107%

*Note: 50Hz will increase all delay timers by 20%

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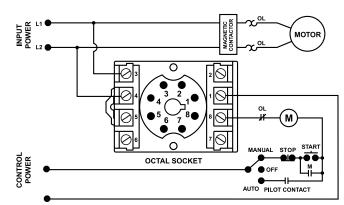
201-XXX-SP SERIES

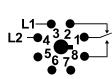
Single-Phase Voltage/Phase Monitor

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Wiring Diagram







PIN-OUT 1 (201-XXX-SP) (view of socket) PIN-OUT 2 (201-200-SP-T-9) (view of socket)

For dimensional drawing see: Appendix, page 509, Figure 8.

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
201-100-SP	95-120VAC	SPDT, protects single phase motors
201-200-SP	190-240VAC	SPDT, protects single phase motors
201-200-SP-T-9	190-240VAC	SPDT, direct replacement for Time Mark [®] #260 series

Description

The 201-xxx-SP Series is an 8-pin octal-base, plug-in voltage monitor designed to protect single-phase motors regardless of size. The 201-100-SP is used on 95-120VAC, 50/60Hz motors to prevent damage caused by low voltage. The 201-200-SP is used on 190-240VAC, 50/60Hz motors. The 201-200-SP-T-9 is a pin-for-pin replacement for a Time Mark[®] #260 Series voltage monitor. High voltage protection is included in the 201-200-SP-T-9.

The unique microcontroller-based voltage and voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

Must use Model OT08PC socket for UL Rating!

Note: Manufacturer's recommended screw terminal torque for the RB Series and OT Series Octal Sockets is 12 in.-lbs.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage to detect harmful power line conditions, even before the motor starts
Fixed trip delay 4s	Prevents nuisance tripping due to rapidly fluctuating power line conditions
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
Compact design for 8-pin; DIN rail or surface mount	Allows flexibility in panel installation

Accessories



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.

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201-XXX-SP SERIES



Specifications

Input Characteristics	
Line Voltage:	
201-100-SP	95-120VAC
201-200-SP, 201-200-SP-T-9	190-240VAC
Frequency	50/60Hz
Functional Characteristics	
Low Voltage (% of setpoint)	
Trip	90%
Reset	93%
For 201-200-SP-T-9 only:	
High Voltage (% of setpoint)	
Trip	110%
Reset	107%
Trip Delay Time:	
High/Low Voltage Fault	4 seconds
Restart Delay Time:	
After a Fault	2 seconds
After a Complete Power Loss	2 seconds
Output Characteristics	
Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC

General Characteristics

Ambient Temperature Range	
Operating	-40° to 70°C (-40° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Maximum Input Power	5 W
Transient Protection (Internal)	2500V for 10 ms
Safety Marks	
UL (OT08PC octal	
socket required)	UL508 (File #E68520)
CE	IEC 60947-6-2
Dimensions	H 44.45 mm (1.75"); W 60.325 mm (2.375");
	D 104.775 mm (4.125") (with socket)
Weight	0.8 lb. (12.8 oz., 362.87 g)
Mounting Method	DIN rail or surface mount
	(plug in to OT08PC socket)
Socket Available	Model OT08PC (UL Rating 600V)

The 600V socket can be surface mounted or installed on DIN Rail.



Wiring Diagram

201-XXX-SP-DPDT SERIES

Single-Phase Voltage/Phase Monitor

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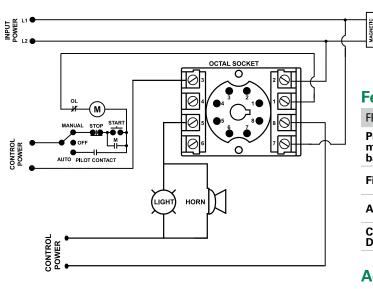
Description

The 201-xxx-SP-DPDT Series is an 8-pin octal-base, plug-in voltage monitor designed to protect single-phase motors regardless of size. The 201-100-SP-DPDT is used on 95-120VAC, 50/60Hz motors to prevent damage caused by low voltage. The 201-200-SP-DPDT is used on 190-240VAC, 50/60Hz motors. The units feature two isolated sets of contacts that are ideal for use with two control circuits with different voltages.

The unique microcontroller-based voltage and voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relays are deactivated after a specified trip delay. The output relays reactivate after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

Must use Model OT08PC socket for UL Rating!

Note: Manufacturer's recommended screw terminal torque for the RB Series and OT Series Octal Sockets is 12 in.-Ibs.



For dimensional drawing see: Appendix, page 509, Figure 8.

Features & Benefits

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FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage to detect harmful power line conditions, even before the motor starts
Fixed trip delay 4s	Prevents nuisance tripping due to rapidly fluctuating power line conditions
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
Compact design for 8-pin; DIN rail or surface mount	Allows flexibility in panel installation

Accessories



OT08PC 8-pin Octal Socket

Octal Socket for plug-in units. 8-pin surface & DIN rail mountable. Rated for 10A @ 600VAC.

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Ordering Information

MODEL	INPUT VOTAGE	DESCRIPTION
201-100-SP-DPDT	95-120VAC	Two isolated Form C relays
201-200-SP-DPDT	190-240VAC	Two isolated Form C relays

www.littelfuse.com/201xxxspdpdt

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201-XXX-SP-DPDT SERIES



Specifications

Input Characteristics Line Voltage: 201-100-SP-DPDT 201-200-SP-DPDT Frequency **Functional Characteristics** Low Voltage (% of setpoint): Trip Reset **Trip Delay Times:** Low Voltage **Restart Delay Times:** After a Fault or Complete

95-120VAC 190-240VAC 50/60Hz

90% +/-1% 93% +/-1%

4 seconds

2 seconds

Output Characteristics Output Contact Rating (DPDT) Pilot Duty General Purpose General Characteristics

Power Loss

Ambient Temperature Range:

Operating Storage **Maximum Input Power Relative Humidity**

480VA @ 240VAC 10A @ 240VAC

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F) 5 W 10-95%, non-condensing per IEC 68-2-3

Standards Passed

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency Immunity,** Radiated **Fast Transient Burst**

Safety Marks UL (OT08PC octal socket required) CE Dimensions

Weight **Mounting Method**

Socket Available

150MHz, 10V/m IEC 61000-4-4, Level 3, 3.5kV input power and controls

UL508 (File #E68520) IEC 60947-6-2 H 44.45 mm (1.75"); W 60.325 mm (2.375"); D 104.775 mm (4.125") (with socket) 0.65 lb. (10.4 oz., 294.84 g) DIN rail or surface mount (plug in to OT08PC socket) Model OT08PC (UL Rating 600V)

The 600V socket can be surface mounted or installed on DIN Rail



202-200-SP SERIES

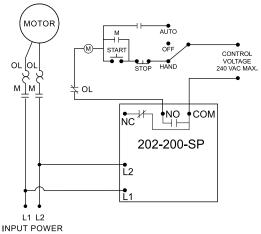
Single-Phase Voltage Monitor





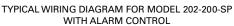
Wiring Diagram

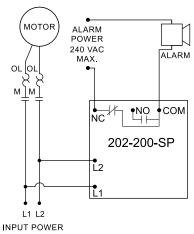
TYPICAL WIRING DIAGRAM FOR MODEL 202-200-SP WITH MOTOR CONTROL



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AC SYSTEM MONITORS/LOAD SENSORS





For dimensional drawing see: Appendix, page 509, Figure 7.

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

Description

The 202-200-SP Series voltage monitor is designed to protect single-phase motors regardless of size. It can be used with 190V-240VAC, 50/60Hz motors to prevent damage caused by incoming power problems.

A unique microcontroller-based voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage to detect harmful power line conditions, even before a motor starts
Fixed trip delay 4s	Prevents nuisance tripping due to rapidly fluctuating power line conditions
Adjustable restart delay (Manual, 2-300s)	Allows staggered start up of multiple motors, after a fault, to prevent a low voltage condition
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
One screw mounting and standard 1/4" quick connect terminals	Fast installation and compact size perfect for panel assembly or OEM applications

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
202-200-SP	190-240VAC	SPDT, high and low voltage protection
202-200-SP-NHV	190-240VAC	SPDT, low voltage protection only

202-200-SP SERIES



Specifications

Input Characteristics Line Voltage: 202-200-SP, 202-200-SP-NHV 190-240VAC Frequency **Functional Characteristics** Low Voltage (% of setpoint)

Trip Reset High Voltage (% of setpoint) (not available on -NHV model) Trip Reset Trip Delay Time: **High and Low Voltage Restart Delay Time:** After a Fault or Complete **Power Loss**

Output Characteristics

Output Contact Rating (SPDT) Pilot Duty

General Purpose

50*/60Hz

90% 93%

110% 107%

4 seconds

Manual, 2-300 seconds adj.

480VA @ 240VAC 10A @ 240VAC

General Characteristics

Temperature Range Trip & Reset Accuracy Repeatability **Input to Output Dielectric** Termination **Maximum Input Power Relative Humidity Transient Protection Safety Marks UL, UL Recognized** Dimensions

Weight **Mounting Method**

-40° to 70°C (-40° to 158°F) ±1% ±0.5% 1480 Vrms (min.) 0.25" male quick connect 5 W 95%, non-condensing IEC 61000-4-5, ±4kV

UL508 (File #E68520) **H** 63.5 mm (2.5"); **W** 63.5 mm (2.5"); **D** 35.56 mm (1.4") 0.5 lb. (8 oz., 226.8 g) 1/4" socket head cap screw (customer supplied)

*Note: 50Hz will increase all delay timers by 20%.

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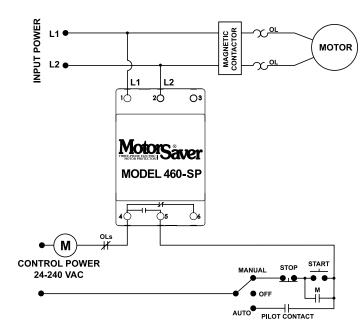
460-XXX-SP SERIES

Single-Phase Voltage Monitor

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Wiring Diagram



For dimensional drawing see: Appendix, page 510, Figure 10.

Description

The 460-100-SP is used on 95-120VAC, 50*/60Hz single-phase motors and the 460-200-SP is used on 190-240VAC, 50*/60Hz single-phase motors to protect them from damaging high and low voltage conditions. An adjustment knob allows the user to set a 1-500 second restart delay. The variable restart delay is also a power-up delay and can be utilized to stagger-start motors on the same system.

A unique microcontroller-based, voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage to detect harmful power line conditions, even before a motor starts
Fixed trip delay 4s	Prevents nuisance tripping due to rapidly fluctuating power line conditions
Adjustable restart delay (1-500s)	Allows staggered start up of multiple motors on the same system to prevent a low voltage condition
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
DIN rail or surface mountable	Allows flexibility for panel assembly

Ordering Information

MODEL	LINE VOTAGE
460-100-SP	95-120VAC
460-200-SP	190-240VAC

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460-XXX-SP SERIES



Specifications

Input Characteristics Line Voltage 460-100-SP 460-200-SP Frequency **Functional Characteristics** Low Voltage (% of setpoint): Trip Reset High Voltage (% of setpoint) Trip Reset **Trip Delay Time** Low or High Voltage **Restart Delay Time** After a Fault

Output Characteristics

Output Contact Rating

General Characteristics Ambient Temperature Range

Maximum Input Power

Class of Protection

Relative Humidity

Terminal Torque

Wire Type

(1 Form C) **Pilot Duty**

Operating Storage

General Purpose

95-120VAC 190-240VAC 50*/60Hz

90% ±1% 93% ±1%

110% ±1% 107% ±1%

4 seconds fixed

1-500 seconds adjustable After a Complete Power Loss 1-500 seconds adjustable

> 480VA @ 240VAC, B300 10A @ 240VAC

-40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F) 6 W IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3 4.5 in.-lbs. Stranded or solid 12-20 AWG, one per terminal

Standards Passed Electrost

Flectrostatic Discharge (FSD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency Immunity,	
Radiated	150 MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5 kV input power and controls
Surge	
IEC	IEC 61000-4-5, Level 3, 4kV line-to-line;
	Level 4, 4kV line-to-ground
ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a
	level of 6kV line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 min)
Safety Marks	
UL	UL508 (File #E68520)
CE	IEC 60947-6-2
Enclosure	Polycarbonate
Dimensions	H 88.9 mm (3.5"); W 52.93 mm (2.084");
	D 59.69 mm (2.35")
Weight	0.9 lb. (14.4 oz., 408.23 g)
Mounting Method	35mm DIN rail or Surface Mount
-	(#6 or #8 screws)
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*Note: 50 Hz will increase all delay timers by 20%

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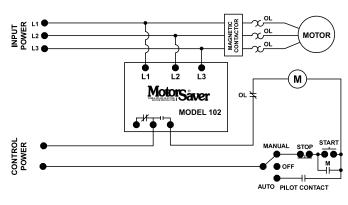
3-Phase Voltage/Phase Monitor

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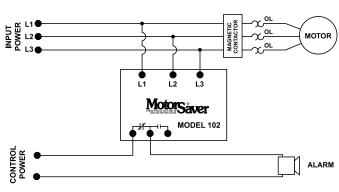


Wiring Diagram

102 WITH MOTOR CONTROL



102 WITH ALARM CONTROL



Description

The 102A is a 3-phase, auto-ranging, dual-range voltage monitor that protects 190-400VAC, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically selects between the 200V and 400V range.

A unique microcontroller-based voltage and phase-sensing circuit constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels. The Model 102A includes advanced single LED diagnostics. Five different light patterns distinguish between faults and normal conditions.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, high voltage (102A-9), voltage unbalance, phase reversal, harmful power line conditions.
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC. Saves setup time.
Advanced LED diagnostics	Quick visual indicator for cause of trip. LED indications include: normal operation, power-up restart delay, reverse-phase trip, unbalance/ single-phase trip, high or low voltage trip
Adjustable trip delay (102A2)	Prevent nuisance tripping due to rapidly fluctuating power line conditions.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
102A	190-480VAC	Fixed low voltage trip delay (4 sec), fixed restart delay (2 sec)
102A2	190-480VAC	Has variable restart delay (manual or adjustable 2-300 seconds)
102A3	190-480VAC	Has adjustable trip delay at 2-30 seconds (unbalance and phasing trip delays remain at 2 seconds).
102A-9	190-480VAC	Has high voltage protection. High Voltage Trip is 110% of setpoint, Reset is 107% of setpoint.
102600	475-600VAC	Fixed low voltage trip delay (4 sec), fixed restart delay (2 sec)

For dimensional drawing see: Appendix page 509, Figure 6.



Specifications

Frequency **Functional Characteristics** Low Voltage (% of setpoint) Trip Reset Voltage Unbalance (NEMA) Trip Reset **Trip Delay Time** Low/High Voltage **Unbalance & Phasing Faults Restart Delay Time** After a Fault After a Complete Power Loss **Output Characteristics Output Contact Rating** (SPDT - 1 Form C) **Pilot Duty General Purpose**

50*/60Hz

90% 93%

6% 4.5%

4 seconds (standard) 2 seconds

2 seconds (standard) 2 seconds (standard)

480VA @ 240VAC 10A @ 240VAC

General Characteristics

Ambient Temperature Range Operating Storage Trip & Reset Accuracy Maximum Input Power Terminal Torque Wire Size Standards Passed Electrostatic Discharge (ESD) Fast Transient Burst Transient Protection (Internal) Safety Marks

Safety Marks UL CSA CE Dimensions

Weight Mounting Method 7 in.-Ibs. 12-18AWG

±1%

5 W

-40° to 70°C (-40° to 158°F)

-40° to 80°C (-40° to 176°F)

IEC 61000-4-2, Level 3, 6kV contact, 8kV air IEC 61000-4-4, Level 3, 4kV input, 2kV input/output IEC 61000-4-5; 1995 ±6kV

UL508 (File #E68520) 22.2 No. 14 (File #46510) IEC 60947-6-2 **H** 74.4 mm (2.93"); **W** 133.9 mm (5.27"); **D** 74.9 mm (2.95") 1.05 lbs. (16.8 oz., 476.27 g) #8 screws

*Note: 50Hz will increase all delay timers by 20%.

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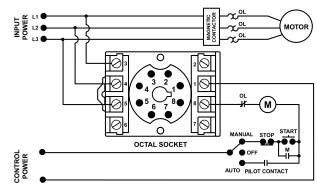
3-Phase Voltage/Phase Monitor



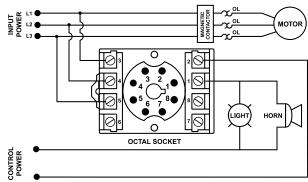
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Wiring Diagram

201A WITH MOTOR CONTROL



201A WITH ALARM CONTROL



For dimensional drawing see: Appendix, page 509, Figure 8.

Description

The 201A is a 3-phase, auto-ranging, dual-range voltage monitor that protects 190-480VAC, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically selects between the 200V and 400V range. The 201A includes advanced single LED diagnostics, where color and light patterns distinguish between faults and normal conditions.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the 201A's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels for a specified restart delay time.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, voltage unbalance, phase reversal, harmful power line conditions. High voltage monitoring optional.
Compact design for 8-pin; DIN rail or surface mount	Allows flexiblility in panel installation
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC. Saves setup time.
Advanced LED diagnostics	Quick visual indicator for cause of trip. LED indications include: normal operation, power-up restart delay, reverse-phase trip, unbalance/ single-phase trip, high/low voltage trip

Accessories

OT08PC Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
201A	190-480VAC	DIN rail or surface mountable
201A-9	190-480VAC	Includes high voltage detection. DIN rail or surface mountable

200



IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-4, Level 3, 3.5kV input power

IEC 61000-4-5, Level 3, 4kV line-to-line;

C62.41 Surge and Ring Wave Compliance to

Meets UL508 (2 x rated V + 1000V for 1 min.)

H 44.45 mm (1.75"); W 60.33 mm (2.38");

D (with socket) 104.78 mm (4.13")

Model OT08PC (UL Rating 600V)

0.7 lbs. (11.2 oz., 317.51 g)

DIN rail or surface mount

(plug in to OT08PC socket)

Level 4, 4kV line-to-ground

a level of 6kV line-to-line

UL508 (File #E68520)

IEC 60947-6-2

150MHz, 10V/m

& controls

Specifications

Frequency 50/60Hz **Functional Characteristics** Low Voltage (% of setpoint) Trip Reset Voltage Unbalance (NEMA) Trip Reset **Optional High Voltage** (% of setpoint) Trip Reset **Trip Delay Time High/Low Voltage Fault** 4 seconds **Unbalance & Phasing Faults Restart Delay Time** After a Fault After a Complete Power Loss 2 seconds **Output Characteristics Output Contact Rating (SPDT) Pilot Duty General Purpose General Characteristics Temperature Range Trip & Reset Accuracy Maximum Input Power Relative Humidity Terminal Torque** Wire Gauge **Transient Protection** (Internal)

90% ±1% 93% ±1% 6% 4.5% 110% ±1%

107% ±1%

2 seconds 2 seconds

480VA @ 240VAC 10A @ 240VAC

-20° to 70°C (-4° to 158°F) ±1% 5 W 10-95%, non-condensing per IEC 68-2-3 12 in.-Ibs. (for OT08-PC socket) 12-22 AWG solid or stranded

2500V for 10 ms

Standards Passed

Electrostatic Discharge (ESD) **Radio Frequency Immunity** (RFI), Radiated Fast Transient Burst Surge **Immunity IEC**

ANSI/IEEE

Hi-potential Test

Safety Marks UL (OT08PC octal socket required) CE Dimensions

Weight **Mounting Method**

Socket Available

The 600V socket can be surface mounted or installed on DIN Rail.

Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-Ibs.

Must use Model OT08PC socket for UL Rating!

201



201A-AU SERIES

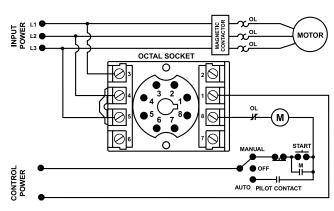
3-Phase Voltage/Phase Monitor

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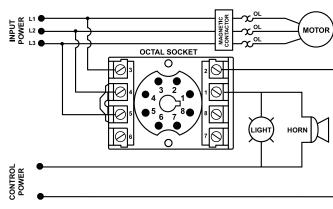


Wiring Diagram

201A-AU WITH MOTOR CONTROL



201A-AU WITH ALARM CONTROL



For dimensional drawing see: Appendix, page 509, Figure 8.

Description

The 201A-AU is a 3-phase, auto-ranging, dual-range voltage monitor that protects 190-480VAC, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically selects between the 200V and 400V range. Additional adjustment knobs allow the user to set a 1-30 second trip delay, a manual restart or 1-500 second restart delay and a 2-8% voltage unbalance trip point. The Model 201A-AU includes advanced single LED diagnostics, where color and light patterns distinguish between faults and normal conditions.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the 201A-AU's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels for a specified amount or restart delay time (or manual reset).

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of loss of any phase, low voltage, high voltage, voltage unbalance, phase reversal, rapid cycling, harmful power line conditions
Compact design for 8-pin; DIN rail or surface mount	Allows flexiblility in panel installation
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC. Saves setup time.
Advanced LED diagnostics	Quick visual indicator for cause of trip.
Adjustable voltage unbalance trip setting	Allows compatibility with a variety of motors and reduces nuisance tripping.
Adjustable trip & restart delay settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions.

Accessories



OT08PC Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
201A-AU	190-480VAC	DIN rail or surface mountable
201575-AU	475-600VAC	DIN rail or surface mountable
201A-AU-OT	190-480VAC	Sold with OT08PC socket
201-575-AU-OT	475-600VAC	Sold with OT08PC socket

201A-AU SERIES



IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-4, Level 3, 3.5kV input power

IEC 61000-4-5, Level 3, 4kV line-to-line;

C62.41 Surge and Ring Wave Compliance to

Meets UL508 (2 x rated V +1000V for 1 min.)

H 44.45 mm (1.75"); W 60.325 mm (2.375");

D 104.775 mm (4.125") (with socket)

Level 4, 4kV line-to-ground

a level of 6kV line-to-line

UL508 (File #E68520)

0.7 lb. (11.2 oz., 317.51 g)

DIN rail or surface mount

(plug in to OT08PC socket)

OT08PC (UL Rating 600V)

IEC 60947-6-2

Polycarbonate

150 MHz, 10V/m

and controls

Specifications

Frequency Functional Characteristics Low Voltage (% of setpoint) Trip Reset High Voltage (% of setpoint) Trip Reset Voltage Unbalance (NEMA) Trip Reset

Trip Delay Time High, Low and **Unbalanced Voltage Single-Phasing Faults Restart Delay Time** After a Fault After a Complete Power Loss **Output Characteristics Output Contact Rating** (1-Form C) **Pilot Duty General Purpose General Characteristics Ambient Temperature Range** Operating Storage **Trip & Reset Accuracy Maximum Input Power Relative Humidity Terminal Torque** Wire Gauge

50/60Hz

90% ±1% 93% ±1% 110% ±1%

107% ±1%

2-8% adjustable Trip Setting Minus 1% (5-8%) Trip Setting Minus 0.5% (2-4%)

1-30 seconds adjustable 1 second fixed

Manual, 1-500 seconds adj.

Manual, 1-500 seconds adj.

480VA @ 240VAC, B300 10A @ 240VAC

-40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F) ±1% 5 W 10-95%, non-condensing per IEC 68-2-3 12 in.-lbs. (for OT08-PC socket) 12-22 AWG solid or stranded

Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity, Radiated Fast Transient Burst

Surge

IEC

ANSI/IEEE

Hi-potential Test Safety Marks UL (OT08PC octal socket required) CE Enclosure Dimensions

Weight Mounting Method

Socket Available

The 600V socket can be surface mounted or installed on DIN Rail.

Note: Manufacturer's recommended screw terminal torque for the OT Series Octal Sockets is 12 in.-lbs.

Must use Model OT08PC socket for UL Rating!

203

www.littelfuse.com/201aau



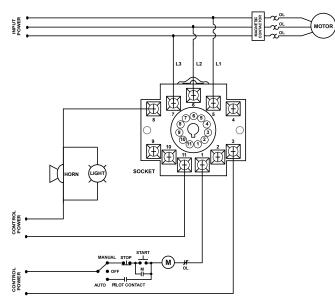
201-XXX-DPDT SERIES

3-Phase Voltage/Phase Monitor

ⓑ€€



Wiring Diagram



For dimensional drawing see: Appendix, page 509, Figure 8.

Description

The 201-xxx-DPDT Series is an 11-pin octal base plug-in voltage monitor designed to protect 3-phase motors regardless of size. The 201-100-DPDT is used on 95-120VAC, 50/60Hz motors and the 201-200-DPDT is used on 190-240VAC, 50/60Hz motors to prevent damage caused by incoming voltage problems. The units feature two isolated sets of contacts that are ideal for use with two control circuits with different voltages.

The unique microcontroller-based voltage and phase-sensing circuit constantly monitors the voltages to detect harmful power line conditions When a harmful condition is detected, the MotorSaver's output relays are deactivated after a specified trip delay. The output relays reactivate after power line conditions return to an acceptable level and a specified amount of time has elapsed (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

This unit is also available with a shorter trip delay and faster restart delay. The 201-xxx-DPDT-60mS has a trip delay of 0.5 seconds and a restart delay of 60 milliseconds.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constantly monitors 3 phase voltage to protect against harmful line conditions, even before the motor is started
Compact design for 11-pin; DIN rail or surface mount	Allows flexibility in panel installation
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
Two isolated Form C relays (DPDT)	Ideal for use in systems which have two control circuits with different voltages

Accessories



OT11PC Octal Socket

11-pin surface & DIN rail mountable. Rated for 10A @ 300VAC

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
201-100-DPDT	95-120VAC	Fixed unbalance, trip delay 4s for low voltage fault and 2s for unbalance and phase loss, restart delay 2s
201-200-DPDT	190-240VAC	Fixed unbalance, trip delay 4s for low voltage fault and 2s for unbalance and phase loss, restart delay 2s
201-100-DPDT-60mS	95-120VAC	Fixed unbalance, trip delay 0.5s, restart delay 60mS

www.littelfuse.com/201xxxdpdt

Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

201-XXX-DPDT SERIES



Specifications

Input Characteristics Line Voltage 201-100-DPDT, 201-100-DPDT-60mS 201-200-DPDT, 201-200-DPDT-60mS Frequency

Functional Characteristics

Low Voltage (% of setpoint)

Unbalance, Phasing Faults

Models with -60ms option

After a Fault or Complete

Models with -60mS option

Output Characteristics Output Contact Rating (DPDT)

Restart Delay Times

Voltage Unbalance

Trip Delay Times

Low Voltage

Power Loss

Pilot Duty

General Purpose

Trip

Trip

Reset.

Reset

95-120VAC 190-240VAC 50/60Hz

90% +/-1% 93% +/-1%

6% 4.5%

> 4 seconds 2 seconds 0.5 second

2 seconds 60 milliseconds

480VA @ 240VAC 10A @ 240VAC

General Characteristics

Temperature Range -40° to 70°C (-40° to 158°F) **Maximum Input Power** 5 W **Standards Passed** Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency** Immunity, Radiated 150MHz, 10V/m **Fast Transient Burst** IEC 61000-4-4, Level 3, 2.5kV input power **Safety Marks** UL (OT11PC octal socket required) UL508 (File #E68520) CE IEC 60947-6-2 Dimensions **H** 44.45 mm (1.75"); **W** 60.33 mm (2.38"); **D** 104.78 mm (4.125") Weight 0.65 lb. (10.4 oz., 294.84 g) DIN rail or surface mount (plug in to

Mounting Method

Socket Available

The 300V socket can be surface mounted or installed on DIN Rail.

Must use Model OT11PC socket for UL Rating!

*Note: Manufacturer's recommended screw terminal torque for the RB Series and OT Series Octal Sockets is 12 in.-Ibs.

OT11PC socket)

Model OT11PC (UL Rated 300V)



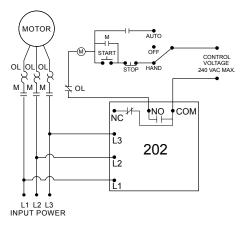
3-Phase Voltage/Phase Monitor



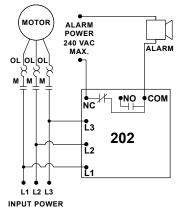


Wiring Diagram

202 WITH MOTOR CONTROL







For dimensional drawing see: Appendix, page 509, Figure 7.

Description

The 202 Series is a 3-phase, auto-ranging, dual-range voltage monitor that protects 190-480VAC, 50*/60Hz motors regardless of size. The 202-RP (and the 202-575-RP for 475-600VAC) monitors the phase rotation of 3-phase systems and trips on reverse-phase only. Critical applications include fan motors, scroll compressors, grinders, conveyor systems, elevators and escalators. Both products provide a user selectable nominal voltage setpoint and automatically select between the 200V and 400V range.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels for a specified amount of restart delay time (or a manual reset). The 202 Series includes advanced single LED diagnostics. Five different light patterns distinguish between faults and normal conditions. The status light turns green and the relay is activated when rotation is correct.

Features & Benefits

FEATURES	BENEFITS
Compact, quick mounting design	1-screw mounting saves time and space. Small footprint ideal for assembly into panels.
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, high voltage, voltage unbalance, phase reversal, harmful power line conditions.
Auto-sensing wide voltage range (202 & 202-RP	Automatically senses system voltage between 90 - 480VAC. Saves setup time.
Advanced LED diagnostics	Ouick visual indicator for cause of trip. LED indications include: normal operation, restart delay, reverse-phase trip, fault
Adjustable trip delay (202)	Prevent nuisance tripping due to rapidly fluctuating power line conditions.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION	
202	190-480VAC	Standard protection with low/high voltage trip, voltage unbalance	
202-RP	190-480VAC	Trips on reverse-phase only	
202-575-RP	475-600VAC	Designed for higher voltage systems and trips on reverse-phase only	

AC SYSTEM MONITORS/LOAD SENSORS



Specifications

Frequency	50*/6
Functional Characteristics	
Phase Sequence	ABC
Low Voltage (% of setpoint)	
Trip	90%
Reset	93%
High Voltage (% of setpoint)	
Trip	110%
Reset	107%
Voltage Unbalance (NEMA)	
Trip	6%
Reset	4.5%
Trip Delay Time	
High and Low Voltage	4 sec
Unbalance & Phasing Faults	2 sec
Restart Delay Time	
After a Fault	Manu
After a Complete Power Loss	Manu

50*/60Hz ABC 90% 93% 10% 07% 9% 9.5% 9 seconds 2 seconds 2 seconds

lanual, 2-300 seconds adj. lanual, 2-300 seconds adj.

Output Characteristics Output Contact Rating (SPDT) Pilot Duty General Purpose General Characteristics

Temperature Range Trip & Reset Accuracy Repeatability Maximum Input Power Relative Humidity Transient Protection Hi-potential Test

Termination

Safety Marks UL Recognized Dimensions

Weight Mounting Method

*Note: 50Hz will increase all delay timers by 20%. CE Pending

480VA @ 240VAC 10A @ 240VAC

-40° to 70°C (-40° to 158°F) ±1% ±0.5% 5 W 95%, non-condensing IEC 61000-4-5, ±4kV Meets UL508 (2x rated V+1000V for 1 minute) 0.25″ male quick connect

UL508 (File #E68520) H 63.5 mm (2.5"); W 63.5 mm (2.5"); D 35.56 mm (1.4") 0.5 lb. (8 oz., 226.8 g) 1/4" socket head cap screw (customer supplied)

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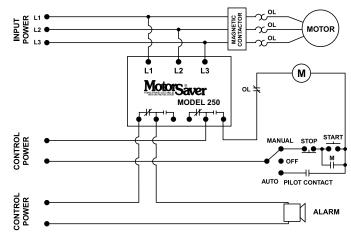


3-Phase Voltage/Phase Monitor

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Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Description

The 250A is a 3-phase, auto-ranging, dual-range voltage monitor that protects 190-480VAC, 50/60Hz motors regardless of size from low and high voltage, unbalance/single-phase, and reverse-phase. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically selects between the 200V and 400V range. The 250A also features adjustable or manual restart delay.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels. The Model 250A includes advanced single LED diagnostics. Five different light patterns distinguish between faults and normal conditions.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, voltage unbalance, phase reversal, harmful power line conditions.
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC. Saves setup time.
Advanced LED diagnostics	Quick visual indicator for cause of trip. LED indications include: normal operation, power-up restart delay, reverse-phase trip, unbalance/ single-phase trip, high or low voltage trip
DPDT relay output	Allows for versitility to meet wide application needs
Manual Reset	Allows for inspection of equipment before system is re-energized

Ordering Information

			% OF SETPOINT				
MODEL	LINE VOLTAGE	LOW VOLTAGE TRIP	LOW VOLTAGE RESET	HIGH VOLTAGE TRIP	HIGH VOLTAGE RESET	DESCRIPTION	
250A	190-480VAC	90%	93%	110%	107%	Provides high and low voltage protection at fixed percentage of nominal voltage.	
250600	475-600VAC	90%	93%	110%	107%	Provides high and low voltage protection at fixed percentage of nominal voltage.	
250A-MET	190-480VAC	85%	88%	N/A	N/A	Designed for use with Fire Control Panels. Has 2 Form C contacts that operate independently. Left Form C energizes when voltage conditions are good and de-energize when a fault condition is detected. Right Form C only energizes during a reverse-phase condition. No high voltage protection.	
250-100-MET	95-120VAC	85%	88%	N/A	N/A	Designed for use with Fire Control Panels. Has 2 Form C contacts that operate independently. Left Form C energizes when voltage conditions are good and de-energize when a fault condition is detected. Right Form C only energizes during a reverse-phase condition. No high voltage protection.	

www.littelfuse.com/250a

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

Specifications

Frequency

Functional Characteristics Voltage Unbalance (NEMA) Trip Reset Trip Delay Time Low Voltage, High Voltage Unbalance, Phasing Faults Restart Delay Time After a Fault or Complete

Power Loss Output Characteristics

Output Contact Rating (DPDT - 2 Form C) **Pilot Duty General Purpose Temperature Range Trip & Reset Accuracy Maximum Input Power Relative Humidity Terminal Torque** Wire Size **Transient Protection** (Internal) **Approvals** UL CSA CE Dimensions

Weight

Mounting Method

480VA @ 240VAC 10A @ 240VAC -40° to 70°C (-40° to 158°F) ±1% 5 W Up to 95% non-condensing per IEC 68-2-3 7 in.-lbs. 12-18AWG

IEC 61000-4-5;1995 ±6kV

Manual, 2-300 seconds adj.

50*/60Hz Low Voltage

6%

4.5%

4 seconds

2 seconds

UL508 (File #E68520) CSA 22.2 No. 14 (File#46510) CE IEC 60947-6-2 H 74.4 mm (2.93"); W 133.9 mm (5.27"); D 74.9 mm (2.95") 1.02 lb. (16.32 oz., 462.66 g) #8 screws

*Note: 50Hz will increase all delay timers by 20%.



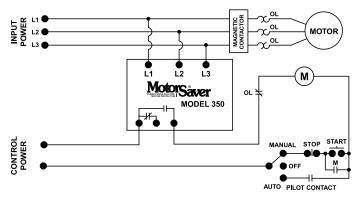


3-Phase Voltage/Phase Monitor





Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Description

The 350 Series is a heavy-duty voltage monitor. This product should be used when high current relays or dual contacts are required, or 480V controls are used. Since the 350 Series uses heavy-duty relays, it comes in fixed voltage range models rather than a dual auto-ranging version like the Model 250.

The 350200 has a 15A general purpose contact. The 350400 provides a SPDT (Form C) relay rated to switch up to 600V, allowing the use of 480V controls, eliminating the need for a control power transformer to step the voltage down to 120-240V. Several DPDT (two Form C contacts) relay models are also available.

The 350 microcontroller-based family of products are low cost yet highly advanced solutions to heavy-duty problems. The 350 includes advanced single LED diagnostics. Five different light patterns distinguish faults and normal operating conditions. Other options such as high voltage trip and adjustable restart delay are available.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constantly monitors 3 phase voltage to protect against harmful line conditions, even before the motor is started
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
Adjustable restart delay (-2 models) settings	Allows staggered start up of multiple motors, after a fault, to prevent a low voltage condition
600V rated relay contacts available on some models	Eliminates the need for a control transformer to step voltage down to 120 - 240V for a control circuit

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION	MODEL	LINE VOTAGE	DESCRIPTION
350200	190-240VAC	SPDT, fixed trip and restart delay	35040026	380-480VAC	DPDT, 2 relays (1)10a. (1) 15A; fixed trip and variable restart delay (manual, 2-300s)
3502002	190-240VAC	SPDT, fixed trip and variable restart delay (manual, 2-300s)	35040028**	380-480VAC	DPDT, 2 relays 15A; variable restart delay (no manual reset)
35020026	190-240VAC	DPDT, 2 relays (1)10a. (1) 15A; fixed trip and variable restart delay (manual, 2-300s)	35040029	380-480VAC	SPDT, fixed trip and variable restart delay (manual, 2-300s), plus high voltage detection
35020028**	190-240VAC	DPDT, 2 relays 15A; variable restart delay (no manual reset)	350600	475-600VAC	SPDT, fixed trip and restart delay
35020029	190-240VAC	SPDT, fixed trip and variable restart delay (manual, 2-300s), plus high voltage detection	3506002	475-600VAC	SPDT, fixed trip and restart delay (manual, 2-300s)
350400	380-480VAC	SPDT, fixed trip and restart delay	35060026	475-600VAC	DPDT, 2 relays (1)10a. (1) 15A; fixed trip and variable restart delay (manual, 2-300s)
3504002	380-480VAC	SPDT, fixed trip and variable restart delay (manual, 2-300s)	35060028**	475-600VAC	DPDT, 2 relays 15A; variable restart delay (no manual reset)
35040025	380-480VAC	DPDT, fixed trip and variable restart delay (manual, 2-300s)	35060029	475-600VAC	SPDT, fixed trip and variable restart delay (manual, 2-300s), plus high voltage detection

** These units are not equipped with Manual Reset.

www.littelfuse.com/350



Specifications

Input Characteristics Line Voltage 350200 350400 350600 Frequency **Functional Characteristics** Low Voltage (% of setpoint) 90% Trip 93% Reset Voltage Unbalance (NEMA) Trip 6% 4.5% Reset **Trip Delay Time:** Low Voltage Unbalance & Phasing Faults 2 seconds **Restart Delay Time** After a Fault After a Complete Power Loss 2 seconds **Output Characteristics Output Contact Rating** SPDT (350200) Pilot Duty **General Purpose** 15A SPDT (350-400, 350-600) **DPDT** (-6 Option) **DPDT** (-8 Option) 2-15A General Purpose

190-240VAC 380-480VAC 475-600VAC 50*/60Hz 4 seconds 2 seconds 480VA @ 240VAC 470VA @ 600VAC 1-10A General Purpose 480VA @ 240VAC Pilot Duty 1-15A General Purpose 480VA @ 240VAC Pilot Duty 1hp @ 240VAC

480VA @ 240VAC Pilot Duty

1hp @ 240VAC

General Characteristics

Ambient Temperature Range -40° to 70°C (-40° to 158°F) Operating Storage -40° to 80°C (-40° to 176°F) **Trip & Reset Accuracy** ±1% **Maximum Input Power** 5 W Terminal Torque 7 in.-lbs. Wire Size 12-18AWG **Transient Protection** (Internal) IEC 61000-4-5;1995 ±6kV **Safety Marks** UL UL508 (File #E68520) CSA 22.2 No. 14 (File #46510) CE IEC 60947-6-2 Dimensions H 74.42 mm (2.93"); W 133.86 mm (5.27"); D 74.93 mm (2.95") Weight 1.05 lbs. (16.8 oz., 476.27 g) **Mounting Method** #8 screws **Special Options** Opt. 2: Variable Restart Delay Manual, 2-300 seconds adj. **Opt. 5: DPDT Relay** Opt. 6: 2 Relays (1) 10A, (1) 15A Opt. 8: 2 Relays (2) 15A **Opt. 9: High Voltage (% of setpoint)** Trip 110% Reset 107%

*Note: 50Hz will increase all delay timers by 20%.

9 **AC SYSTEM MONITORS/LOAD SENSORS**

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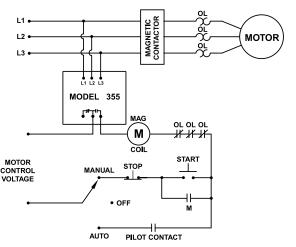
3-Phase Voltage/Phase Monitor





Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 355 WITH MOTOR CONTROL



Description

The 355 Series is a 3-phase voltage monitor with adjustable trip and restart delay, adjustable voltage unbalance and multiple diagnostic lights. It is perfect for heavy-duty applications that need both protection and simple user-friendly diagnostics. Applications include pump panels, commercial HVAC, oil rigs and others.

The 355 Series uses microcontroller technology to monitor incoming voltage and de-energize its output relay if power problems exist. The 355 Series can protect motors from damage caused by single-phasing, high and low voltage, phase reversal and voltage unbalance. It has four diagnostic LEDs that clearly show overvoltage, undervoltage, voltage unbalance, reverse-phase and normal conditions.

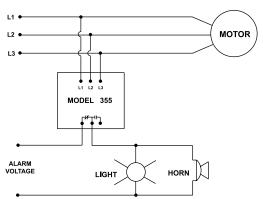
The 355200 is equipped with a heavy-duty 10A general purpose SPDT relay. The 355400 and 355600 are equipped with a 470VA @ 600VAC pilot duty SPDT relay. A high voltage (600V) DPDT relay output option is available with the 400V model.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constantly monitors 3 phase voltage to protect against harmful line conditions, even before the motor is started
Advanced LED indication	Provides diagnostics which can be used for troubleshooting and to determine relay status
Adjustable trip and restart delay settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions and allows staggered start up of multiple motors, after a fault, to prevent a low voltage condition
Combines protection and diagnostics	Perfect for heavy duty applications: pump panels, commercial HVAC, and oil rigs
600V rated relay contacts available on some models	Eliminates the need for a control transformer to step voltage down to 120 - 240V for a control circuit

9

TYPICAL WIRING DIAGRAM FOR MODEL 355 WITH ALARM CONTROL



Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
355200	190-240VAC	SPDT
355400	380-480VAC	SPDT
3554005	380-480VAC	DPDT
355600	475-600VAC	SPDT

For dimensional drawing see: Appendix page 509, Figure 6.

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Specifications

Input Characteristics Line Voltage 355200 355400 355600 (Specify voltage range) Frequency

Functional Characteristics

Low Voltage (% of setpoint) Trip Reset High Voltage (% of setpoint) Trip Reset Voltage Unbalance (NEMA) Trip Reset **Trip Delay Time:** Low & High Voltage and Unbalance **Single-phasing Faults** (>25% UB) **Restart Delay Time** After a Fault or Power Loss **Output Characteristics Output Contact Rating** SPDT (355200) **Pilot Duty General Purpose**

SPDT (355400, 355600)

Pilot Duty

Pilot Duty

DPDT (-5 Option)

190-240VAC 380-480VAC 475-600VAC

50*/60Hz

90% ±1% 93% ±1%

110% ±1% 107% ±1%

2-8% adjustable Trip setting minus 1%

2-30 seconds adjustable

2 seconds

Manual, 2-300 seconds adj.

480VA at 240VAC 10A

470VA @ 600VAC

470VA @ 600VAC

General Characteristics

Temperature Range Operating Storage Repeat Accuracy Fixed Conditions Maximum Input Power Terminal Torque Wire Size Transient Protection (Internal) Safety Marks UL Dimensions

Weight Mounting Method Special Options Option 5 - DPDT Relay

*Note: 50Hz will increase all delay times by 20%.

-40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F)

±0.1% 6 W

7 in.-Ibs. 12-18AWG

2500V for 10 ms

UL508 (File #E68520) H 74.42 mm (2.93"); W 133.86 mm (5.27"); D 74.93 mm (2.95") 0.94 lb. (15.04 oz., 426.38 g) #8 screws

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www.littelfuse.com/355



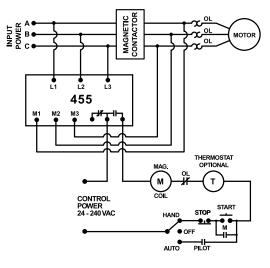
3-Phase Voltage/Phase Monitor

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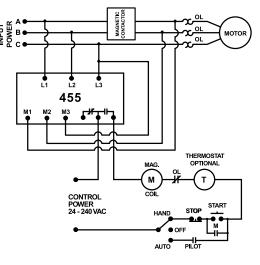


Wiring Diagram

MODEL 455 WITH MOTOR CONTROL USING A 3-POLE CONTACTOR



MODEL 455 WITH MOTOR CONTROL USING A 2-POLE CONTACTOR



For dimensional drawing see: Appendix page 509, Figure 6.

Description

The 455 Series are 3-phase voltage monitors that combine load and line side monitoring to offer complete protection. Monitoring the load side will alert the user of contactor failure or impending contactor failure. Line side monitoring will also protect the motor from damaging fault conditions that may be present prior to the motor starting. With other line/load side monitors, the motor must be started before a voltage fault is detected. With the 455, your motor is fully protected at all times.

The 455 Series are 3-phase, dual range voltage monitors that protect 190-480VAC, 50*/60Hz motors, regardless of their size. It automatically selects between the 200V and 400V range when the user selects the nominal voltage setpoint. Other adjustments include a 2-30 second trip delay, a 2-300 second restart delay (and manual restart) and a voltage unbalance trip point of 2-8%. The voltage monitor's circuitry is powered through the line side connections, so there is no need for separate control power, making it easy to install.

Equipped with an infrared LED, the 455 Sereies can communicate to the optional hand-held diagnostic tool, Informer-MS to obtain valuable information such as real-time voltage, voltage unbalance on both line and load sides, motor run hours, last 20 faults, last 32 motor starts, high and low voltage trip points, voltage unbalance trip point, restart and trip delay settings, LED status and more.

Features & Benefits

FEATURES	BENEFITS	
Load side monitoring of contactor	Protects motor from contactor failure or worn contacts.	
Monitors contactor or starter	Prevents rapid cycling	
Infrared LED Capable	Increases personnel safety line of sight monitoring using optional Informer-MS	

Accessories



Informer-MS

Informer IR Kit-36

A hand-held diagnostic tool designed for use with Littelfuse® 455 equipped with an infrared LED transmitter



36" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without opening the panel.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
455	190-480VAC	Universal line and load side monitor
455480R	380-480VAC	Used in high voltage applications with pilot duty 470VA @ 600VAC
455575	475-600VAC	For use in Canada or NE USA where 575V utility power services are common.

www.littelfuse.com/455

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Specifications

Frequency Low Voltage (% of setpoint) Trip Reset High Voltage (% of setpoint) Trip Reset Voltage Unbalance (NEMA) Trip Reset **Trip Delay Time** Low & High Voltage and Unbalance **Single-phasing Faults** (>25% UB) **Restart Delay Time** After a Fault After a Complete Power Loss Manual, 2-300 seconds adj. After a Motor Shut-down **Output Characteristics Output Contact Rating (SPDT) Pilot Duty**

General Purpose

Pilot Duty

High Voltage Relay (-480R)

50*/60Hz

90% ±1% 93% ±1%

110% ±1% 107% ±1%

2-8% adjustable Trip setting minus 1%

2-30 seconds adjustable

2 seconds fixed

Manual, 2-300 seconds adj. Manual, 2-300 seconds adj.

480VA @ 240VAC 10A 470VA @ 600VAC

General Characteristics

Ambient Temperature Range -40° to 70°C (-40° to 158°F) Operating -40° to 80°C (-40° to 176°F) Storage **Repeat Accuracy Fixed Conditions** ±0.1% **Maximum Input Power** 6 W Terminal Torque 7 in.-lbs. Wire Size 12-18AWG **Transient Protection** (Internal) IEC 61000-4-5;1995 ±6kV **Safety Marks** UL UL508 (File #E68520) CSA C22.2 No. 14 (File #46510) CE IEC 60947-6-2 Dimensions H 74.4 mm (2.93"); W 133.9 mm (5.27"); **D** 74.9 mm (2.95") Weight 1.1 lbs. (17.6 oz., 498.95 g) **Mounting Method** #8 screws

*Note: 50Hz will increase all delay times by 20%



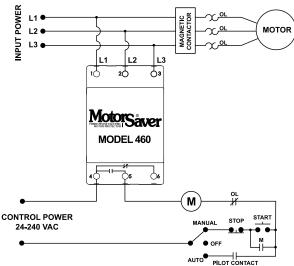
3-Phase Voltage Monitor

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Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 460 WITH MOTOR CONTROL



For dimensional drawing see: Appendix, page 510, Figure 10.

Ordering Information

Description

The 460 is a 3-phase voltage monitor that protects 190-480VAC or 475-600V, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically senses line voltage.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions such as low, high, and unbalanced voltage, loss of any phase, and phase reversal. When a harmful condition is detected, the MotorSaver® output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (restart delay). The trip and restart delays prevent nuisance tripping due to rapidly fluctuating power line conditions.

All 460 models feature adjustable 1-30 second trip delay, 1-500 second restart delay, 2-8% voltage unbalance trip point, and one form C contact except where noted below.

Features & Benefits

FEATURES	BENEFITS
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC or 475-600VAC. Saves set-up time
Adjustable trip & restart delay settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions
Microcontroller based circuitry	Improved accuracy and higher reliability
Advanced LED diagnostics	Quick visual indicator for cause of trip and relay status
Adjustable voltage unbalance trip setting	Provides reliable protection when regenerative voltage is present

MODEL	VOLTAGE	DESCRIPTION		
460	190-480VAC	Automatically senses line voltage, adjustable 1-30 second trip delay, 1-500 second restart delay, and 2-8% voltage unbalance trip point		
460-L	190-480VAC	Fixed 4 second trip delay and 1 second for single-phase faults, and fixed 6% voltage unbalance trip point		
460-14	190-480VAC	Equipped with 2 sets of contacts: Form A (NO) and Form B (NC). Used for applications requiring 2 different voltages such as 5VDC for a PLC input and 115VAC for an alarm		
460-575	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power		
460-575-14	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power. Equipped with 2 sets of contacts: Form A and Form B		
460-15	190-480VAC	Equipped with 2 sets of Form A (NO) contacts. Used on applications where two different units are to be controlled at once such as a unit that has separate contacts for a compressor and a fan		
460-MR	190-480VAC	Equipped with a 2-prong connection for a normally open push button mounted outside the panel. Used in applications requiring an external manual reset button		
460-VBM	190-480VAC	Fixed 6% voltage unbalance trip point. User adjustable low and high voltage trip points		
460-400HZ	190-480VAC	For use with 400Hz power supply		
460-0EM	190-480VAC	Bulk package of 460, 20 units		
460L-0EM	190-480VAC	Bulk package of 460-L, 20 units		

www.littelfuse.com/460

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Specifications

Frequency Low Voltage (% of setpoint) Trip Reset **High Voltage (% of setpoint)** Trip Reset Voltage Unbalance (NEMA) Trip Reset

460L

Trip Delay Time

Low, High and **Unbalanced Voltage** 460L **Single-Phase Faults** (>25% UB)

Restart Delay Time After a Fault

After a Complete Power Loss **Output Contact Rating** Form C **Pilot Duty General Purpose** Form A & Form B **Pilot Duty General Purpose**

50/60Hz

90% ±1% 93% ±1%

110% ±1% 107% ±1%

2-8% adjustable Trip setting minus 1% (5-8%) Trip setting minus 0.5% (2-4%) 6% UB fixed (4.5% reset)

1-30 seconds adjustable 4 seconds fixed

1 second fixed

1-500 seconds adjustable 1-500 seconds adjustable

480VA @ 240VAC, B300 10A @ 240VAC

360VA @ 240VAC, B300 8A @ 240VAC

Ambient Temperature Range

Operating Storage **Maximum Input Power Class of Protection Relative Humidity Terminal Torque** Wire Type **Standards Passed**

RFI, Radiated **Fast Transient Burst**

Surge IEC

ANSI/IEEE

Hi-potential Test Safety Marks UL CE Enclosure Dimensions

Weight **Mounting Method**

460-MR (manual reset)

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F) 6 W IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3 4.5 in.-lbs. Stranded or solid 12-20 AWG, one per terminal

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air 150 MHz, 10V/m IEC 61000-4-4, Level 3, 3.5kV input power and controls

> IEC 61000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute)

UL508 (File #E68520) IEC 60947-6-2 Polycarbonate H 88.9 mm (3.5"); W 52.9 mm (2.08"); **D** 59.69 mm (2.35") 0.7 lb. (11.2 oz., 317.51 g) 35 mm DIN rail or Surface Mount (#6 or #8 screws) External NO pushbutton required.



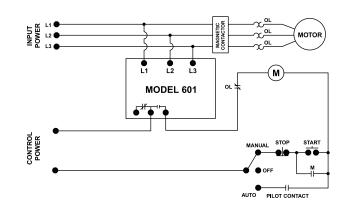
3-Phase Voltage & Frequency Monitor

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Wiring Diagram

MODEL 601 WITH MOTOR CONTROL



For dimensional drawing see: Appendix page 507, Figure 1.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION		
601	190-480VAC	Universal 3-Phase Voltage & Frequency Monitor		
601575	500-600VAC	Used primarily in Canada and NE USA where 575V utility power services are common		

Description

The Model 601 is a fully-programmable voltage monitor designed to protect 3-phase motors from loss of any phase (single-phasing), phase reversal, low or high voltage, voltage unbalance, low or high frequency, and rapid cycling. It can be used as a stand-alone product or networked with an RM1000, RM2000, PLC, computer or SCADA system.

When a harmful condition is detected, the 601's output relay is deactivated after the specified trip delay. The output relay reactivates after power line conditions return to an acceptable level for the programmed restart delay (RD2).

Eleven (11) setpoints are viewable with the 3-digit LED display or from a networked device:

- Iow voltage high voltage
- trip delay for single-phase faults rapid-cycle timer (RD1)

restart delay after all faults (RD2)

 type of restart after all faults (manual or automatic)

- voltage unbalance
- Iow frequency
- high frequency
- RS485 address
- trip delay for voltage/ frequency faults

Six (6) parameters are viewable while the motor is running:

- L1-L2 voltage
- L2-L3 voltage
- L1-L3 voltage

- average voltage
 - voltage unbalance (%)
 - frequency

When used with the RS485MS-2W communications module, the 601 can communicate with most Modbus RTU master devices. Voltage conditions can be monitored and setpoints can be changed remotely using Solutions software, an RM1000, RM2000 or other device.

Features & Benefits

FEATURES	BENEFITS
Built-in display	Provides real time information and diagnostics to help with troubleshooting
Programmable voltage and frequency settings	Allows usage on wide range of systems
2 programmable restart delay timers	Program separate restart delay time for rapid cycle protection and motor cool down
2 programmable trip delay timers	1 trip delay specifically for Phase Loss/Single-Phase fault condition, 1 trip delay for all other fault conditions
Programmable restart control	Choose between an adjustable automatic or manual restart to best meet individual application needs
Flexible reset	Reset options include pushbutton on relay or remote reset with optional 777-MRSW or OL-RESET remote reset kit
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Network communications capability	Compatible with RS-485 Modbus communications module

www.littelfuse.com/601

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

9 **AC SYSTEM MONITORS/LOAD SENSORS**



Accessories

601 SERIES



RS485MS-2W Communication Module (for limited Modbus capabilities) Required to

enable the Modbus communications function on Model 77X-type products.



RM1000 Remote Monitor

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



RM2000 Remote Monitor

The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



OL-RESET Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

Specifications

Input Characteristics Frequency **Functional Characteristics Programmable Operating Points** LV - Low Voltage Threshold **HV- High Voltage Threshold VUB - Voltage Unbalance** Threshold **LF - Low Frequency** Threshold **HF - High Frequency** Threshold TD1 - Trip Delay for Voltage/Unbalance/ **Frequency Faults** TD2 - Trip Delay for **Single-Phase Faults RD1 - Rapid-Cycle Timer RD2 - Restart Delay After All Faults #RF - Type of Restart** ADDR - RS-485 Address **Fixed Reset Points Overvoltage Reset** Low Voltage Reset Voltage Unbalance Reset **Low Frequency Reset High Frequency Reset Output Characteristics Output Contact Rating Pilot Duty General Characteristics Temperature Range** Accuracy Voltage Timing Repeatability Voltage **Maximum Input Power Transient Protection (Internal) Safety Marks** UL CSA CE

50/60Hz

170V (450V*) - HV Setting LV Setting - 528V (660V*)

2-15% or off

35Hz - HF Setting

LF Setting - 75Hz

1-50 seconds

1-50 seconds 0, 2-500 seconds

2-500 seconds Manual or Automatic A01-A99

97% of HV Setting 103% of LV Setting UB Setting -1% LF Setting +0.6Hz HF Setting -0.6Hz

480VA @ 240VAC

-20° to 70°C (-4° to 158°F)

±1% 5% ±1 second

±0.5% 5 W 2500 V for 10 ms

UL508 (File #E68520) C22.2 No. 14 (File #46510) IEC 60947-6-2 H 77.47 mm (3.05"); W 97.79 mm (3.85"); D 128.27 mm (5.05") 1.2 lbs. (19.2 oz., 544.31 g) Surface mount (4 - #8 screws) or DIN rail mount

The 601 can be preprogrammed prior to installation by applying at least 120V to the L1 and L2 terminals.

*575V Model

Dimensions

Mounting Method

Weight

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601-CS-D-P1

Wiring Diagram

L2

3-Phase Power Monitor

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Description

The 601-CS-D-P1 3-phase power monitor is a fully programmable electronic power monitor designed to monitor 3-phase systems. The 601-CS-D-P1 has a single relay that can be configured as a general purpose network output or to trip on ground faults. The 601-CS-D-P1 monitors ground fault current, phase currents, phase voltages, power factor and frequency. The RS485MS-2W communications module allows the 601-CS-D-P1 to communicate using the Modbus RTU protocol. The Modbus connection can be used to monitor power parameters, setup the device or control the fault relay. A DeviceNet[™] communications I/O module (CIO-601CS-DN-P1) is available as well. This CIO module only works with the 601-CS-D-P1 unit. It is used for sending the information from the 601-CS-D-P1 over a DeviceNet[™] network. It also provides I/O capabilities and the ability to set the parameters of the 601-CS-D-P1.

Note: This product must be used with an external Zero-Sequence CT for proper operation (not included).

Features & Benefits

FEATURES	BENEFITS
Built-in display	Visual indication for programming and viewing real-time parameters for nominal voltage, voltage unbalance, current, current unbalance, ground fault warning, ground fault trip, and ground fault motor acceleration
15 Programmable parameters to control the device operation	Allows the user to customize the protection required for their system
2 programmable trip delay timers	Program separate trip delay time for motor acceleration and ground fault
Network communications capability	Compatible with Modbus RTU and DeviceNet™ protocols with the use of separate communications module

Accessories



CIO-601CS-DN-P1 Module Convenient_cost-effective DeviceN

Convenient, cost-effective DeviceNet[™] interface device capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet[™] network.

9

CONTROL CONTACTOR CONTACTOR CONTACTOR CONTROL POWER CONTROL POWER CONTROL POWER CONTROL CONTROL POWER CONTROL POWER CONTROL POWER

For dimensional drawing see: Appendix page 507, Figure 1.

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601-CS-D-P1



Specifications

Input Characteristics Line Voltage Frequency Motor Full Load Amp Range Input Ground Fault Current Output Characteristics Output Contact Rating (SPDT) Pilot Duty

General Purpose Expected Life Mechanical Electrical

General Characteristics

Ambient Temperature Range Operating Storage Accuracy at 25° C (77° F) Voltage Current GF Current Repeatability Voltage Current Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque 200-480VAC 50/60Hz 0.5-175A (direct) 176-800A (CTs required) 0.5-10A

480VA @ 240VAC 10A @ 240VAC

 $1 \ x \ 10^6 \ operations$ $1 \ x \ 10^5 \ operations \ at rated \ load$

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

+/-1% +/-3% (<175A direct) +/-3%

+/-0.5% of nominal voltage +/-1% (<175A direct) 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7in.-Ibs.

Standards Passed

Electrostatic Discharge (ES Radio Frequency Immunity, Conducted Radio Frequency Immunity, Radiated Fast Transient Burst Short Circuit Rating Surge Immunity IEC

ANSI/IEEE

High Potential Test Safety Marks UL CE Max Conductor Size (with insulation) Dimensions

Weight Mounting Method

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air Radio Frequency Immunity,

IEC 61000-4-6, Level 3 10V

IEC 61000-4-3, Level 3, 10 V/m IEC 61000-4-4, Level 3, 3.5kV input power 100kA rms, SYM, 600VAC max.

IEC 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute)

UL508 (File #E68520) IEC 60947-1, IEC 60947-5-1

0.65" **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.2 lbs. (19.2 oz., 544.31 g) Surface mount (4 - #8 screws) or DIN rail mount

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WVM SERIES

CE & &



Wiring Diagram

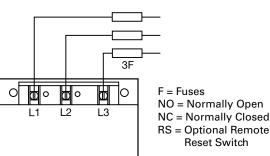
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Ordering Information

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For dimensional drawing see: Appendix, page 513, Figure 29.



Relay contacts are isolated.

CAUTION: 2 amp max fast acting fuses must be installed externally in series with each input. (3)

Description

The WVM Series provides protection against premature equipment (motor) failure caused by voltage faults on the 3-phase line. The WVM's microcontroller design provides reliable protection even if regenerated voltages are present. It combines dependable fault sensing with a 10 fault memory and a 6 LED status display. Part instrument, part control, the WVM protects your equipment when you're not there and displays what happened when you return. The WVM is fully adjustable and includes time delays to prevent nuisance tripping and improve system operation. Time delays include a 0.25 to 30s adjustable trip delay, an adjustable 0.25 to 64m (in 3 ranges) restart delay, plus a unique 3 to 15s true random start delay. The random start delay prevents voltage sags caused by simultaneous restarting of numerous motor loads after a power outage.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring to protect against phase loss, phase reversal, over voltage, under voltage, unbalance, and short cycling
Fault memory	Stores the 10 most recent faults, which provides diagnostics for troubleshooting
LED indication	Provides visual indictation of existing relay/fault status or faults stored in memory.
Switch selectable automatic restart, delayed automatic restart, and manual reset	Allows user adjustment to handle unique application requirements
Random start delay	Prevents voltage sags caused by simultaneous restarting of multiple motor loads after a power outage

Operation

The output relay is energized when all conditions are acceptable and the WVM is reset. A restart and/or random start delay may occur before the output relay is energized.

Field Adjustment: Select the line voltage listed on the motor's name plate. This automatically sets the over and undervoltage trip points. No further adjustment should be required to achieve maximum equipment protection.

MODEL	LINE VOLTAGE	UNBALANCE	TRIP DELAY	SWITCH SELECTABLE RESET METHOD	RESTART DELAY
WVM011AL	500 to 600VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64s
WVM611AH	200 to 240VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64m
WVM611AL	200 to 240VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64s
WVM611RL	200 to 240VAC	2 - 10%	0.25 - 30s	Auto restart upon fault correction	0.25 - 64s
WVM811AH	355 to 425VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64m
WVM811RL	355 to 425VAC	2 - 10%	0.25 - 30s	Auto restart upon fault correction	0.25 - 64s
WVM911AH	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64m
WVM911AL	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64s
WVM911AL-60	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	0.25 - 64s, no random start delay
WVM911AN	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault trip	6 - 300s
WVM911RH	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault correction	0.25 - 64m
WVM911RL	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault correction	0.25 - 64s
WVM911RN-60	400 to 480VAC	2 - 10%	0.25 - 30s	Auto restart upon fault correction	6 - 300s, no random start delay

If you don't find the part you need, call us for a custom product 800-843-8848

www.littelfuse.com/wvm

WVM SFRIFS



Read Memory: Fault(s) stored in the memory are indicated when the yellow LED is flashing, up to 10 faults are noted.

Memory Reset: To clear the memory of all faults stored, rotate selector to Clear Memory for 5 seconds. The yellow LED will turn off.

Memory Overload: Only the 10 most recent faults are retained.

Random Start Delay: A new 3 to 15s random start delay is selected by the microcontroller when a fault is corrected and when the operating voltage (L1, L2, L3) is applied to the WVM. A random start delay does not occur when the reset is manual.

Automatic Restart: Upon fault correction, the output will re-energize after a random start delay.

Automatic Restart Upon Fault Trip: When a fault is sensed for the full trip delay, the output de-energizes and a restart delay is initiated. This delay locks out the output for the delay period. Should the fault be corrected by the end of the restart delay, the output will re-energize after a random start delay. A restart delay will also occur when operating voltage (L1, L2, L3) is applied to the WVM.

Manual Reset: After a fault condition is corrected, the WVM can be manually reset. There are two methods; a customer supplied remote switch, or the onboard selector switch.

Manual Reset (Onboard): Rotate selector switch from the Manual Reset position to Auto Restart w/Delay then back again to Manual Reset within 3 seconds. The output will immediately energize.

Remote Reset: Reset (Restart) is accomplished by a momentary contact closure across terminals 1 & 2. The output will immediately energize. Remote switch requirements are ≥10mA @ 20VDC and the reset terminals are not isolated from line voltage. A resistance of $\leq 20 K\Omega$ across terminals 1 & 2 will cause immediate automatic restart.

Automatic Restart Upon Fault Correction: (P/N includes an R) When a fault is sensed for the full trip delay, the output relay de-energizes. Upon correction of the fault, a restart delay begins. At the end of this delay, the output will re-energize after a random start delay. If a fault occurs during restart timing, the restart time delay will be reset to zero, and the output will not energize until the restart delay is completed.

Accessories



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders

Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC



0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity,

current-limiting type fuse. 600 Vac/500 Vdc

C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Specifications

Line Voltage Туре

Type	to neutral		
Operating Voltage	Model	Adj. Line Voltage Range	
	240	200-240VAC	
	380	355-425VAC	
	480	400-480VAC	
	600	500-600VAC	
AC Line Frequency	50/60 Hz		

-2% of trip point

+2% of trip point

≥ 15% unbalance

0.25-64s ±15%

0.25-64m ±15%

Nonvolatile RAM

memory readout

status indicators

(0.4 PF) @ 250VAC

Mechanical - 1 x 107

ASME A17.1 Rule 210.6

NEMA MG1 14:30, 14:35

IEEE 62.41-1991 Level B

D 61.0 mm (2.4")

≈ 25 oz (709 q)

 \geq 2500V RMS input to output

up to #12 AWG (3.2 mm²) wire

-40° to 65°C / -40° to 85°C

Surface with 2 or 4 #8 (M4 x 0.7) screws

Screw terminals with captive wire clamps for

H 175.3 mm (6.9"); **W** 111.8 mm (4.4");

Isolated, SPDT

Electromechanical relay

Stores last 10 faults

6 LEDs provide existing status &

Note: 50% of operating line voltage must

be applied to L1 & L2 for operation of

10A resistive @ 250VAC; 6A inductive

6-300s ±15%

≤ 200 ms

3 - 15s

109-113% of adjusted voltage

88-92% of adjusted voltage

Adjustable from 0.25 - 30s ±15%

Adjustable from 2-10%*

3-phase delta or www.with.no.connection

Overvoltage, Undervoltage, & Voltage Unbalance

Overvoltage Trip Point Reset Voltage Undervoltage Trip Point Reset Voltage Voltage Unbalance **Trip Delay Phase Loss Response Time Random Start Delay Range Reset (Restart) Delay** Low Range

Normal Range High Range Fault Memory Type

```
Capacity
Status Indicators
```

Output

Type Form Rating

Life Protection

Phase Reversal/Failure Motors and Generators Surge **Isolation Voltage** Mechanical Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Weight

* Unbalance reset is 90% of the unbalance setting (i.e. VUB at 5% reset is 4.5%)

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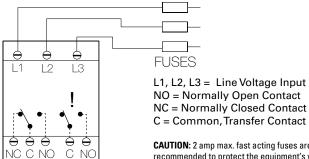


DLMU SERIES





Wiring Diagram



L1, L2, L3 = Line Voltage Input NO = Normally Open Contact NC = Normally Closed Contact

CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the DLMU.

! = Select alarm contact connection as N.O. or N.C. when ordering; N.O. Shown.

For dimensional drawing see: Appendix, page 513, Figure 30.

Description

The DLMU Series is a universal voltage, 3-phase voltage monitor. It continuously measures the voltage of each of the three phases with microcontroller accuracy and compares the value to preset trip points. It separately senses phase reversal and loss; over, under and unbalanced voltages; and over or under frequency. Protection is assured during periods of large average voltage fluctuations or when regenerated voltages are present. The unit trips within 200ms when phase loss is detected. Adjustable time delays are included to prevent nuisance tripping and short cycling of sensitive equipment. The isolated, 10A, SPDT and 2A alarm output relay contacts trip when a phase voltage exceeds the trip limits for the trip delay. Nominal line voltage, voltage unbalance, and time delays are knob adjustable. The phase loss setpoint and the acceptable frequency range are fixed. Both delta and wye systems can be monitored; no connection to neutral is required.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring to protect against phase loss, phase reversal, over voltage, under voltage, unbalance, short cycling and over/under frequency
Universal line voltage range	Flexibility to work in 200 to 480VAC or 500 to 600VAC applications
DIN rail (35mm) or surface mounting	Installation flexibility
LED indication	Provides diagnostics of relay, fault and time delay status
User adjustable time delays	Prevents nuisance tripping and short cycling of sensitive equipment

Accessories



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders

Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC



0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Ordering Information

•						
MODEL	LINE VOLTAGE	OUTPUT	RESTART FUNCTION	VOLTAGE UNBALANCE	TRIP DELAY	RESTART DELAY
DLMHBRAAA	500 to 600VAC	SPDT & NO	Staggered restart	Adjustable 2 - 10%	Adjustable 1 - 30s	Adjustable 0.6 - 300S
DLMUBLAAA	200 to 480VAC	SPDT & NO	Lockout, min off time	Adjustable 2 - 10%	Adjustable 1 - 30s	Adjustable 0.6 - 300S
DLMUBNAAN	200 to 480VAC	SPDT & NO	No restart delay	Adjustable 2 - 10%	Adjustable 1 - 30s	None
DLMUBRAAA	200 to 480VAC	SPDT & NO	Staggered restart	Adjustable 2 - 10%	Adjustable 1 - 30s	Adjustable 0.6 - 300S
If you don't find the part you need, call us for a custom product 800-843-8848						

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DLMU SERIES



Operation

Upon application of line voltage, the output is de-energized and the restart delay begins. If all the 3-phase voltages are within the acceptable range, the output energizes at the end of the restart delay. The microcontroller circuitry automatically senses the voltage range, and selects the correct operating frequency (50 or 60Hz). The over and undervoltage trip points are set automatically. When the measured value of any phase voltage exceeds the acceptable range limits (lower or upper) the trip delay begins. At the end of the trip delay the output relay de-energizes. If the phase voltage returns to an acceptable value before the trip delay expires, the trip delay is reset and the output remains energized. Under, over, and unbalanced voltages plus over or under frequency must be sensed for the complete trip delay before the unit trips. The unit trips in 200ms when phase loss or reversal are sensed. The unit will not energize if a fault is sensed as the line voltage is applied.

Reset: Reset is automatic upon correction of the voltage or frequency fault or phase sequence.

Restart Delay Options

L = Lockout or minimum OFF time. The restart delay begins when the output trips. The unit cannot be re-energized until the restart delay is complete. This provides a minimum off time or lockout time to allow equipment sensitive to short cycling, time to reset. If the fault is corrected after the restart delay is complete the output energizes immediately. The restart delay also occurs when line voltage is applied/reapplied.

R = Restart Delay on fault correction. The restart delay begins when line voltage is reapplied or when a voltage fault is corrected. This option is normally selected when staggered restarting of multiple motors on a power system is required.

N = No Restart Delay. 0.6 second initialization delay on application of line voltage applies.

Restart Notes: All restart options remain reset when the following conditions are detected:

- 1. Phase loss (phase unbalance greater than 25%)
- 2. Average line voltage less than 120VAC
- 3. Phase reversal

The restart delay begins when the condition is corrected.

LED Operation

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay then glows red when the output de-energizes. It flashes red/green if phase reversal is sensed. If a fault is sensed during the restart delay, the LED will glow red during that portion or the full restart delay.

Specifications

Line Voltage Type

Operating Voltage 200-480VAC

600VAC

AC Line Frequency Phase Loss Response Time Undervoltage & Voltage Unbalance Type

Overvoltage TripVoltage Reset Voltage Undervoltage Trip Voltage Reset Voltage Voltage Unbalance

Reset on balance Trip Delay

Active On

Range

Tolerance Restart Delay Range

Tolerance Over/Under Frequency Phase Sequence Response Time -Phase Reversal & Phase Loss Reset Output Type Form C Form C Rating

Form A Form A Rating Life 3-phase delta or wye with no connection to neutral

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lange	Voltage Adj.Range	Line Frequency	Line Voltage Max.				
240	200-240VAC	50/60Hz					
380	340-420VAC	50Hz					
480	400-480VAC	60Hz	550VAC				
600	500-600VAC	50/60Hz	600VAC				
0/60 Hz automatically detected 25% unbalance 200ms							
/oltage detection with delayed trip & automatic reset							
09 - 113% of the adjusted line voltage = -3% of the trip voltage							

88 - 92% of the adjusted line voltage \approx +3% of the trip voltage Adjustable 2 - 10% or specify fixed unbalance of 2 - 10% in 1% increments \approx -0.7% unbalance

Over/undervoltage, voltage unbalance, over/ under frequency Adjustable from 1 - 30s or specify fixed delay 1 - 30s in 1s increments ± 15%

Adjustable from 0.6 - 300s; if no restart delay is selected a 0.6s initialization delay applies ± 15% ±4%; Reset ±3%; 50/60 Hz A, B, C, L1, L2, L3

≤200 ms Automatic

Isolated Electromechanical Relay Isolated, SPDT 10A resistive @ 240VAC; 8A resistive @ 277VAC; NO-1/4 hp @ 120VAC; 1/3 hp @ 240VAC

lsolated, NO, SPST 2A @ 277VAC Mechanical - 1 x 10^s; Electrical - 1 x 30³ 9

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DLMU SERIES

Protection

Phase Reversal/Failure Motors and Generators Surge **Isolation Voltage Mechanical** Mounting

Dimensions

Termination

Terminal Torque Environmental

Operating/Storage Temperature Humidity Weight

ASME A17.1 Rule 210.6 NEMA MG1 14:30, 14:35 IEEE C62.41-1991 Level B ≥ 2500V RMS input to output

Surface mount with 2 #8 (M4 x 0.7) screw or snap on 35mm DIN Rail Note: 0.25 in.(6.35 mm) spacing between units or other devices is required **H** 110 mm (4.33"); **W** 75 mm (2.95"); **D** 50 mm (1.97") Screw terminals with captive wire clamps for up to #14 AWG (2.5 mm²) wire 4.4 in.-lbs.

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 8.6 oz (244 g)

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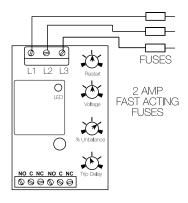


 $\mathsf{C} \in \mathcal{C}_{\mathsf{U}}$

HLMU SERIES



Wiring Diagram



L1, L2, L3 = Line Voltage Input NO = Normally Open Contact NC = Normally Closed Contact C = Common, Transfer Contact

CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the HLMU.

NOTE: Relay contacts are isolated, 277VAC max.

For dimensional drawing see: Appendix, page 513, Figure 31.

Ordering Information

MODEL	OUTPUT	RESTART FUNCTION	VOLTAGE UNBALANCE	TRIP DELAY	RESTART DELAY
HLMUDLAAA	DPDT	Lockout, min off time	Adjust. 2 - 10%	Adjust. 1 - 30s	Adjust. 0.6 - 300s
HLMUDN0405N	DPDT	No restart delay	Fixed, 4%	Fixed, 5s	None
HLMUDNAAN	DPDT	No restart delay	Adjust. 2 - 10%	Adjust. 1 - 30s	None
HLMUDRAAA	DPDT	Staggered restart	Adjust. 2 - 10%	Adjust. 1 - 30s	Adjust. 0.6 - 300s

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Description

The HLMU Series is a universal voltage, encapsulated, 3-phase voltage monitor. It continuously measures the voltage of each of the three phases with microcontroller accuracy and compares the value to preset trip points. It separately senses phase reversal and loss; over, under and unbalanced voltages; and over or under frequency. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present. The unit trips within 200ms when phase loss is detected. Adjustable time delays are included to prevent nuisance tripping and short cycling of sensitive equipment. The isolated, 10A, DPDT relay contacts trip when a phase voltage exceeds the trip limits for the trip delay. Nominal line voltage, voltage unbalance, and time delays are knob adjustable. The phase loss setpoint and the acceptable frequency range are fixed. Both delta and wye systems can be monitored; no connection to neutral is required.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring to protect against phase loss, phase reversal; over, under, and unbalanced voltage; over and under frequency
Universal line voltage range	Flexibility to work in 200 to 480VAC applications
DIN rail (35mm) or surface mounting	Installation flexibility
LED indication	Provides diagnostics of relay, fault and time delay status
Encapsulated	Protects against shock, vibration, and humidity
Finger-safe terminal blocks	Meets IEC 61000 safety requirements

Accessories



LPSM003ZXID (Indicating),

0KLK002.T Midget Fuse (2 Amp)

C103PM (AL) DIN Rail

(91.4 cm) length.

LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC

10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 VAC/500 VDC

35 mm aluminum DIN rail available in a 36 in.







P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Protection Relays Voltage Monitoring Relays

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Operation

Upon application of line voltage, the output is de-energized and the restart delay begins. If all the three-phase voltages are within the acceptable range, the output energizes at the end of the restart delay. The microcontroller circuitry automatically senses the voltage range, and selects the correct operating frequency (50 or 60Hz). The over and under voltage trip points are set at ± 10% of the adjusted line voltage. When the measured value of any phase voltage exceeds the acceptable range limits (lower or upper) the trip delay begins. At the end of the trip delay the output relay de-energizes. If the phase voltage returns to an acceptable value before the trip delay expires, the trip delay is reset and the output remains energized. Under, over, and unbalanced voltages plus over or under frequency must be sensed for the complete trip delay before the unit trips. The unit trips in 200ms when phase loss or reversal are sensed. The unit will not energize if a fault is sensed as the line voltage is applied.

Reset: Reset is automatic upon correction of the voltage or frequency fault or phase sequence.

Restart Delay Options

L = Lockout or minimum OFF time. The restart delay begins when the output trips. The unit cannot be re-energized until the restart delay is complete. This provides a minimum off time or lockout time to allow equipment sensitive to short cycling, time to reset. If the fault is corrected after the restart delay is complete, the output energizes immediately. The restart delay also occurs when line voltage is applied/reapplied.

R = Restart Delay on fault correction. The restart delay begins when line voltage is reapplied or when a voltage fault is corrected. This option is normally selected when staggered restarting of multiple motors on a power system is required.

N = No Restart Delay. 0.6 second initialization delay on application of line voltage applies.

Restart Notes: All restart options remain reset when the following conditions are detected:

- 1. Phase loss (phase unbalance greater than 25%)
- 2. Average line voltage less than 120VAC
- 3. Phase reversal

The restart delay begins when the condition is corrected.

LED Operation

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay then glows red when the output de-energizes. It flashes red/green if phase reversal is sensed. If a fault is sensed during the restart delay, the LED will glow red during that portion or the full restart delay.

Specifications

Line Voltage Туре

Operating Voltage

Line Voltage Max. **AC Line Frequency**

200 - 480VAC

3-phase delta or wye with no connection to neutral

Range	Voltage Adj. Range	Frequency
240	200-240VAC	50 or 60Hz
380	340-420VAC	50Hz
480	400-480VAC	60Hz
550VAC		

50/60 Hz automatically detected

Phase Loss **Response Time Undervoltage & Voltage Unbalance** Type

Overvoltage **Trip Voltage Reset Voltage** Undervoltage **Trip Voltage Reset Voltage Voltage Unbalance Trip Setpoint**

Reset on Balance Trip Delay Active On

Range

Tolerance **Restart Delay** Range

Tolerance **Over/Under Frequency Phase Sequence Response Time-Phase Reversal & Phase Loss** Reset Output Type Form Rating

Life

Protection

Phase Reversal/Failure Motors and Generators Surae **Isolation Voltage** Circuitry Mechanical Mounting

Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

≥ 25% unbalance <200ms

Voltage detection with delayed trip & automatic reset

109 - 113% of the adjusted line voltage \approx -3% of the trip voltage

88 - 92% of the adjusted line voltage \approx +3% of the trip voltage

Adjustable 2 - 10% or specify fixed unbalance of 2 - 10% in 1% increments ≃ -0.7% unbalance

Over/undervoltage, voltage unbalance, over/under frequency Adjustable from 1 - 30s or specify fixed delay 1 - 30s in 1s increments ± 15%

Adjustable from 0.6 - 300s; if no restart delay is selected a 0.6s initialization delay applies ± 15% ±4%; Reset ±3%; 50/60 Hz A, B, C, L1, L2, L3

≤200 ms Automatic

Isolated Electromechanical Relay DPDT 10A resistive @ 240VAC: 8A resistive @ 277VAC; NO-1/4 hp @ 120VAC; 1/3 hp @ 240VAC Mechanical - 1 x 106 Electrical (at 10A) - DPDT - 1 x 303

ASME A17.1 Rule 210.6 NEMA MG1 14:30, 14:35 IEEE C62.41-1991 Level B ≥ 2500V RMS input to output Encapsulated

Surface mount with one #10 (M5 x 0.7) screw Note: 0.25 in.(6.35 mm) spacing between units or other devices is required **H** 76.7 mm (3.0"); **W** 50.8 mm (2.0"); **D** 41.7 mm (1.64") Screw terminal connection up to 12 AWG (3.3 mm²) wire

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 3.9 oz (111 g)

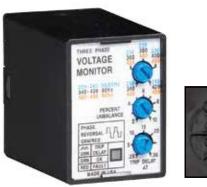
AC SYSTEM MONITORS/LOAD SENSORS



PLMU11

Voltage Monitor

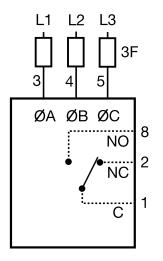
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8-PIN

Wiring Diagram



F = Fuses ØA = Phase A = L1 ØB = Phase B = L2 ØC = Phase C = L3

NO = Normally Open NC = Normally Closed

2A fast acting fuses recommended for safety (not required).

Relay contacts are isolated

For dimensional drawing see: Appendix, page 513, Figure 32.

Description

The PLMU11 continuously measures the voltage of each of the three phases to provide protection for 3-phase motors and sensitive loads. Its microcontroller senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Universal voltage operation and standard base connection allows the PLMU11 to replace hundreds of competitive part numbers.

Operation

Upon application of power, a 0.6s random start delay begins and the PLMU11 measures the voltage levels and line frequency and selects the voltage range. The output relay is energized and the LED glows green when all voltages are acceptable and the phase sequence is correct. LED flashes green during trip delay, glows red when output de-energizes. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay before the relay de-energizes. Re-energization is automatic upon fault correction. The output relay will not energize if a fault condition is sensed as 3-phase input voltage is applied. The LED alternately flashes red/green when phase reversal is sensed. Line voltage is selected with the knob, setting the over and under voltage trip points. Voltage range is automatically selected by the microcontroller.

LED Indicator	
Steady Green	Energized
Steady Red	De-engergized (tripped on fault)
Flashing Green	Trip Delay
Alternate Flashing Red/Green	Phase Reversal

Features & Benefits

FEATURES	BENEFITS
Quick octal 8-pin mounting	Small footprint with universal mounting: ideal replacement for hundreds of competitive part numbers.
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, high voltage, voltage unbalance, phase reversal.
LED diagnostics	Quick visual indicator for cause of trip. LED indications include: normal operation, trip delay, phase reversal, fault
Isolated, 10A, SPDT output contacts	Allows control of loads for AC voltages
Simple 3-wire connection for delta or wye systems	Allows flexibility across wide range of systems
ASME A17.1 Rule 210.6	Complies with safety codes for elevators, escalators, moving walkways
NEMA MG1 14:30, 14:35	Complies with safety codes for motors and generators
IEEE C62.41-1991 Level B	Complies with safety codes for surge and voltage protection

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Accessories

PLMU11



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8-pin or 11-pin plug-in timers, flashers, and other controls.



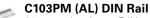
OT08PC Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Rated at

10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC

0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity,



35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

current-limiting type fuse. 600 Vac/500 Vdc

Specifications

Line Voltage Type

Line Voltage Adjustable Voltage Ranges (Automatic Range Selection) 200 to 240VAC, 50/60 Hz

Maximum Voltage Phase Sequence Power Consumption Overvoltage, Undervoltage, & Voltage Unbalance Туре

Overvoltage & Undervoltage Undervoltage Trip Point Reset Voltage Overvoltage Trip Point Reset Voltage Voltage Unbalance Trip Point Adjustable from 2 - 10% **Reset on Balance (%) Selected Unbalance** Reset **Trip Delay Range** Severe Unbalance -**2X Selected Unbalance**

Random Start Delay Phase Reversal & Phase Loss Trip Time **Phase Loss Setpoint Reset Type Output Type** Type Form Rating

Life Protection Surge **Isolation Voltage Mechanical** Mounting* Termination Dimensions

Environmental

Operating/Storage Temperature Weight

3-phase delta or wye with no connection to neutral 200 to 480VAC ±15%, 50/60 Hz ±2 Hz

340 to 420VAC, 50 Hz 400 to 480VAC, 60 Hz 552VAC ABC $\leq 5W$

Voltage detection with delayed trip and automatic reset

88 - 92% of adjusted line voltage +2% of trip voltage 109 - 113% of adjusted line voltage -2% of trip voltage

2 3 4 5 6 7 8 9 10 1.5 2.5 3.5 4.5 5.4 6.3 7.2 8.1 9 Adjustable from 0.25 - 30s

0.25 - 2s; disabled when the trip delay is less than 2s ≅ 0.6s

≤ 150ms ≥ 15% unbalance Automatic Energized when voltages are acceptable Electromechanical relay Isolated, SPDT 10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/3 hp @ 250VAC; max. 277VAC Mechanical - 1 x 10⁶; Electrical - 1 x 10⁵

IEEE C62.41-1991 Level B ≥ 2500V RMS input to output

Plug-in socket rated 600VAC Octal 8-pin plug-in H 77.0 mm (3.03"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78")

-40° to 60°C / -40° to 85°C $\approx 8.6 \text{ oz} (244 \text{ q})$

*CAUTION: Select an octal socket rated for 600VAC operation.

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PLM SERIES

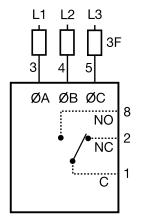
Voltage Monitor

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Wiring Diagram



 $F = Fuses \\ ØA = Phase A = L1 \\ ØB = Phase B = L2 \\ ØC = Phase C = L3 \\ NO = Normally Open \\ NC = Normally Closed$

2A fast acting fuses recommended for safety (not required).

Relay contacts are isolated

For dimensional drawing see: Appendix, page 512, Figure 23.

Ordering Information

MODEL	LINE VOLTAGE	VOLTAGE UNBALANCE (FIXED)	TRIP DELAY (FIXED)
PLM6405	240VAC	4%	5 sec
PLM6502	240VAC	5%	2 sec
PLM6805	240VAC	8%	5 sec
PLM8405	380VAC	4%	5 sec
PLM9405	480VAC	4%	5 sec
PLM9502	480VAC	5%	2 sec
PLM9805	480VAC	8%	5 sec

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Description

The PLM Series is a 3-phase voltage monitor that continuously monitors each of the three phases. Monitors both delta and wye systems and no connection to neutral is required. The microcontroller circuit design protects against undervoltage, voltage unbalance, phase loss and phase reversal. Protection is assured when regenerated voltages are present.

Operation

The output relay is energized and the LED glows green when all voltages are acceptable and the phase sequence is correct. Under and unbalanced voltages must be sensed for a continuous trip delay period before the relay de-energizes. Reset is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied. The LED flashes red during the trip delay, then glows red when the output de-energizes. The LED flashes green/red if phase reversal is sensed.

Field Adjustment

Set voltage adjustment knob at the desired operating line voltage for the equipment. This adjustment automatically sets the undervoltage trip point. Apply power. If the PLM fails to energize, (LED glows red) check wiring of all three phases, voltage, and phase sequence. If phase sequence is incorrect, the LED flashes green/red. To correct this, swap any two line voltage connections at the mounting socket. No further adjustment should be required.

Features & Benefits

FEATURES	BENEFITS
Quick octal 8-pin mounting	Small footprint with universal mounting: ideal replacement for hundreds of competitive part numbers.
Proprietary microcontroller based circuitry	Constant monitoring of single-phase, low voltage, high voltage, voltage unbalance, phase reversal.
LED diagnostics	Quick visual indicator for trip versus normal operation.
Isolated, 10A, SPDT output contacts	Allows control of loads for AC voltages
Adjustable nominal voltage set point	Allows setting for specific application voltage to optimize protection
Simple 3-wire connection for delta or wye systems	Allows flexibility across wide range of systems
ASME A17.1 Rule 210.6	Complies with safety codes for elevators, escalators, moving walkways
NEMA MG1 14:30, 14:35	Complies with safety codes for motors and generators
IEEE C62.41-1991 Level B	Complies with safety codes for surge and voltage protection

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PLM SERIES

Protection Relays Voltage Monitoring Relays

Accessories



BZ1 Front Panel Mount Kit Provides an easy method of through-the-panel

mounting of 8- pin or 11-pin plug-in timers, flashers, and other controls.



OT08PC Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Rated at 10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for

Class CC and Midget-Style fuses. 600 VAC/DC

OKLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Specifications

Line Voltage Type

Operating Voltage

AC Line Frequency Phase Sequence Power Consumption

Low Voltage & Voltage Unbalance

Туре

- Low Voltage Trip Reset Voltage Voltage Unbalance Trip Reset on Balance Trip Delay Range Tolerance Phase Reversal & Phase Loss Response Time
- Phase Loss Reset Output Type Form Rating

Life Protection Surge Isolation Voltage Mechanical Mounting* Dimensions

Environmental

Operating/Storage Temperature Weight 3-phase delta or wye with no connection to neutral

Adj. Line Voltage Range	Line Voltage Max
200-240VAC	270VAC
360-430VAC	480VAC
400-480VAC	530VAC

50/100 Hz ABC ≅ 2W for 240V units ≅ 3W for 380 - 480V units

Voltage detection with delayed trip & automatic reset

88 - 92% of adjusted line voltage Plus 3% of trip voltage

Factory fixed from 4 - 8% -0.7% unbalance typical

Factory fixed from 2 - 20s ±15%

≤ 200ms
> 35% unbalance
Automatic

Electromechanical relay Isolated, SPDT 10A resistive @ 240VAC, 277VAC max; 1/2 Hp @ 240VAC; 1/4 Hp @ 120VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁵

IEEE C62.41-1991 Level B $\geq 2500V$ RMS input to output

8-pin plug-in socket rated 600VAC H 81.3 mm (3.2"); W 60.7 mm (2.39"); D 45.2 mm (1.78")

-40° to 60°C / -40° to 85°C ≅ 4.4 oz (125 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

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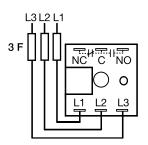


 $C \in \mathbf{A}$

TVW SERIES



Wiring Diagram



L1 = Phase A L2 = Phase B L3 = Phase C NO = Normally Open NC = Normally Closed

C = Common, Transfer Contact

Relay contacts are isolated.

F = 2A Fast acting fuses are recommended, but not required

For dimensional drawing see: Appendix, page 514, Figure 44.

Ordering Information

MODEL	LINE VOLTAGE	VOLTAGE UNBALANCE	TRIP DELAY	RESTART DELAY
TVW5103S5S	208 to 240VAC Selectable	Fixed, 10%	Fixed, 3s	Fixed, 5s
TVW575S1M	208 to 240VAC Selectable	Fixed, 7%	Fixed, 5s	Fixed, 1m
TVW6510S0.4S	208, 220, 230, 240VAC	Fixed, 5%	Fixed, 10s	Fixed, 0.4s
TVW8510S0.4S	380, 400 & 415VAC	Fixed, 5%	Fixed, 10s	Fixed, 0.4s
TVW9510S0.4S	430, 440, 460, 480VAC	Fixed, 5%	Fixed, 10s	Fixed, 0.4s

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The TVW Series Provides protection for motors and other sensitive loads. Continuously measures the voltage of each of the three phases using a microcontroller circuit design that senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Includes a trip delay to prevent nuisance tripping and a restart delay to prevent short cycling after a momentary power outage.

Operation

Upon application of line voltage, the restart delay begins. The output is de-energized during restart delay. Under normal conditions, the output energizes after the restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for the complete trip delay period before the output de-energizes. The restart delay begins as soon as the output de-energizes. If the restart delay is completed when a fault is corrected, the output energizes immediately. The output will not energize if a fault is sensed as the input voltage is applied. If the voltage selector is set between two voltage marks (i.e. between 220 and 230V), the LED will flash red rapidly. The TVW provides fault protection at the lower of the two line voltages (i.e. 220V).

Reset: Reset is automatic upon correction of a fault.

LED Operation

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay then glows red when the output de-energizes. It flashes red/green if phase reversal is sensed. If the voltage selector knob is between settings, it rapidly flashes red.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring to protect against phase loss, phase reversal; over, under, and unbalanced voltage; short cycling
Compact design measures 2 in. (50.8mm) square	Perfect for OEM applications where cost, size and ease of installation are important
LED indication	Provides diagnostics of relay, fault and time delay status
Encapsulated	Protects against shock, vibration and humidity

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www.littelfuse.com/tvw



TVW SERIES

Accessories



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC

0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



Specifications

Line Voltage Type

Input Voltage/Tolerance AC Line Frequency Phase Sequence Power Consumption

Overvoltage, Undervoltage, & Voltage Unbalance Overvoltage & Undervoltage

Undervoltage Trip Point88 - 92Reset Voltage $\cong +3\%$ Overvoltage Trip Point109 - 1Reset Voltage $\cong -3\%$ Trip Variation vs Temperature $\leq \pm 2\%$ Voltage UnbalanceFactorReset On Balance $\cong -0.7\%$ Trip Delay RangeFixed fit

Restart Delay Range

Phase Reversal & Phase Loss Response Phase Loss Output Type Rating 208 to 240VAC (55°C)

380 to 480VAC

Life

Protection Phase Reversal/Failure Motors and Generators Surge Dielectric Breakdown 208 to 240VAC 380 to 480VAC Mechanical Mounting Dimensions

Termination Environmental Operating/Storage Temperature Humidity Weight 3-phase delta or wye with no connection to neutral 208 to 480VAC in 4 ranges/-30% - 20% 50 - 100 Hz ABC Approx. 2W for 240V units Approx. 3W for 480V units

Voltage detection with delay trip & automatic reset 88 - 92% of the selected line voltage = +3% of trip voltage 109 - 113% of the selected line voltage = -3% of trip voltage $\le \pm 2\%$ Factory fixed, from 4 - 10% = -0.7% unbalance Fixed from 0.2 - 100s $\pm 15\%$ or ± 0.1 s, whichever is greater Fixed from 0.4s - 999m $\pm 15\%$ or ± 0.2 s, whichever is greater

≤ 200ms; automatic reset ≥ 25% unbalance

Isolated, SPDT

10A resistive @ 125VAC, 5A @ 250VAC, 1/4 hp @ 125VAC 10A resistive @ 240VAC, 1/4 hp @ 125VAC, 1/3 hp @ 250VAC, max. voltage 277VAC Mechanical - 1 x 10⁶; Electrical - 1 x 10⁵

ASME A17.1 Rule 210.6 NEMA MG1 14:30, 14:35 IEEE C62.41-1991 Level B

1500V RMS input to output terminals
 2500V RMS input to output terminals

Surface mount with one #8 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 31.75 mm (1.25") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 55°C / -40° to 85°C 95% relative, non-condensing \approx 2.8 oz (79 g)

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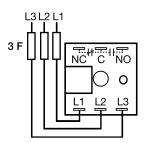


 $(\in \mathbf{R})$

TVM SERIES



Wiring Diagram



L1 = Phase A L2 = Phase B L3 = Phase C NO = Normally Open NC = Normally Closed C = Common, Transfer Contact

Relay contacts are isolated.

F = 2A Fast acting fuses are recommended, but not required

For dimensional drawing see: Appendix, page 514, Figure 44.

Ordering Information

MODEL	LINE VOLTAGE	VOLTAGE UNBALANCE	TRIP DELAY	RESTART DELAY
TVM208A100.5S3S	208VAC	10%	0.5s	3s
TVM230A101S1S	230VAC	10%	1s	1s
TVM460A41S5M	460VAC	4%	1s	5m
TVM460A75S2M	460VAC	7%	5s	2m
TVM480A45S5S	480VAC	4%	5s	5s
TVM480A100.5S3S	480VAC	10%	0.5s	3s

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Description

The TVM Series Provides protection for motors and other sensitive loads. Continuously measures the voltage of each of the three phases using a microcomputer circuit design that senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Includes a trip delay to prevent nuisance tripping and a restart delay to prevent short cycling after a momentary power outage.

Operation

Upon application of line voltage, the restart delay begins. The output relay is de-energized during restart delay. Under normal conditions, the output energizes after restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay period before the output is de-energized. The output will not de-energize if a fault is corrected during the trip delay. The restart delay begins as soon as the output relay de-energizes. If the restart delay is completed when the fault is corrected, the output relay will energize immediately.

The output relay will not energize if a fault or phase reversal is sensed as 3-phase input voltage is applied.

Reset: Reset is automatic upon correction of a fault.

LED Operation

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay then glows red when the output de-energizes. It flashes red/green if phase reversal is sensed.

Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring to protect against phase loss, phase reversal; over, under, and unbalanced voltage; short cycling
Compact design measures 2 in. (50.8mm) square	Perfect for OEM applications where cost, size and ease of installation are important
LED indication	Provides diagnostics of relay, fault and time delay status
Encapsulated	Protects against shock, vibration and humidity

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www.littelfuse.com/tvm



TVM SERIES

Accessories



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC

E AL

0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



VRM6048 Voltage Reduction Module Allows the voltage monitor to monitor a 3-phase 550 to 600VAC Line.

Specifications

Line Voltage Type

Input Voltage AC Line Frequency Phase Sequence Power Consumption 3-phase delta or wye with no connection to neutral 208 to 480VAC 50 - 100 Hz ABC Approx. 2W for 240V units Approx. 3W for 480V units

Overvoltage, Undervoltage, & Voltage Unbalance Overvoltage & Undervoltage

Undervoltage Trip Point88 - 92Reset Voltage $\approx +3\%$ Overvoltage Trip Point109 - 1Reset Voltage $\approx -3\%$ Trip Variation vs Temperature $\leq \pm 2\%$ Voltage UnbalanceFactorReset On Balance $\approx -0.7\%$ Trip Delay RangeFixed f

Restart Delay Range

Phase Reversal & Phase Loss Response Phase Loss Output Type Rating 208 to 240VAC (55°C)

Phase Reversal/Failure

Motors and Generators

Dielectric Breakdown 208 to 240VAC

380 to 480VAC

Mechanical Mounting

Dimensions

Termination

Humidity

Weight

Environmental Operating/Storage Temperature

380 to 480VAC

Life

Surge

Protection

voltage detection with delay trip & automatic reset
88 - 92% of the selected line voltage
≈ +3% of trip voltage
109 - 113% of the selected line voltage
≈ -3% of trip voltage
re ≤ ±2%
Factory fixed from 4 - 10%

 \approx -0.7^o unbalance Fixed from 0.2 - 100s ±15% or ±0.1s, whichever is greater Fixed from 0.5s - 999m ±15% or ±0.2s, whichever is greater

≤ 200ms; automatic reset ≥ 25% unbalance

Isolated SPDT relay contacts

10A resistive @ 125VAC, 5A @ 250VAC, 1/4 hp @ 125VAC 10A resistive @ 240VAC, 1/4 hp @ 125VAC, 1/3 hp @ 250VAC, max. voltage 277VAC Mechanical - 1 x 10⁶; Electrical - 1 x 10⁵

ASME A17.1 Rule 210.6 NEMA MG1 14:30, 14:35 IEEE C62.41-1991 Level B

 \ge 1500V RMS input to output terminals \ge 2500V RMS input to output terminals

Surface mount with one #8 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 31.75 mm (1.25") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 55°C / -40° to 85°C 95% relative, non-condensing \approx 2.8 oz (79 g)

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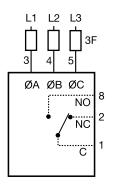
 $C \in \mathbf{N}$

PLR SERIES





Wiring Diagram



F = Fuses
ØA = Phase A = L1
ØB = Phase B = L2
ØC = Phase C = L3
NO = Normally Open
NC = Normally Closed

Relay contacts are isolated

2A fast acting fuses recommended for safety (not required).

For dimensional drawing see: Appendix, page 512, Figure 23.

Description

The PLR Series provides a cost effective means of preventing 3-phase motor startup during adverse voltage conditions. Proper A-B-C sequence must occur in order for the PLR's output contacts to energize. In addition, the relay will not energize when an undervoltage or phase loss condition is present. The PLR Series protects a motor against undervoltage operation. The adjustment knob sets the undervoltage trip point.

Operation

The output relay is energized and the LED glows when all voltages are acceptable and the phase sequence is correct. Undervoltage must be sensed for a continuous dropout delay period before the relay de-energizes. Reset is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied.

Field Adjustment: Turn the adjustment knob fully counterclockwise and apply three-phase power. The LED should be ON. Increase adjustment until the LED goes OFF. Decrease adjustment until LED glows again. If nuisance tripping occurs, decrease the adjustment slightly.

NOTE: When properly adjusted and operating in an average system, a voltage unbalance of 10% or more is required for phase loss detection. When a phase is lost while the motor is running, a voltage will be induced into the open phase nearly equal in magnitude to the normal phase-to-phase voltage. This condition is known as regeneration. When regenerated voltages are present, the voltage unbalance during single phasing may not exceed 10% for some motors. The PLR Series may not provide protection under this condition. For systems that require superior phase loss protection, select the PLMU Series.

Features & Benefits

FEATURES	BENEFITS
Continuous monitoring	Prevents 3-phase motor startup when undervoltage or phase loss condition is present
Industry standard 8-pin octal plug connection	Eliminates need for special connectors
LED indication	Quick visual indication of output status and correct phase sequence

Ordering Information

MODEL	LINE VOLTAGE
PLR120A	95 to 140VAC
PLR240A	190 to 270VAC
PLR380A	340 to 450VAC
PLR480A	380 to 500VAC

If you don't find the part you need, call us for a custom product 800-843-8848

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PLR SERIES

Protection Relays Voltage Monitoring Relays

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



OT08PC Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 600VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC



0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Specifications

Line Voltage Type

Nominal Voltage

120VAC 240VAC 380VAC 480VAC AC Line Frequency Phase Sequence **Response Times** Pull-in Drop-out Hysterisis Pull-in/Drop-out **Output** Type

- Form Rating Maximum Voltage Protection Phase Reversal/Failure Motors and Generators Surge Isolation Voltage 120 & 240VAC 380 & 480VAC Mechanical Dimensions
- Mounting* Termination Environmental Operating/Storage Temperature Weight

170 to 240VAC 270VAC 480VAC 310 to 410VAC 350 to 480VAC 530VAC 50/60Hz ABC $\leq 400 ms$ ≤ 100ms ≅2% Electromechanical relay, energized when all voltages are acceptable SPDT 5A resistive @ 240VAC, 1/4 Hp @ 120VAC 250VAC

3-phase delta or wye with no connection

Line Voltage Max.

143VAC

to neutral

Undervoltage

Dropout Adj. Range

85 to 130VAC

ASME A17.1 Rule 210.6 NEMA MG1 14:30, 14:35 IEEE C62.41-1991 Level B

 \geq 1500V RMS input to output \geq 2500V RMS input to output

H 81.3 mm (3.2"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Plug-in socket Octal 8-pin, plug-in

0° to 55°C / -40° to 85°C ≅ 6 oz (170 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

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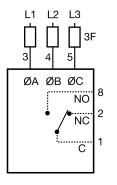
 $C \in \mathbf{N}$

PLS SERIES





Wiring Diagram



F = Fuses	
ØA = Phase A = L	.1
ØB = Phase B = L	2
ØC = Phase C = L	.3

NO = Normally Open

NC = Normally Closed

Relay contacts are isolated

2A fast acting fuses recommended for safety (not required).

For dimensional drawing see: Appendix, page 513, Figure 33.

Ordering Information

MODEL	LINE VOLTAGE
PLS120A	120VAC
PLS240A	208/240VAC
PLS480A	440/480VAC

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The PLS Series is a low cost phase sensitive control that provides an isolated contact closure when the proper A-B-C phase sequence is applied. Protects sensitive 3-phase equipment and equipment operators from reverse rotation. Designed to be compatible with motor overloads or other 3-phase equipment protection devices. Protection for equipment control centers where frequent reconnection or electrical code makes reverse rotation protection essential. Examples include: mobile refrigerated containers, construction equipment, hoists, pumps, conveyors, elevators and escalators.

Operation

The internal relay and LED are energized when the phase sequence is correct. The output relay will not energize if the phases are reversed. Reset is automatic upon correction of the fault.

Features & Benefits

FEATURES	BENEFITS	
Continuous monitoring	Cost effective protection of 3-phase equipment and operators from reverse rotation. Meets reverse rotation protection code requirements. Designed to be compatible with motor overloads or other 3-phase equipment protection devices	
Universal motor compatibility		
Industry standard 8-pin octal plug connection	Eliminates need for special connectors	
Factory calibrated	Easy to install. No field adjustment needed	
LED indicator	Provides visual indication of relay status	

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Rated at 10A @ 6 00VAC. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail.



LPSM003ZXID (Indicating), LPSM003Z (Non-indicating) Fuse Holders Littelfuse POWR-SAFE Dead Front holders provide optimum protection to personnel for Class CC and Midget-Style fuses. 600 VAC/DC



0KLK002.T Midget Fuse (2 Amp) 10 x 38 fast acting, high-interrupting capacity, current-limiting type fuse. 600 Vac/500 Vdc



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



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PLS SERIES

Protection Relays Voltage Monitoring Relays

Specifications

Line Voltage Туре

AC Line Frequency Phase Sequence Response Times Pull-in Drop-out Output Туре

Form Rating 120 & 240VAC 380 & 480VAC **Maximum Voltage**

3-phase delta or wye with no connection to neutral

to neutral		
Nominal	Minimum	Maximum
Voltage	Voltage	Voltage
120VAC	95VAC	135VAC
208/240VAC	175VAC	255VAC
380/415VAC	310VAC	430VAC
440/480VAC	380VAC	500VAC
50/60Hz		
ABC		
≤ 300ms		
≤ 50ms		
Electromechanic	al relay, energiz	ed when the
phase sequence	is correct	
Isolated SPDT		

10A resistive @ 240VAC 8A resistive @ 240VAC 250VAC

Protection

Isolation Voltage 120 & 240VAC 380 & 480VAC Mechanical Mounting* Dimensions

Termination **Environmental Operating/Storage** Temperature Weight

 \geq 1500V RMS input to output \geq 2500V RMS input to output

Plug-in socket H 81.3 mm (3.2"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78") Octal 8-pin plug-in

-40° to 55°C / -40° to 85°C ≈ 6 oz (170 g)

*CAUTION: Select an octal socket rated for 600VAC operation.



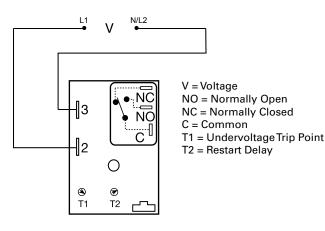
HLVA6I23

Single-Phase Monitor

(€¶\®



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 17.

Description

The HLVA6I23 is a single-phase undervoltage monitor designed to protect sensitive equipment from brownout or undervoltage conditions. Time delays are included to prevent nuisance tripping and short cycling. The 30A, 1hp rated, SPDT relay contacts allow direct control of motors, solenoids and valves. The output relay can be ordered with isolated SPDT contact to allow monitoring of one voltage and switching a separate voltage. Two undervoltage trip point ranges allow monitoring of 110 to 120VAC or 208 to 240VAC systems.

Operation

Upon application of input voltage the output relay remains de-energized. When the input voltage value is above the pull-in voltage, the restart delay begins. At the end of the restart delay, the output relay energizes. When the input voltage falls below the trip point, the trip delay begins. If the input voltage remains below the pull-in voltage for the entire trip delay the relay deenergizes. If the input voltage returns to a value above the pull-in voltage, during the trip delay, the trip delay is reset and the relay remains energized. If the input voltage falls below the trip point voltage during the restart delay, the delay is reset and the relay remains de-energized. Reset is automatic upon correction of an undervoltage fault.

Reset: Removing input voltage resets the output relay and the time delays.

Features

- 30A, SPDT, NO output contacts
- 100 to 240VAC input voltage
- 70 to 220VAC adjustable undervoltage trip point in 2 ranges
- Restart delays from 3 300s
- Trip delay 1 20s fixed
- Isolated or non-isolated relay contacts

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Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



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Specifications

HLVA6123

Input

Min & Max RMS Voltage **AC Line Frequency Power Consumption Undervoltage Sensing** Type

Ranges (4) (6) **Pull-In Voltage Trip Point Accuracy Time Delay Restart Delays Trip Delav Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Time Delay vs. Temp. & Voltage

Output

Туре Form Ratings **General Purpose** Resistive

Motor Load

Life

Protection Surge

> Circuitry **Isolation Voltage Insulation Resistance Mechanical** Mounting Dimensions

Termination **Environmental Operating/Storage** Temperature Humidity Weight

70 to 264VAC 50/60 Hz $AC \le 4VA$

Peak voltage sensing

70 to 120VAC 170 to 220VAC 105% or trip point voltage ± 3% of trip point

3 - 300s adjustable 1 - 20s fixed in 1s increments ±0.5% or 20ms, whichever is greater

±5% ≤ 150ms

 $\leq \pm 10\%$

Electromechanical relay SPDT

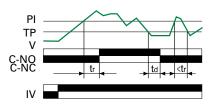
	SPDT-NO	SPDT-NC
125/240VAC	30A	15A
125/240VAC	30A	15A
28VDC	20A	10A
125VAC	1 hp*	1/4 hp**
240VAC	2 hp**	1 hp**
Mechanical - 1 x 1	06	
Electrical - 1 x 10 ⁵ ,	*3 x10 ⁴ , **6,0	000

IEEE C62.41-1991 Level A Encapsulated ≥ 1500V RMS input to output; isolated units ≥ 100 MΩ

Surface mount with one #10 (M5 x 0.8) screw H 76.7 mm (3"); W 51.3 mm (2"); **D** 38.1 mm (1.5") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing $\approx 3.9 \text{ oz} (111 \text{ g})$

Function Diagram



tr = Restart Delay td =Trip Delay PI = Pull-in 105% or trip point TP = Trip Point V = Monitored Voltage IV = Input voltage C-NO = Normally Open Contacts C-NC = Normally Closed Contacts

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Description

The KVM Series is a single-phase undervoltage monitor designed to protect sensitive equipment against brownout undervoltage conditions. The compact design and encapsulated construction make the KVM Series an excellent choice for OEM equipment.

Operation

The output relay is energized and the LED glows green when the input voltage is above the reset voltage threshold. If the input voltage drops below the undervoltage setpoint, the output relay and LED will de-energize. The output relay will remain de-energized as long as the input voltage is below the reset voltage. Reset is automatic when the input voltage returns to a normal range.

Features & Benefits

FEATURES	BENEFITS	
Continuous monitoring	Low cost single-phase undervoltage (brownout) protection	
Compact design measures 2 in. (50.8mm) square	Perfect for OEM applications where, cost, size and ease of installation are important	
LED indication	Quick visual indication of output status	
Encapsulated	Protects against shock, vibration, and humidity	

Accessories



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

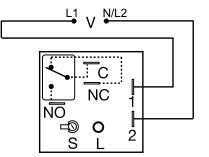


P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

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Wiring Diagram



V = Voltage L = LED S = Undervoltage Setpoint NO = Normally Open NC = Normally Closed C = Common, Transfer Contact

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	MAXIMUM LINE VOLTAGE	UNDERVOLTAGE SETPOINT
KVM4	132VAC	Adjustable, 78 to 99VAC
KVM6	264VAC	Adjustable, 156 to 199VAC

If you don't find the part you need, call us for a custom product 800-843-8848

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KVM SERIES

Protection Relays Voltage Monitoring Relays

Specifications

Line Voltage

Type Input Voltage AC Line Frequency Power Consumption Power Off Reset Time Undervoltage Detection Undervoltage Setpoint

KVM4 KVM6 Undervoltage Reset Point KVM4 KVM6 Repeatability

Voltage Sensing Accuracy Output Type Form Rating Life LED Indicator Protection Surge Circuitry Isolation Voltage Insulation Resistance Mechanical

Mounting Dimensions

Termination Environmental

Operating /Storage Temperature Humidity Weight Single phase 110 to 120VAC or 220 to 240VAC 50/60 Hz 2.5W @ 132VAC; 4.5W @ 264VAC ≤ 150ms

78 to 99VAC 156 to 199VAC

Fixed at 104VAC Fixed at 209VAC ± 0.5% under fixed conditions ±1% over temperature range ±2% at 25°C

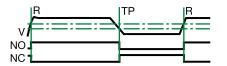
Electromechanical relay SPDT 8A resistive @ 120VAC, 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁶; Electrical - 1x10⁵ Glows green when output is energized

 $\begin{array}{l} \mbox{IEEE C62.41-1991 Level A} \\ \mbox{Encapsulated} \\ \mbox{\geq 1500V RMS input to output} \\ \mbox{\geq 100 M\Omega minimum} \end{array}$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-25 to 55°C / -40 to 85°C 95% relative, non-condensing 2.6 oz (74 g)

Function Diagram



TP = Undervoltage Setpoint R = Reset Point

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REMOTE INDICATION & MONITORING

Improve safety for service and operations personnel by allowing control and monitoring of the relay without opening the electrical cabinet.

RM1000 Series	Remote Monitor	246
RM2000 Series	Remote Monitor	248
Informer	Remote Diagnostics Tool	250
Informer-MS	Remote Diagnostics Tool	252

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RM1000 SERIES

Protection Relays Remote Indication and Monitoring

Remote Monitor



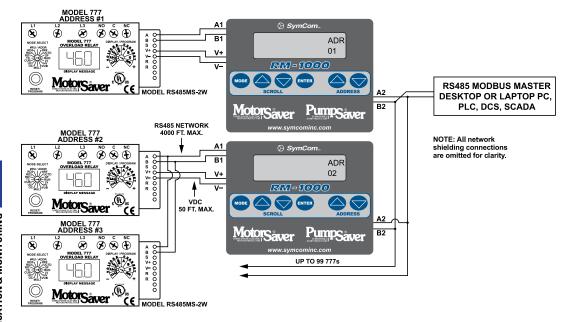


Description

The RM1000 Series is a motor-monitoring device to be used in conjunction with the 777 family of products (excluding the P1 Series), 77C family of products and the 601 voltage monitors, via Modbus protocol with a communications module. The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring.

The RM1000 Series can monitor up to 16 MotorSaver® and/or PumpSaver® units through an RS-485 network using Modbus RTU protocol. A second communication port allows monitoring and control of up to 99 MotorSaver® and/or PumpSaver® units from a computer, PLC, DCS or SCADA system and can be accessed from the host computer or PLC with the RM1000 acting as a repeater for any of its motor protectors. In addition to the monitoring functions, the RM1000 can be used to reset a tripped MotorSaver® or PumpSaver®.

Wiring Diagram



For dimensional drawing see: Appendix, page 508, Figure 4.

Ordering Information

MODEL	DESCRIPTION
RM1000	NEMA 3R and/or UL Type 12
RM1000-3R	NEMA 3R
RM1000 NEMA 4	NEMA 4X

The RM1000 Series is easily mounted remotely and improves safety for service and operations personnel by allowing them to control and monitor the device without opening the electrical cabinet. Using the RM1000 is a simple, cost-effective method for aiding compliance with arc flash safety regulations. The enclosure and keypad assembly is water and ultraviolet light resistant. The enclosure is NEMA 3R or NEMA 4X (optional) rated. The RM1000 and RM1000 NEMA 4 also carry a UL Type 12 rating, whereas the RM1000-3R does not carry the UL Type 12 rating due to added weep holes. The added weep holes in the RM1000-3R make it suitable for applications subjected to condensing moisture/humidity.

RM1000 SERIES



Features

Displays:

- Individual line currents and average current
- Current and voltage unbalance
- Individual phase voltages and average voltage
- Displays last four faults, trip reason, and restart timer status
- MotorSaver[®] and/or PumpSaver[®] setpoints
- Run-hours on each motor
- Warning of pending (imminent) faults Controls:
- Reset run-hour meter
- Reset MotorSaver[®] or PumpSaver[®]
- Change setpoints from the RM1000 Convenience:
- Power from RS485MS-2W communications module
- Monitor up to 16 777s with one display
- NEMA 3R outdoor rated
- Secondary steel enclosure available

Accessories



RS485-RS232 Converter with cable & plug

Allows RS485 devices to be connected to a PC via the RS232 (serial) port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.



RS485-USB Converter with cable & plug/RS232:USB

Allows RS485 devices to be connected to a PC via the USB port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.



RM1000 ENCL

Steel enclosure for protecting the RM1000 remote communications monitor from adverse affects of weather and vandalism, while allowing normal communications connections to the RM1000 unit.

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Solutions Software: Solutions-M

Software features include data logging, real-time data monitoring and fault and event monitoring.

Specifications

Input Characteristics Control Power Functional Characteristics Communication **Baud Rate** Setup

Protocol Serial Interface Available Addresses

Mechanical Life Overlay Material UV Exposure w/o degradation 2000 hrs **Terminal Torque (depluggable** terminal block) Panel Thickness **General Characteristics Ambient Temperature Range** Operating Storage **Maximum Input Power Class of Protection** RM1000, RM1000 NEMA 4

RM1000-3R

Relative Humidity Safety Marks UL CSA CE **Enclosure Material** Display Size Keypad

Dimensions

Weight

Mounting Method

12-24VDC (Supplied by RS485MS-2W)

Port #1 for 777(s) 1200-28800 None, Odd, or Even Parity 1 or 2 Stop Bits Modbus RTU RS-485 1-99 addresses (max 16 per RM1000)

100,000 actuations

0.03" min, 0.12" max

Polyester

3 in.-Ibs.

1200-28800 None, Odd, or Even Parity 1 or 2 Stop Bits Modbus RTU RS-485 Responds to all port #1

Port #2 for PC, PLC, etc.

-40° to 70°C (-40° to 158°F)

-40° to 80°C (-40° to 176°F) 100mA

NEMA 3R and/or UL Type12, NEMA 4X (optional) NEMA 3R only Up to 85%, non-condensing

UL508 (File #E68520) 22.2 No. 14 (File #46510) IEC 60947-6-2 Black polycarbonate Liquid Crystal with extended temp. range 2 rows x 16 characters Six 0.5" stainless steel dome buttons for tactile feedback **H** 91.92 mm (3.62"); **W** 115.42 mm (4.54"); **D** 22.86 mm (0.9") 1.5 lbs. (24 oz., 680.39 g) Surface mountable on backplane using 4 screws

REMOTE INDICATION & MONITORING



RM2000 SERIES

Protection Relays Remote Indication and Monitoring

Remote Monitor

(€) C € **(6)** •

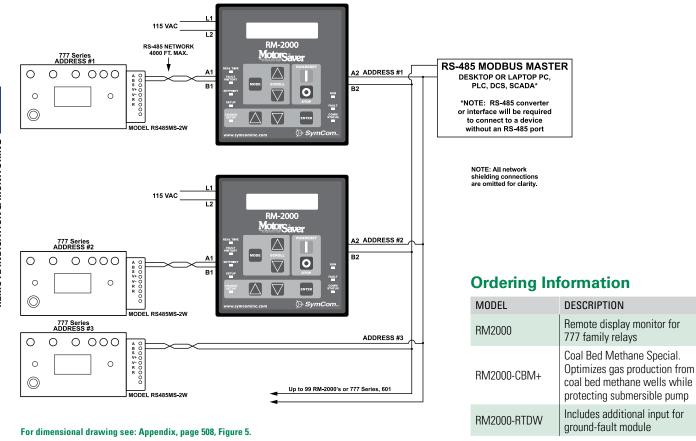


Description

The RM2000 Series is a motor-monitoring device to be used in conjunction with the 777 family of products (excluding the P1 Series), 77C family of products and the Model 601 voltage monitors, via Modbus protocol with a communications module. The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, userfriendly, motor monitoring.

The RM2000 has membrane keypad controls which allow both monitoring and control of a 777 MotorSaver® through an RS-485 network using Modbus RTU protocol. A second communication port allows monitoring and control of up to 99 RM2000 devices from a PLC, DCS, or SCADA system or a PC with Solutions software installed. The RM2000 will act as a repeater for its motor protector when accessed from the host computer or PLC. In addition to the monitoring functions, the RM2000 can be used to reset a tripped MotorSaver® or PumpSaver®.

The RM2000 is easily mounted remotely and improves safety for service and operations personnel by allowing them to control and monitor the device without opening the electrical cabinet. Using the RM2000 is a simple, cost-effective method for aiding compliance with arc flash safety regulations. The enclosure and keypad assembly is water and ultraviolet light resistant.



Wiring Diagram

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RM2000 SERIES



Features

Displays:

- Average current, individual line currents and current unbalance
- Current to ground
- Average voltage, line-line voltages and voltage unbalance
- Instantaneous power
- Power factor
- Last four faults
- All parameters programmed into 777 MotorSaver®
- Remaining restart delay times
- Controls:
- Start and stop buttons
- Key lock input to prevent setpoint changes
- Change 777 setpoints from keypad

The RM2000 is also equipped with a real-time clock, which allows access to the following motor management information (most readings can be reset):

- Total motor run-time
- Time and date of last four faults, along with voltage and current at time of trip
- Time and date of last 10 motor starts
- Total number of motor restarts
- Minimum time between any two starts with time and date
- Run-time since last start
- kWh consumed
- kVARs consumed

Accessories



RS485-RS232 Converter with cable & plug Allows RS485 devices to be connected to a PC

via the RS232 (serial) port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.



RS485-USB Converter with cable & plug/RS232:USB

Allows RS485 devices to be connected to a PC via the USB port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.

Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.

Specifications

Input Characteristics

Control Voltage Transient Protection (Internal) **Functional Characteristics** Communication

Baud Rate Setup

Protocol Serial Interface Available Addresses **Real-time Clock Battery Back-up Life**

Last fault memory

Configuration

Contact Material Output Characteristics (RM2000-RTDW version only)

Pilot Duty Rating General Purpose Rating

General Characteristics Ambient Temperature Range Operating

Storage **Maximum Input Power Class of Protection Relative Humidity Safety Marks** UL CSA CE Enclosure Material Display Size

Lighting Keypad

Mechanical Life Overlay Material UV Exposure w/o degradation **Terminal Torque** (depluggable terminal block) 3 in.-lbs. Dimensions

Weight

Mounting Method

115VAC ±10%; 50/60Hz

2500V for 10ms

Port #1 for 777	Port #2 for PC, PLC, etc.
1200-28800	1200-28800
Even Parity	None, Odd, or Even Parity
1 Stop Bit	1 or 2 Stop Bits
Modbus RTU	Modbus RTU
RS-485	RS-485
01	A01-A99

10 years @ 25°C without external power Stores up to 4 faults with time and date stamp, includes voltages and currents at time of trip Two independent electro-mechanical Form C (SPDT) Silver/Tin Oxide

240VA @ 120VAC 5A @ 120VAC

-20° to 70°C (-4° to 158°F) -30° to 70°C (-22° to 158°F) 3 W NEMA 3R and/or UL Type 12 Up to 85%, non-condensing

UL508 (File #E68520) C22.2 No. 14 (File #46510) IEC 60947-6-2

Black polycarbonate Liquid crystal with extended temp. range 2 rows x 20 characters LED Backlight Eight 0.5" stainless steel dome buttons for tactile feedback 100,000 actuations Polyester

2000 hrs.

H 162.56 mm (6.4"); **W** 154.94 mm (6.1"); **D** 27.94mm (1.1") 1.2 lbs. (19.2 oz., 544.31 q) Surface mountable on backplane using 4 screws



INFORMER

Remote Diagnostic Tool for use with Single-Phase Pump Relays



For dimensional drawing see: Appendix, page 510, Figure 9.

Description

The Informer is a hand-held diagnostic tool designed for use with single-phase models equipped with infrared LED transmitters (111-Insider-P; 231-Insider-P; 232-Insider; 111P; 233P; 233P-1.5; 234-P and 235P).

The Informer uses an infrared receiver to access information sent from the relay which can be helpful for troubleshooting the system.

Each Littelfuse single-phase model listed above is equipped with an infrared LED that transmits valuable information from the device. To retrieve this information, the Informer's receiver must be directed toward the unit's LED transmitter and be within 8 feet of the unit. The green COMM STATUS light indicates when the Informer is receiving data from the unit. If communication is lost, the Informer will display the last values it received. The Informer will automatically shut off after 2 minutes of non-use.

An infrared adapter (IR Kit-12) is included with all new and updated Informers. This adapter allows communication with the unit without opening the panel door (for select models).

Features & Benefits

The Informer displays:

- Model number
- Real-time voltage, current, and power
- Drywell and overload trip points
- Calibration voltage
- Restart delay setpoint and restart delay time remaining
- CT size (if applicable)
- Number of pump starts
- Total run-time
- · Fault history for last 20, most recent, faults
- Voltage, current, power, and run-time for each fault at time of the fault
- Highest and lowest voltage and current since last calibration

Accessories



Informer IR Kit-12 12" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without

opening the panel. Included with the Informer

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Protection Relays Remote Indication and Monitoring

INFORMER

Littelfuse Expertise Applied | Answers Delivered

Specifications

Functional Characteristics Power Input

	(requires or
Auto Shut-off	2 minutes
Communication	
Signal	Infrared
Range	1-8 ft. (app
Data Update	4 seconds
General Characteristics	
Temperature Range	0 to 60°C (
Accuracy	
Voltage	±2%
Current	±2%
Power	±4%
Maximum Input	0.25 W
Resolution	
Voltage	1.0VAC
Display	Liquid crys
Size	2 rows x 16
Keypad	Three 0.5"
Mechanical Life	100,000 ac
Overlay Material	Polyester
Enclosure	
Dimensions	H 139.70 m
	D 28.70 mr
Weight	0.375 lb. (6
	0.70 lb. (11.

Material

(requires one 9-volt alkaline battery) 2 minutes Infrared 1-8 ft. (approx. 0.25 ft. when using IR Kit) 4 seconds 0 to 60°C (32° to 140°F) ±2% ±2% ±4% 0.25 W

9 Volts DC

1.0VAC Liquid crystal 2 rows x 16 characters Three 0.5" diameter buttons 100,000 actuations min. Polyester H 139.70 mm (5.50"); W 91.44 mm (3.60"); D 28.70 mm (1.13") 0.375 lb. (6 oz., 170.10 g) (w/out battery); 0.70 lb. (11.2 oz., 317.51 g) (total package) Black ABS 94HB

10



INFORMER-MS

Remote Diagnostic Tool for use with the 455 3-Phase, Dual-Range Voltage Monitor



For dimensional drawing see: Appendix, page 510, Figure 9.

Specifications

Consumption

Auto Shut-off

Data Update

Accuracy

Resolution

Voltage

Voltage

Trip Delay

Restart Delay

Time

Size

General Characteristics

Temperature Range

Maximum Input

Voltage Unbalance

Range

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REMOTE INDICATION & MONITORING

Communication Signal

Functional Characteristics Power Input

9 Volts DC (requires one 9-volt alkaline battery) 0.25 Watt (max.)

1-8 ft. (approx. 0.25 ft. when using IR Kit)

0 to 60°C (32° to 140°F)

±2% 0.25 W

1% 1 minute increments 2 second increments 2 second increments

2 rows x 16 characters

Keypad (three 0.5" dia. buttons) **Mechanical Life Overlay Material** Enclosure

Display (liquid crystal)

Dimensions

Weight

Material

2 minutes Infrared 4 seconds

1.0VAC

100,000 actuations min. Polyester

H 139.70 mm (5.50"); **W** 91.44 mm (3.60"); **D** 28.70 mm (1.13") 0.375 lb. (6 oz., 170.10 g) (w/out battery); 0.70 lb. (11.2 oz., 317.51 g) (total package) Black ABS 94HB

Description

The Informer-MS is a hand-held diagnostic tool designed for use with the Littelfuse 455.*

The Informer-MS uses an infrared receiver to read valuable information transmitted from the 455*, which can be helpful for troubleshooting the system. A green communication status light indicates the Informer-MS is receiving data from the 455. If communication is lost, the Informer-MS will display the last values it received.

*Model 455s manufactured after 03/01/06 are equipped with the infrared LED transmitter. Models manufactured prior to this date are not compatible with the Informer-MS. An infrared adapter (IR Kit-36) can be purchased to allow communication with the Model 455 without opening the panel door.

Features

The Informer-MS displays:

- Real-time, line and load side voltage
- Real-time, line and load side voltage unbalance
- Motor run hours
- Last 20 faults
- Last 32 motor starts
- High and low voltage trip points
- Voltage unbalance trip point
- Restart and trip delay settings
- Voltage at last fault
- Communication status LED
- Auto shut off
- Last fault with trip conditions

Accessories



Informer IR Kit-36 36" infrared adapter cable attaches to the face of the model 455 to provide remote diagnostics without opening the panel.

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COMMUNICATION MODULES

RS485MS-2W	Communication Module	254
CIO-MB/CIO-120-MB	Communication Module	255
CIO-DN-P/ CIO-120-DN-P	Devicenet™ Interface	257
CIO-777-PR	Profibus Interface	259
CIO-EN	Modbus-TCP and Modbus-RTU Interface	260
COM 4-20	Output Module for use with Model 777-AccuPower	261

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RS485MS-2W

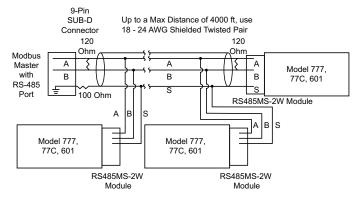
Communication Module

(l) ((

R5485MS-2W (6

Wiring Diagram

TYPICAL RS485 NETWORK



Refer to the manual for basic and extended network diagrams.

For dimensional drawing see: Appendix, page 507, Figure 2.

Specifications

Functional Specifications Remote Reset (for optional use with 777 Series)

General Characteristics

Ambient Operating Temperature **Terminal (depluggable** terminal block) Torque Wire AWG **Class of Protection Relative Humidity Standards Passed**

Radio Frequency

Immunity, Radiated Fast Transient Burst **Hi-Potential Test**

Normally open pushbutton rated 24VDC, 10mA (min.)

-20° to 50°C (-4° to 122°F)

3 in.-lbs. (max.) 12-20 AWG IP20 10-95%, non-condensing per IEC 68-2-3

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air 150 MHz, 10V/m

IEC 61000-4-4, Level 3, 4kV input power Meets UL508 (2 x rated V + 1000V for 1 min)

Description

The RS485MS-2W is required to enable the Modbus communications function on Model 77x-type products. This module is required when the RM1000, RM2000 or other Modbus capable device is used with 77x-type products.

Features

- Optical isolation from line potentials
- Powered by the 77x product
- RS-485 compliant bus drive capability
- Remote reset input connection
- Power connection for the Model RM1000

RS485-USB

Accessories



RS485-RS232 Converter with cable & plug

Allows RS485 devices to be connected to a PC via the RS232 (serial) port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.



Converter with cable & plug/RS232:USB

Allows RS485 devices to be connected to a PC via the USB port. Provides convenient terminal blocks for making signal and DC power supply connections. Pre-wired.

Surge

Input Power Inputs/Data Lines Safety Marks UL CE Enclosure Dimensions

Weight **Mounting Method** IEC 61000-4-5, Level 1 IEC 61000-4-5, Level 2

UL508 (File #E68520) IEC 60947 Polycarbonate H 52.83 mm (2.08"); W 73.66 mm (2.9"); **D** 19.56 mm (.77") 0.26 lb. (4.16oz., 117.93 g) 9-pin D-Sub connector on the side of a 777-Series

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CIO-MB / CIO-120-MB

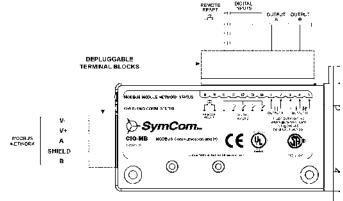
Communication Link to PLC/SCADA/ Monitoring Systems

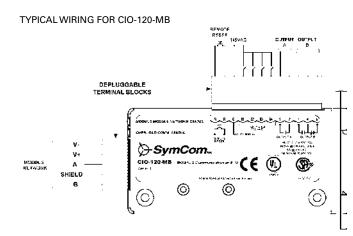




Wiring Diagram

TYPICAL WIRING FOR CIO-MB





For dimensional drawing see: Appendix, page 507, Figure 3.

Ordering Information

MODEL	LINE VOTAGE
CIO-MB	12 to 24VDC
CIO-120-MB	90 to 130VAC

Description

The CIO-MB/CIO-120-MB Modules are convenient and cost-effective Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network.

Features & Benefits

FEATURES	BENEFITS
Compact size 3.46" H x 1.0" W x 5.0" D	Easily adapts to existing as well as new applications
Flexible addressing standard allows function as stand-alone interface or in conjunction with 777 series overload relay	Provides flexibility for control and monitoring
Remote reset option	Additional remote reset input allows user to reset 777 series relays without opening the panel
DIN rail or surface mountable	Allows installation flexibility
Unpluggable terminal block connections	Allows user to wire terminal blocks before installing the module and reduces field wiring

Specifications

Functional Specifications Remote Reset (for use with

optional 777 Series)

Power Requirements: Voltage Current Power **Ethernet Controller** Capability **Input Characteristics General Purpose (4)** Voltage Range: CIO-MB CIO-120-MB Current **Output Characteristics SPDT (1), SPST (1) Pilot Duty General Purpose**

General Characteristics

Ambient Operating Temperature Terminal (depluggable terminal block) Torque Wire AWG Class of Protection Relative Humidity Normally open pushbutton rated 24VDC, 10mA (min.)

24VDC +10% 95mA (max.) 70mA (typical) 2.28 W (max.) 1.7 W (typical) IEEE 802.3 10Base-T

12-24VDC 90-130VAC 2mA (typical)

MA (typical)

480VA & 240VAC, B300 5A @ 240VAC

-20° to 70°C (-4° to 158°F)

3 in.-lbs. (max.) 12-20 AWG IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3

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CIO-MB / CIO-120-MB

Standards Passed

Radio Frequency Immunity, Radiated Fast Transient Burst **Hi-Potential Test** Surge Input Power Inputs/Data Lines **Safety Marks** UL CSA CE Enclosure Dimensions

Weight

Mounting Methods

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

150 MHz, 10V/m IEC 61000-4-4, Level 3, 4kV input power Meets UL508 (2 x rated V + 1000V for 1 min)

IEC 61000-4-5, Level 1 IEC 61000-4-5, Level 2

UL508 (File #E68520) C22.2 (File #46510) IEC 60947-6-2 Polycarbonate **H** 86.36 mm (3.40"); **W** 25.40 mm (1.00"); **D** 138.68 mm (5.46") (w/depluggable connectors) 0.25 lb. (4 oz., 113.4 g) DIN Rail or surface mount (w/two #8 screws)

www.littelfuse.com/ciomb-cio120mb 256 Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com



CIO-DN-P / CIO-120-DN-P

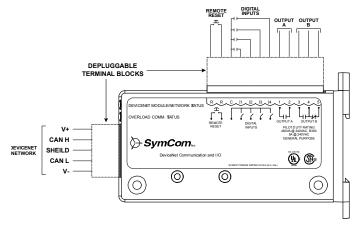
Communication Link to PLC/SCADA/ Monitoring Systems





Wiring Diagram

TYPICAL WIRING FOR CIO-DN-P



Description

The CIO-DN-P/CIO-120-DN-P are convenient and cost-effective Devicenet[™] interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a Devicenet[™] network.

Features & Benefits

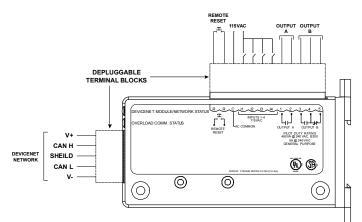
FEATURES	BENEFITS
Compact size 3.4" H x 1.0" W x 5.46" D	Easily adapts to existing as well as new applications
Flexible addressing standard allows function as stand-alone interface or in conjunction with 777 series overload relay	Provides flexibility for control and monitoring
Remote reset option	Additional remote reset input allows user to reset 777 series relays without opening the panel
DIN rail or surface mountable	Allows installation flexibility
Unpluggable terminal block connections	Allows user to wire terminal blocks before installing the module and reduces field wiring

Ordering Information

MODEL	LINE VOTAGE
CIO-DN-P	12 to 24VAC
CIO-120-DN-P	90 to 130VAC

11 COMMUNICATION MODULES

TYPICAL WIRING FOR CIO-120-DN-P



For dimensional drawing see: Appendix, page 507, Figure 3.

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CIO-DN-P / CIO-120-DN-P

Specifications

Input Characteristics Power Requirements Voltage (nominal) Current Power Digital Inputs Voltage Range CIO-DN-P CIO-120-DN-P Frequency Maximum Current Remote Reset Output Characteristics

Form A & Form C Contactors Pilot Duty General Purpose General Characteristics

Temperature Range Relative Humidity Wire Gauge Terminal Torque Hi-Potential Test (relays to other circuits) 24VDC 137mA (max.) 3.28 W (max.)

12-24 VAC 90-130VAC 50/60Hz 2mA (typical) 24VDC, 10mA (min.), NO pushbutton

480VA @ 240VAC, B300 5A @ 240VAC

-20° to 70°C (-4° to 158°F) 10-95%, non-condensing Solid or stranded, 12-20 AWG 3 in.-lbs.

(2 x rated V + 1000V for 1 minute)

EMC Standards

Electrostatic Discharge (ES Radio Frequency Immunity, Radiated Fast Transient Burst Safety Marks UL, ULC Listed, CSA Enclosure Dimensions

Weight Mounting Methods

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency Immunity**,

150 MHz, 10V/m IEC 61000-4-4, Level 3, 4kV input power

UL508 (File #E68520), C22.2 (File #46510) Polycarbonate H 86.36 mm (3.4"); W 25.4 mm (1.0"); D 138.68 mm (5.46") (w/depluggable connectors) 0.25 lb. (4 oz., 113.4 g) (w/depluggable connectors) DIN Rail or surface mount (w/two #8 screws)



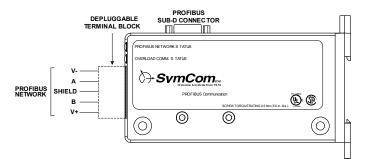
CIO-777-PR

Communication Link to PLC/SCADA/ **Monitoring Systems**





Wiring Diagram



For dimensional drawing see: Appendix, page 507, Figure 3.

Specifications

Input Characteristics

Power Requirements Voltage (nominal) Current Power **Digital Inputs Voltage Range Maximum Current Remote Reset Output Characteristics** Form A & Form C Contactors **Pilot Duty General Purpose General Characteristics Ambient Temperature Range** Operating Storage **Relative Humidity** Wire Gauge **Terminal Torque Hi-Potential Test** (relays to other circuits)

12-24VDC 150mA (max.) 3.6 W (max.)

12-24VAC 2mA (typical) 24VDC, 10mA, (min.), NO pushbutton

480VA @ 240VAC, B300 5A @ 240VAC

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F) 10-95%, non-condensing per IEC 68-2-3 Solid or stranded, 12-20 AWG 3 in.-Ibs.

Meets UL508 (2 x rated V + 1000V for 1 min.)

Description

The CIO-777-PR Module is a convenient and cost-effective Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network.

Features & Benefits

FEATURES	BENEFITS
Compact size 3.4" H x 1.0" W x 5.46" D	Easily adapts to existing as well as new applications
Flexible addressing standard allows function as stand-alone interface or in conjunction with 777 series overload relay	Provides flexibility for control and monitoring
Remote reset option	Additional remote reset input allows user to reset 777 series relays without opening the panel
DIN rail or surface mountable	Allows installation flexibility
Built in sub-D connector	Provides a quick and easy connection to a network and reduces field wiring

EMC Standards Electr

Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency	
Immunity, Radiated	150 MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 4kV input power
Safety Marks	
UL, ULC Listed	UL508 (File #E68520)
CSA	C22.2 (File #46510)
Enclosure	Polycarbonate
Dimensions	H 86.36 mm (3.4"); W 25.4 mm (1.0");
	D 138.68 mm (5.46")
	(w/depluggable connectors)
Weight	0.25 lb. (4 oz., 113.4 g)
	(w/depluggable connectors)
Mounting Methods	DIN Rail or surface mount (w/ two #8 screws)

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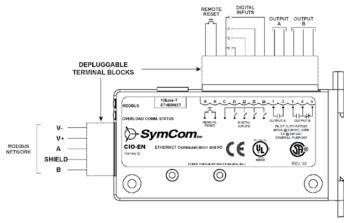
CIO-EN

Communication Link to PLC/SCADA/ Monitoring Systems

€ €€∰.



Wiring Diagram



For dimensional drawing see: Appendix, page 507, Figure 3.

Specifications

Input Characteristics Power Requirements:

Power Digital Inputs General Purpose (4) Voltage Range Current Functional Specifications Remote Reset (for use with optional 777 Series) Ethernet Controller Capability

Voltage

Current

Output Characteristics SPDT (1), SPST (1) Pilot Duty General Purpose General Characteristics Ambient Operating Temperature 24VDC +10% 95mA (max.) 70mA (typical) 2.28 W (max.) 1.7 W (typical)

12-24VDC 2mA (typical)

Normally open pushbutton rated 24VDC, 10mA (min.) IEEE 802.3 10Base-T

480VA & 240VAC, B300 5A @ 240VAC

-20° to 70°C (-4° to 158°F)

Description

The CIO-EN Module (non-POE) is a convenient and costeffective Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network.

Features & Benefits

FEATURES	BENEFITS
Compact size 3.4" H x 1.0" W x 5.46" D	Easily adapts to existing as well as new applications
Flexible addressing standard allows function as stand-alone interface or in conjunction with 777 series overload relay	Provides flexibility for control and monitoring
Remote reset option	Additional remote reset input allows user to reset 777 series relays without opening the panel
DIN rail or surface mountable	Allows installation flexibility
Built in Ethernet jack	Reduces field wiring

Terminal	(depluggable
terminal	block)

Torque Wire AWG **Class of Protection Relative Humidity Standards Passed Radio Frequency** Immunity, Radiated **Fast Transient Burst Hi-Potential Test** Surge Input Power Inputs/Data Lines Safety Marks UL CSA CE Enclosure Dimensions Weight **Mounting Methods**

3 in.-lbs. (max.) 12-20 AWG IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

150 MHz, 10V/m IEC 61000-4-4, Level 3, 4kV input power Meets UL508 (2 x rated V + 1000V for 1 min)

IEC 61000-4-5, Level 1 IEC 61000-4-5, Level 2

UL508 (File #E68520) C22.2 (File #46510) IEC 60947-6-2 Polycarbonate H 86.36 mm (3.4"); W 25.4 mm (1.0"); D 138.68 mm (5.46") 0.25 lb. (4 oz., 113.4 g) DIN Rail or surface mount (w/two #8 screws)

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COM 4-20

Communication Link to PLC/SCADA/ Monitoring Systems





Description

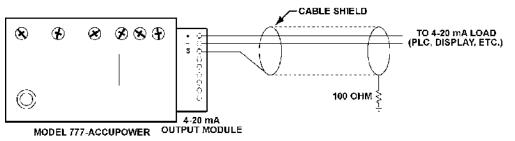
The COM 4-20 Output Module is intended for use with ONLY the Model 777-AccuPower output power monitor. The module will send a 4-20mA signal proportional to the output power. It can also be used to send the input power by setting the efficiency setting on the 777-AccuPower monitor to one. This module allows communication to a PLC with an analog input and no Modbus input.

Features

- Powered by the 777-AccuPower
- Scalable 4-20mA output proportional to Hp or kW
- Signal can be used for displays, controllers, or PLCs

Wiring Diagram

4-20mA OUTPUT MODULE



For dimensional drawing see: Appendix, page 507, Figure 2.

Specifications

Output Characteristics Current General Characteristics Temperature Range Terminal (depluggable terminal block) Torque Wire AWG Class of Protection Relative Humidity Standards Passed Electrostatic Discharge Radio Frequency Immunity, Radiated Fast Transient Burst

Hi-Potential Test

4-20mA

-20° to 50°C (-4° to 122°F)

3 in.-lbs. (max.) 12-20 AWG IP20 10-95%, non-condensing per IEC 68-2-3

IEC 61000-4-2, Level 3, 6kV contact, 8kV air

150 MHz, 10V/m IEC 61000-4-4, Level 3, 4kV input power Meets UL508 (2 x rated V + 1000V for 1 min) Surge Input Power Inputs/Data Lines Safety Marks UL CE Enclosure Dimensions

Weight Mounting Method IEC 61000-4-5, Level 1 IEC 61000-4-5, Level 2

UL508 (File #E68520) IEC 60947 Polycarbonate H 52.83 mm (2.08"); W 73.66 mm (2.9"); D 19.56 mm (0.77") 0.25 lb. (4 oz., 113.4 g) #8 screws; mount to side of 777-AccuPower unit

TIME DELAY RELAYS

The largest selection of time delay relays known since 1968 for its reliable designs that provide long service lives with low maintenance costs. Versatile multifunction time delay relays give you the option of choosing among functions and time delay ranges to ensure that you receive the perfect timer to fit your needs. Electromechanical relay-output time delay relays are available with a number of different functions and assure isolation between input and output, as well as no voltage drop across output contact. Solid-state time delay relays have no moving parts to arc and wear out over time, giving them a lifespan of up to 100x that of a relay-output timer. In addition, all solid state time delay relays are fully encapsulated to protect against shock, vibration, humidity, etc.

Timer Function Guide	. 264
Multifunction	
TRDU Series	. 265
TRU Series	. 268
ASQU / ASTU Series	. 270
DSQU / DSTU Series	. 272

Dedicated On Delay

Delay-on-Make KRDM Series. 279 KSPS Series 288

Delay-on-Make, Normally Closed	
TS441165	
Delay-on-Break	
HRDB Series	
HRPS / HRIS Series	
KRDB Series	
KSDB Series	
ORB Series	
TDB / TDBH / TDBL Series	
TDUB Series	
THDB Series	
TRB Series	
TSB Series	
TSDB Series	
HRDS Series	
HSPZA22SL	
KRDS Series	
KSDS Series	
ORS Series	
Single Shot	
PRS65	
TDS / TDSH / TDSL Series	
TDUS Series	
THC / THS Series	
THDS Series	
TRS Series	
TSDS Series	
TSS Series	

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Interval

Retriggerable Single Shot

KRD9 Series	
TSD94110SB	

Recyle

ERD3425A	
ESDR Series	
HRDR Series	
KRD3 Series	
KRDR Series	
KSD3 Series	
KSDR Series	
KSPD Series	
RS Series	
TDR Series	
THD3C42A0	
TSD3411S	
TSDR Series	

Percentage

PTHF4900DK	
Dual Function	
TDMB Series	
ESD52233	
KRPD Series	
HVAC	
CT Series	426
T2D120A15M	
TA Series	
TAC1 Series	
TL Series	
TSA141300	436
Coin Vending	
HRV Series	



For More Information... and to download our HVAC Timer Application Guide, visit Littelfuse.com/timedelayrelays

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Expertise Applied | Answers Delivered

TIMER FUNCTION GUIDE

Selecting a Timer's Function

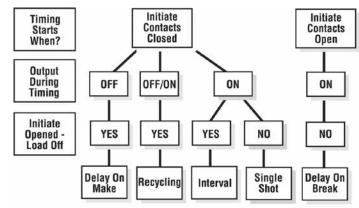
Selecting one of the five most common timing functions can be as easy as answering three questions on the chart below. If you have trouble answering these questions, try drawing a connection diagram that shows how the timer and load are connected. Time diagrams and written descriptions of the five most popular functions, plus other common functions. Instantaneous contacts, accumulation, pause timing functions, and flashing LED's are included in some units to expand the versatility of the timer. These expanded operations are explained on the product's catalog page. Time diagrams are used on these pages along with text and international symbols for functions.

Function Selection Guide

Selection Questions

- The timing starts when the initiate (starting) contacts are:
 A) Closed
 B) Opened
- 2) What is the status of the output (or load) during timing?A) OnB) OffC) On/Off
- **3)** Will the load de-energize (or remain de-energized) if the initiate (starting) contacts are opened during timing?
 - A) Yes B) No

THE FIVE MOST USED FUNCTIONS



Understanding Time Diagrams

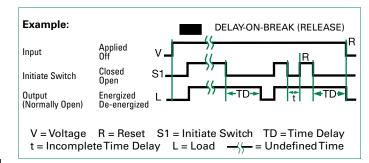
Time diagrams are used to show the relative operation of switches, controls, and loads as time progresses. Time begins at the first vertical boundary. There may be a line indicating the start of the operation or it may just begin with the transition of the device that starts the operation. Each row in the time diagram represents a separate component. These rows will be labeled with the name of the device or its terminal connection numbers. In a bistable or digital system, the switches, controls, or loads can only be ON or OFF. The time lines are drawn to represent these two possible conditions. Vertical lines are used to define important starting or ending points in the operation.

The example to the right is the most common type of time diagram in use in North America. It shows the energizing of loads, and the closing of switches and contacts by an ascending vertical transition of the time line. Opening switches or contacts or de-energizing loads are represented by descending vertical transitions.

International Timing Function Symbols

- 🖂 = Delay-on-Make; ON-delay
- = Delay-on-Break; OFF-delay
- 🖂 🔳 = Delay-on-Make and Break; ON and OFF-delay
- 1 ___ =Trailing Edge Interval; Impulse-OFF
 - ות] = Single Shot; Pulse Former
- □ □ = Flasher ONTime First; Recycling EqualTimes ON First

TIME DIAGRAM



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TRDU SERIES



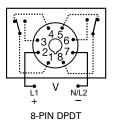


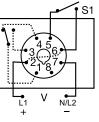
8-PIN



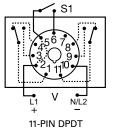
11-PIN

Wiring Diagram





8-PIN SPDT



V = Voltage S1 = Initiate Switch

For dimensional drawing see: Appendix, page 512, Figure 20.

Ordering Information

MODEL	INPUT VOLTAGE	BASE CONNECTION
TRDU120A1	120VAC	8-pin, DPDT*
TRDU120A2	120VAC	8-pin, SPDT
TRDU120A3	120VAC	11-pin, DPDT
TRDU12D1	12VDC	8-pin, DPDT*
TRDU12D2	12VDC	8-pin, SPDT
TRDU230A2	230VAC	8-pin, SPDT
TRDU24A1	24VAC/DC	8-pin, DPDT*
TRDU24A2	24VAC/DC	8-pin, SPDT
TRDU24A3	24VAC/DC	11-pin, DPDT

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*Limited to 9 operating functions in 8-pin DPDT units.

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Description

The TRDU Series is a versatile universal time delay relay with 21 selectable single and dual functions. The dual functions replace up to three timers required to accomplish the same function. Both the function and the timing range are selectable with switches located on the face of the unit. Two LED's indicate input voltage and output status. This device offers full 10A isolated relay output contacts in either SPDT or DPDT. The TRDU replaces hundreds of part numbers, thereby, reducing your stock inventory requirements.

21 Functions

Five switches are provided to set one of 10 single or 11 dual modes of operation.

Features & Benefits

FEATURES	BENEFITS
: 21 timing functions	Replace hundreds of parts and reduce stocking requirements
Microcontroller based	Repeat Accuracy + / - 0.1%
User selectable time delay	Timing settings are switch selectable 0.1s - 1,705h in eight ranges for added flexibility
Isolated 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages
LED indicators	Provides visual indication of input voltage and relay status

Accessories



BZ1 Front Panel Mount Kit

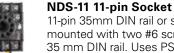
NDS-8 Octal 8-pin Socket

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a

35 mm DIN rail. Uses PSC8 hold-down clips.





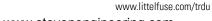
11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.

PSC8 or PSC11 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in sets of two.

C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



Time Delay Relays Multifunction

TRDU SERIES

Specifications

Time Delay
Туре
Range: Switch Selectable**

Adjustments

Setting Accuracy Repeat Accuracy Timing Functions

Reset Time Initiate Time Time Delay vs Temp. & Voltage Indication **Two LEDs indicate** Input Voltage Tolerance **12VDC & 24VAC/DC** 120 & 230VAC **AC Line Frequency Power Consumption** Output Туре Form

Rating

Life

Microcontroller Single Functions: 0.1s - 1,705h in 8 ranges Dual Functions: 0.1s - 3,100m each in 8 ranges Multiplier: 3 position DIP switches select 0.1, 1, 10, or 100 in s or m ±1% or 50ms, whichever is greater ±0.1% or 20ms, whichever is greater Five switches are provided to set one of twenty-one single or dual functions ≤ 50ms 120VAC: 75ms

±1%

1) Input voltage applied 2) Output relay status

12VDC, 24VAC/DC, 120VAC, or 230VAC

-15% - 20% -20% - 10% 50/60Hz 24 to 230V ≤ 3W; 12VDC ≤ 2W

Electromechanical relay SPDT or DPDT 10A resistive @ 120/240VAC & 28 VDC; 1/3 hp @ 120/240VAC Mechanical – 1 x 10⁷; Electrical – 1 x 10⁶

Protection

Isolation Voltage Insulation Resistance Polarity Mechanical Mounting Dimensions

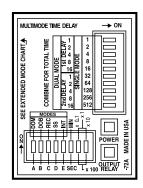
Termination Environmental Operating/Storage Temperature Weight

 \geq 1500V RMS input to output \geq 100 $M\Omega$ DC units are reverse polarity protected

Plug-in socket H 76.7 mm (3.1"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Octal 8-pin plug-in or magnal 11-pin plug-in

-20° to 65°C / -40° to 85°C ≅ 5.8 oz (164 g)

**For CE approved applications, power must be removed from the unit when a switch position is changed.



Function Diagrams

Single Functions Dual Functions DELAY-ON-MAKE/DELAY-ON-BREAK DELAY-ON-MAKE (ON-DELAY) R R ON ON S1 TD1 TD2 NO ABCDE ABCDE NC DELAY-ON-BREAK DELAY-ON-MAKE / RECYCLE * \bowtie л⊠ (ON TIME FIRST) ON ON DRODDRR TD NO ABCDE ÅBCDE NC TD TD RECYCLE (ON TIME \bowtie FIRST, EQUAL DELAYS) DELAY-ON-MAKE/INTERVAL л⊠ ON ON JODROF TD2 NO NO NC TD TD ABCDE ABCDE NC SINGLE SHOT DELAY-ON-MAKE / SINGLE SHOT 1Л. ON ON V HUDHUL S1 ÅBCDE ABCDE NO NO NČ NC

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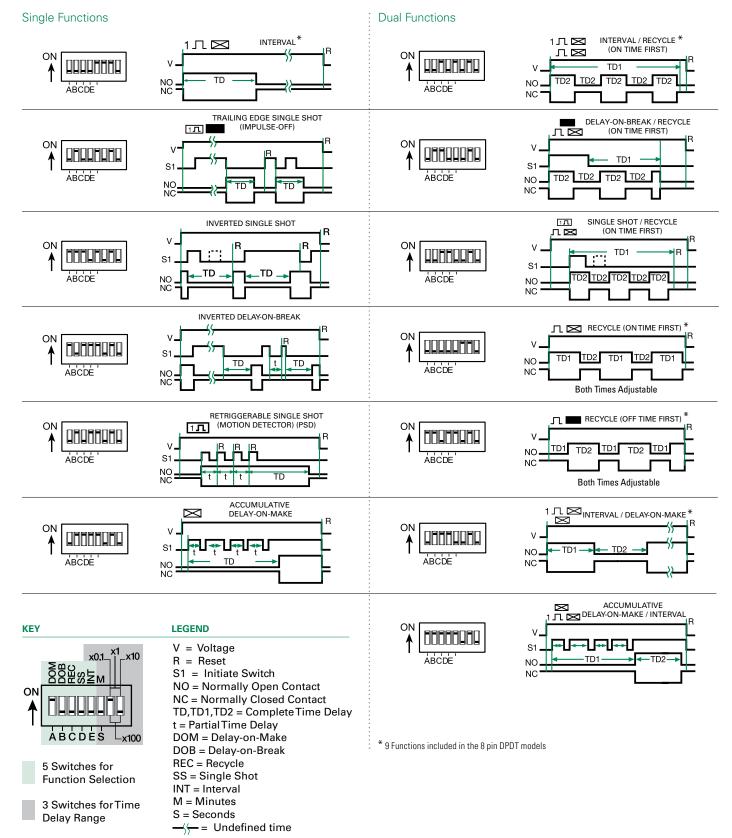
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Time Delay Relays

TRDU SERIES



NOTE: The time delay range is the same for both functions when dual functions are selected.

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TRU SERIES

Knob Adjustable Universal Time Delay Relay

(€¶\$®







11-PIN

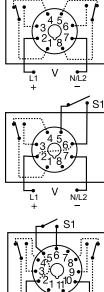
V = Voltage

Relay contacts

are isolated

S1 = Initiate Switch

Wiring Diagram



8-PIN SPDT Delay-on-Make Interval Single Shot Recycling (ON Time First, Equal Recycle Delays) Delay-on-Break Retriggerable Single Shot

8-PIN DPDT Delay-on-Make Interval Recycling

11-PIN DPDT

Delay-on-Make Interval Single Shot Recycling (ON Time First, Equal Recycle Delays) Delay-on-Break Retriggerable Single Shot

For dimensional drawing see: Appendix, page 512, Figure 21.

Ordering Information

MODEL	INPUT VOLTAGE	BASE WIRING	FUNCTIONS
TRU1	19 to 264VAC; 19 to 30VDC	8-pin DPDT	3
TRU2	19 to 264VAC; 19 to 30VDC	8-pin SPDT	6
TRU3	19 to 264VAC; 19 to 30VDC	11-pin DPDT	6

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Description

The TRU Series is a multifunction, knob adjustable, Universal Time Delay Relay. It includes six of the most popular timing functions selected by a slide switch. The time delay is knob adjustable and the time delay range is switch selectable. The repeat accuracy is + 0.1%. Both function and time range can be selected on the top face of the unit. In addition to multifunctioning and multiple time ranges, the TRU Series features universal input voltage; 19 to 264VAC and 19 to 30VDC and full 10A output relay. The TRU Series can directly replace up to 1000 competitive time delay relay models.

Operation

A six position slide switch selects delay-on-make, interval, single shot, recycling (ON time first, equal recycle delays), delay-on-break, and retriggerable single shot. 8-pin DPDT base wiring is limited to delay-on-make, interval, and recycling functions. All six functions are available in the 8-pin SPDT and 11-pin DPDT versions.



Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1% or + / - 20ms, whichever is greater
6 time ranges (0.1s to 1,000m)	Broad range will satisfy most requirements
Knob adjustable time delay	Allows user to fine tune time delay based on application needs
Universal input voltage	Makes it versatile for use in most applications
	Provides the most common standard
Multifunction	timing functions
LED Indicators	

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TRU SERIES



Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



NDS-11 11-pin Socket

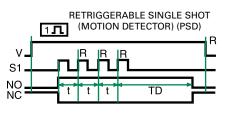
11-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5×0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.



PSC8 or PSC11 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in pairs.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact t = Incomplete Time Delay TD = Time Delay R = Reset

Specifications

Time Delay

Type Range Switch Selectable*

Adjustments Multiplier

.....

Time Setting

Two LEDs indicate

Repeat Accuracy Reset Time Time Delay vs Temp. & Voltage Input Voltage - Universal Input Range AC Line Frequency Output Type Form

Life

Rating

Protection Transient Isolation Voltage Polarity Mechanical Mounting Dimensions

Termination Environmental Operating/Storage Temperature Weight Digital integrated circuitry 0.1s - 1000m in 6 ranges: 1) 0.1 - 10s 2) 1 - 100s 3) 10 - 1000s 4) 0.1 - 10m 5) 1 - 100m 6) 10 - 1000m

4 position DIP switch selects x0.1, x1, x10, and sec. or min. Onboard knob adjustment with 1 - 100 reference dial 1) Input voltage applied 2) Output relay status $\pm 0.1\%$ or $\pm 20ms$, whichever is greater $\leq 300ms$

±2%

19 to 264VAC and 19 to 30VDC 50/60Hz

Electromechanical relay SPDT or DPDT, isolated 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁶

38 joules ≥ 1500V RMS input to output DC units are reversed polarity protected

Plug-in socket H 87.3 mm (3.44"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Octal 8-pin plug-in or magnal 11-pin plug-in

-20° to 65°C / -30° to 85°C ≅ 6 oz (170 g)

* For CE approved applications, power must be removed when a switch position is changed.

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ASQU / ASTU SERIES

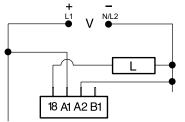




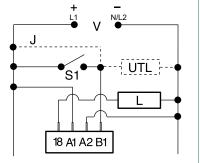


Wiring & Adjustment Diagrams

DELAY-ON-MAKE & RECYCLING



SINGLE SHOT, INTERVAL & **DELAY-ON-BREAK**



V = Voltage L = LoadJ=Wire Required for S1= Initiate Switch

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FIME DELAY RELAYS



For dimensional drawing see: Appendix, page 512, Figure 22.

ADJUSTMENTS AI DOM В A SS В A R B A DOB B

DOM = Delay-on-Make SS = Single Shot/Interval R = Recycling DOB = Delay-on-Break

R	М	S
0.1-10s	X1s	C∎⊟E D∎⊒F
1-100s	X10s	C □∎ E D ∎□ F
10-1000s	X100s	C III E D III F
1-100m	X10m	C □∎ E D □∎ F

R = Range M = Multiplier S = Setting

Description

The ASQU and ASTU Series of 17.5 mm, knob adjustable, universal solid-state timers offer multiple functions, voltages, and time delay ranges. Choose one of 5 functions and 4 time delay ranges via 4 selection switches located on face of the unit. Adjustment through the time range is accomplished by an onboard knob.

The ASQU Series has guick connect terminals and the ASTU Series has terminal blocks.

Features & Benefits

FEATURES	BENEFITS
Universal AC or DC voltage	Choose from 24 to 240VAC or 9 to 110VDC models
Compact 17.5mm size	Allows for high rail density
Microcontroller based	Repeat Accuracy + / -1%
Multifunction: 5 timing functions	Reduce stocking requirements
Knob Adjustable Time Delay	Field adjustable delay ranging from 0.1s - 100m
0.7A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Mounting fasteners lincluded	Each unit ships with both surface and DIN rail quick mount adapters
Watchdog circuitry	Self monitoring and self correcting for improved performance

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P0500-178 Surface Mount Adapter P0500-179 DIN Rail Mount Adapter For use with the ASxx/DSxx Series timers.

Ordering Information

MODEL	INPUT VOLTAGE	CONNECTION
ASQUA3	24 to 240VAC	Quick Connects
ASQUD3	9 to 110VDC	Quick Connects
ASTUA3	24 to 240VAC	Terminal Blocks
ASTUD3	9 to 110VDC	Terminal Blocks

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ASQU / ASTU SERIES



Specifications

Time Delay Type

Adjustment

Range* Repeat Accuracy Tolerance (Factory Calibration) Reset Time Initiate Time Time Delay vs Temp. & Voltage Input Voltage

AC Line Frequency/DC Ripple 50/60Hz / ≤ 10% Output Type Solid state

Form Rating Voltage Drop Protection Surge Circuitry Dielectric Breakdown Polarity Mechanical

Mounting DIN Rail Surface

Dimensions

Termination ASQU

ASTU

Environmental

Operating/Storage Temperature Humidity Weight Microcontroller based with ceramic resonator and watchdog circuitry Knob with dial; 2 switches select 1 of 4 multipliers 0.1 - 10s, 1 - 100s, 10 - 1000s, 1 - 100m ±1% or ±50ms, whicheer is greater

 $\pm 2\%$ or $\pm 50ms,$ whichever is greater $\leq 300ms$ Single Shot & Delay-on-Break: $\leq 32ms$

±2%, or ±50ms, whichever is greater

AC: 24 to 240VAC; -20% - 10% DC: 9 to 110VDC; -0% - 20% @ -25°C 9.4 to 110VDC; -0% - 20% @ -40°C 50/60Hz / < 10%

Solid state NO 0.7A steady state, 10A inrush AC \approx 2.5V @ 0.7A; DC \approx 1.5V @ 0.7A

IEEE C62.41-1991 Level A Encapsulated ≥ 2000V RMS terminals to mounting surface DC units are reverse polarity protected

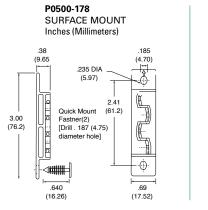
Two base adaptors are available Snap on to 32 mm DIN 1 & 35 mm DIN 3 rail Two #6 (M3.5 x 0.6) screws or quick mount fasteners H 76.2 mm (3.0"); W 17.52 mm (0.69"); D 61.2 mm (2.41")

0.25 in. (6.35 mm) male quick connect terminals 0.197 in. (5 mm) push-on terminal blocks for up to #14 AWG (2.5 mm²) wire

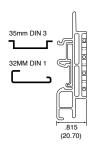
 -40° to 60° C / -40° to 85° C 95% relative, non-condensing ≈ 4 oz (113 g)

*For CE approved applications, power must be removed from the unit when a switch position is changed.

Mounting Diagrams



P0500-179 DIN RAIL MOUNT Inches (Millimeters)



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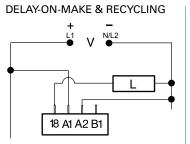
DSQU / DSTU SERIES







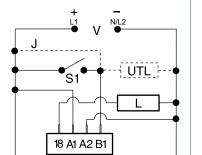
Wiring & Adjustment Diagrams



АШ DOM Вп

ADJUSTMENTS

SINGLE SHOT, INTERVAL & DELAY-ON-BREAK



FIME DELAY RELAYS

12

V = Voltage L = LoadJ=Wire Required for Interval Operation S1= Initiate Switch

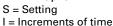
UTL = Optional Untimed Load

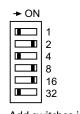
SS	A⊡∎ B∎⊡			
R	A□∎ B□∎			
DOB	A∎ B⊡∎			
DOM = Delay-on-Mak				

ke SS = Single Shot/Interval R = Recycling DOB = Delay-on-Break

R	М	S	Ι
0.1-6.3s	X0.1s	C □∎ E D □∎ F	0.1s
1-63s	X1s	C∎⊐E D∎⊐F	1s
10-630s	X10s	C □∎ E D ∎□ F	10s
1-63m	X1m	C∎⊐E D⊡∎F	1m







Add switches in ON position TD = 2+8+16=26

Description

The DSQU and DSTU Series of 17.5 mm, DIP switch adjustable, universal solid-state timers offer multiple functions, voltages, and time delay ranges. Choose one of 5 functions and 4 time delay ranges via 4 selection switches located on face of the unit. Six switches adjust the time delay through the selected range. The DSQU Series has guick connect terminals and the DSTU Series has terminal blocks.

Features & Benefits

FEATURES	BENEFITS
Universal AC or DC voltage	Choose from 24 to 240VAC or 9 to 110VDC models
Compact 17.5mm size	Allows for high rail density
Microcontroller based	Repeat Accuracy + / -1%
Multifunction: 5 timing functions	Reduce stocking requirements
DIP switch adjustable time delay	Field adjustable delay ranging from 0.1s - 63m
0.7A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Mounting fasteners included	Each unit ships with both surface and DIN rail quick mount adapters
Watchdog circuitry	Self monitoring and self correcting for improved performance

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P0500-178 Surface Mount Adapter P0500-179 DIN Rail Mount Adapter For use with the ASxx/DSxx Series timers.

Ordering Information

MODEL	INPUT VOLTAGE	CONNECTION
DSQUA3	24 - 240VAC	Quick Connects
DSQUD3	9 - 110VDC	Quick Connects
DSTUA3	24 - 240VAC	Terminal Blocks
DSTUD3	9 - 110VDC	Terminal Blocks

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For dimensional drawing see: Appendix, page 512, Figure 22.

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DSQU / DSTU SERIES



Specifications

Time Delay Type

Adjustment

Range*

Repeat Accuracy Setting Accuracy **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage

AC Line Frequency/DC Ripple 50/60Hz / $\leq 10\%$ Output Type Form Rating Voltage Drop Protection Surge Circuitry **Dielectric Breakdown** Polarity **Mechanical** Mounting **DIN Rail** Surface Dimensions

Termination DSQU

DSTU

Environmental

Operating/Storage Temperature Humidity Weight

Microcontroller based with ceramic resonator and watchdog circuitry 6 switches adjust the time delay; 2 switches select 1 of 4 multipliers x0.1s = 0.1 - 6.3s in 0.1s increments x1s = 1 - 63s in 1s increments x10s = 10 - 630s in 10s increments x1m = 1 - 63m in 1m increments ±0.1% or ±20ms, whichever is greater ±2% or ±50ms, whichever is greater ≤ 300ms Single Shot & Delay-on-Break: ≤ 32ms ±2% or ±50ms, whichever is greater

AC: 24 to 240VAC; -20% - 10% DC: 9 to 110VDC; -0% - 20% @ -25°C 9.4 to 110VDC; -0% - 20% @ -40°C

Solid state

NO 0.7A steady state, 10A inrush AC ≈ 2.5V @ 0.7A; DC ≈ 1.5V @ 0.7A

IEEE C62.41-1991 Level A Encapsulated ≥ 2000V RMS terminals to mounting surface DC units are reverse polarity protected

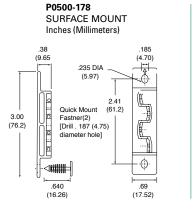
Two base adaptors are available Snap on to 32 mm DIN 1 & 35 mm DIN 3 rail Two #6 (M3.5 x 0.6) screws or quick mount fasteners H 76.2 mm (3.0"); W 17.52 mm (0.69"); **D** 61.2 mm (2.41")

0.25 in. (6.35 mm) male quick connect terminals 0.197 in. (5 mm) push-on terminal blocks for up to #14 AWG (2.5 mm²) wire

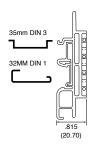
-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 4.2 oz (119 g)

*For CE approved applications, power must be removed from the unit when a switch position is changed.

Mounting Diagrams



P0500-179 **DIN RAIL MOUNT** Inches (Millimeters)



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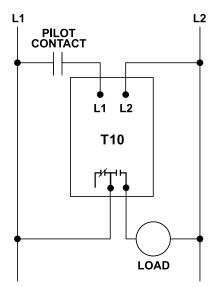
T10 SERIES

Solid-State On-Delay Timer

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Pure la serie de l

Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Ordering Information

MODEL	LINE VOLTAGE	DESCRIPTION
T10120	115VAC	0.1 to 10 minute range, 240 VAC rated output contacts
T10200	230VAC	0.1 to 10 minute range, 240 VAC rated output contacts
T10400	460VAC	0.1 to 10 minute range, 600 VAC rated output contacts
T10S400	460VAC	0.5 to 12 second range, 600 VAC rated output contacts

Description

The T10 Series on-delay timer is a solid-state electronic device that provides accurate and reliable timing for control circuits up to 460VAC. The T10 features a user-selectable time delay from 6 seconds to 10 minutes (0.5 to 12 seconds on the T10S400 model) and SPDT output contacts. When power is applied to the T10, it immediately begins its timing cycle. During this time, the indicator LED alternates between red and green and the output contacts remain inactive. When the timing cycle is complete, the indicator LED turns solid green and the output contacts are activated. The output contacts will remain activated until power is removed from the T10.

The SPDT contact ratings are 480V @ 240VAC on the 115V and 230V models, and 470VA @ 600VAC on the 460V model.

Features & Benefits

- Status LED
- 600V control relay on 460V models

Specifications

Input Characteristics	
Frequency	50*/60Hz
Functional Characteristics	
Timing Range	
T10100, T10200, T10400	6 seconds to 10 minutes
T10S400	0.5 seconds to 12 seconds
Repeat Accuracy	
Fixed Condition	±1%
Output Characteristics	
Output Contact Rating (SPDT)	
Pilot Duty	
T10100, T10200	480VA @ 240VAC
T10400, T10S400	470VA @ 600VAC
General Characteristics	
Maximum Input Power	5 W
Terminal	
Torque	7 inlbs.
Wire Size	12-18AWG
Safety Marks	
UL	UL508 (File #E68520)
Dimensions	H 74.4 mm (2.93"); W 133.9 mm (5.27");
	D 74.9 mm (2.95")
Weight	0.94 lb. (15.04 oz., 426.38 g)
Mounting Method	#8 screws
-	

*Note: 50Hz will increase all delay timers by 20%.

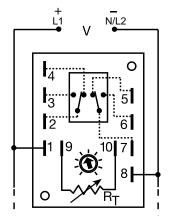
ERDM SERIES







Wiring Diagram



V = Voltage

A knob, or terminals 9 & 10 are only included on adjustable units. Relay contacts are isolated.

 R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 25.

Description

The ERDM Series is a combination of digital electronics and a reliable electromechanical relay. These devices offer a DPDT relay output for relay logic circuits, and isolation of input to output voltages. Cost effective for OEM applications, such as random starting, sequencing ON, switch de-bouncing, anti-short cycling, and other common delay-on-make applications.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Digital integrated circuitry with electromechanical relay	Repeat Accuracy + / - 0.5%
Isolated 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-16, P1004-16-XVersa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1015-64 (AVVG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
ERDM123	12VDC	Onboard knob	0.1 - 10s	ERDM422	120VAC	Onboard knob	0.1 - 5s
ERDM126	12VDC	Onboard knob	0.6 - 60s	ERDM423	120VAC	Onboard knob	0.1 - 10s
ERDM128	12VDC	Onboard knob	0.1 - 10m	ERDM425	120VAC	Onboard knob	0.3 - 30s
ERDM222	24VAC	Onboard knob	0.1 - 5s	ERDM427	120VAC	Onboard knob	0.1 - 5m
ERDM4130S	120VAC	Fixed	30s	ERDM429	120VAC	Onboard knob	0.2 - 15m
ERDM4210	120VAC	Onboard knob	1 - 100m				

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ERDM SERIES

Time Delay Relays Dedicated — Delay-on-Make

Specifications

Time Delay Type Range

Adjustment Repeat Accuracy Tolerance (Factory Calibration) Recycle Time Time Delay vs Temp. & Voltage Input Voltage Tolerance

12VDC & 24VDC/AC 120VAC/DC & 230VAC AC Line Frequency

Output Type

Form Rating

Life

Protection Isolation Voltage Insulation Resistance Polarity Mechanical Mounting

Dimensions

Termination Environmental Operating/Storage Temperature Weight Digital integrated circuitry 0.1s - 500m in 11 adjustable ranges or 0.1s - 1000m fixed Fixed, onboard or external adjust $\pm 0.5\%$

≤ ±10% ≤ 150ms

≤±2%

12, 24, or 120VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

Isolated relay contacts DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Full Load - 1 x 10⁶

≥1500V RMS input to output ≥100 MΩ DC units are reverse polarity protected

Surface mount with two #6 (M3.5 x 0.6) screws H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 43.2 mm (1.7") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 65°C / -40° to 85°C ≅ 5.7 oz (162 g)

Selection Guides

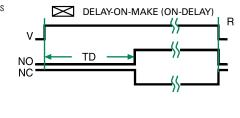
	R _T Selection Chart						
	Des	sired Ti	me De	lay*		B-	
		Sec	onds			11	
1	2	3	4	5	6	Megohm	
0.1	0.1	0.1	0.2	0.3	0.6	0.0	
0.19	0.6	1	1.7	3	6	0.1	
0.28	1.1	2	3.2	6	12	0.2	
0.37	1.6	3	4.7	9	18	0.3	
0.46	2.1	4	6.2	12	24	0.4	
0.55	2.6	5	7.7	15	30	0.5	
0.64	3.0	6	9.2	18	36	0.6	
0.73	3.5	7	10.7	21	42	0.7	
0.82	4.0	8	12.2	24	48	0.8	
0.91	4.5	9	13.7	27	54	0.9	
1.0	5.0	10	15	30	60	1.0	

 * When selecting an external R_{T} add at least 20% for tolerance of unit and the R_{T}

	R _T Selection Chart					
	Desire	d Time	Delay*	•	R-	
		Minutes			11	
7	8	9	10	11	Megohm	
0.1	0.1	0.2	1	10	0.0	
0.6	1	1.7	10	50	0.1	
1.1	2	3.2	20	100	0.2	
1.6	3	4.7	30	150	0.3	
2.1	4	6.2	40	200	0.4	
2.6	5	7.7	50	250	0.5	
3.0	6	9.2	60	300	0.6	
3.5	7	10.7	70	350	0.7	
4.0	8	12.2	80	400	0.8	
4.5	9	13.7	90	450	0.9	
5.0	10	15	100	500	1.0	

 * When selecting an external RT add at least 20% for tolerance of unit and the RT.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\overrightarrow{}$ = Undefined Time

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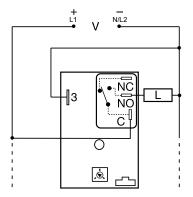
HRDM SERIES

Delay-on-MakeTimer

$C \in \mathbf{A}$



Wiring Diagram



NO = Normally Open L = Load C = Common, Transfer Contact

NOTE: A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered. Relay contacts are not isolated.

For dimensional drawing see: Appendix, page 512, Figure 17.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
HRDM120	12VDC	Onboard	0.1 - 10s
HRDM3112S	24VDC	Fixed	12s
HRDM413M	120VAC	Fixed	3m
HRDM415M	120VAC	Fixed	5m

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Description

The HRDM Series combines an electromechanical relay output with microcontroller timing circuitry. It offers 12 to 230V operation in five ranges and factory fixed, onboard, or external adjustable time delays with a repeat accuracy of ±0.5%. The output contact rating allows for direct operation of heavy loads, such as compressors, pumps, blower motors, heaters, etc. This series is ideal for OEM applications where cost is a factor.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output relay energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

BENEFITS
Repeat Accuracy + / - 0.5%
Allows flexibility for OEM applications
Allows direct operation of heavy loads: compressors, pumps, blower moters, heaters.
Protects against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

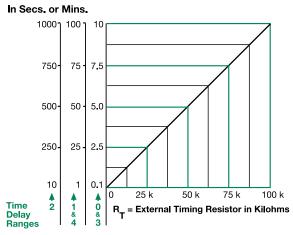
type rail with two #10 screws.

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HRDM SERIES

External Resistance vs. Time Delay



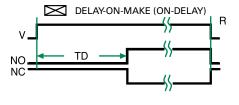
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external RT, add the tolerances of the timer and the RT for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



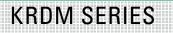
V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\rightarrow \overleftarrow{\leftarrow}$ = Undefined Time

Specifications

Time Delay Type Microcontroller circuitry Range 0.1s - 100m in 5 adjustable ranges or fixed **Repeat Accuracy** ±0.5% or 20 ms, whichever is greater Tolerance (Factory Calibration) ±1%, ±5% **Reset Time** ≤ 150ms Time Delay vs Temp. & Voltage ±2% Input Voltage 12 or 24VDC; 24, 120, or 230VAC Tolerance **12VDC & 24VDC** -15% - 20% 24 to 230VAC -20% - 10% **AC Line Frequency** 50/60 Hz $AC \le 4VA; DC \le 2W$ **Power Consumption** Output Туре Electromechanical relay Form Non-isolated, SPDT Ratings SPDT-NO SPDT-NC **General Purpose 125/240VAC** 30A 15A Resistive 125/240VAC 30A 15A 28VDC 20A 10A Motor Load 125VAC 1 hp* 1/4 hp** 240VAC 2 hp** 1 hp** Life Mechanical - 1 x 106; Electrical - 1 x 105, *3 x 104, **6,000 Protection IEEE C62.41-1991 Level A Surge Circuitry Encapsulated ≥ 2000V RMS terminals to mounting surface **Dielectric Breakdown Insulation Resistance** \geq 100 M Ω Polarity DC units are reverse polarity protected Mechanical Mounting Surface mount with one #10 (M5 x 0.8) screw Dimensions 3 x 2 x 1.5 in. (76.7 x 51.3 x 38.1mm) Termination 0.25 in. (6.35 mm) male guick connect terminals **Environmental Operating/Storage** Temperature -40° to 60°C / -40° to 85°C Humidity 95% relative, non-condensing Weight ≅ 3.9 oz (111 g)

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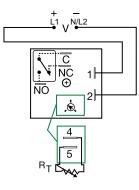




$C \in \mathbb{R}$



Wiring Diagram



V = Voltage C = Common, Transfer Contact NO = Normally Open

NC = Normally Closed

A knob is supplied for adjustable units, or RT terminals 4 & 5 for external adjust. See external adjustment vs time delay chart. Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KRDM Series is a compact time delay relay measuring only 2 in. (50.8 mm) square. Its solid-state timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRDM Series is a cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output relay energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%
Compact, low cost design	Allows flexibility for OEM applications
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of

Versa-Pot. Semi-gloss industrial black finish.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
KRDM1110S	12VDC	Fixed	10s	KRDM4110M	120VAC	Fixed	10m
KRDM1130S	12VDC	Fixed	30s	KRDM4110S	120VAC	Fixed	10s
KRDM120	12VDC	Onboard knob	0.1 - 10s	KRDM4145S	120VAC	Fixed	45s
KRDM121	12VDC	Onboard knob	1 - 100s	KRDM420	120VAC	Onboard knob	0.1 - 10s
KRDM2110M	24VAC/DC	Fixed	10m	KRDM421	120VAC	Onboard knob	1 - 100s
KRDM215M	24VAC/DC	Fixed	5m	KRDM424	120VAC	Onboard knob	1 - 100m
KRDM220	24VAC/DC	Onboard knob	0.1 - 10s	KRDM430	120VAC	External	0.1 - 10s
KRDM221	24VAC/DC	Onboard knob	1 - 100s	KRDM433	120VAC	External	0.1 - 10m
KRDM223	24VAC/DC	Onboard knob	0.1 - 10m	KRDM6115M	230VAC	Fixed	15m
KRDM310.2S	24VDC	Fixed	0.2s				

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KRDM SERIES

Time Delay Relays Dedicated — Delay-on-Make

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

strain relief P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

all modules with 0.25 in. (6.35 mm) male quick connect terminals.





35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

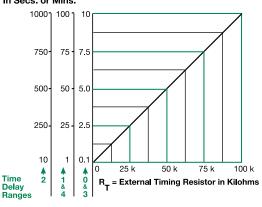


P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

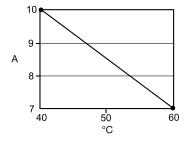
In Secs. or Mins.



This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the

time delav increases. when selecting an external Rr, add the tolerances of the timer and the Rr for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm Rr. For 1 to 100 S use a 100 K ohm Rr.

Output Current/Ambient Temperature



Specifications

Time Delay Range **Repeat Accuracy** Tolerance **Factory Calibration**) **Recvcle Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **12VDC & 24VAC/DC** 110VDC 120 & 230VAC AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Type Form

Max. Switching Voltage Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Rating (at 40°C)

Termination **Environmental Operating/Storage** Temperature Humidity Weight

0.1s - 100m in 5 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

≤ 150ms

 $\leq \pm 5\%$

 $\leq \pm 5\%$

12, 24 or 110VDC; 24, 120 or 230VAC

-15% - 20% -20% - 10% $AC \le 2VA$: $DC \le 2W$

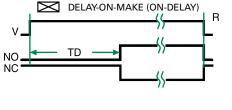
Isolated relay contacts SPDT 10A resistive @ 125VAC; 5A resistive @ 230VAC & 28VDC; 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105

Encapsulated ≥ 1500V RMS input to output $\geq 100 \ M\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing $\approx 2.6 \text{ oz} (74 \text{ g})$

Function Diagram

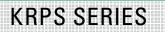


V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delav R = Reset Time

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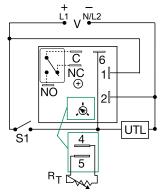




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Wiring Diagram



V = Voltage C = Common, Transfer Contact NC = Normally Closed NO = Normally Open S1 = Initiate Switch UTL = Untimed Load

A knob is supplied for adjustable units, or R_T terminals 4 & 5 for external adjust. See external adjustment vs. time delay chart. The untimed load is optional. S1 is not used for some functions.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUST.	TIME DELAY	FUNCTION
KRPS4160MM	120VAC	Fixed	60m	Delay-on-Make
KRPS913MB	230VAC	Fixed	3m	Delay-on-Break
KRPSA10.1SFT	24 - 240VAC/DC	Fixed	0.1s	Alternating
KRPSA21RE	24 - 240VAC/DC	Onboard	0.1 - 10s	Recycling, On Time First
KRPSA22B	24 - 240VAC/DC	Onboard	1 - 100s	Delay-on-Break
KRPSA24M	24 - 240VAC/DC	Onboard	0.1 - 10m	Delay-on-Make
KRPSD10.1SF	12 to 48VDC	Fixed	0.1s	Leading Edge Flip-Flop
KRPSD21B	12 to 48VDC	Onboard	0.1 - 10s	Delay-on-Break
KRPSD21M	12 to 48VDC	Onboard	0.1 - 10s	Delay-on-Make
KRPSD22M	12 to 48VDC	Onboard	1 - 100s	Delay-on-Make
KRPSD22S	12 to 48VDC	Onboard	1 - 100s	Single Shot
KRPSD25S	12 to 48VDC	Onboard	1 - 100m	Single Shot

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Description

The KRPS Series is a factory programmed time delay relay available with 1 of 15 functions and measures only 2 inches square. The KRPS offers a wide range of fixed, onboard, or externally adjustable time delays. The output relay contacts offer a full 10A rating with complete isolation. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRPS Series is a cost effective approach for OEM applications that require small size, isolation, accuracy, and long life. Special time ranges and functions are available.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%
Compact design	Allows flexibility for OEM applications
Isolated, SPDT, 10A output	Allows control of loads for AC or DC voltages
Encapsulated	Encapsulated to protect against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer

recommended for remote time delay adjustment.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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KRPS SERIES

Time Delay Relays Dedicated — Delay-on-Make

Specifications

Time Delay

Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance 12 to 48VDC 24 to 240VAC/DC AC Line Frequency/DC Ripple 50/60Hz / $\leq 10\%$ **Power Consumption** Output Туре Form Rating (at 40°C)

Microcontroller circuitry 0.1s - 1000h in 9 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 2\%$ ≤ 150ms \leq 40ms; \leq 750 operations per minute

≤ ±2%

12 to 48VDC; 24 to 240VAC/DC

-15% - 20% -20% - 10% $AC \le 2VA; DC \le 2W$

Isolated relay contacts SPDT 10A resistive @ 125VAC 5A resistive @ 230VAC & 28VDC 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105

Protection

Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

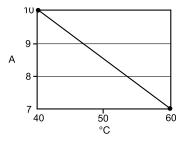
Termination **Environmental Operating/Storage** Temperature Humidity Weight

Encapsulated ≥ 1500V RMS input to output $\geq 100 \text{ MO}$ DC units are reverse polarity protected

Surface mt. with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 q)

Output Current/Ambient Temperature





Life (Operations)

Max. Switching Voltage

Upon application of the input voltage, the dime delay begins. The output relay is de-energized before and during the time delay. At the end of the time delay, the put energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Operation (Delay-on-Break)

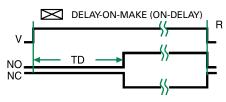
Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

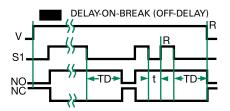
Reset: Re-closing the initiate switch during timing resets the time delay. Removing input voltage resets the time delay and output.

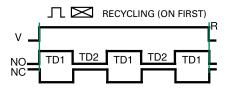
Operation (Recycling)

Upon application of input voltage, the output relay energizes and the ON time begins. At the end of the ON time, the output deenergizes and the OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.







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Operation (Alternating)

Input voltage must be applied at all times for proper operation. The operation begins with the output relay de-energized. Closing S1 enables the next alternating operation. When S1 opens (trailing edge triggered), the time delay begins. At the end of the time delay, the output energizes and remains energized until S1 is (re-closed and) re-opened. Then the output relay de-energizes and remains until S1 opens again. Each time S1 opens the time delay occurs and the output transfers.

Reset: Removing input voltage resets the output and the time delay.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output (relay or solid state) energizes and the time delay begins. At the end of the delay, the output de-energizes. Opening or re-closing the initiate switch during timing has no effect on the time delay. Note (for most single shot timers): If the initiate switch is closed when input voltage is applied, the output energizes and the time delay begins.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Removing input voltage resets the time delay and output.

Operation (Retriggerable Single Shot, Motion Detector)

Input voltage must be applied prior to and during timing. The output relay is de-energized. When the initiate switch S1 closes momentarily or maintained, the output energizes and the time delay begins. Upon completion of the delay, the output de-energizes.

Reset: Re-closing S1 resets the time delay and restarts timing. Removing input voltage resets the time delay and output.

Operation (Trailing Edge Single Shot, Impulse-OFF)

Input voltage must be applied before and during timing. When the initiate switch S1 opens, the output relay energizes. At the end of the time delay, the output de-energizes. Re-closing and opening S1 during timing has no affect on the time delay. The output will not energize if S1 is open when input voltage is applied.

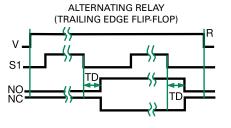
Reset: Reset occurs when the time delay is complete and S1 is closed. Removing input voltage resets the time delay and output.

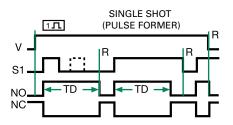
LEGEND

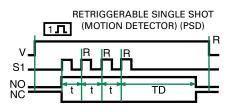
V = Voltage R = Reset T1 = ON Time

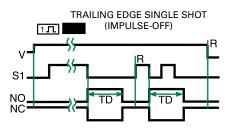
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T2 = OFFTime S1 = Initiate Switch NO = Normally Open Contact









NC = Normally Closed Contact t = Incomplete Time Delay TD,TD1,TD2 =Time Delay

C = Count **P** = Pulse Duration = Undefined Time

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KSD1 SERIES

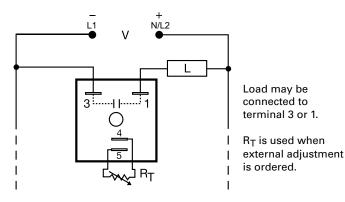
Time Delay Relays Dedicated — Delay-on-Make

Delay-on-MakeTimer

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSD1 Series features two-terminal, series-connection with the load. The KSD1 Series is an ideal choice for delay-onmake timing applications. This series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable solid-state timer is required. The factory calibration for fixed time delays is within 5% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. This series is designed for popular AC and DC voltages. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, + / -5% time delay accuracy
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories

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P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

12 LIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
KSD11120S	12VDC	Fixed	20s
KSD1123	12VDC	External	0.1 - 10m
KSD1230	24VAC	Onboard	0.1 - 10s
KSD1320	24VDC	External	0.1 - 10s
KSD1412S	120VAC	Fixed	2s
KSD14130S	120VAC	Fixed	30s
KSD1420	120VAC	External	0.1 - 10s
KSD16130S	230VAC	Fixed	30s

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KSD1 SERIES



Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

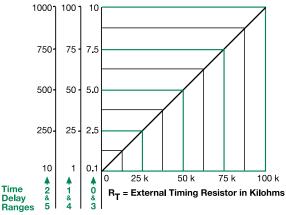


P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay





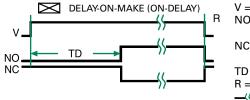
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external $\mathsf{R}_{T},$ add the tolerances of the timer and the R_{T} for the full time range adjustment.

 $\mbox{Examples: 1}$ to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay R = Reset Time

Specifications

Time Delav Range 0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater **Repeat Accuracy** Tolerance (Factory Calibration) $\leq \pm 5\%$ **Recycle Time** Time Delay vs. Temperature & Voltage $\leq \pm 10\%$ Input Voltage Tolerance **AC Line Frequency** Output Type Form **Maximum Load Current Minimum Holding Current OFF State Leakage Current** Voltage Drop Protection Circuitry

Dielectric Breakdown Insulation Resistance Polarity **Mechanical**

Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

≤ 150ms

24, 120, or 230VAC; 12 or 24VDC ±20% 50/60 Hz

Solid state NO, open during timing 1A steady state, 10A inrush at 60°C $\leq 40 m A$ ≈ 7mA @ 230VAC ≅ 2.5V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface ≥ 100 MΩ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing $\approx 2.4 \text{ oz} (68 \text{ g})$

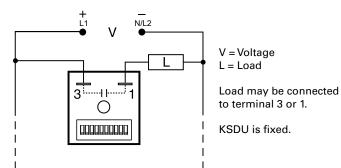


KSDU SERIES

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
KSDU8120	24 to 120VAC/DC	Fixed	20s
KSDU811200	24 to 120VAC/DC	Fixed	1200s

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Description

The KSDU Series are encapsulated solid-state, delay-on-make timers that combine digital timing circuitry with universal voltage operation. The KSDU Series is factory fixed from 0.1s to 10,230s and does not include the DIP switch. These series are excellent choices for process control systems and OEM equipment.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Universal Voltage	24 to 240VAC/DC in 2 ranges
Digital Integrated Circuitry	Repeat accuracy + / - 5%
1A Steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
2 terminal design	Provides series connection for easy installation

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.

P1015-64 (AWG 14/16) Female Quick

Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Time Delay Relays Dedicated — Delay-on-Make

KSDU SERIES



Specifications

Time Delay Туре Range* Fixed **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time** Time Delay vs Temp. & Voltage Input Voltage **AC Line Frequency** Tolerance Output Туре Form **Maximum Load Current Minimum Holding Current Voltage Drop** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight Digital integrated circuitry

Fixed from 0.1s - 10230s ±0.5% or 20ms, whichever is greater

±10% ≤150ms

±5%

24 to 120VAC/DC; 100 to 240VAC/DC 50/60 Hz ±20%

Solid state NO, open during timing 1A steady state, 10A inrush at 60°C 40mA ≅ 2.5V @ 1A

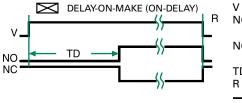
 $\begin{array}{l} \mbox{Encapsulated} \\ \geq 2000V \mbox{ RMS terminals to mounting surface} \\ \geq 100 \mbox{ } M\Omega \end{array}$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

* For CE approved applications, power must be removed from the unit when a switch position is changed.

Function Diagram



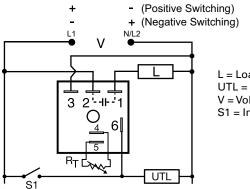


KSPS SERIES

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Wiring Diagram



L = LoadUTL = Untimed Load V = Voltage S1 = Initiate Switch

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSPS Series is a factory programmed module available in any 1 of 14 standard functions. The KSPS Series offers a single, fixed, externally or onboard adjustable time delay. The 1A steady, 10A inrush rated solid-state output provides 100 million operations typical. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KSPS Series is a cost effective approach for OEM applications that require small size and solid state reliability.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat Accuracy + / - 0.5%	
Compact design	Allows flexibility for OEM applications	
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.	
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	FUNCTION
KSPS2180SB	24VAC	Fixed	80s	Delay-on-Break
KSPSA21FT	24 - 240VAC, positive switching	Onboard	0.1 - 10s	Recycling, On Time First
KSPSN13MI	12 - 120VDC, negative switching	Fixed	3m	Interval
KSPSN21B	12 - 120VDC, negative switching	Onboard	0.1 - 10s	Delay-on-Break
KSPSP145SM	12 - 120VDC, positive switching	Fixed	45s	Delay-on-Make
KSPSP22B	12 - 120VDC, positive switching	Onboard	1 - 100s	Delay-on-Break
KSPSP35PSD	12 - 120VDC, positive switching	External	1 - 100m	Retriggerable Single Shot

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Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Specifications

Time Delay

Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance AC Line Frequency/DC Ripple 50/60Hz / $\leq 10\%$ **Power Consumption**

Microcontroller circuitry 0.1s - 1000h in 9 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 2\%$ ≤ 150ms < 20ms; < 1500 operations per minute

 $\leq \pm 2\%$

12 to 120VDC; 24 to 240VAC $\leq \pm 15\%$ $AC \le 2VA; DC \le 1W$

Output

Type Rating Voltage Drop **OFF State Leakage Current** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting

Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

Solid-state output 1A steady, 10A inrush for 16ms AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A AC ≈ 5mA @ 240VAC, DC ≈ 1mA

Encapsulated ≥ 2000V RMS terminals to mounting surface $\geq 100 \ M\Omega$ DC units are reverse polarity protected

Surface mt. with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

Timer Functions

Operation (Delay-on-Make)

Upon application of the input voltage, the dime delay begins. The output relay is de-energized before and during the time delay. At the end of the time delay, the put energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Operation (Delay-on-Break)

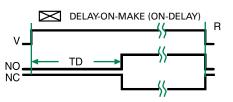
Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

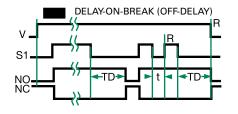
Reset: Re-closing the initiate switch during timing resets the time delay. Removing input voltage resets the time delay and output.

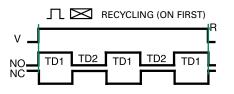
Operation (Recycling)

Upon application of input voltage, the output relay energizes and the ON time begins. At the end of the ON time, the output de-energizes and the OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.







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KSPS SERIES

Operation (Alternating)

Input voltage must be applied at all times for proper operation. The operation begins with the output relay de-energized. Closing S1 enables the next alternating operation. When S1 opens (trailing edge triggered), the time delay begins. At the end of the time delay, the output energizes and remains energized until S1 is (re-closed and) re-opened. Then the output relay de-energizes and remains until S1 opens again. Each time S1 opens the time delay occurs and the output transfers.

Reset: Removing input voltage resets the output and the time delay.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output (relay or solid state) energizes and the time delay begins. At the end of the delay, the output de-energizes. Opening or re-closing the initiate switch during timing has no effect on the time delay. Note (for most single shot timers): If the initiate switch is closed when input voltage is applied, the output energizes and the time delay begins.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Removing input voltage resets the time delay and output.

Operation (Trailing Edge Single Shot, Impulse-OFF)

Input voltage must be applied before and during timing. When the initiate switch S1 opens, the output relay energizes. At the end of the time delay, the output de-energizes. Re-closing and opening S1 during timing has no affect on the time delay. The output will not energize if S1 is open when input voltage is applied.

Reset: Reset occurs when the time delay is complete and S1 is closed. Removing input voltage resets the time delay and output.

Operation (Inverted Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch S1, the output relay de-energizes. At the end of the time delay, the output energizes. Opening or re-closing S1 during timing has no affect on the time delay. The output will remain de-energized if S1 is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and S1 is open. Removing input voltage resets the time delay and output.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output (relay or solid state) energizes during the time delay. At the end of time delay the output de-energizes and remains de-energized until input voltage is removed.

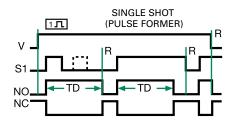
Reset: Removing input voltage resets the time delay and output.

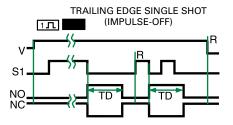
LEGEND

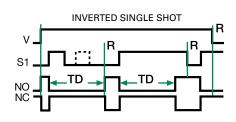
V = Voltage R = Reset T1 = ONTime T2 = OFFTime S1 =Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact t = IncompleteTime Delay TD,TD1,TD2 =Time Delay C = Count P = Pulse Duration →→→→ = Undefined Time

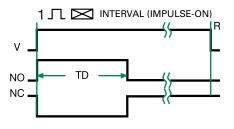
(TRAILING EDGE FLIP-FLOP)

ALTERNATING RELAY









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Time Delay Relays Dedicated — Delay-on-Make

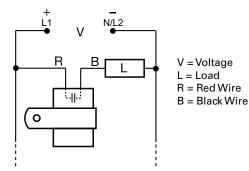


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MSM SERIES



Wiring Diagram



For dimensional drawing see: Appendix, page 514, Figure 39.

Description

The MSM Series replaces bi-metal type timing with reliable solid-state circuitry. There are no moving parts to arc or wear. It is a cost effective solution for OEM designers. It is available for printed circuit board mounting or surface mounting with a removable bracket and wire leads. The MSM Series offers immediate reset on removal of power.

Operation (Delay-on-Make)

The time delay begins upon application of input voltage. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat Accuracy + / - 5%, Factory calibration + / - 15%
Compact, low cost design	Allows flexibility for OEM applications
Long life	No moving parts to arc or wear
PCB or wire harness	Offers design and installation flexibility
Immediate reset	Occurs on removal of power
Totally Encapsulated	Protects against shock, vibration and humidity

Ordering Information

or doning in	lionnation				
MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	WIRE TYPE	WIRE LENGTH inches (mm)
MSM10.5W6	12VDC	Fixed	0.5s	Standard Lead	6.0 (152.4)
MSM10.7W6	12VDC	Fixed	0.7s	Standard Lead	6.0 (152.4)
MSM11W6	12VDC	Fixed	1s	Standard Lead	6.0 (152.4)
MSM110W6	12VDC	Fixed	10s	Standard Lead	6.0 (152.4)
MSM130W9	12VDC	Fixed	30s	Standard Lead	9.0 (228.6)
MSM190W6	12VDC	Fixed	90s	Standard Lead	6.0 (152.4)
MSM20.15W9	24VAC	Fixed	0.15s	Standard Lead	9.0 (228.6)
MSM210P3	24VAC	Fixed	10s	PC Mount	0.5 (12.7)
MSM25W9	24VAC	Fixed	5s	Standard Lead	9.0 (228.6)
MSM30.7W6	24VDC	Fixed	0.7s	Standard Lead	6.0 (152.4)
MSM42W6	120VAC	Fixed	2s	Standard Lead	6.0 (152.4)
MSM43W6	120VAC	Fixed	3s	Standard Lead	6.0 (152.4)
MSM420W6	120VAC	Fixed	20s	Standard Lead	6.0 (152.4)
MSM450W6	120VAC	Fixed	50s	Standard Lead	6.0 (152.4)

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TIME DELAY RELAYS

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MSM SERIES

Specifications

Time Delay

Туре Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency** Output Туре Form **Maximum Load Current**

Minimum Holding Current Voltage Drop Protection Circuitry Dielectric Breakdown Insulation Resistance Polarity Mechanical Mounting

Environmental

Operation/Storage Temperature Humidity Weight Analog Circuitry 0.05 - 180s fixed ±5%

±15% ≤ 75ms

±15%

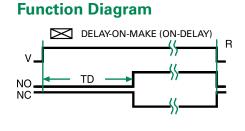
12 or 24VDC; 24, 120, or 230VAC ±10% 50/60 Hz

Solid State NO, open during timing 0.5A steady state 25°C; 0.25A steady state 60°C 40mA

≅ 2.5V @ 0.5A

- A.) PC mount 14 AWG (2.087mm²) wires (Can be inserted in AMP Miniature Spring Socket #645980-1)
- **B.)** Stranded 18 AWG wire leads (0.933 mm²) with mounting bracket

 $\begin{array}{l} -20^{\circ} \mbox{ to } 60^{\circ}\mbox{C} \ / \ .30^{\circ} \mbox{ to } 85^{\circ}\mbox{C} \\ 95\% \ relative, \ non-condensing \\ P: \ \cong 1.1 \ oz \ (31.2 \ g) \quad W: \ \cong 1.2 \ oz \ (34 \ g) \end{array}$



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\rightarrow =$ Undefined Time

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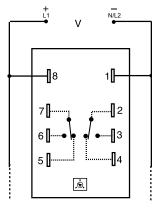
ORM SERIES



(€¶¶®



Wiring Diagram



V = Voltage

R_T is used when external adjustment is ordered. Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 26.

Description

The ORM Series features open PC board construction for reduced cost. It has isolated, 10A, DPDT relay contacts and all connections are 0.25 in (6.35 mm) male quick connect terminals. The time delay may be ordered as factory fixed, onboard knob, or external adjustment. Time delays from 0.05 - 300 seconds.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry with electromechanical relay	Repeat Accuracy + / - 2%
Isolated 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
Open PCB contruction	Reduces cost for OEM applications

Accessories



P1004-12, P1004-12-X Versa-Pot Panel mountable, industrial potentiometer

recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
ORM120A17	120VAC	Fixed	7s
ORM120A25	120VAC	Onboard knob	3 - 300s
ORM230A17	230VAC	Fixed	7s
ORM24D13.5	24VDC/28VDC	Fixed	3.5s
ORM24D22	24VDC	Onboard knob	0.5 - 30s

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ORM SERIES

Time Delay Relays Dedicated — Delay-on-Make

Specifications

Time Delay Type Range Repeat Accuracy Tolerance

Recycle Time

Time Delay vs Temp. & Voltage Input Voltage Tolerance 24VDC/AC 110 to 230VAC/DC AC Line Frequency Power Consumption Output Type

Form Rating

Life

Protection Polarity Isolation Voltage Mechanical Mounting Dimensions

Termination Environmental Operating/Storage

Temperature Weight

ations

Analog circuitry 0.05 - 300s in 5 adjustable ranges or fixed $\pm 2\%$ or 20ms, whichever is greater Adjustable: guaranteed range Fixed: $\pm 10\%$ After timing - $\le 16ms$; During timing - 0.1% of max. time delay or 75ms, whichever is greater

 $\leq \pm 10\%$

24 or 110VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz 2.25W

Electromechanical relay DPDT, Isolated 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1x10⁷; Electrical - 1x10⁶

DC units are reverse polarity protected ${\geq}1500V~RMS$ input to output

Surface mount with four #6 (M3.5 x 0.6) screws H 53.8 mm (2.12"); W 93.7 mm (3.69"); D 47.8 mm (1.88") 0.25 in. (6.35 mm) male quick connect terminals

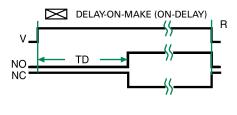
-20° to 65°C / -30° to 85°C ≅ 2.7 oz (77 g)

Selection Guide

	R _T Selection Chart				
	Desired Time Delay*				B-
		Second	S		
1	2	3	4	5	Megohm
0.05	0.5	0.6	1.2	3.0	0.0
0.5	5.0	10	20	50	0.5
1.0	10	20	40	100	1.0
1.5	15	30	60	150	1.5
2.0	20	40	80	200	2.0
2.5	25	50	100	250	2.5
3.0	30	60	120	300	3.0

 * When selecting an external RT add at least 20% for tolerance of unit and the RT.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset \rightarrow / \rightarrow = Undefined Time

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PRLM SERIES



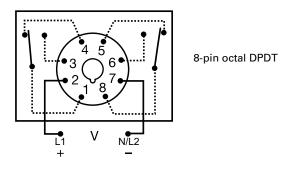






8-PIN

Wiring Diagram



For dimensional drawing see: Appendix B, page 512, Figure 24

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
PRLM41180	120VAC	Fixed	180s
PRLM423	120VAC	Adjustable	1 - 60s

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Description

The PRLM Series is designed for use in non-critical timing applications. It offers low cost, knob adjustable timing control, full 10A relay output, and onboard LED indication. The knob adjustment provides a guaranteed time range of up to 10 minutes in 6 ranges. The onboard LED indicates whether or not the unit is timing (flashing LED) as well as the status of the output.

Operation (Delay-on-Make)

The time delay is initiated when input voltage is applied. LED flashes during timing. At the end of the delay period, the output contacts energize. LED is on steady after the unit times out.

Reset: Reset is accomplished by removal of input voltage. There is no false output when reset during timing.

Features & Benefits

FEATURES	BENEFITS
Electronic circuitry with electromechanical relay	Repeat Accuracy + / - 2%
Knob adjustable time delay	Guaranteed time range of up to 10 mins in 6 ranges
Isolated 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
LED indication	Provides relay status both during and after timing
Industry standard octal plug connection	Eliminates need for special connectors

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



PSC8 Hold-down Clips Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

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PRLM SERIES

Time Delay Relays Dedicated — Delay-on-Make

Specifications

Time Delay Type Range Repeat Accuracy Tolerance

Reset Time Recycle Time

Time Delay vs Temp.

& Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 110 to 240VAC/DC AC Line Frequency Power Consumption Output Type Form

Life

Rating

Protection

Surge Isolation Voltage Insulation Resistance Polarity Indication Type Operation

Mechanical

Mounting Dimensions

Termination Environmental Operating/Storage Temperature Weight

5

Analog circuitry 0.05 - 600s in 6 adjustable ranges or fixed ±2% or 20ms, whichever is greater Knob adjust: guaranteed range Fixed: ±10% ≤ 50ms After timing: ≤ 20ms During timing: 0.1% of max. time delay or 75ms, whichever is greater

 $\leq \pm 10\%$

12, 24, or 110VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz ≤ 2.25W

Electromechanical relay Isolated, DPDT 10A resistive @ 28VDC; 10A resistive @ 240VAC; 1/3 hp @ 120/240VAC Mechanical - 1x10⁷; Electrical - 1x10⁶

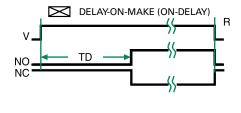
 $\begin{array}{l} \mbox{IEEE C62.41-1991 Level A} \\ \ge 1500V \mbox{ RMS input to output} \\ \ge 100 \mbox{ M}\Omega \\ \mbox{DC units are reverse polarity protected} \end{array}$

LED During timing - flashing Output energized - on steady

Plug-in socket H 91.6 mm (3.62"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Octal 8-pin plug-in

-20° to 65°C / -30° to 85°C ≅ 6 oz (170 g)





V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\overrightarrow{}$ = Undefined Time

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Time Delay Relays

Dedicated — Delay-on-Make

TDM / TDMH / TDML SERIES

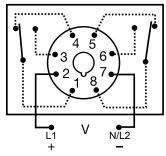
Delay-on-MakeTimer





8-PIN

Wiring Diagram



Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 23.

Ordering Information

•		
MODEL	INPUT VOLTAGE	DELAY RANGE
TDM120AL	120VAC	1 - 1023s in 1s increments
TDM12DL	12VDC	1 - 1023s in 1s increments
TDM230AL	230VAC	1 - 1023s in 1s increments
TDM24AL	24VAC	1 - 1023s in 1s increments
TDM24DL	24VDC/28VDC	1 - 1023s in 1s increments
TDMH120AL	120VAC	10 - 10230s in 10s increments
TDMH24AL	24VAC	10 - 10230s in 10s increments
TDML110DL	110VDC	0.1 - 102.3s in 0.1s increments
TDML120AL	120VAC	0.1 - 102.3s in 0.1s increments
TDML12DL	12VDC	0.1 - 102.3s in 0.1s increments
TDML24DL	24VDC/28VDC	0.1 - 102.3s in 0.1s increments
10 1 10 0 101	1 11 6	

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Applied Answers Delivered

*8-pin models UL listed when used in combination with P1011-6 socket only.

Description

The TDM/TDMH/TDML Series is a delay-on-make timer that combines accurate digital circuitry with isolated, DPDT relay contacts in an industry standard 8-pin plug-in package. DIP switch adjustment allows precise selection of the time delay over the full time delay range. The TDM/TDMH/TDML Series is the product of choice for custom control panel and OEM designers.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output relay energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Wide delay range (0.1s to 2.8h)	User selectable via DIP switches for fine tuning to individual applications.
Microcontroller based	Repeat Accuracy + / - 0.1%
DIP switch adjustment	Provides first time setting accuracy of +/-2%
Setting accuracy +/-2%	Provides flexibility for use in most applications
LED indication	Provides visual indication of time delay status
Isolated 10A, DPDT output contacts	Allows control of loads for AC or DC voltages

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



PSC8 or PSC11 Hold-down Clips Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in sets of two.



P1011-6 Octal Socket for UL listing* 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC.

C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

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TDM / TDMH / TDML SERIES

Digital integrated circuitry

1 - 1023s in 1s increments 10 - 10,230s in 10s increments

≤ 50ms

±2%

de-energized

-15% - 20%

-20% - 10%

Electromechanical relay

1/3 hp @ 120/240VAC

50/60 Hz

≤ 2.25W

DPDT

0.1 - 102.3s in 0.1s increments

±0.1% or 20ms, whichever is greater

±2% or 50ms, whichever is greater

During Timing - TDMH: ≤ 500ms

LED glows during timing; relay is

12, 24, or 110 VDC; 24, 120, or 230VAC

10A resistive @ 120/240VAC & 28VDC;

Mechanical - 1 x107; Electrical - 1 x 106

DC units are reverse polarity protected

H 81.3 mm (3.2"); **W** 60.7 mm (2.39");

≥ 1500V RMS input to output

TDM, TDML: ≤ 300ms

Specifications

Time Delay Type Range*

Repeat Accuracy Setting Accuracy Reset Time Recycle Time

Time Delay vs. Temperature & Voltage Indicator

Input

Voltage Tolerance 12VDC & 24VDC/AC 110VAC/DC to 230VAC AC Line Frequency Power Consumption Output

Type Form Rating

Life

Protection Polarity Isolation Voltage Mechanical Mounting Dimensions

Termination Environmental

Operating/Storage Temperature Weight

-20° to 65°C / -30° to 85°C ≅ 6 oz (170 g)

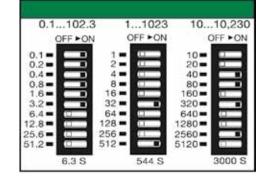
*For CE approved applications, power must be removed from the unit when a switch position is changed.

Plug-in socket

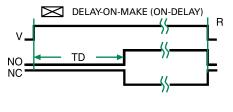
D 45.2 mm (1.78")

Octal 8-pin plug-in

Binary Switch Operation



Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $-\frac{1}{100} = Undefined$ Time



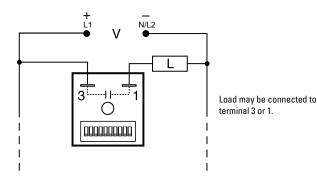
TDU / TDUH / TDUL SERIES

Encapsulated Solid-State, **Delay-on-MakeTimers**

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	TIME RANGE (SEC)
TDUL3000A	24 to 120VAC/DC	0.1-102.3
TDUL3001A	100 to 240VAC/DC	0.1-102.3
TDU3000A	24 to 120VAC/DC	1-1023
TDU3001A	100 to 240VAC/DC	1-1023
TDU3003A	120 to 277VC/DC	1-1023
TDUH3000A	24 to 120VAC/DC	10-10230
TDUH3001A	100 to 240VAC/DC	10-10230

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Description

The TDU Series are encapsulated solid-state, delay-on-make timers that combine digital timing circuitry with universal voltage operation. The TDU offers DIP switch adjustment allowing accurate selection of the time delay over the full time delay range. This series is an excellent choice for process control systems and OEM equipment.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Universal input voltage	Meets wide application needs	
Microcontroller based	Repeat Accuracy +/- 0.5% or 20ms, whichever is greater	
Totally solid state and encapsulated	No moving parts to arc and wear out over time, and encapsulated to protect against shock, vibration, and humidity	
3 time ranges available (0.1s to 2.8h)	Makes it versatile for use in many applications	
DIP switch adjustment	Provides first time setting accuracy	

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.









P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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TDU / TDUH / TDUL SERIES

Specifications

Time Delay Туре Range*

Repeat Accuracy Tolerance (Factory Calibration) **Recycle Time** Time Delay vs Temp. & Voltage Input Voltage **AC Line Frequency** Tolerance Output Type Form **Maximum Load Current Minimum Holding Current Voltage Drop** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

Digital integrated circuitry 0.1 - 102.3s in 0.1s increments 1 - 1.023s in 1s increments 10 - 10.230s in 10s increments ±0.5% or 20ms, whichever is greater

±10% ≤ 150ms

±5%

24 to 120VAC/DC; 100 to 240VAC/DC 50/60 Hz ±20%

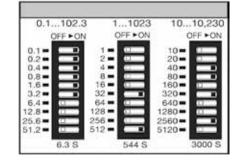
Solid state NO, open during timing 1A steady state, 10A inrush at 60°C 40mA ≅ 2.5V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface ≥100 MΩ

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

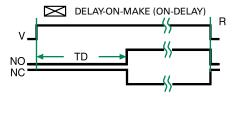
-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

Binary Switch Operation



*For CE approved applications, power must be removed from the unit when a switch position is changed.

Function Diagram



V = Voltage NO = Normally**Open Contact** NC = Normally**Closed Contact** TD = Time Delay R = Reset Time

TIME DELAY RELAYS

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Time Delay Relays Dedicated — Delay-on-Make

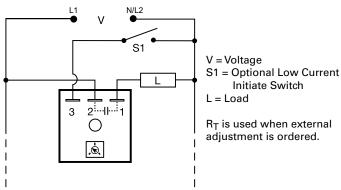


TH1 SERIES





Wiring Diagram



| = | oadR_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

MODEL	OUTPUT RATING	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TH1B633	10A	230VAC	Onboard	2 - 180s
TH1C415	20A	120VAC	Fixed	5s
TH1C621	20A	230VAC	External	0.1 - 3s

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Description

The TH1 Series is a solid-state relay and timer combined into one compact, easy-to-use control. This highly reliable device eliminates the need for a separate solid-state relay. When mounted to a metal surface, it can switch load currents up to 20A steady state, and 200A inrush.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 2%, Factory calibration + / - 5%
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps, and heaters directly without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer for high current applications

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male guick connect terminals.

www.littelfuse.com/th1

TH1 SERIES

Specifications

Time Delay

Range **Repeat Accuracy** Tolerance (Factory Calibration) Time Delay vs Temp. & Voltage **Recycle Time** Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Туре Form **Maximum Load Currents**

Minimum Load Current Voltage Drop OFF State Leakage Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions

Termination Environmental

Operating/Storage Temperature Humidity Weight

0.1 - 600s in 4 adjustable ranges or fixed ±2% or 20ms, whichever is greater

≤ ± 5% ≤ ±10% ≤ 150ms

24, 120, or 230VAC ±15% 50/60 Hz ≤ 2VA

Solid state

NO, open during timing				
Output	Steady State	Inrush*		
A	6A	60A		
В	10A	100A		
С	20A	200A		
100mA				
≅ 2.5V at ra	ted current			
≃ 5mA @ 230VAC				

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 3.9 oz (111 g)

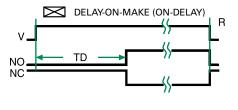
**Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

Selection Guide

R _T Selection Chart				
Desired Time Delay*			Вт	
	Sec	conds		
1	2	3	4	Kohms
0.1	0.5	2	5	0
0.3	6	20	60	10
0.6	12	38	120	20
0.9	18	55	180	30
1.2	24	73	240	40
1.5	30	90	300	50
1.8	36	108	360	60
2.1	42	126	420	70
2.4	48	144	480	80
2.7	54	162	540	90
3.0	60	180	600	100

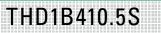
* When selecting an external R_T add at least 15% for tolerance of unit and the R_T .

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\overrightarrow{}$ = Undefined Time

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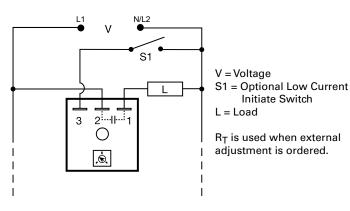




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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The THD1B410.5S combines accurate timing circuitry with high power solid-state switching. It can switch motors, lamps, and heaters directly without a contactor. You can reduce labor, component cost, and increase reliability with these small, easy-to-use, timers.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 1%
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps, and heaters directly without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer for high current applications

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide



strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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THD1B410.5S

Time Delay Relays Dedicated — Delay-on-Make

Inrush**

60A

100A

200A

0.1s - 1000m in 6 adjustable ranges or fixed

Steady State

6A

10A

20A

 \geq 2000V RMS terminals to mounting surface

Surface mount with one #10 (M5 x 0.8) screw

0.25 in. (6.35 mm) male quick connect terminals

H 50.8 mm (2.0"); **W** 50.8 mm (2.0");

±0.5% or 20ms, whichever is greater

 $\leq \pm 1\%$

 $\leq \pm 2\%$

±20%

50/60 Hz $\leq 2VA$

Solid state

Output

А В

С

Encapsulated

≥ 100 MΩ

100mA

24, 120, or 230VAC

NO, open during timing

≤ 2.5V @ rated current

≅ 5mA@230VAC

≤ 150ms

Specifications

Time Delay

Range
Repeat Accuracy
Tolerance
(Factory Calibration)
Recycle Time
Time Delay vs Temp.
& Voltage
Input
Voltage
Tolerance
Line Frequency
Power Consumption
Output
Туре
Form
Maximum Load Current

Minimum Load Current Voltage Drop **OFF State Leakage Current** Protection Circuitry **Dielectric Breakdown Insulation Resistance Mechanical** Mounting ** Dimensions

Termination Environmental

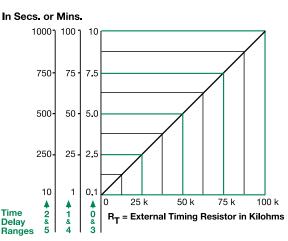
Operating/Storage Temperature Humidity Weight

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 3.9 oz (111 g)

D 38.4 mm (1.51")

**Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

External Resistance vs. Time Delay

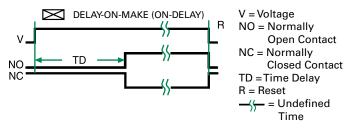


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases

When selecting an external $R_{T_{\rm i}}$ add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram





TMV8000 / TSU2000 SERIES

Universal Voltage Delay-on-MakeTimer



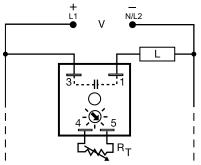




TSU2000

Wiring Diagram

TMV8000



Load may be connected to terminal 3 or 1.

TMV has knob adjustment.

TSU has external adjustment terminals 4 & 5.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TMV8000	24 to 240VAC/DC	Onboard	0.1 - 8m
TSU2000	24 to 240VAC/DC	External	5 - 480s

If you don't find the part you need, call us for a custom product 800-843-8848



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Description

The TMV and TSU Series are universal voltage delay-on-make timers. Two models cover all the popular voltages and time delays. Available with knob or external adjust time delay. Its simple two terminals can easily be connected in series with a relay coil, contactor coil, solenoid, lamps, small motor, etc., to delay their energization, prevent short cycling or to sequence on various loads.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Universal AC/DC operating voltage	Provides flexibility for use in all systems
Totally solid-state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Two terminal series connection with the load	Provides quick and easy installation for new or existing systems
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions

Accessories



P1004-95, P1004-95-X Versa-Pot

P1023-6 Mounting bracket

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

IENT TIME DELAY





TMV8000 / TSU2000 SERIES

Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

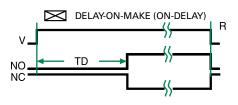
Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Selection Guide

R _T Selection Chart	
Time [Delay*
Seconds	RT
oooonao	Megohm
5	0.0
85	0.5
163	1.0
240	1.5
320	2.0
400	2.5
480	3.0

When selecting an external R_T add at least 20% for tolerance of unit and the R_T.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset \rightarrow = Undefined Time

Specifications

Time Delay Type Range

Repeat Accuracy Tolerance (Factory Calibration) **Reset Time** Input Voltage **AC Line Frequency** Output Type Form **Maximum Load Current Minimum Holding Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical Mounting Dimensions

Termination Environmental Operating/Storage Temperature Humidity Weight Analog circuitry 5 - 480s (TSU2000) 0.1 - 8m (TMV8000) ±2%

≤ ±10% ≤ 100ms

24 to 240VAC/DC ±20% 50/60 Hz

Solid State NO, open during timing 1A steady state, 10A inrush at 55°C ≤ 40mA ≅ 2.5V @ 1A

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 70°C / -30° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

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Time Delay Relays Dedicated — Delay-on-Make



TRM SERIES





8-PIN



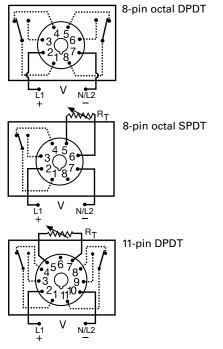
V = Voltage

R_T is used when

external adjustment is ordered. Relay

contacts are isolated.

Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 24.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	OUTPUT	TIME TOLERANCE	TIME DELAY
TRM120A2X30	120VAC	Knob	Octal, DPDT	+/- 20%	1 - 30s
TRM120A2Y120	120VAC	Knob	Octal, DPDT	+/- 10%	2 - 120s
TRM120A2Y180	120VAC	Knob	Octal, DPDT	+/- 10%	2 - 180s
TRM24A8Y5	24VAC	External	Octal, SPDT without potentiometer	+/- 10%	0.1 - 5s
TRM24D1X10	24VDC/28VDC	Fixed	Octal, DPDT	+/- 20%	10s
TRM24D1X2	24VDC/28VDC	Fixed	Octal, DPDT	+/- 20%	2s
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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

C E 🖌 🕀 🕪 *8-pin models UL listed when used in

combination with P1011-6 socket only.

Description

The TRM Series is a combination of analog electronic circuitry and electromechanical relay output. It provides input to output isolation with a wide variety of input voltages and time ranges. Standard plug-in base wiring, fast reset, rugged enclosure, and good repeat accuracy make the TRM a select choice in any OEM application.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output relay energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Electronic circuitry with electromechanical relay	Repeat Accuracy + / - 2%
Isolated 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages.

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



NDS-11 11-pin Socket

11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.

PSC8 or PSC11 Hold-down Clips



Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in sets of two.





TRM SERIES

Accessories



P1011-6 Octal Socket for UL listing* 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC.



P1004-13, P1004-13-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

Selection Guides

R _T Selection Chart					
Time Delay*					
Range	RT				
Seconds	Megohm				
0.051	1.0				
0.052	2.0				
0.053	3.0				
0.15	5.0				
0.110	3.0				
130	1.5				
160	3.0				
2120	2.0				
2180	3.0				
7240	1.5				
7300	2.0				
7360	2.0				
7420	3.0				
7480	3.0				
7600	5.0				

External R _T P/	N Selection Table
VALUE	PART NUMBER
1M ohm	P1004-16
1.5M ohm	P1004-15
2M ohm	P1004-14
3M ohm	P1004-12
5M ohm	P1004-13
1M ohm	P1004-16-X
1.5M ohm	P1004-15-X
2M ohm	P1004-14-X
3M ohm	P1004-12-X
5M ohm	P1004-13-X

 * When selecting an external RT add at least 15...30% for tolerance of unit and the RT.

Function Diagram



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NO TD SALE (ON-DELAY)

V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\overrightarrow{}$ = Undefined Time

Specifications

Time Delay Type Range Repeat Accuracy Fixed Time Tolerance & Setting Accuracy Reset Time Recycle Time

Time Delay vs Temp. & Voltage Input Voltage Tolerance 24VDC/AC 110 to 230VAC/DC AC Line Frequency Power Consumption Output Type Form Rating

Life Protection Isolation Voltage

Insulation Resistance Polarity Mechanical Mounting Dimensions

Termination Environmental

Operating/Storage Temperature Weight Analog circuitry 50ms - 10m in 15 adjustable ranges or fixed ±2% or 20 ms, whichever is greater

±5, 10, or 20% < 50ms After timing: < 20ms During timing: 0.1% of max. time delay or 75ms, whichever is greater

≤±10%

24 or 110VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz ≤ 2.25W

Electromechanical relay Isolated DPDT or SPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁶

 \geq 1500V RMS between input & output terminals \geq 100 M Ω DC units are reverse polarity protected

Plug-in socket **H** 91.6 mm (3.62"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78") Octal 8-pin or 11-pin plug-in

-20° to 65°C / -30° to 85°C ≅ 6 oz (170 g)

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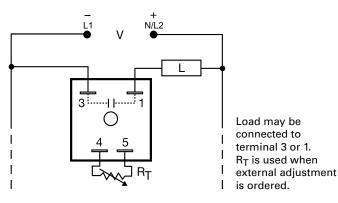
TS1 SERIES

Delay-on-MakeTimer

(**EN**)



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL INPUT VOLTAGE ADJUSTMENT TIME DELAY MODEL INPUT VOLTAGE ADJUSTMENT TIME DELAY 24VAC Fixed TS1412 120VAC 2s TS1211.5 1.5s Fixed TS121150 24VAC Fixed 150s TS14120 120VAC Fixed 20s TS12130 24VAC Fixed 30s TS14130 120VAC Fixed 30s TS1214 24VAC TS1415 120VAC Fixed 4s Fixed 5s TS12190 24VAC Fixed 90s 120VAC 6s TS1416 Fixed TS1221 24VAC External 0.05 - 3s TS1421 120VAC External 0.05 - 3s TS1222 24VAC External 0.5 - 60s TS1422 120VAC External 0.5 - 60s 24VAC 5 - 600S 120VAC External TS1224 External TS1423 2 - 180s TS13115 24VDC Fixed 15s TS1424 120VAC External 5 - 600s 2s TS1321 24VDC External 0.05 - 3s TS1612 230VAC Fixed TS1410.25 120VAC Fixed 0.25s TS1615 230VAC Fixed 5s TS14110 120VAC Fixed 10s TS1621 230VAC External 0.05 - 3s 120VAC TS141180 Fixed 180s TS1622 230VAC External 0.5 - 60s

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12

TIME DELAY RELAYS

Description

The TS1 Series offers proven reliability and performance with years of use in OEM equipment and commercial applications. This encapsulated general use timing module is capable of controlling load currents ranging from 5mA to 1A. May be connected in series with contactors, relays, valves, solenoids, small motors, and lamps.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat Accuracy +/-2%
Fixed or external adjustable time delay	External time delay settings are adjustable from 0.05s - 10m in 8 ranges for added flexibility
5mA to 1A load current range	Minimum holding current of 5mA ensures proper operation with the lightest of loads
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Two terminal series load connections	Allows connection in series with contactors, relays, valves, solenoids, small motors and lamps. Provides quick and easy installation for new or existing systems



TS1 SERIES

Accessories



P1004-XX, P1004-XX-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female t

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

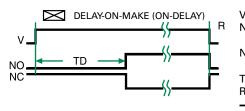


VTP(X)(X) Plug-on Adjustment Module Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in resistance values from $5K\Omega$ to $5M\Omega$.

Selection Table for VTP Plug-on Adjustment Accessory

All Other Voltages		12VDC			
Time Delay VTP P/N		Time Delay	VTP P/N		
1 - 0.05-3s	VTP4B	1 - 0.05-1s	VTP2A		
2 - 0.5-60s	VTP4F	2 - 0.5-20s	VTP2E		
3 - 2-180s	VTP4J	3 - 2-60s	VTP2F		
4 - 5-600s	VTP5N	4 - 5-120s	VTP2H		

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset \neg / \neg = Undefined Time

Specifications

Time Delay Type Range 12VDC

Other Voltages Repeat Accuracy Tolerance (Factory Calibration) Recycle Time

Time Delay vs. Temperature & Voltage Input Voltage Tolerance **AC Line Frequency** Output Type Form **Maximum Load Current Minimum Holding Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination Environmental Operating/Storage Temperature Humidity Weight

Selection Chart

R _T Selection Chart							
Des	ired Ti	me De	lay*	B-			
	Sec	conds		1.1			
1	2	3	4	Megohm			
0.05	0.5	2	5	0.0			
0.5	10	30	60	0.5			
1.0	20	60	120	1.0			
•	24VD0	C or AC	ONLY†	•			
1.5	30	90	180	1.5			
2.0	40	120	240	2.0			
2.5	50	150	300	2.5			
3.0	60	180	360	3.0			
			420	3.5			
			480	4.0			
			540	4.5			
			600	5.0			

 When selecting an external R_T add at leas 20% for tolerance of unit and the R_T.
 1 Megohm max for 12 VDC Units

 $\begin{array}{l} 0.05 - 120s \mbox{ in 4 adjustable ranges or fixed} \\ (1 \ M\Omega \mbox{ max}. \mbox{ } R_T \mbox{)} \\ 0.05 - 600s \mbox{ in 4 adjustable ranges or fixed} \\ \pm 2\% \mbox{ or 20ms, whichever is greater} \end{array}$

 $\leq\pm10\%$ After timing $-\leq16ms$ During timing -0.1% of time delay or 75ms, whichever is greater

≤ ±10%

12, 24 or 120VDC; 24, 120, or 230VAC ±20% 50/60 Hz

Solid state NO, open during timing 1A steady state, 10A inrush at 60°C 5mA ≅ 2.5V @ 1A

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 80°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

12 TIME DELAY RELAYS



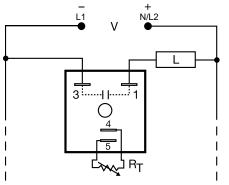
TSD1 SERIES

Delay-on-MakeTimer

(€¶\®



Wiring Diagram



Load may be connected to terminal 3 or 1.

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TSD1311.2S	24VDC	Fixed	1.2s
TSD1321	24VDC	External	1 - 100s
TSD1424	120VAC	External	1 - 100m

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Description

The TSD1 Series is designed for more demanding commercial and industrial applications where small size and accurate performance is required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.1% of the time delay. The TSD1 Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 100 hours are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1%, + / -1% time delay accuracy
Extended temperature range	Rated to 75°C operating temperature to withstand high heat applications.
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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TSD1 SERIES

Accessories



C103PM (AL) DIN Rail

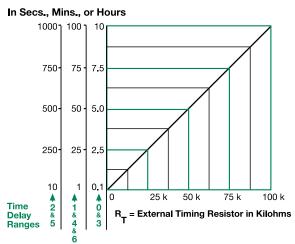
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

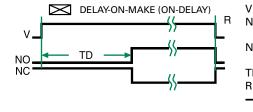


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external R_T , add the tolerances of the timer and the R_T for the full time range adjustment. Examples: 1 to 50 S adjustable time delay, select time delay range 1 and

Kohm R⊤ For 1 to 100 S use a 100 K ohm R1

Function Diagram



V = Voltage NO = Normally **Open Contact** NC = Normallv**Closed Contact** TD = Time Delay R = Reset = Undefined Time

Specifications

Time Delay

Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time Time Delay vs. Temperature** & Voltage Input Voltage Tolerance **AC Line Frequency** Output Type Form Maximum Load Current **Minimum Holding Current Off State Leakage Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

0.1s - 100h in 7 adjustable ranges or fixed ±0.1% or 20ms, whichever is greater

≤ ±1% ≤ 150ms

≤ ±1%

12, 24, 120VDC; 24, 120, 230VAC ±20% 50/60 Hz

Solid state NO, open during timing 1A steady state, 10A inrush at 60°C $\leq 40 \text{mA}$ ≃ 7mA @ 230VAC ≃ 2.5V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface ≥ 100 MΩ DC units are reverse polarity protected

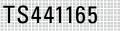
Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

12

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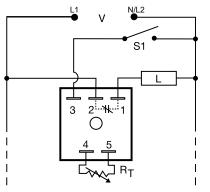




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Wiring Diagram



V = Voltage S1 = Initiate Switch L = Load

 R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The TS441165 is an analog delay-on-make timer with a normally closed solid-state output. Unlike an interval timer, the load is energized prior to and during the time delay period. It can be used as a faster starting interval time delay when S1 is closed upon application of input voltage.

Operation (Delay-on-Make NC)

Upon application of input voltage, the load is energized immediately. When the initiate switch is closed, the time delay begins. At the end of the time delay, the load de-energizes.

Reset: When the initiate switch is reopened, the load again energizes and the time delay is reset. Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat Accuracy + / - 2%
Compact, low cost design	Allows flexibility for OEM applications
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Load energized prior to and during time delay	Faster operation
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Normally closed output	Can be used as a faster starting interval time delay

Accessories



P1004-XX, P1004-XX-X Versa-Pot

P1023-6 Mounting bracket

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.





installation/removal of modules quick and easy.
P0700-7 Versa-Knob

The 90° orientation of mounting slots makes



Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modulos with 0.25 in (6.35 mm) male quick

all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

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www.littelfuse.com/ts441165



Accessories

TS441165



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



VTP(X)(X) Plug-on Adjustment Module Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in resistance values from $5K\Omega$ to $5M\Omega$.

Selection Table for VTP Plug-on Adjustment Accessory

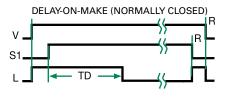
Time Delay	VTP P/N
1 - 0.05-3s	VTP4B
2 -0.5-60s	VTP4F
3 - 2-180s	VTP4J
4 - 5-600s	VTP5N

Selection Guide

R _T Selection Chart					
Des	B-				
	Sec	conds			
1	2	3	4	Megohm	
0.05	0.5	2	5	0.0	
0.5	10	30	60	0.5	
1.0	20	60	120	1.0	
1.5	30	90	180	1.5	
2.0	40	240	2.0		
2.5	50	150	300	2.5	
3.0	60	180	360	3.0	
			420	3.5	
			480	4.0	
			540	4.5	
			600	5.0	
* Whon o	alaatina	on ovtorr	al P- ac	ld at looo	

When selecting an external R_T add at least 20% for tolerance of unit and the R_T.

Function Diagram



V = Voltage S1 =Initiate Switch L = Load TD = Time Delay R = Reset \longrightarrow = Undefined Time

Specifications

Time Delay Type Range Adjustment

Repeat Accuracy

Tolerance (Factory Calibration) Time Delay vs Temp. & Voltage **Recycle Time** Input Voltage Tolerance **AC Line Frequency** Output Туре Form **Maximum Load Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance Mechanical** Mounting Dimensions

Termination Environmental

Operating/Storage Temperature Humidity Weight Analog circuitry 165s Fixed ±2% or 20ms, whichever is greater; under fixed conditions

≤ ±10% ≤ ±10% ≤ 150ms

> 120VAC ±20% 50/60 Hz

Solid state NC, closed during timing 1A steady state, 10A inrush at $60^{\circ}C \approx 2.5V @ 1A$

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 $M\Omega$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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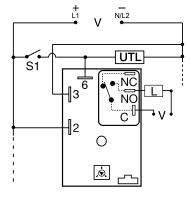
HRDB SERIES

Delay-on-BreakTimer

$C \in \mathbf{A}$



Wiring Diagram



V = Voltage S1 = Initiate Switch L = Timed Load UTL = Untimed Load (optional) NO = Normally Open

C = Common, Transfer Contact

NOTE: A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered. Relay contacts are isolated. Dashed lines are internal connections. The untimed load is optional.

For dimensional drawing see: Appendix, page 512, Figure 17.

Description

The HRDB Series combines an electromechanical, relay output with microcontroller timing circuitry. The HRDB offers 12 to 230V operation in five options and factory fixed, external, or onboard adjustable time delays with a repeat accuracy of ±0.5%. The isolated output contact rating allows for direct operation of heavy loads, such as compressors, pumps, blower motors, heaters, etc. The HRDB is ideal for OEM applications where cost is a factor.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%
Compact, low cost design	Allows flexibility for OEM applications
Isolated, 30A, SPDT, NO output contacts	Allows direct operation of heavy loads: compressors, pumps, blower moters, heaters.

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME TOLERANCE	TIME DELAY	MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME TOLERANCE	TIME DELAY
HRDB1110M	12VDC	Fixed	+/-5%	10m	HRDB223	24VAC	Onboard	+/-5%	0.1 - 10m
HRDB117S	12VDC	Fixed	+/-5%	7s	HRDB321	24VDC	Onboard	+/-5%	1 - 100s
HRDB120	12VDC	Onboard	+/-5%	0.1 - 10s	HRDB324	24VDC	Onboard	+/-5%	1 - 100m
HRDB121	12VDC	Onboard	+/-5%	1 - 100s	HRDB423	120VAC	Onboard	+/-5%	0.1 - 10m
HRDB124	12VDC	Onboard	+/-5%	1 - 100m	HRDB623	230VAC	Onboard	+/-5%	0.1 - 10m
HRDB21A65M	24VAC	Fixed	+/-1%	65m					

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HRDB SERIES

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick



connect terminals. C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in.

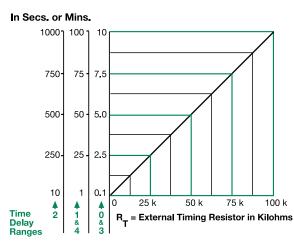
(91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN

External Resistance vs. Time Delay



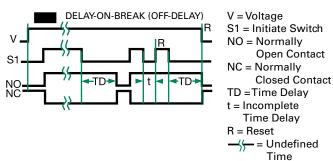
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external RT, add the tolerances of the timer and the RT or the full time range adjustment

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



Specifications

Time Delay Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **12VDC & 24VDC** 24 to 230VAC **AC Line Frequency Power Consumption** Output Туре Form Ratings **General Purpose** Resistive

Motor Load

Life

- Protection Surge Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions
- **Termination Environmental Operating/Storage** Temperature Humidity Weight

Microcontroller circuitry 0.1s - 100m in 5 adjustable ranges or fixed ±0.5 % or 20ms, whichever is greater

±1%, ±5% ≤ 150ms ≤ 20ms

±2%

12 or 24VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz $AC \le 4VA; DC \le 2W$

Electromechanical relay Isolated, SPDT

	SPDT-NO	SPDT-NC					
125/240VAC	30A	15A					
125/240VAC	30A	15A					
28VDC	20A	10A					
125VAC	1 hp*	1/4 hp**					
240VAC	2 hp**	1 hp**					
Mechanical - 1	x 10 ⁶ ;						
Electrical - 1 x 10 ⁵ , *3 x 10 ⁴ , **6,000							

IEEE C62.41-1991 Level A Encapsulated ≥ 2000V RMS terminals to mounting surface \geq 100 M Ω DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 38.1 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 3.9 oz (111 g)

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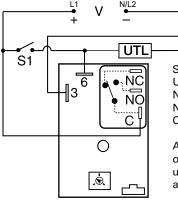


 $C \in \mathbb{R}$

HRPS / HRIS SERIES



Wiring Diagram

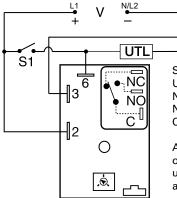


HRPS Relay contacts are

non-isolated.

S1 = Initiate Switch UTL = Untimed Load (optional) NO = Normally Open NC = Normally Closed C = Common

A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered.



HRIS

Relay contacts are isolated.

S1 = Initiate Switch UTL = Untimed Load (optional) NO = Normally Open NC = Normally Closed C = Common

A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered.

Description

The HRPS/HRIS Series combines an electromechanical relay output with microcontroller timing circuitry. It is a factory programmed module available in any 1 of 13 standard functions. It offers 12 to 240V operation in two universal ranges and factory fixed, onboard, or external adjustable time delays with a repeat accuracy of $\pm 0.5\%$. The output contact rating allows for direct operation of heavy loads, such as compressors, pumps, blower motors, heaters, etc. This series is ideal for OEM applications where cost is a factor. The HRPS has non-isolated SPDT relay contacts, and the HRIS has isolated SPDT relay contacts. Both offer the most popular timer functions in the industry.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output (relay or solid state) energizes during the time delay. At the end of time delay the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5% , factory calibration +/- 2%
Compact design	Allows flexibility for OEM applications
30A, SPDT, Normally Open output contacts	Allows for direct operation of heavy loads
Encapsulated	Protects against shock, vibration, and humidity

Ordering Information

MODEL	INPUT VOLTAGE	ADJUST.	TIME DELAY	FUNCTION
HRISW21FT	24 - 240VAC/24 - 110VDC	Onboard	0.1 - 10s	Alternating
HRISW27I	24 - 240VAC/24 - 110VDC	Onboard	0.1 - 10h	Interval
HRPSD12HI	12 - 48VDC	Fixed	2h	Interval
HRISW25B	24 - 240VAC/24 - 110VDC	Onboard	1 - 100m	Delay on break

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For dimensional drawing see: Appendix, page 512, Figure 17.



HRPS / HRIS SERIES

Accessories



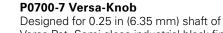
P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16), P1015-13 (AWG 10/12) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male guick connect terminals.



C103PM (AL) DIN Rail

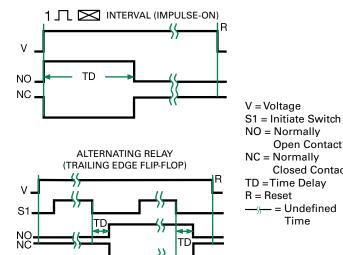
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

Function Diagrams



Specifications Time Delay

Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Initiate Time Time Delay vs Temp. & Voltage Input Voltage Tolerance 12 to 48VDC 24 to 110VDC/240VAC **AC Line Frequency Power Consumption** Output Type Form Ratings **General Purpose** 125/240VAC Resistive 125/240VAC **28VDC** Motor Load 125VAC 240VAC Life

- Protection
- Surge Circuitry **Isolation Voltage Insulation Resistance** Polarity Mechanical Mounting Dimensions

Termination **Environmental Operating/Storage** Temperature

Humidity Weight

Microcontroller circuitry 0.1s - 1000h in 9 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

±2% ≤ 150ms ≤ 20ms

±2%

12 to 48VDC; 24 to 240VAC/24 to 110VDC

-15% - 20% -20% - 10% 50/60Hz $AC \le 4VA: DC \le 2W$

Electromechanical relay SPDT SPDT-NO SPDT-NC

30A 30A 20A

1/4 hp** 1 hp* 2 hp** 1 hp** Mechanical - 1 x 106 Electrical - 1 x 105, *3 x 104, **6,000

15A

15A

10A

IEEE C62.41-1991 Level A Encapsulated ≥ 1500V RMS input to output; isolated units $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mt. with one #10 (M5 x 0.8) screw **H** 76.2 mm (3.0"); **W** 50.8 mm (2.0"); **D** 38.1 mm (1.5") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing $\approx 3.9 \text{ oz} (111 \text{ g})$

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Open Contact

Closed Contact

- = Undefined

Time

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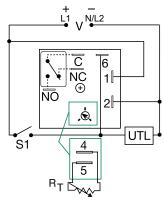
KRDB SERIES



$C \in \mathfrak{R}$



Wiring Diagram



V = Voltage

S1 = Initiate Switch C = Common, Transfer Contact NO = Normally Open

NC = Normally Closed

UTL = Untimed Load (optional)

A knob is supplied for adjustable units. The untimed load is optional. Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KRDB Series is a compact time delay relay measuring only 2 in. (50.8 mm) square. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRDB Series is a cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat accuracy + / - 0.5%, Factory calibration + / - 5%
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	To protect against shock, vibration, and humidity
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of

Versa-Pot. Semi-gloss industrial black finish.

Ordering Information

	MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY		MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
	KRDB110.1S	12VDC	Fixed	0.1s		KRDB31120S	24VDC	Fixed	20s
	KRDB112.5S	12VDC	Fixed	2.5s		KRDB415S	120VAC	Fixed	5s
	KRDB1120M	12VDC	Fixed	20m		KRDB4160S	120VAC	Fixed	60s
	KRDB115M	12VDC	Fixed	5m		KRDB420	120VAC	Onboard	0.1 - 10s
	KRDB120	12VDC	Onboard	0.1 - 10s		KRDB421	120VAC	Onboard	1 - 100s
	KRDB124	12VDC	Onboard	1 - 100m		KRDB422	120VAC	Onboard	10 - 1000s
	KRDB21180S	24VAC/DC	Fixed	180s		KRDB423	120VAC	Onboard	0.1 - 10m
	KRDB217S	24VAC/DC	Fixed	7s		KRDB424	120VAC	Onboard	1 - 100m

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KRDB SERIES

Time Delay Relays Dedicated — Delay-on-Break

Accessories



P1015-64 (AVVG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are



constructed with an insulator barrel to provide strain relief. P1015-18 Quick Connect to Screw Adapter

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

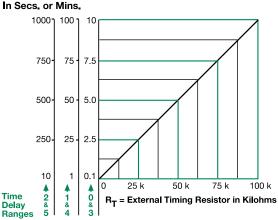


C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in.

(91.4 cm) length. P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

In Secs. or Mins.



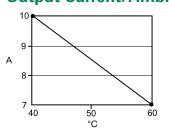
This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying

the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_{T} , add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Output Current/Ambient Temperature



Specifications

Time Delay Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 110VDC. 120 or 230VAC AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Туре Form Rating (at 40°C)

Max. Switching Voltage

Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination Environmental

Operating/Storage Temperature Humidity Weight

Microcontroller with watchdog circuitry 0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 5\%$ ≤ 150ms ≤ 40ms

 $\leq \pm 5\%$

12, 24, 110VDC; 24, 120 or 230VAC

-15% - 20% -20% - 10% $AC \le 2VA; DC \le 2W$

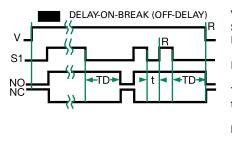
Isolated relay contacts SPDT 10A resistive @ 125VAC; 5A resistive @ 230VAC & 28VDC; 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105

Encapsulated ≥ 1500V RMS input to output $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 g)

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally**Open Contact** NC = Normally **Closed Contact** TD =Time Delay t = Incomplete Time Delay R = Reset = Undefined Time

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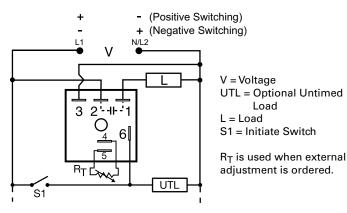


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KSDB SERIES



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSDB Series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable solid-state timer is required. The factory calibration for fixed time delays is within 5% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. This series is designed for popular AC and DC voltages. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output energizes if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat accuracy + / - 0.5% , Factory calibration + / - 5%
1A Steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Compact, low cost design	Allows flexibility for OEM applications

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE		MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
KSDB1110MP	12VDC	Fixed	10m	Positive		KSDB314SP	24VDC	Fixed	4s	Positive
KSDB1115SP	12VDC	Fixed	15s	Positive		KSDB315SP	24VDC	Fixed	5s	Positive
KSDB1120SP	12VDC	Fixed	20s	Positive		KSDB324N	24VDC	External	1 - 100m	Negative
KSDB113MP	12VDC	Fixed	3m	Positive		KSDB330N	24VDC	Onboard	0.1 - 10s	Negative
KSDB113SP	12VDC	Fixed	3s	Positive		KSDB4120M	120VAC	Fixed	20m	n/a
KSDB120P	12VDC	External	0.1 - 10s	Positive		KSDB4160S	120VAC	Fixed	60s	n/a
KSDB134P	12VDC	Onboard	1 - 100m	Positive		KSDB4190M	120VAC	Fixed	90m	n/a
KSDB2115S	24VAC	Fixed	15s	n/a		KSDB431	120VAC	Onboard	1 - 100s	n/a
KSDB220	24VAC	External	0.1 - 10s	n/a		KSDB61150S	230VAC	Fixed	150s	n/a
KSDB231	24VAC	Onboard	1 - 100s	n/a		KSDB631	230VAC	Onboard	1 - 100s	n/a

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TIME DELAY RELAYS

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KSDB SERIES

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in.

(91.4 cm) length.



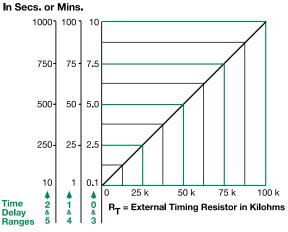
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TIME DELAY RELAYS

P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

External Resistance vs. Time Delay



This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases

When selecting an external R_{T} , add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn R_T . For 1 to 100 S use a 100 K ohm R_T .

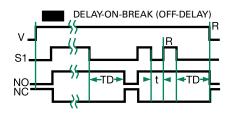
Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **Power Consumption** AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10 \%$ Output Type Form **Maximum Load Current OFF State Leakage Current Voltage Drop DC** Operation Protection Circuitry

Dielectric Breakdown Insulation Resistance Polarity Mechanical Mounting Dimensions

Termination Environmental **Operating/Storage** Temperature Humidity Weight

Function Diagram



V = VoltageS1 = Initiate Switch NO = Normally **Open Contact** NC = Normally **Closed Contact** TD =Time Delay t = Incomplete Time Delay R = Reset - = Undefined

0.1s - 1000m in 6 adjustable ranges or fixed

±0.5 % or 20ms, whichever is greater

12, 24, or 120VDC; 24, 120, or 230VAC

NO, closed before & during timing

AC≅ 5mA @ 230VAC; DC ≅ 1mA

AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A

Positive or negative switching

1A steady state, 10A inrush at 60°C

≥ 2000V RMS terminals to mounting surface

Surface mount with one #10 (M5 x 0.8) screw

0.25 in. (6.35 mm) male quick connect terminals

DC units are reverse polarity protected

H 50.8 mm (2.0"); **W** 50.8 mm (2.0");

 $\leq \pm 5\%$

≤ 150ms

≤ 20ms

 $\leq \pm 10\%$

+20%

Solid state

Encapsulated

D 30.7 mm (1.21")

≅ 2.4 oz (68 g)

-40° to 60°C / -40° to 80°C

95% relative, non-condensing

 $\geq 100 \text{ M}\Omega$

 $AC \le 2VA$: $DC \le 2W$

Time

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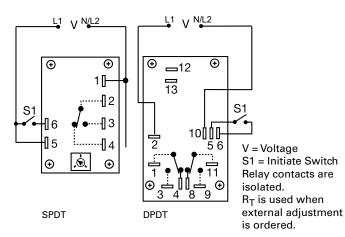


ORB SERIES





Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 26.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT FORM
ORB120A160	120VAC	Fixed	60s	SPDT
ORB120A25	120VAC	Onboard	3 - 300s	SPDT
ORB24A11D	24VAC	Fixed	1s	DPDT
ORB24A21D	24VAC	Onboard	0.05 - 3s	DPDT
ORB24A25	24VAC	Onboard	3 - 300s	SPDT

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Description

The ORB Series' open PCB construction offers the user good economy without sacrificing performance and reliability. The output relay is available in isolated, 10A, DPDT or SPDT forms. The time delay may be ordered as factory fixed, onboard knob, or external adjustment. All connections are 0.25 in. (6.35 mm) male quick connect terminals.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened (trailing edge triggered). The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Open PCB construction	Reduces cost for OEM applications	
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 10%	
Isolated, 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages	
Line voltage initiation	Separate control voltage is not required for operation	

Accessories



P1004-12, P1004-12-X Versa-Pot

P1015-64 (AWG 14/16)

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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ORB SERIES

Specifications

Time Delay

Туре Range **Repeat Accuracy** Tolerance (Factory Calibration)

Reset Time Initiate Time Time Delay vs Temp. & Voltage Input Voltage Tolerance 24VAC 120 & 230VAC **AC Line Frequency Power Consumption** Output

Туре Form Rating

Life

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TIME DELAY RELAYS

Protection **Isolation Voltage** Mechanical Mounting Dimensions

Termination **Environmental**

Operating/Storage Temperature Weight

Analog circuitry 0.05 - 300s in 5 adjustable ranges or fixed ±2% or 20ms, whichever is greater

Adjustable: guaranteed range Fixed: ±10% ≤ 50ms ≤ 70ms

 $\leq \pm 10\%$

24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz 2.25W

Electromechanical relay Isolated, SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1x107; Electrical - 1x106

≥1500V RMS input to output

Surface mount with four #6 (M3.5 x 0.6) screws **H** 53.8 mm (2.12"); **W** 93.7 mm (3.69"); **D** 47.8 mm (1.88") 0.25 in. (6.35 mm) male quick connect terminals

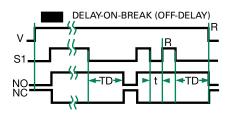
-20° to 65°C / -30° to 85°C ≅ 2.7 oz (77 g)

Selection Guides

R _T Selection Chart					
	Desired Time Delay*				B-
	:	Seconds	3		1.1
1	2	3	4	5	Megohm
0.05	0.5 5.0	0.6 10	1.2 20	3.0 50	0.0
1.0	10	20	40	100	1.0
1.5	15	30	60	150	1.5
2.0	20	40	80	200	2.0
2.5	25	50	100	250	2.5
3.0	30	60	120	300	3.0
1.0 1.5 2.0 2.5	10 15 20 25	20 30 40 50	40 60 80 100	100 150 200 250	1.0 1.5 2.0 2.5 3.0

* When selecting an external RT add at least 20% for tolerance of unit and the RT.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay t = Incomplete Time Delay R = Reset Time

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TDB / TDBH / TDBL SERIES

Relay Output, Delay-on-Break



The TDB Series combines accurate digital circuitry with isolated, 10A, DPDT or SPDT contacts in an 8-pin or 11-pin plug-in package. The TDB Series features DIP switch selectable time delays ranging from 0.1-10,230 seconds in three ranges. The TDB Series is the product of choice for custom control panel and

Input voltage must be applied to the input before and during timing. Upon closure of the initiate switch, the output relay is energized. The time delay begins when the initiate switch is opened (trailing edge triggered). The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

BENEFITS

whichever is greater

Makes it versatile for use in many applications

greater; Setting Accuracy + / - 2% or 50ms,

Provides visual indication of relay status

Allows control of loads for AC or DC voltages

Provides first time setting accuracy

Repeat Accuracy + / - 0.1% or 20ms, whichever is





Description

OEM designers.

Operation (Delay-on-Break)

closed when input voltage is applied.

Features & Benefits

3 time ranges available (0.1s to 2.8h)

Microcontroller based

DIP switch adjustment

Isolated output contacts

LED indication

(select models)

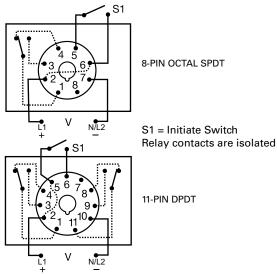
FFATURES

8-PIN



Wiring Diagram

11-PIN



For dimensional drawing see: Appendix, page 512, Figure 23.

Ordering Information

MODEL	INPUT VOLTAGE	DELAY RANGE (SEC)	LED	TYPE PLUG/OUTPUT FORM
TDB120AL	120VAC	1-1023 in 1s increments	X	Octal (8-pin) plug, SPDT
TDB120ALD	120VAC	1-1023 in 1s increments	Х	11-pin plug, DPDT
TDB12D	12VDC	1-1023 in 1s increments		Octal (8-pin) plug, SPDT
TDB230AL	230VAC	1-1023 in 1s increments	X	Octal (8-pin) plug, SPDT
TDB24AL	24VAC	1-1023 in 1s increments	X	Octal (8-pin) plug, SPDT
TDB24DL	24VDC/ 28VDC	1-1023 in 1s increments	X	Octal (8-pin) plug, SPDT
TDBH120AL	120VAC	10-10230 in 10s increments	X	Octal (8-pin) plug, SPDT
TDBH120ALD	120VAC	10-10230 in 10s increments	X	11-pin plug, DPDT
TDBL120AL	120VAC	0.1-102.3 in 0.1s increments	X	Octal (8-pin) plug, SPDT
TDBL120ALD	120VAC	0.1-102.3 in 0.1s increments	Х	11-pin plug, DPDT
TDBL24DL	24VDC/ 28VDC	0.1-102.3 in 0.1s increments	X	Octal (8-pin) plug, SPDT

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TIME DELAY RELAYS



TDB / TDBH / TDBL SERIES

Accessories



BZ1 Front Panel Mount Kit

mounting of 8- or 11-pin plug-in timers, flashers, and other controls. NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.

Provides an easy method of through-the-panel

NDS-11 11-pin Socket 11-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.



PSC8 or PSC11 Hold-down Clips Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in pairs.



and provides protection against vibration. Sold



P1011-6 Octal Socket for UL listing 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC. Combination is UL Listed when used with TDB Series timers. Use PSCRB8 Hold-down brackets.

Digi-Set Binary Switch Operation



0.1 0.2 0.4

0.8

3.2

6.4 12.8

25.6

51.2

0.1102.3	11023	1010,230
OFF NON	OFF .ON	OFF HON
.1	1	10-
2	2	20-
4	4	40
.8	8	80-
.6	16 - 0	160
.2=	32 -	320 -
4	64 =	640 - 0
.8	128 -	1280
.6=	256 -	2560 -
.2 -	512 -	5120-
6.3 S	544 S	3000 S

** For CE approved applications, power must be removed from the unit when a switch position is changed.

Specifications

Digital integrated circuitry

1 - 1023s in 1s increments

≤ 50ms

≤ 150ms

±5%

≤ 60ms

-15% - 20%

-20% - 10%

SPDT or DPDT

Plug-in socket

D 45.2 mm (1.8")

 \approx 6 oz (170 g)

Electromechanical relay

1/3 hp @ 120/240VAC

 \geq 1500V RMS input to output

DC units reverse polarity protected

H 81.3 mm (3.2"); W 60.7 mm (2.4");

Octal 8-pin plug-in or 11-pin plug-in

-20° to 65°C / -30° to 85°C

50/60 Hz

≤ 3.25W

0.1 - 102.3s in 0.1s increments

10 - 10.230s in 10s increments

±0.1% or 20ms, whichever is greater

±2% or 50ms, whichever is greater

LED indicates relay is energized

12. 24/28. or 110VDC: 24. 120. or 230VAC

10A resistive @ 120/240VAC & 28VDC;

Mechanical - 1 x 107; Electrical - 1 x 106

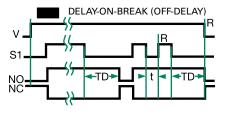
Time Delay Type Range**

Repeat Accuracy Setting Accuracy **Reset Time Recycle Time** Time Delay vs Temp. & Voltage Indicator **Initiate Time** Input Voltage Tolerance **12VDC & 24VDC/AC** 110 to 230VAC/DC **AC Line Frequency Power Consumption** Output Туре Form Rating

Life Protection **Isolation Voltage** Polarity Mechanical Mounting Dimensions

Termination **Environmental Operating/Storage** Temperature Weight

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally**Closed Contact** TD = Time Delay t = Incomplete Time Delay R = Reset - = Undefined Time

PSCRB8 Hold-down Brackets Designed for use with P1011-6 socket. Securely mounts 8-pin plug-in controls in any position, in pairs.

www.littelfuse.com/tdb-tdbh-tdbl

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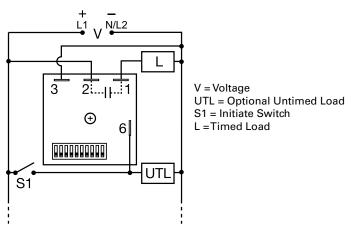
TDUB SERIES

Delay-on-BreakTimer

$C \in \mathfrak{R}$



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE RANGE	TIME RANGE
TDUB3000A	24 to 120VAC	1-1023s
TDUB3002A	12 to 24VDC	1-1023s
TDUBH3002A	12 to 24VDC	0.1-102.3m
TDUBH3001A	100 to 240VAC	0.1-102.3m
TDUBL3002A	12 to 24VDC	0.1-102.3s

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Description

The TDUB Series combines digital timing circuitry with universal voltage operation. Voltages of 24 to 240VAC and 12 to 24VDC are available in three ranges. The TDUB Series offers DIP switch selectable time delays ranging from 0.1 seconds to 102.3 minutes in three ranges. Its 1A rated output, ability to operate on multiple voltages, and wide range of switch selectable time delays make the TDUB Series an excellent choice for process control systems and OEM equipment.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output energizes. The time delay begins when the initiate switch is opened (trailing edge triggered). The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
DIP switch timing adjustment	Provides setting accuracy of +/-2%
User selectable time delay	Timing settings are switch selectable 0.1s - 102.3m in three ranges for added flexibility
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity.

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

C103PM (AL) DIN Rail

P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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TDUB SERIES

Time Delay Relays Dedicated — Delay-on-Break

Specifications

Time Delay Range*

Repeat Accuracy Setting Accuracy Reset Time Initiate Time Time Delay vs. Temperature & Voltage Input Voltage/Tolerance AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Туре Form Rating Voltage Drop **Off State Leakage Current** Protection Circuitry

Dielectric Breakdown Insulation Resistance Polarity

Mechanical

Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

0.1 - 102.3s in 0.1s increments 1 - 1023s in 1s increments 0.1 - 102.3m in 0.1m increments ±0.5% or 20ms, whichever is greater $\leq \pm 2\%$ or 20ms, whichever is greater ≤ 150ms ≤ 20ms

 $\leq \pm 5\%$

24 to 240VAC, 12 to 24VDC /±20% $AC \le 2VA; DC \le 1W$

Solid state NO, closed before and during timing 1A steady state, 10A inrush at 60°C AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A AC ≈ 5mA @ 230VAC: DC ≈ 1mA

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

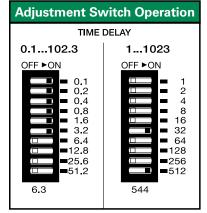
DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C /-40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

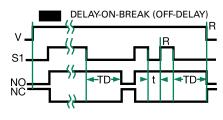
*For CE approved applications, power must be removed from the unit when a switch position is changed.

Adjustment Switch Operation



Add the value of switches in the ON position for the total time delay.

Function Diagram



V = Voltage
S1 = Initiate Switch
NO = Normally
Open Contact
NC = Normally
Closed Contact
TD =Time Delay
t = Incomplete
Time Delay
R = Reset
<mark>──{⊱</mark> = Undefined
" Time

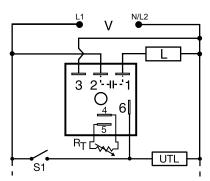




(€¶\$`®



Wiring Diagram



V = Voltage UTL = Optional Untimed Load L = Timed Load S1 = Initiate Switch

 R_{T} is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

	MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT RATING
	THDB421A	120VAC	External	1 - 100s	6A
	THDB434C	120VAC	Onboard	1 - 100m	20A
If you don't find the part you need, call us for a custom product 800-843-8848					

Description The THDB Series combines accurate timing circuitry with high power, solid-state switching. It can switch motors, lamps, and

power, solid-state switching. It can switch motors, lamps, and heaters directly without a contactor. You can reduce labor, component cost, and increase reliability with these small, easy-to-use, timers.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output energizes if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat accuracy + / - 0.5%, Factory calibration + / - 1%
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps and heaters without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and components costs

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

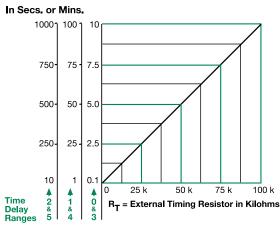
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THDB SERIES

External Resistance vs. Time Delay



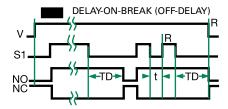
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the ${\sf R}_{\rm T}$ terminals; as the resistance increases the tie delay increases.

When selecting an external $\mathsf{R}_{T},$ add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay t = Incomplete Time Delay R = Reset $-\sqrt{-}$ = Undefined Time

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Туре Form **Maximum Load Current**

Voltage Drop Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions

Termination Environmental Operating/Storage

Temperature Humidity Weight

0.1s - 1000m in 6 adjustable ranges or fixed $\pm 0.5\%$ or 20ms, whichever is greater

≤ 150ms
 ≤ 20ms
 ≤ ±2%
 24, 120, cv

 $\leq \pm 1\%$

24, 120, or 230VAC ±20% 50/60 Hz ≤ 2VA

Solid state NO, closed before & during timing

110,010000	obioio a aaring tining	1
Output	Steady State	Inrush**
A	6A	60A
В	10A	100A
С	20A	200A
≅ 2.5V @ ra	ited current	
≃ 5mA @ 23	30VAC	
100mA		

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing \approx 3.9 oz (111 g)

**Must be bolted to a metal surface using the included heat sink compound. The maximum surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

Time Delay Relays Dedicated — Delay-on-Break



*8-pin models UL listed when used in combination with P1011-6 socket only.

TRB SERIES



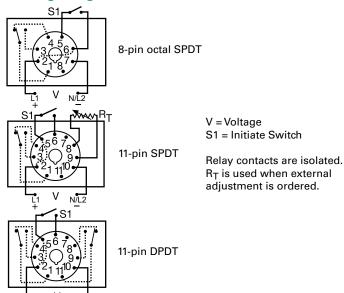


8-PIN



11-PIN

Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 24.

Description

The TRB Series combines an isolated, 10A electromechanical relay output with analog timing circuitry. False trigger of the TRB by a transient is unlikely because of the complete isolation of the circuit from the line prior to initiation. The initiate contact is common to one side of the line and may be utilized to operate other loads. Installation is easy due to the TRB's industry standard 8- or 11-pin plug-in base wiring.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output relay energizes. The time delay begins when the initiate switch is opened (trailing edge triggered). The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Complete isolation of circuit from line	No false trip due to transients
Industry standard 8 or 11-pin connection	Provides easy installation and field replacement
Isolated, 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages
Analog circuitry	Repeat accuracy + /- 2%

Accessories



P1004-XX, P1004-XX-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



BZ1 Front Panel Mount Kit Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	OUTPUT FORM	TIME TOLERANCE	TIME DELAY
TRB120A2Y30	120VAC	Onboard	Octal, SPDT (AC only)	+ /- 10%	1 - 30s
TRB120A3X600	120VAC	Lock shaft	Octal, SPDT (AC only)	+ /- 20%	7 - 600s
TRB120A4Y120	120VAC	Onboard	11-pin, DPDT	+ /- 10%	2 - 120s
TRB24D10Y10	24VDC/28VDC	Fixed	11-pin, DPDT	+ /- 10%	10s

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TRB SERIES

Accessories



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface



NDS-11 11-pin Socket

11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.

mounted with two #6 screws or snaps onto a

35 mm DIN rail. Uses PSC8 hold-down clips.



P1011-6 Octal Socket for UL listing* 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC.

Selection Guides

External R _T P/N Selection Table		
VALUE	PART NUMBER	
1M ohm	P1004-16	
1.5M ohm	P1004-15	
2M ohm	P1004-14	
3M ohm	P1004-12	
5M ohm	P1004-13	
1M ohm	P1004-16-X	
1.5M ohm	P1004-15-X	
2M ohm	P1004-14-X	
3M ohm	P1004-12-X	
5M ohm	P1004-13-X	

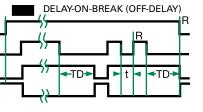
R _T Selecti	R _T Selection Chart			
Time I	Delay*			
Range	R _T			
Seconds	Megohm			
0.051	1.0			
0.052	2.0			
0.053	3.0			
0.15	5.0			
0.110	3.0			
130	1.5			
160	3.0			
2120	2.0			
2180	3.0			
7240	1.5			
7300	2.0			
7360	2.0			
7420	3.0			
7480	3.0			
7600	5.0			

* When selecting an external RT add at least 15...30% for tolerance of unit and the RT.

S

NC NC

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally**Open Contact** NC = Normallv**Closed Contact** TD = Time Delay t = Incomplete Time Delay R = Reset Time

Specifications

Time Delay

Type Range **Repeat Accuracy Fixed Time Tolerance** & Setting Accuracy **Initiate Time Reset Time Recycle Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance

24VDC/AC 10 to 230VAC/DC **AC Line Frequency Power Consumption** Output Туре Form Rating

Life Protection **Insulation Resistance Isolation Voltage** Polarity Mechanical Mounting

Dimensions Termination

Environmental **Operating/Storage** Temperature Weight

Analog circuitry 50ms - 10m in 15 adjustable ranges or fixed ±2% or 20ms, whichever is greater

±5, 10, or 20% ≤ 70ms ≤ 75ms ≤ 250ms

≤±10%

24/28 or 110VDC: 24, 120, or 230VAC (DC voltages on DPDT output models only)

-15% - 20% -20% - 10% 50/60 Hz $\leq 3.25W$

Electromechanical relay Isolated SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 107; Electrical - 1 x 106

 $\geq 100 \text{ M}\Omega$ ≥ 1500V RMS between input to output DC units are reverse polarity protected

Plug-in socket H 91.6 mm (3.62"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78") Octal 8-pin plug-in or 11-pin plug-in

-20° to 65°C / -30° to 85°C ≈ 6 oz (170 g)

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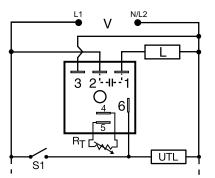


 $C \in \mathfrak{R}$

TSB SERIES



Wiring Diagram



V = Voltage S1 = Initiate Switch UTL = Optional Untimed Load L = Load

 $R_{T}\xspace$ is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The TSB Series is a totally solid-state, delay-on-break timing module. The TSB Series is available with a fixed, external, or onboard adjustable time delay. Time Delays from 0.05 to 600 seconds, in 4 standard ranges, cover over 90% of all OEM and commercial appliance timing applications. The repeat accuracy is $\pm 2\%$. Operating voltages of 24, 120, or 230VAC are available. The TSB's 1A steady state, 10A rated, solid-state output is perfect for direct control of solenoids, contactors, relays, lamps, buzzers, and small heaters. The TSB Series can be surface mounted with a single screw, or snapped on a 35 mm DIN rail using the P1023-20 adaptor.

Operation (Delay-on-Break)

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output energizes. The time delay begins when the initiate switch opens. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the output and the time delay.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 5%
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Wide time delay range	Meets almost all OEM and commercial appliance timing applications
1A steady, 10A inrush solid state output	Provides 100 million operations in typical conditions

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY		MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TSB2190	24VAC	Fixed	90s		TSB434	120VAC	Onboard	5 - 600s
TSB222	24VAC	External	0.5 - 60s		TSB632	230VAC	Onboard	0.5 - 60s
TSB41300	120VAC	Fixed	300s		TSB634	230VAC	Onboard	5 - 600s
TSB422	120VAC	External	0.5 - 60s					

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TSB SERIES

Accessories



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AVVG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in.

(91.4 cm) length.

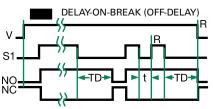
P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Selection Guide

R _T Selection Chart					
Des	B-				
	Sec	conds		11	
1	2	3	4	Kohms	
0.05	0.5	2	5	0	
0.3	6	20	60	10	
0.6	12	38	120	20	
0.9	18	55	180	30	
1.2	24	73	240	40	
1.5	30	90	300	50	
1.8	36	108	360	60	
2.1	42	126	420	70	
2.4	48	144	480	80	
2.7	54	162	540	90	
3.0	60	180	600	100	

* When selecting an external RT add at least 20% for tolerance of unit and the RT.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** Normally NC =**Closed Contact** TD =Time Delay t = Incomplete Time Delay R = Reset= Undefined Time

Specifications

Time Delay Range **Repeat Accuracy** Tolerance **Factory Calibration**) Time Delay vs Temp. & Voltage **Reset Time** Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Type Form **Maximum Load Current Off State Leakage Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical Mounting Dimensions Termination

Environmental

Operating/Storage Temperature Humidity Weight

0.05s - 600s in 4 adjustable ranges or fixed ±2% or 20ms, whichever is greater

 $\leq \pm 5\%$ $\leq \pm 10\%$ ≤ 150ms

24, 120, or 230VAC ±20% 50/60 Hz $\leq 2VA$

Solid state NO, closed before & during timing 1A steady state, 10A inrush at 60°C ≃ 5mA @ 230VAC ≅ 2.5V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C $\,$ / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

TSDB SERIES



 $C \in \mathbb{R}$



The TSDB Series is designed for more demanding commercial and industrial applications where small size, and accurate performance are required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the time delay.

The TSDB Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 1000 minutes are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Delay-on-Break)

Description

Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reclosing the initiate switch during timing resets the time delay. Loss of input voltage resets the time delay and output.

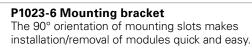
Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat accuracy + / - 0.5%, Factory calibration + / - 1%
Compact design	Allows flexibility for OEM applications
1A Steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Wide temperature range: -40° to 75°C	Reliable in demanding commercial and industrial applications

Accessories



P1004-13, P1004-13-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.





P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

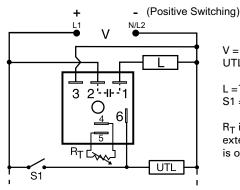


P1015-64 (AVVG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



Wiring Diagram



V = Voltage UTL = Optional Untimed Load L = Timed Load S1 = Initiate Switch

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
TSDB320P	24VDC	External	0.1 - 10s	Positive
TSDB421	120VAC	External	1 - 100s	n/a
TSDB431	120VAC	Onboard	1 - 100s	n/a

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TSDB SERIES

Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



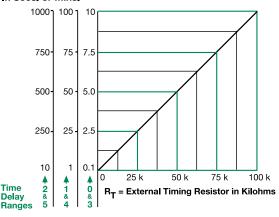
C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay



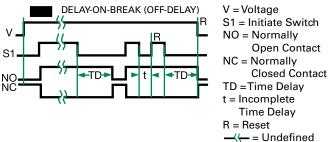


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases

When selecting an external R_T , add the tolerances of the timer and the R_T for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



Time

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **Power Consumption** AC Line Frequency/DC Ripple 50/60 Hz / \leq 10 % Output Туре Form **Maximum Load Current Off State Leakage Current Voltage Drop DC** Operation Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity Mechanical Mounting Dimensions

Termination

Environmental **Operating/Storage** Temperature Humidity Weight

0.1s - 1000m in 6 adjustable ranges or fixed ±0.5 % or 20ms, whichever is greater

≤ 150ms ≤ 20ms $\leq \pm 2\%$

 $\leq \pm 1\%$

12 or 24VDC; 24, 120, or 230VAC ±15% $AC \le 2VA$; $DC \le 1W$

Solid state NO, closed before & during timing 1A steady state, 10A inrush at 60°C ≃ 5mA @ 230VAC; DC ≃ 1mA AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A Positive or negative switching

Encapsulated

≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°F / -40° to 85°F 95% relative, non-condensing ≈ 2.4 oz (68 g)

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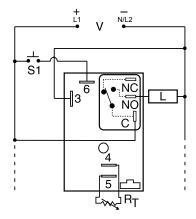
 $C \in \mathbf{A}$

HRDS SERIES

Single ShotTimer



Wiring Diagram



- NO = Normally Open S1 = Initiate Switch L = Load
- C = Common, Transfer Contact

NOTE: A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered. Relay contacts are not isolated.

For dimensional drawing see: Appendix, page 512, Figure 17.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
HRDS120	12VDC	Onboard	0.1 - 10s
HRDS313M	24VDC	Fixed	3m
HRDS321	24VDC	Onboard	1 - 100s
HRDS421	120VAC	Onboard	1 - 100s
HRDS430	120VAC	External	0.1 - 10s

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Description

The HRDS Series combines an electromechanical relay output with microcontroller timing circuitry. It offers 12 to 230V operation in five options and factory fixed, onboard or external adjustable time delays with a repeat accuracy of $\pm 0.5\%$. The output contact rating allows for direct operation of heavy loads, such as compressors, pumps, blower motors, heaters, etc. This series is ideal for OEM applications where cost is a factor.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output relay energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%
Compact, low cost design	Allows flexibility for OEM applications
Isolated, 30A, SPDT, NO output contacts	Allows direct operation of heavy loads: compressors, pumps, blower moters, heaters.
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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HRDS SERIES

Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

External Resistance vs. Time Delay

In Secs. or Mins. 10001 100 J 10 750 75 -7.5 5.0 500 50 250 25. 2.5 10 0.1 1 25 k 50 k 75 k 100 k Δ ▲ 0 & 3 Time 2 R_ = External Timing Resistor in Kilohms 1 Delav & Ranges

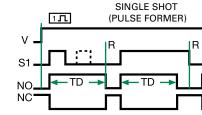
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external R_T , add the tolerances of the timer and the R_T for the full time range adjustment.

For the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset

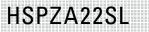
Specifications

Time Delay Type Microcontroller circuitry Range 0.1s - 100m in 5 adjustable ranges or fixed **Repeat Accuracy** ±0.5% or 20 ms, whichever is greater Tolerance (Factory Calibration) ±1%, ±5% **Reset Time** ≤ 150ms **Initiate Time** ≤ 20ms Time Delay vs Temp. ±2% & Voltage Input Voltage 12 or 24VDC; 24, 120, or 230VAC Tolerance **12VDC & 24VDC** -15% - 20% 24 to 230VAC -20% - 10% **AC Line Frequency** 50/60 Hz **Power Consumption** $AC \le 4VA; DC \le 2W$ Output Туре Electromechanical relay SPDT, non-isolated Form SPDT-NO SPDT-NC Ratings General Purpose 125/240VAC 30A 15A Resistive 125/240VAC 30A 15A 28VDC 20A 10A 125VAC Motor Load 1 hp* 1/4 hp** 240VAC 2 hp** 1 hp** Life Mechanical - 1 x 106; Electrical - 1 x 105, *3 x 104, **6,000 Protection Surge IEEE C62.41-1991 Level A Circuitry Encapsulated **Dielectric Breakdown** ≥ 2000V RMS terminals to mounting surface **Insulation Resistance** ≥ 100 MΩ Polarity DC units are reverse polarity protected **Mechanical** Mounting Surface mount with one #10 (M5 x 0.8) screw Dimensions **H** 76.7 mm (3"); **W** 51.3 mm (2"); **D** 38.1 mm (1.5") Termination 0.25 in. (6.35 mm) male quick connect terminals **Environmental Operating/Storage** Temperature -40° to 60°C/-40° to 85°C Humidity 95% relative, non-condensing Weight $\approx 3.9 \text{ oz} (111 \text{ q})$

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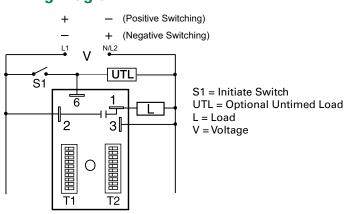








Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 18.

Description

The HSPZA22SL is a factory programmed module available in any 1 of 13 standard functions. The HSPZA22SL offers dual switch adjustable timer or counter functions. Switch adjustment allows accurate selection of the time delay or number of counts the first time and every time. The 1A steady, 10A inrush rated solid-state output provides 100 million operations, typical. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The HSPZA22SL is a cost effective approach for OEM applications that require small size, solid state reliability, and accurate switch adjustment.

Operation (Single Shot Lockout)

Upon application of input voltage and momentary or maintained closure of S1, the output relay energizes and TD1 single shot time delay begins. The output relay de-energizes at the end of TD1 and the TD2 lockout time delay begins. During TD2 (and TD1) closing switch S1 has no effect on the operation. After TD2 is complete, closing S1 starts another operation. If S1 is closed when input voltage is applied, the output energizes and the TD1 time delay begins.

Reset: Removing input voltage resets the time delays and the output and returns the cycle to the first delay.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat Accuracy + / - 0.1%	
User selectable time delay	Timing settings are switch selectable 0.1s - 1023h in a dual switch timer function for added flexibility	
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.	
Totally solid-state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	

Accessories



P1015-18 Quick Connect to Screw Adapter

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

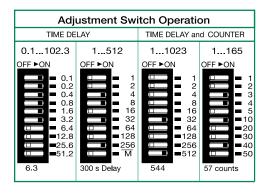
Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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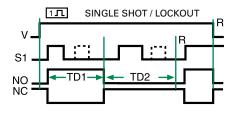


HSPZA22SL

Switch Adjustment



Function Diagrams



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD1,TD2 = Time Delay R = Reset Specifications Time Delay

Type Range **Repeat Accuracy** Setting Accuracy **Reset Time Initiate Time** Time Delay vs Temp. & Voltage **Count Range Count Rate** Input Voltage Tolerance AC Line Frequency/ **DC Ripple Power Consumption** Output Туре Rating **Voltage Drop OFF State Leakage Current Counter Output** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity Mechanical Mounting

Dimensions

Termination

Environmental Operating/Storage

Temperature Humidity

Weight

Microcontroller circuitry 1-1023s, m or h in 1s, m or h increments $\pm 0.1\%$ or 20ms, whichever is greater $\leq \pm 1\%$ or 20ms, whichever is greater ≤ 150 ms ≤ 20 ms

 $\leq \pm 2\%$ 1 - 1023 in 2 ranges ≤ 25 counts per second

24 to 240VAC ≤ ±15%

 $\begin{array}{l} 50/60Hz\;/\leq10\%\\ AC\leq2VA;\;\; DC\leq1W \end{array}$

Solid-state output 1A steady, 10A inrush for 16ms AC $\approx 2.5V @$ 1A; DC $\approx 1V @$ 1A AC $\approx 5mA @$ 240VAC; DC $\approx 1mA$ Output pulse width: 300ms ±20%

 $\begin{array}{l} \mbox{Encapsulated} \\ \ge 2000V \mbox{ RMS terminals to mounting surface} \\ \ge 100 \mbox{ M}\Omega \\ \mbox{DC units are reverse polarity protected} \end{array}$

Surface mount with one #10 (M5 x 0.8) screw H 76.2 mm (3.0"); W 50.8 mm (2.0"); D 38.1 mm (1.5") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 3.9 oz (111 g)

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Time Delay Relays Dedicated — Single Shot



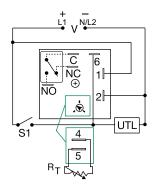
 $C \in \mathbf{A}$

KRDS SERIES

Single Shot



Wiring Diagram



V = Voltage S1 = Initiate Switch C = Common, Transfer Contact NO = Normally Open NC = Normally Closed UTL = Untimed Load

R_T is used when external adjustment is ordered. A knob is supplied for adjustable units. The untimed load is optional. Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

-			
MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
KRDS1135M	12VDC	Fixed	35m
KRDS120	12VDC	Onboard	0.1 - 10s
KRDS221	24VAC/DC	Onboard	1 - 100s
KRDS420	120VAC	Onboard	0.1 - 10s
KRDS421	120VAC	Onboard	1 - 100s
KRDS424	120VAC	Onboard	1 - 100m
KRDS430	120VAC	External	0.1 - 10s

If desired part number is not listed, please call us to see if it is technically possible to build.

Description

The KRDS Series is a compact time delay relay measuring only 2 in. (50.8 mm) square. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRDS Series is a cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output relay energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications	
Microcontroller based	Repeat Accuracy + / -0.5%, Factory calibration + / - 5%	
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages	
Encapsulated	To protect against shock, vibration, and humidity	

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AWG 14/16)



Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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KRDS SERIES

Accessories



C103PM (AL) DIN Rail

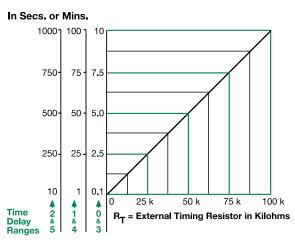
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

External Resistance vs. Time Delay



This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the tie delay increases

When selecting an external R_T, add the tolerances of the timer and the R_T for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Output Current/Ambient Temperature

12 **TIME DELAY RELAYS**

10

9 А 8 7 50 40 60

°C

Specifications

Time Delay Туре Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 110VDC, 120VAC or 230VAC AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Туре Form Rating (at 40°C)

Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination **Environmental Operating/Storage** Temperature Humidity Weight

Microcontroller with watchdog circuitry 0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 5\%$ ≤ 150ms ≤ 40ms

 $\leq \pm 5\%$

12, 24 or 110VDC; 24, 120 or 230VAC

-15% - 20% -20%- 10% $AC \le 2VA; DC \le 2W$

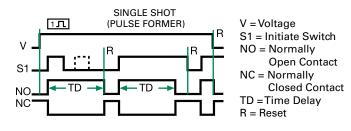
Isolated relay contacts SPDT 10A resistive @ 125VAC; 5A resistive @ 230VAC & 28VDC; 1/4 hp @ 125VAC Mechanical - 1 x 107; Electrical - 1 x 105

Encapsulated ≥ 1500V RMS input to output $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 60°C/-40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 g)

Function Diagram



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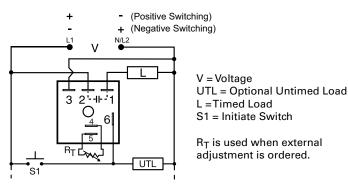


 $C \in \mathbf{A}$

KSDS SERIES



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
KSDS1115SP	12VDC	Fixed	15s	Positive
KSDS230	24VAC	Onboard	0.1 - 10s	n/a
KSDS320P	24VAC	External	0.1 - 10s	Positive
KSDS415M	120VAC	Fixed	5m	n/a
KSDS420	120VAC	External	0.1 - 10s	n/a

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The KSDS Series is ideal for applications that require momentary start interval timing including dispensing, exposure timing, or pulse shaping. This series is available for both AC and DC voltages. This series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable solid-state timer is required. The factory calibration for fixed time delays is within 5% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will not energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration +/- 5%
1A Steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Compact, low cost design	Allows flexibility for OEM applications

P1004-95, P1004-95-X Versa-Pot

Accessories



Panel mountable, industrial potentiometer recommended for remote time delay adjustment. P1023-6 Mounting bracket



The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief. 12

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www.littelfuse.com/ksds



KSDS SERIES

Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



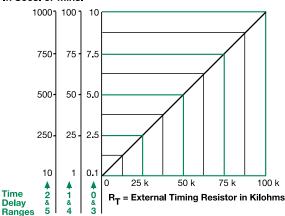
C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length. P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN

type rail with two #10 screws.

External Resistance vs. Time Delay





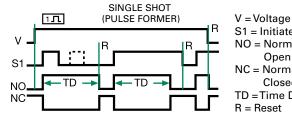
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_{T} , add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn R_T . For 1 to 100 S use a 100 K ohm R_T .

Function Diagram



S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally**Closed Contact** TD = Time Delay R = Reset

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10 \%$ **Power Consumption** Output Туре Form **Maximum Load Current OFF State Leakage Current Voltage Drop DC** Operation Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity Mechanical

Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

0.1s - 1000m in 6 adjustable ranges or fixed ±0.5 % or 20ms, whichever is greater

 $\leq \pm 5\%$ ≤ 150ms ≤ 20ms

 $\leq \pm 10\%$

12 or 24VDC; 24, 120, or 230VAC ±20% $AC \le 2VA; DC \le 1W$

Solid state NO, closed during timing 1A steady state, 10A inrush at 60°C AC ≈ 5mA @ 230VAC; DC ≈ 1mA AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A Positive or negative switching

Encapsulated ≥ 2000V RMS terminals to mounting surface \geq 100 M Ω

DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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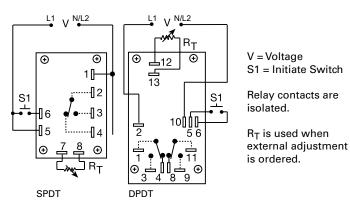




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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 26.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT FORM
ORS120A150SD	120VAC	Fixed	50s	DPDT
ORS230A150SD	230VAC	Fixed	50s	DPDT

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The ORS Series' open PCB construction offers the user good economy without sacrificing performance and reliability. The output relay is available in isolated, 10A, DPDT or SPDT forms. The time delay may be ordered as factory fixed, onboard knob, or external adjustment. All connections are 0.25 in. (6.35 mm) male quick connect terminals.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output relay energizes for a measured interval of time. At the end of the time delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Open PCB construction	Reduces cost without sacrificing performance and reliability
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 10%
Isolated, 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages
Line voltage initiation	Separate control voltage is not required for operation

Accessories



P1004-12, P1004-12-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



strain relief.

P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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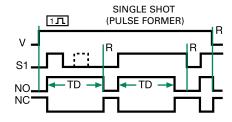
Selection Guide

ORS SERIES

	R _T Selection Chart				
	Desire	d Time	Delay*		B-
	;	Second	3		11
1	2	3	4	5	Megohm
0.05	0.5	0.6	1.2	3.0	0.0
0.5	5.0	10	20	50	0.5
1.0	10	20	40	100	1.0
1.5	15	30	60	150	1.5
2.0	20	40	80	200	2.0
2.5	25	50	100	250	2.5
3.0	30	60	120	300	3.0

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay R = Reset

Specifications

Time Delay Type Range

Repeat Accuracy Tolerance (Factory Calibration)

Reset Time Initiate Time Time Delay vs Temp. & Voltage Input Voltage Tolerance 24VAC 120 & 230VAC **AC Line Frequency Power Consumption** Output Туре Form Rating

Life Protection **Isolation Voltage Mechanical** Mounting

Dimensions Termination **Environmental Operating/Storage**

Temperature

Weight

Analog circuitry 0.05 - 300s in 5 adjustable ranges or fixed ±2% or 20ms, whichever is greater

Adjustable: guaranteed range Fixed: ±10% ≤ 50ms ≤ 70ms

 $\leq \pm 10\%$

24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz 2.25W

Electromechanical relay Isolated, SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1x107; Electrical - 1x106

≥1500V RMS input to output

Surface mount with four #6 (M3.5 x 0.6) screws H 53.8 mm (2.12"); W 93.7 mm (3.69"); **D** 47.8 mm (1.88") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 65°C / -30° to 85°C ≈ 2.7 oz (77 g)



PRS65

Single ShotTimer

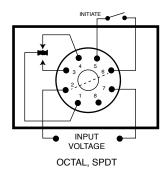






011

Wiring Diagram



For dimensional drawing see: Appendix, page 515, Figure 48.

Specifications

Time Delay Type Range Repeat Accuracy Tolerance Reset Time Recycle Time After Timing During Timing

Time Delay vs. Temp. & Voltage Input Voltage Tolerance AC Line Frequency Output Type Form Rating Analog circuitry 7 to 480 seconds ±2% under fixed conditions Knob adjustable: guaranteed range 80ms max.

16ms max. 0.1% of max. time delay or 75ms, whichever is greater

15% max.

230VAC, nominal ±15% of nominal 50/60 Hz

Relay Single Pole, Double Throw 10 amperes resistive at 240VAC

Description

The PRS65 is a single shot time delay relay for use on noncritical timing applications. The knob adjustable time delay carries a guaranteed time range of up to 8 minutes.

Operation

Power must be applied to the input at all times prior to and during timing. Upon closure of the initiate switch (momentary or maintained) the output contacts transfer and the time delay is initiated. At the end of the delay interval, the output contacts revert to their original position. If the initiate switch is reclosed during timing, the time delay will not be affected.

Features & Benefits

- Electronic Circuit with Electromechanical Relay
- Popular Operating Voltages
- Octal Plug-in
- Hold Down Clamps Available

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 (M 3.5×0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.

Protection Transient Dielectric Breakdown

Mechanical Mounting

Termination Dimensions

Environmental

Operating/Storage Temperature Humidity Weight ± 1500 volts for 150 microseconds ≥ 1500 V rms min. at 60 Hz between input and output terminals

Plug in (hold-down clips for panel mounting also available) Standard Octal Plug-in H 92.2 mm (3.63"); W 60.45 mm (2.38"); D 44.45 mm (1.75")

-20° to 65°C / -30° to 85°C 95% relative, non-condensing Approx. 6 oz (170 g)

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Wiring Diagram

TDS / TDSH / TDSL SERIES

Relay Output, Single Shot Time Delay Relay







11-PIN

Description

The TDS Series combines accurate digital circuitry with isolated, 10A rated, DPDT or SPDT relay contacts in an 8-pin or 11-pin plug-in package. The TDS Series features DIP switch selectable time delays ranging from 0.1s to 10,230s in three ranges. The TDS Series is the product of choice for custom control panel and OEM designers.

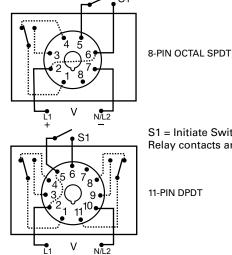
Operation (Single Shot)

Input voltage must be applied to the input before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output relay energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
3 time ranges available (0.1s to 2.8h)	Makes it versatile for use in many applications	
Microcontroller based	Repeat Accuracy + / - 0.1% or 20ms, whichever is greater; Setting Accuracy + / - 2% or 50ms, whichever is greater	
LED indication (select models)	Provides visual indication of relay status	
DIP switch adjustment	Provides first time setting accuracy	
Isolated output contacts	Allows control of loads for AC or DC voltages	



S1 = Initiate Switch

Relay contacts are isolated.

11-PIN DPDT

12 **FIME DELAY RELAYS**

Ordering Information

For dimensional drawing see: Appendix, page 512, Figure 23.

MODEL	INPUT VOLTAGE	DELAY RANGE (SEC)	LED	PLUG TYPE/OUTPUT FORM
TDS120AL	120VAC	1-1023 in 1s increments	Х	Octal (8-pin) plug, SPDT
TDS120ALD	120VAC	1-1023 in 1s increments	Х	11-pin plug, DPDT
TDS12D	12VDC	1-1023 in 1s increments		Octal (8-pin) plug, SPDT
TDS230AL	230VAC	1-1023 in 1s increments	Х	Octal (8-pin) plug, SPDT
TDS24AL	24VAC	1-1023 in 1s increments	Х	Octal (8-pin) plug, SPDT
TDSH120AL	120VAC	10-10230 in 10s increments	Х	Octal (8-pin) plug, SPDT
TDSL120AL	120VAC	0.1-102.3 in 0.1s increments	Х	Octal (8-pin) plug, SPDT
TDSL12D	12VDC	0.1-102.3 in 0.1s increments		Octal (8-pin) plug, SPDT

If you don't find the part you need, call us for a custom product 800-843-8848

www.littelfuse.com/tds-tdsh-tdsl

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TDS / TDSH / TDSL SERIES

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



NDS-11 11-pin Socket

11-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.



PSC8 or PSC11 Hold-down Clips Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8

with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in pairs.



PSCRB8 Hold-down Brackets

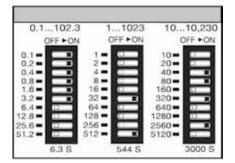
Designed for use with P1011-6 socket. Securely mounts 8-pin plug-in controls in any position, and provides protection against vibration. Sold in pairs.



P1011-6 Octal Socket for UL listing* 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC. Uses PSCBR8 Hold-down Brackets.

*8-pin models UL listed when used in combination with P1011-6 socket only.

Digi-Set Binary Switch Operation



**For CE approved applications, power must be removed from the unit when a switch position is changed.

Specifications

Time Delay Type Range**

Repeat Accuracy Setting Accuracy Reset Time Recycle Time Time Delay vs Temp. & Voltage Indicator **Initiate Time** Input Voltage Tolerance **12VDC & 24VDC/AC** 110 to 230VAC/DC **AC Line Frequency Power Consumption** Output Type

Form Rating

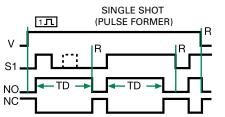
Life

Protection **Isolation Voltage** Polarity **Mechanical** Mounting Termination Dimensions

Environmental

Operating/Storage Temperature Weight

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally**Open Contact** NC = NormallvClosed Contact TD = Time Delay R = Reset

Digital integrated circuitry 0.1 - 102.3s in 0.1s increments 1 - 1023s in 1s increments 10 - 10,230s in 10s increments ±0.1% or 20ms, whichever is greater ±2% or 50ms, whichever is greater ≤ 50ms ≤ 150ms

pertise Applied Answers Delivered

±5% LED glows during timing; relay is energized ≤ 60ms

12, 24/28, or 110VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz ≤ 3.25W

Electromechanical relay SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 107; Electrical - 1 x 106

 \geq 1500V RMS input to output DC units are reverse polarity protected

Plug-in socket Octal 8-pin plug-in or 11-pin plug-in H 81.3 mm (3.2"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78")

-20° to 65°C/-30° to 85°C ≅ 6 oz (170 g)

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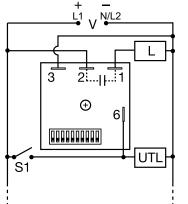
Single ShotTimer

TDUS SERIES

(€¶¶®



Wiring Diagram



V = Voltage UTL = Optional Untimed Load S1 = Initiate Switch L = Timed Load

Description

The TDUS Series combines digital timing circuitry with universal voltage operation. Voltages of 24 to 240VAC and 12 to 24VDC are available in three ranges. The TDUS Series offers DIP switch selectable time delays ranging from 0.1 seconds to 102.3 minutes in three ranges. Its 1A rated output, ability to operate on multiple voltages, and wide range of switch selectable time delays make the TDUS Series an excellent choice for process control systems and OEM equipment.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat Accuracy + / - 0.1%	
Compact design	Allows flexibility for OEM applications	
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.	
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	

P1015-64 (AWG 14/16) Female Quick Connect

strain relief.

Accessories



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with



all modules with 0.25 in. (6.35 mm) male quick connect terminals. C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Ordering Information

For dimensional drawing see: Appendix, page 512, Figure 16.

-		
MODEL	INPUT VOLTAGE	TIME RANGE
TDUS3000A	24 to 120VAC	1 - 1023s
TDUS3001A	100 to 240VAC	1 - 1023s
TDUS3002A	12 to 24VDC	1 - 1023s
TDUSH3001A	100 to 240VAC	0.1 - 102.3m
TDUSL3000A	24 to 120VAC	0.1 - 102.3s

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TDUS SERIES



Specifications

Time Delay Range*

Repeat Accuracy Setting Accuracy Reset Time Initiate Time Time Delay vs. Temperature & Voltage Input Voltage/Tolerance AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Туре Form Rating **Voltage Drop Off State Leakage Current** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions Termination **Environmental**

Operating/Storage Temperature Humidity Weight 0.1 - 102.3m in 0.1m increments $\pm 0.5\%$ or 20 ms, whichever is greater $\leq \pm 2\%$ or 20 ms, whichever is greater $\leq 150ms$ $\leq 20ms$ $\leq \pm 5\%$ 24 to 240VAC, 12 to 24VDC / \pm 20% 50/60 Hz / $\leq 10\%$ AC $\leq 2VA$; DC $\leq 1W$ Solid state

0.1 - 102.3s in 0.1s increments

1 - 1023s in 1s increments

N0, closed during timing 1A steady state, 10A inrush at 60°C AC \approx 2.5V @ 1A; DC \approx 1V @ 1A AC \approx 5mA @ 230VAC; DC \approx 1 mA

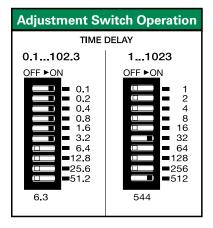
 $\begin{array}{l} \mbox{Encapsulated} \\ \ge 2000V \mbox{ RMS terminals to mounting surface} \\ \ge 100 \mbox{ M}\Omega \\ \mbox{DC units are reverse polarity protected} \end{array}$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

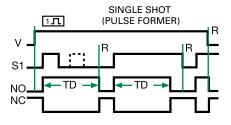
-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

*For CE approved applications, power must be removed from the unit when a switch position is changed.

Adjustment Switch Operation



Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset

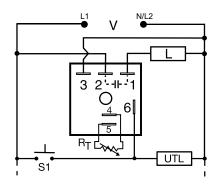


THC / THS SERIES

(€¶\®



Wiring Diagram



V = Voltage S1 = Initiate Switch L = Timed Load UTL = Optional Untimed Load

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 19.

112 TIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT RATING
THC421C	120VAC	External	0.1 - 3s	20A
THS422B	120VAC	External	0.5 - 60s	10A
THS422C	120VAC	External	0.5 - 60s	20A

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Description

The THC/THS Series is a solid-state relay and timer combined into one compact, easy-to-use control. When mounted to a metal surface, the THC/THS Series may be used to directly control lamp or heater loads of up to 20A steady, 200A inrush. Its single shot function can perform dispensing and pulse shaping operations. The initiate switch can be a momentary or maintained type of switch. Time delays can be selected from 0.1 - 600 seconds in 4 ranges. The THC/THS Series is used for coin vending applications where fast initiate response is required.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch opens. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 5%
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps, and heaters directly without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



strain relief.

P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

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P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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THC/THS SERIES

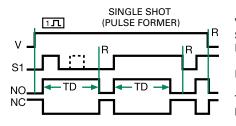


Selection Guide

R _T Selection Chart					
Des	B-				
	Sec	conds		nT	
1	2	3	4	Kohms	
0.1	0.5	2	5	0	
0.3	6	20	60	10	
0.6	12	38	120	20	
0.9	18	30			
1.2	24 73 240			40	
1.5	30	90	300	50	
1.8	36	108	360	60	
2.1	42	126	420	70	
2.4	48	144	480	80	
2.7	2.7 54 162 540				
3.0	60	180	600	100	

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T.

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset

Specifications

Time Delay			
Range	0.1 - 600s in	4 adjustable ranges o	or fixed
Repeat Accuracy	±2% or 20ms, whichever is greater		
Tolerance			
(Factory Calibration)	$\leq \pm 5\%$		
Reset Time	≤ 150ms		
Initiate Time	≤ 20ms		
Time Delay vs Temp.			
& Voltage	$\leq \pm 10\%$		
Input			
Voltage	24, 120, or 2	230VAC	
Tolerance	±15%		
AC Line Frequency	50/60 Hz		
Power Consumption	≤2VA		
Output			
Туре	Solid state		
Form	NO, closed during timing		
Maximum Load Currents	Output	Steady State	Inru
	Ā	6A	60

Minimum Load Current Voltage Drop OFF State Leakage Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions

Termination Environmental Operating/Storage Temperature

Humidity

Weight

)% 20, or 230VAC 60 Hz А state closed during timing Inrush** **Steady State** put 60A 6A В 10A 100A С 20A 200A 100mA ≈ 2.5V at rated current ≈ 5mA @ 230VAC Encapsulated ≥ 2000V RMS terminals to mounting surface ≥100 MΩ Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2.0"); **W** 50.8 mm (2.0");

0.25 in. (6.35 mm) male quick connect terminals

iximum

**Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

≅ 3.9 oz (111 g)

D 38.4 mm (1.51")

-20° to 60°C / -40° to 85°C 95% relative, non-condensing

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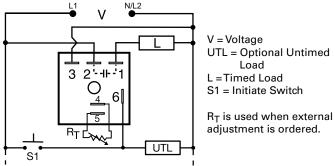


THDS SERIES

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The THDS Series combines accurate timing circuitry with high power solid-state switching. It can switch motors, lamps, and heaters directly without a contactor. You can reduce labor, component cost, and increase reliability with these small, easy-to-use, timers.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output energizes if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration +/- 1%
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps and heaters without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



Load



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AVVG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

12 **TIME DELAY RELAYS**

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT RATING
THDS410.25S	4 120VAC	Fixed	0.25s	6A
THDS431C	120VAC	Onboard	1 - 100s	20A
THDS610.25S	4 230VAC	Fixed	0.25s	6A

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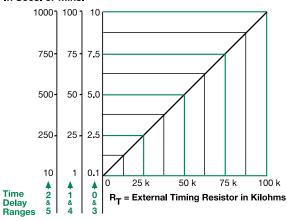
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THDS SERIES



External Resistance vs. Time Delay

In Secs. or Mins.

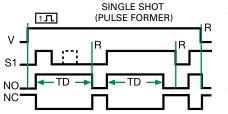


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T, add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay R = Reset

adifications S

Specifications				
Time Delay				
Range	0.1s - 1000m in 6 adjustable ranges or fixed			
Repeat Accuracy	±0.5% or 20ms, whichever is greater			
Tolerance	,			
(Factory Calibration)	≤ ±1%			
Reset Time	≤150ms			
Initiate Time	≤ 20ms			
Time Delay vs Temp.				
& Voltage	$\leq \pm 2\%$			
Input				
Voltage	24, 120, or 230	DVAC		
Tolerance	±20%			
AC Line Frequency	50/60 Hz			
Power Consumption	≤2VA			
Output				
Туре	Solid state			
Form	NO, closed during timing			
Maximum Load Current	Output	Steady State	Inrush**	
	A	6A	60A	
	В	6A 10A	100A	
	B C	10A 20A		
Voltage Drop	B C ≅ 2.5V @ rate	10A 20A d current	100A	
Off State Leakage Current	B C ≅ 2.5V @ rate ≅ 5mA @ 230	10A 20A d current	100A	
Off State Leakage Current Minimum Load Current	B C ≅ 2.5V @ rate	10A 20A d current	100A	
Off State Leakage Current Minimum Load Current Protection	B C ≃ 2.5V @ rate ≃ 5mA @ 230 100mA	10A 20A d current	100A	
Off State Leakage Current Minimum Load Current Protection Circuitry	B C ≃ 2.5V @ rate ≃ 5mA @ 230 100mA Encapsulated	10A 20A d current VAC	100A 200A	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown	B C ≅ 2.5V @ rate ≅ 5mA @ 230 100mA Encapsulated ≥ 2000V RMS	10A 20A d current	100A 200A	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance	B C ≃ 2.5V @ rate ≃ 5mA @ 230 100mA Encapsulated	10A 20A d current VAC	100A 200A	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical	B C ≅ 2.5V @ rate ≅ 5mA @ 230 100mA Encapsulated ≥ 2000V RMS ≥ 100 MΩ	10A 20A d current VAC terminals to mount	100A 200A	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting **	B C ≈ 2.5V @ rate ≈ 5mA @ 230 100mA Encapsulated ≥ 2000V RMS ≥ 100 MΩ Surface moun	10A 20A d current VAC terminals to mount t with one #10 (M5	100A 200A ting surface x 0.8) screw	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical	B C $\cong 2.5V @ rate \cong 5mA @ 230100mAEncapsulated≥ 2000V RMS≥ 100 MΩSurface mounH 50.8 mm (2.$	10A 20A d current VAC terminals to mount t with one #10 (M5 0″); ₩ 50.8 mm (2.	100A 200A ting surface x 0.8) screw	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions	B C $\approx 2.5V @ rate\approx 5mA @ 230100mAEncapsulated≥ 2000V RMS≥ 100 MΩSurface mounH 50.8 mm (2.D 38.4 mm (1.)$	10A 20A d current VAC terminals to mount t with one #10 (M5 0″); ₩ 50.8 mm (2. 51″)	100A 200A ting surface x 0.8) screw 0");	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions Termination	B C $\approx 2.5V @ rate\approx 5mA @ 230100mAEncapsulated≥ 2000V RMS≥ 100 MΩSurface mounH 50.8 mm (2.D 38.4 mm (1.)$	10A 20A d current VAC terminals to mount t with one #10 (M5 0″); ₩ 50.8 mm (2.	100A 200A ting surface x 0.8) screw 0");	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions Termination Environmental	B C $\approx 2.5V @ rate\approx 5mA @ 230100mAEncapsulated≥ 2000V RMS≥ 100 MΩSurface mounH 50.8 mm (2.D 38.4 mm (1.)$	10A 20A d current VAC terminals to mount t with one #10 (M5 0″); ₩ 50.8 mm (2. 51″)	100A 200A ting surface x 0.8) screw 0");	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions Termination Environmental Operating/Storage		10A 20A d current VAC t with one #10 (M5 0″); ₩ 50.8 mm (2. 51″) mm) male quick cor	100A 200A ting surface x 0.8) screw 0");	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions Termination Environmental Operating/Storage Temperature	B C ≈ 2.5V @ rate ≈ 5mA @ 230 100mA Encapsulated ≥ 2000V RMS ≥ 100 MΩ Surface moun H 50.8 mm (2. D 38.4 mm (1. 0.25 in. (6.35 m) -40° to 60°C /	10A 20A d current VAC terminals to mount t with one #10 (M5 0"); ₩ 50.8 mm (2. 51") mm) male quick cor	100A 200A ting surface x 0.8) screw 0");	
Off State Leakage Current Minimum Load Current Protection Circuitry Dielectric Breakdown Insulation Resistance Mechanical Mounting ** Dimensions Termination Environmental Operating/Storage	B C ≈ 2.5V @ rate ≈ 5mA @ 230 100mA Encapsulated ≥ 2000V RMS ≥ 100 MΩ Surface moun H 50.8 mm (2. D 38.4 mm (1. 0.25 in. (6.35 m) -40° to 60°C /	10A 20A d current VAC terminals to mount t with one #10 (M5 0"); ₩ 50.8 mm (2. 51") mm) male quick cor '-40° to 85°C non-condensing	100A 200A ting surface x 0.8) screw 0");	

**Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

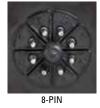
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TRS SERIES









11-PIN

Description

The TRS Series combines an isolated, 10A electromechanical, relay output with analog timing circuitry. False trigger of the TRS Series by a transient is unlikely because of the complete isolation of the circuit from the line prior to initiation. The initiate contact is common to one side of the line and may be utilized to operate other loads. Installation is easy due to the TRS's industry standard 8 or 11-pin plug-in base wiring.

Operation (Single Shot)

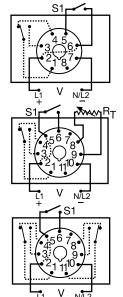
Input voltage must be applied to the input before and during timing. Upon momentary or maintained closure of the initiate switch (leading edge triggered), the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. Applying input voltage with the initiate switch closed will energize the load and begin the time delay.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Complete isolation of circuit from line	No false trip due to transients	
Industry standard octal plug connection	Eliminates need for special connectors	
Isolated, 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages	
Analog circuitry	Repeat accuracy + / - 2%	

Wiring Diagram



11-PIN SPDT

8-PIN OCTAL SPDT

11-PIN DPDT

For dimensional drawing see: Appendix, page 512, Figure 24.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	OUTPUT FORM	TIME TOLERANCE	TIME DELAY
TRS120A2X30	120VAC	Knob	Octal, SPDT	+ / - 20%	1 - 30s
TRS120A2X300	120VAC	Knob	Octal, SPDT (AC only)	+ / - 20%	7 - 300s
TRS120A2Y10	120VAC	Knob	Octal, SPDT	+ / - 10%	0.1 - 10s
120A2Y30	120VAC	Knob	Octal, SPDT	+ / - 20%	1 - 30s
TRS24D7Z10	24VDC/28VDC	External	11-Pin, SPDT no potentiometer	+ / - 5%	0.1 - 10s

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TRS SERIES



Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



NDS-11 11-pin Socket

11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.



PSC8 or PSC11 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in sets of two.



P1011-6 Octal Socket for UL listing* 8-pin surface mount socket with binder head screw terminals. Rated 10A @ 600VAC.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

*8-pin models UL listed when used in combination with P1011-6 socket only.

Selection Guides

External R _T P/N Selection Table			
Value	Part Number		
1M ohm 1.5M ohm 2M ohm 3M ohm 1M ohm 1.5M ohm 2M ohm 3M ohm	P1004-16 P1004-15 P1004-14 P1004-12 P1004-13 P1004-16-X P1004-16-X P1004-15-X P1004-14-X P1004-12-X P1004-13-X		

R _T Selection Chart				
Time I	Time Delay*			
Range	RT			
Seconds	Megohm			
0.051	1.0			
0.052	2.0			
0.053	3.0			
0.15	5.0			
0.110	3.0			
130	1.5			
160	3.0			
2120	2.0			
2180	3.0			
7240	1.5			
7300	2.0			
7360	2.0			
7420	3.0			
7480	3.0			
7600	5.0			

When selecting an external R_T add at least 15...30% for tolerance of unit and the R_T .

Specifications

Time Delay

Type Range **Repeat Accuracy Fixed Time Tolerance &** Setting Accuracy **Initiate Time Reset Time Recycle Time** Time Delay vs Temp. & Voltage Input Voltage

Tolerance 24VDC/AC 110 to 230VAC/DC **AC Line Frequency Power Consumption** Output Туре Form Rating

Life

Protection **Insulation Resistance Isolation Voltage** Polarity **Mechanical** Mounting

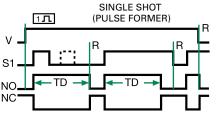
Termination Dimensions

Termination

EnvironmentaL

Operating/Storage Temperature Weight

Function Diagram



Analog circuitry 0.05s - 10m in 15 adjustable ranges or fixed ±2% or 20ms, whichever is greater

±5, 10, or 20% ≤ 70ms ≤ 75ms ≤ 250ms

≤±10%

24/28 or 110VDC; 24, 120, or 230VAC (DC voltages on DPDT output models only)

-15% - 20% -20% - 10% 50/60 Hz ≤ 3.25W

Electromechanical relay Isolated SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 107; Electrical - 1 x 106

 $\geq 100 \text{ M}\Omega$ ≥ 1500V RMS between input & output terminals DC units are reverse polarity protected

Plug-in socket Octal 8-pin plug-in or 11-pin plug-in H 91.6 mm (3.62"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78") Octal 8-pin plug-in or 11-pin plug-in

-20° to 65°C/-30° to 85°C ≅ 6 oz (170 g)

> V = Voltage S1 = Initiate Switch NO = Normally **Open Contact** NC = Normally Closed Contact TD = Time Delay

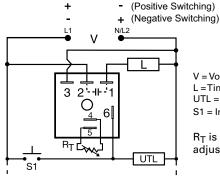


TSDS SERIES

(€¶\®



Wiring Diagram



V = Voltage L =Timed Load UTL = Optional Untimed Load S1 = Initiate Switch

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The TSDS Series is designed for more demanding commercial and industrial applications where small size and accurate performance are required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the time delay. The TSDS Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 1000 minutes are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry. This product is suitable for many applications, including dispensing, welding, and exposure timing.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will not energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch is opened. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications	
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 1%	
1A Steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.	
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	
Wide temperature range: -40° to 75°C	Reliable in demanding commercial and industrial applications	

P1023-6 Mounting bracket

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

J



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

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Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
TSDS2110S	24VAC	Fixed	10s	n/a
TSDS320N	24VDC	External	0.1 - 10s	Negative
TSDS321P	24VDC	External	1 - 100s	Positive
TSDS421	120VAC	External	1 - 100s	n/a

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TSDS SERIES



Accessories



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

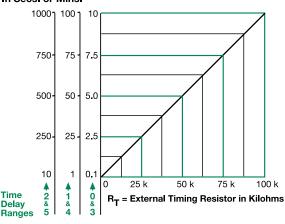


P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

In Secs. or Mins.



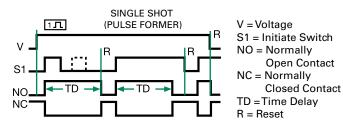
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T, add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Initiate Time Time Delay vs Temp. & Voltage Input Voltage Tolerance **Power Consumption** AC Line Frequency/DC Ripple Output Type Form **Maximum Load Current** Voltage Drop

Off State Leakage Current DC Operation Protection

Circuitry

Dielectric Breakdown Insulation Resistance Polarity **Mechanical**

Mounting

Dimensions

Termination

Environmental Operating/Storage Temperature Humidity

0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 1\%$ ≤ 150ms ≤ 20ms $\leq \pm 2\%$

12 or 24VDC; 24, 120, or 230VAC ±15% $AC \le 2VA; DC \le 1W$ 50/60 Hz / ≤ 10%

Solid state NO, closed during timing 1A steady state, 10A inrush at 60°C AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A AC ≈ 5mA @ 230VAC; DC ≈ 1mA Positive or negative switching

Encapsulated

 \geq 2000V RMS terminals to mounting surface \geq 100 M Ω DC units are reverse polarity protected Surface mount with one #10 (M5 x 0.8) screw

H 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 q)

Weight

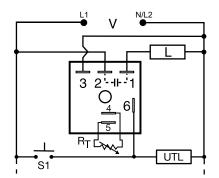


TSS SERIES

(€¶¶®



Wiring Diagram



V = Voltage S1 = Initiate Switch L =Timed Load UTL = Optional Untimed Load

 $R_{T}\xspace$ is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The TSS Series is a totally solid-state timing module. Its 1A rated, solid-state output provides an excellent method of time control for exposures, dispensing, or for increasing or decreasing a switch closure. Time delays from 0.05 to 600 seconds, in 4 ranges, cover 90% of all OEM applications. Factory calibration of fixed delays is $\pm 5\%$ and the repeat accuracy is $\pm 2\%$. The TSS Series can be surface mounted with a single screw, or snapped on a 35mm DIN rail using the P1023-20 accessory adaptor.

Operation (Single Shot)

Voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output energizes for a measured interval of time. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no affect on the time delay. The output will energize if the initiate switch is closed when input voltage is applied.

Reset: Reset occurs when the time delay is complete and the initiate switch opens. Loss of input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 5%
Compact, low cost design	Allows flexibility for OEM applications
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Surface or DIN rail mounting	Provides flexibility for installation

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TSS410.5	120VAC	Fixed	0.5s
TSS421	120VAC	External	0.05 - 3s
TSS422	120VAC	External	0.5 - 60s
TSS424	120VAC	External	5 - 600s
TSS622	230VAC	External	0.5 - 60s
TSS624	230VAC	External	5 - 600s

If desired part number is not listed, please call us to see if it is technically possible to build.

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TSS SERIES



Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick



connect terminals. **C103PM (AL) DIN Rail** 35 mm aluminum DIN rail available in a 36 in.

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



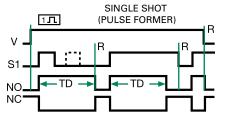
P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Selection Guide

R _T Selection Chart				
Des	B-			
	Sec	conds		
1	2	3	4	Kohms
0.05	0.5	2	5	0
0.3	6	20	60	10
0.6	12	38	120	20
0.9	18	55	180	30
1.2	24	73	240	40
1.5	30	90	300	50
1.8	36	108	360	60
2.1	42	126	420	70
2.4	48	144	480	80
2.7	54	162	540	90
3.0	60	180	600	100

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T .

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Туре Form **Maximum Load Current Off State Leakage Current Voltage Drop** Protection Circuitry **Dielectric Breakdown Insulation Resistance Mechanical** Mounting Dimensions

Termination

Environmental Operating/Storage

Temperature Humidity Weight 0.05s - 600s in 4 adjustable ranges or fixed ±2% or 20ms, whichever is greater

< 20ms < ±10% 24, 120, or 230VAC ±20% 50/60 Hz ≤ 2VA

 $\leq \pm 5\%$

≤ 150ms

Solid state NO, closed during timing 1A steady state, 10A inrush at $60^{\circ}C$ $\approx 5mA @ 230VAC$ $\approx 2.5V @ 1A$

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2.0"); W 50.8 mm (2.0"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

- 40° to 75°C / - 40° to 85°C 95% relative, non-condensing \approx 2.4 oz (68 g)

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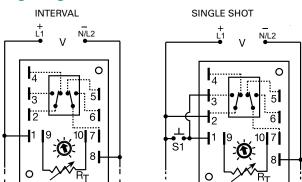


ERDI SERIES

$(\in \mathbf{R})$



Wiring Diagram



2-3 & 7-6 are Normally Open Contacts (NO) 2-4 & 7-5 are Normally Closed Contacts (NC)

For dimensional drawing see: Appendix, page 512, Figure 25.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
ERDI436	120VAC	External	0.6 - 60s
ERDI6210	230VAC	Onboard	1 - 100m

If you don't find the part you need, call us for a custom product 800-843-8848

Description

Econo-Timers are a combination of digital electronics and an electromechanical relay. DPDT relay output for relay logic circuits, and isolation of input to output voltages. For applications, such as interval on, pulse shaping, minimum run time, etc. The ERD Series is encapsulated to protect the circuitry from shock, vibration and humidity.

Operation (Interval)

Upon application of input voltage, time delay begins, and output relay energizes. At the end of time delay, output de-energizes until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Operation (Single Shot)

Input voltage must be applied before and during timing. Upon momentary or maintained closure of initiate switch, output relay energizes for time delay. At the end of the delay, output de-energizes. Opening or reclosing initiate switch during timing has no affect on time delay. Output will energize if initiate switch is closed when input voltage is applied.

Reset: Reset occurs when time delay is complete & initiate switch is opened. Loss of input voltage resets time delay and output.

Features & Benefits

FEATURES	BENEFITS
Digital integrated circuitry	Repeat Accuracy + / - 0.5%, Factory calibration +/ - 10%
Isolated, 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-16, P1004-16-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AWG 14/16)

Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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ERDI SERIES



Selection Guides

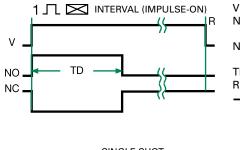
	R _T Selection Chart					
	Desired Time Delay*					
	Seconds					11
1	2	3	4	5	6	Megohm
0.1	0.1	0.1	0.2	0.3	0.6	0.0
0.19	0.6	1	1.7	3	6	0.1
0.28	1.1	2	3.2	6	12	0.2
0.37	1.6	3	4.7	9	18	0.3
0.46	2.1	4	6.2	12	24	0.4
0.55	2.6	5	7.7	15	30	0.5
0.64	3.0	6	9.2	18	36	0.6
0.73	3.5	7	10.7	21	42	0.7
0.82	4.0	8	12.2	24	48	0.8
0.91	4.5	9	13.7	27	54	0.9
1.0	5.0	10	15	30	60	1.0

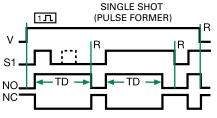
 * When selecting an external RT add at least 20% for tolerance of unit and the RT.

R _T Selection Chart					
	B-				
		Minutes			1.1
7	8	9	10	11	Megohm
0.1	0.1	0.2	1	10	0.0
0.6	1	1.7	10	50	0.1
1.1	2	3.2	20	100	0.2
1.6	3	4.7	30	150	0.3
2.1	4	6.2	40	200	0.4
2.6	5	7.7	50	250	0.5
3.0	6	9.2	60	300	0.6
3.5	7	10.7	70	350	0.7
4.0	8	12.2	80	400	0.8
4.5	9	13.7	90	450	0.9
5.0	10	15	100	500	1.0

 * When selecting an external R_{T} add at least 20% for tolerance of unit and the R_{T}

Function Diagrams





V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $\overrightarrow{}$ = Undefined Time

V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset

Specifications

Time Dela	١
Туре	
Range	

Adjustment **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **12VDC & 24VDC/AC** 120VDC/AC & 230VAC **AC Line Frequency** Output Туре Form Rating

Life

Protection Isolation Voltage Insulation Resistance

Polarity Mechanical Mounting

screws Dimensions

Termination

terminals Environmental

Operating/Storage Temperature Weight Digital integrated circuitry 0.1s - 500m in 11 adjustable ranges, 0.1s - 1000m fixed External adjust or onboard ±0.5%

≤ ±10% ≤ 150ms

 $\leq \pm 2\%$

120VAC or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

Isolated relay contacts DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁶

 \geq 1500V RMS input to output \geq 100 $M\Omega$ DC units are reverse polarity protected

Surface mount with two #6 (M3.5 x 0.6)

H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 43.2 mm (1.7") 0.25 in. (6.35 mm) male quick connect

 -40° to 65° C / -40° to 85° C ≈ 5.7 oz (162 g)

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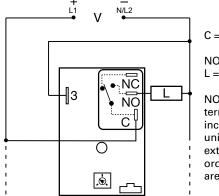
HRDI SERIES

Interval Timer

$(\in \mathbf{R})$



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 17.

C = Common, Transfer Contact NO = Normally Open L = Load

NOTE: A knob, or terminals 4 & 5 are only included on adjustable units. R_T is used when external adjustment is ordered. Relay contacts are not isolated.

Description

The HRDI Series combines an electromechanical relay output with microcontroller timing circuitry. It offers 12 to 230V operation in five ranges and factory fixed, external, or onboard adjustable time delays with a repeat accuracy of ±0.5%. The output contact rating allows for direct operation of heavy loads, such as compressors, pumps, blower motors, heaters, etc. This series is ideal for OEM applications where cost is a factor.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output relay is energized during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

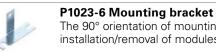
Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat Accuracy +/- 0.5%	
Compact, low cost design	Allows flexibility for OEM applications	
Isolated, 30A, SPDT, NO output contacts	Allows direct operation of heavy loads: compressors, pumps, blower moters, heaters.	
Encapsulated	Protects against shock, vibration, and humidity.	

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
HRDI117S	12VDC	Fixed	7s
HRDI421	120VAC	Onboard	1 - 100s
HRDI422	120VAC	Onboard	10 - 1000s

If you don't find the part you need, call us for a custom product 800-843-8848



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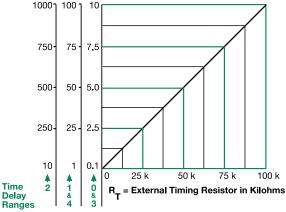
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HRDI SERIES



External Resistance vs. Time Delay

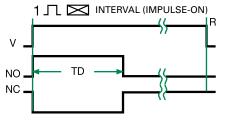
In Secs. or Mins. ן 100 ך 100



This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases. When selecting an external RT, add the tolerances of the timer and the RT $\,$

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay R = Reset **_,,_** = Undefined Time

Specifications

Specificatio	ons			
Time Delay				
Туре		Microcontroller circuitry		
Range		0.1s - 100m in 5 adjustable ranges or fixed		
Repeat Accuracy		±0.5 % or 20ms, whichever	-	
Tolerance			- 5	
(Factory Calibrat	ion)	±1%, ±5%		
Recycle Time	,	≤ 150ms		
Time Delay vs Ten	nn	- 1001110		
& Voltage	P .	+2%		
Input		±270		
Voltage		12 or 24VDC; 24, 120, or 23	nvac	
Tolerance		12 01 241 00, 24, 120, 01 20	0 17 10	
12VDC & 24VDC		-15% - 20%		
24 to 230VAC		-20% - 10%		
AC Line Frequenc	v	50/60 Hz		
Power Consumpti	,	$AC \le 4VA; DC \le 2W$		
Output	011	$AU \leq 4VA, DU \leq 2VV$		
Туре		Electromechanical relay		
Form		SPDT, non-isolated		
		SPDT, non-isolated SPDT-NO	SPDT-NC	
Ratings	125/2401/40		15A	
General Purpose				
Resistive	125/240VAC		15A	
	28VDC	20A	10A	
Motor Load	125VAC	1 hp*	1/4 hp**	
	240VAC	2 hp**	1 hp**	
Life		Mechanical - 1 x 10 ⁶ ;		
		Electrical - 1 x 105, *3 x 104	4, **6,000	
Protection				
Surge		IEEE C62.41-1991 Level A		
Circuitry		Encapsulated		
Dielectric Breakd		≥ 2000V RMS terminals to mounting surface		
Insulation Resista	ince	≥ 100 MΩ		
Polarity		DC units are reverse polari	ty protected	
Mechanical				
Mounting		Surface mount with one #1		
Dimensions		H 76.7 mm (3"); W 51.3 mm	n (2″);	
		D 38.1 mm (1.5")		
Termination		0.25 in. (6.35 mm) male quick connect terminals		
Environmental				
Operating/Storag	e			
Temperature		-40° to 60°C / -40° to 85°C	<u>,</u>	
Humidity		95% relative, non-condensing		

≅ 3.9 oz (111 g)

12 TIME DELAY RELAYS

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Weight

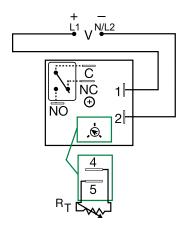


KRDI SERIES

$(\in \mathfrak{R})$



Wiring Diagram



V = Voltage C = Common, Transfer Contact NO = Normally Open NC = Normally Closed

A knob is supplied for adjustable units, or RT terminals 4 & 5 for external adjust. See external adjustment vs time delay chart.

Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

12 **TIME DELAY RELAYS**

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
KRDI120	12VDC	Onboard knob	0.1 - 10s
KRDI121	12VDC	Onboard knob	1 - 100s
KRDI122	12VDC	Onboard knob	10 - 1000s
KRDI2110S	24VAC	Fixed	10s
KRDI2160S	24VAC	Fixed	60s
KRDI220	24VDC	Onboard knob	0.1 - 10s
KRDI320	24VDC	Onboard knob	0.1 - 10s
KRDI420	120VAC	Onboard knob	0.1 - 10s
KRDI424	120VAC	Onboard knob	1 - 100m

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Description

The KRDI Series is a compact time-delay relay measuring only 2 in. (50.8 mm) square. Its solid-state timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRDI Series is a cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output relay energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 5%
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male guick connect terminals.



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Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

 $\leq \pm 5\%$

< +5%

≤ 150ms

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

0.1s - 100m in 5 adjustable ranges or fixed

±0.5% or 20ms, whichever is greater

Specifications

Time Delay Range Repeat Accuracy Tolerance (Factory Calibration) Reset Time Time Delay vs Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 110VDC, 120VAC or 230VAC AC Line Frequency/DC Ripple Power Consumption

Output

Type Form Rating (at 40°C)

Max. Switching Voltage Life (Operations)

Protection

Circuitry Isolation Voltage Insulation Resistance Polarity Mechanical Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight 12, 24 or 110VDC; 24, 120 or 230VAC -15% - 20% -20% - 10% 50/60 Hz / \leq 10% AC \leq 2VA; DC \leq 2W Isolated relay contacts SPDT 10A resistive @ 125VAC;

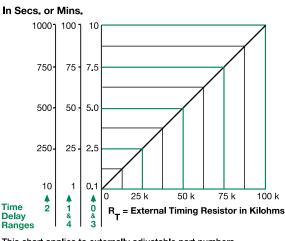
5A resistive @ 230VAC & 28VDC; 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁵

Encapsulated \geq 1500V RMS input to output \geq 100 M Ω DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing \approx 2.6 oz (74 g)

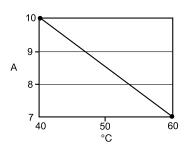
External Resistance vs. Time Delay



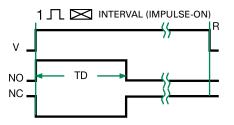
This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the BT terminals; as the resistance increases the time delay increases.

When selecting an external RT, add the tolerances of the timer and the RT for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Output Current/Ambient Temperature



Function Diagram



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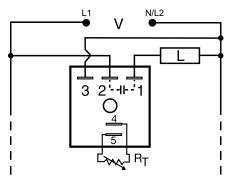


KSD2 SERIES

Interval Timer



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

 $R_{T} \mbox{ is used when } \\ external adjustment \\ \mbox{ is ordered. } \\$

Description

The KSD2 Series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable, solid-state timer is required. The factory calibration for fixed time delays is within 5% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. This series is designed for input voltages of 24, 120 or 230VAC. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry. An excellent choice for most OEM pulse shaping, maximum run time, and other process control applications.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, + / -5% time delay accuracy
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

Ordering Information

•			
MODEL	INPUT VOLTAGE VAC	ADJUSTMENT	TIME DELAY
KSD2221	24	External	1 - 100s
KSD2413M	120	Fixed	3m
KSD2420	120	External	0.1 - 10s

If you don't find the part you need, call us for a custom product 800-843-8848

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Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

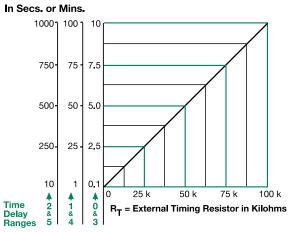
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay



This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn R_T . For 1 to 100 S use a 100 K ohm R_T .

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Time Delay vs. Temperature** & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Type Form **Maximum Load Current OFF State Leakage Current** Voltage Drop

Protection Circuitry Dielectric Breakdown Insulation Resistance

Mechanical Mounting

Dimensions

Termination

Environmental

```
Operating/Storage
Temperature
Humidity
Weight
```

0.1s - 1000m in 6 adjustable ranges or fixed $\pm 0.5\%$ or 20ms, whichever is greater

≤ ±5% ≤ 150ms ≤ ±10%

24, 120, or 230VAC ±20% 50/60 Hz ≤ 2VA

Solid state NO, closed during timing 1A steady state, 10A inrush at 60° C $\approx 5mA @ 230VAC$ $\approx 2.5V @ 1A$

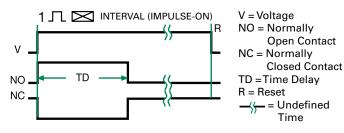
Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 $M\Omega$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

12 TIME DELAY RELAYS

Function Diagram



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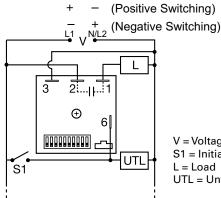


KSPU SERIES

C E **FN** @



Wiring Diagram



V = Voltage S1 = Initiate Switch L = Load UTL = Untimed Load

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSPU Series is a factory programmed module available in any 1 of 14 standard functions. The KSPU offers a single adjustable timer or counter function. Switch adjustment allows accurate selection of the time delay or number of counts the first time and every time. The 1A steady, 10A inrush rated solid-state output provides 100 million operations, typical. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KSPU Series is a cost effective approach for OEM applications that require small size, solid state reliability, and accurate switch adjustment.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1%
Compact design	Allows flexibility for OEM applications
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY/COUNTS	FUNCTION
KSPUA2I	24 to 240VAC	1 - 1023s	Interval
KSPUA8C	24 to 240VAC	1 - 1023 counts (binary) with pulsed output	Counter with pulsed output

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KSPU SERIES

Specifications

Time Delay Range*

1 - 633 or m in 18Repeat Accuracy $\pm 0.1\%$ or 20 ms,Setting Accuracy $\leq \pm 1\%$ or 20 ms,Reset Time $\leq 150ms$ Initiate Time $\leq 20ms$ Time Delay vs. Temperature& Voltage& Voltage $\leq \pm 2\%$ InputVoltage/ToleranceAC Line Frequency/DC Ripple $50/60 Hz/\leq 10\%$ Power ConsumptionAC $\leq 2VA; DC \leq 12\%$

Output Type Form Rating Voltage Drop Off State Leakage Current Counter Output

Protection

Circuitry Dielectric Breakdown Insulation Resistance Polarity Mechanical Mounting Dimensions

Termination Environmental

Operating/Storage Temperature Humidity Weight 0.1 - 102.3s, m or h in 0.1s, m or h increments 1 - 1023s, m or h in 1s, m or h increments 1 - 63s or m in 1s or m increments $\pm 0.1\%$ or 20 ms, whichever is greater $\leq \pm 1\%$ or 20 ms, whichever is greater ≤ 150 ms ≤ 20 ms $\leq \pm 2\%$

24 to 240VAC, 12 to 120VDC/s $\pm 15\%$ 50/60 Hz/s 10% AC s 2VA; DC s 1W

Solid state NO, SPST-NO 1A steady state, 10A inrush for 16ms AC \approx 2.5V @ 1A; DC \approx 1V @ 1A AC \approx 5mA @ 240VAC; DC \approx 1 mA Output pulse width: 300ms \pm 20% Time Delay/Counts Variable 7 & 8

Encapsulated

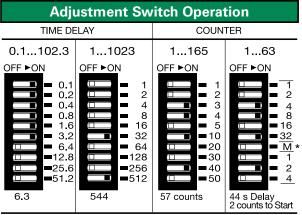
 \ge 2000V RMS terminals to mounting surface \ge 100 M Ω DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

*For CE approved applications, power must be removed from the unit when a switch position is changed.

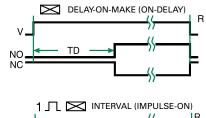
Adjustment Switch Operation

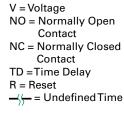


* for selecting time in minutes or seconds

Function Diagrams

TD





pertise Applied Answers Delivered

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

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NO

NC



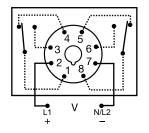
TDI / TDIH / TDIL SERIES

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Wiring Diagram



Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 23.

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY	LED
TDI120AL	120VAC	1 - 1023s in 1s increments	Yes
TDI12D	12VDC	1 - 1023s in 1s increments	No
TDIH24AL	24VAC	10 - 10,230s in 10s increments	Yes
TDIL120AL	120VAC	0.1 - 102.3s in 0.1s increments	Yes
TDIL24DL	24VDC	0.1 - 102.3s in 0.1s increments	Yes

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Description

The TDI Series is an interval timer that combines accurate digital circuitry with isolated, 10A rated, DPDT relay contacts in an 8-pin plug-in package. The TDI Series features DIP switch selectable time delays ranging from 0.1 to 10,230 seconds in three ranges. The TDI Series is the product of choice for custom control panel and OEM designers.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output relay is energized during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Digital circuitry	Repeat Accuracy + / - 0.1%, Setting accuracy + / - 2%
Isolated, 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
DIP switch adjustment	Provides first time setting accuracy
Industry standard octal plug connection	Eliminates need for special connectors
LED indication	Provides visual indication of timing and output status

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 (M 3.5×0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.

PSC8 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.

C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

TDI / TDIH / TDIL SERIES



Specifications

Time Delay Type Range**

Repeat Accuracy Setting Accuracy **Reset Time Recycle Time** Time Delay vs Temp. & Voltage Indicator Input Voltage Tolerance **12VDC & 24VDC/AC** 110 to 230VAC/DC **AC Line Frequency Power Consumption** Output Туре Form Rating

Life

Protection Polarity Isolation Voltage Mechanical Mounting

Dimensions

Termination Environmental Operating/Storage Temperature Weight Digital integrated circuitry 0.1 - 102.3s in 0.1s increments 1 - 1023s in 1s increments 10 - 10,230s in 10s increments ±0.1% or 20ms, whichever is greater ±2% or 50ms, whichever is greater ≤ 50ms ≤ 150ms

±2% LED glows during timing; relay is energized

12, 24, or 110VDC; 24, 120, or 230VAC

-15% - +20% -20% - +10% 50/60 Hz ≤ 3.25W

Electromechanical relay DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x10⁷; Electrical - 1 x 10⁶

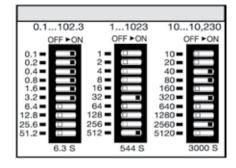
DC units are reverse polarity protected \geq 1500V RMS input to output

Plug-in socket H 81.3 mm (3.2"); W 60.7 mm (2.4"); D 45.2 mm (1.8") Octal 8-pin plug-in

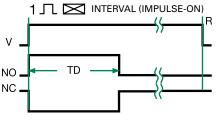
-20° to 65°C / -30° to 85°C ≅ 6 oz (170 g)

** For CE approved applications, power must be removed from the unit when a switch position is changed.

Digi-Set Binary Switch Operation



Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD = Time Delay R = Reset $- \langle \rangle = Undefined$ Time

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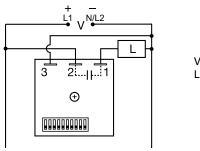


TDUI / TDUIH / TDUIL SERIES

$C \in \mathfrak{R}$



Wiring Diagram



V = Voltage L = Load

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY
TDUI3000A	24 to 120VAC	1 - 1023s
TDUIH3002A	12 to 24VDC	0.1 - 102.3m
TDUIL3001A	100 to 240VAC	0.1 - 102.3s
TDUIL3002A	12 to 24VDC	0.1 - 102.3s

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Description

The TDUI Series combines digital timing circuitry with universal voltage operation. Voltages of 24 to 240VAC and 12 to 24VDC are available in three ranges. The TDUI Series offers DIP switch selectable time delays ranging from 0.1 seconds to 102.3 minutes in three ranges. Its 1A rated output, ability to operate on multiple voltages, and wide range of switch selectable time delays make the TDUI Series an excellent choice for process control systems and OEM equipment.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Setting accuracy + / - 2%
Compact design	Allows flexibility for OEM applications
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Wide voltage ranges	Flexibility to handle multiple voltages found in control systems and OEM applications
DIP switch Adjustment	Provides first time setting accuracy

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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TDUI / TDUIH / TDUIL SERIES



Specifications

Time Delay Range*

Repeat Accuracy Setting Accuracy Reset Time Time Delay vs Temp. & Voltage Input Voltage **AC Line Frequency Power Consumption DC Ripple** Output Туре Form Rating **Voltage Drop OFF State Leakage Current** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting Dimensions Termination **Environmental Operating/Storage**

Temperature Humidity Weight 0.1 - 102.3s in 0.1s increments 1 - 1023s in 1s increments 0.1 - 102.3m in 0.1m increments $\pm 0.5\%$ or 20ms, whichever is greater $\leq \pm 2\%$ or 20ms, whichever is greater ≤ 150 ms $\leq \pm 5\%$

24 to 240VAC, 12 to 24VDC \pm 20% 50/60 Hz AC \leq 2VA; DC \leq 1W \leq 10%

Solid state NO, closed during timing 1A steady state, 10A inrush at 60°C AC \approx 2.5V @ 1A; DC \approx 1V @ 1A AC \approx 5mA @ 230VAC; DC \approx 1mA

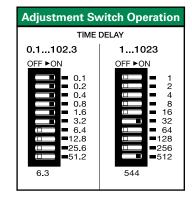
 $\begin{array}{l} \mbox{Encapsulated} \\ \geq 2000V \mbox{ RMS terminals to mounting surface} \\ \geq 100 \mbox{ M}\Omega \\ \mbox{DC units are reverse polarity protected} \end{array}$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

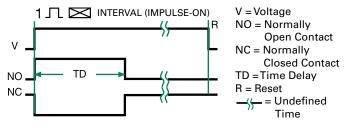
-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

*For CE approved applications, power must be removed from the unit when a switch position is changed.

Switch Operation



Function Diagram



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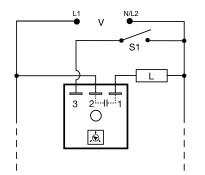
THD2 SERIES

Time Delay Relays Dedicated — Interval

(€¶\®®



Wiring Diagram



V = Voltage L = Load S1 = Optional Low Current Initiate Switch

 R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 19.

112 TIME DELAY RELAYS

Ordering Information

MODEL	OUTPUT RATING	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
THD2C420	20A	120VAC	External	0.1 - 10s
THD2C423	20A	120VAC	External	0.1 - 10m
THD2C433	20A	120VAC	Onboard	0.1 - 10m
THD2C620	20A	230VAC	External	0.1 - 10s
THD2C633	20A	230VAC	Onboard	0.1 - 10m

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Description

The THD2 Series combines accurate timing circuitry with high power solid-state switching. It can switch motors, lamps, and heaters directly without a contactor. You can reduce labor, component cost, and increase reliability with these small, easy-to-use, Digi-Power timers.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 1%
High load currents up to 20A, 200A inrush	Allows direct control of motors, lamps and heaters without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and components costs

Accessories

2

P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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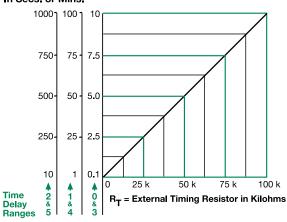
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THD2 SERIES



External Resistance vs. Time Delay

In Secs. or Mins.

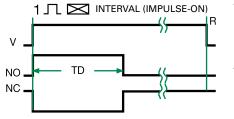


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T, add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD =Time Delay R = Reset Time

Specifications

Specifications			
Time Delay			
Range	0.1s - 1000m in 6 adjustable ranges or fixed		
Repeat Accuracy		ns, whichever is gre	
Tolerance		-,	
(Factory Calibration)	≤±1%		
Reset Time	≤ 150 ms		
Time Delay vs Temp.			
& Voltage	≤ ±2%		
Input	$\leq \pm Z / 0$		
Voltage	24, 120, or 23		
Tolerance	24, 120, 01 23 +20%	JUVAG	
AC Line Frequency	50/60 Hz		
Output	0 11 1 1 1		
Туре	Solid state		
Form	NO, closed d	0 0	
Maximum Load Current	Output	Steady State	Inrush**
	A	6A	60A
	В	10A	100A
	С	20A	200A
Minimum Load Current	100mA		
Voltage Drop	≅ 2.5V at rate	ed current	
OFF State Leakage Current	≅ 5mA @ 230	OVAC	
Protection			
Circuitry	Encapsulated	b	
Dielectric Breakdown	≥ 2000V RM	S terminals to mount	ting surface
Insulation Resistance	≥ 100 MΩ		0
Mechanical			
Mounting **	Surface mou	nt with one #10 (M5	x 0.8) screw
Dimensions		2"): W 50.8 mm (2"):	
	D 38.4 mm (1.51")		
Termination	0.25 in. (6.35 mm) male quick connect terminals		
Environmental	0.20 III. (0.00		
Operating/Storage			
• • •	40º +o 60ºC	/ 40° to 05°C	
Temperature	-40° to 60°C / -40° to 85°C		
Humidity		, non-condensing	
Weight	≅ 3.9 oz (111	g)	

**Must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

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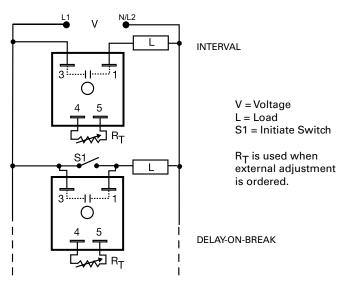
THD7 SERIES

Time Delay Relays Dedicated — Interval





Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OUTPUT RATING
THD7421A	120VAC	External	1 - 100s	6A
THD7621C	230VAC	External	1 - 100s	20A

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Description

The THD7 Series utilizes only two terminals connected in series with the load. Interval timing mode is achieved by using a small portion of the AC sine wave allowing sufficient voltage for circuit operation. The THD7 Series can be used for interval or delay-on-break timing. It is designed to operate large loads directly, such as motors, heater elements, and motor starters.

Operation (Interval)

Upon application of input voltage, the output energizes and the time delay begins. The output remains energized throughout the time delay. At the end of the time delay the output de-energizes and remains de-energized until power is removed.

Reset: Removing input voltage resets the time delay and the output.

Operation (Delay-on-Break)

Upon closure of SW1, the load energizes and the timer is reset (zero voltage across its input terminals). Opening SW1 re-applies input voltage to the timer, the load remains energized and the time delay begins. At the end of the time delay the output de-energizes. If SW1 is open when power is applied, the load will energize for the time delay then de-energize.

Reset: Reclosing SW1 resets the timer.

Features & Benefits

FEATURES	BENEFITS
Digital integrated circuitry	Repeat Accuracy + / - 0.5%
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps and heaters without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs

Accessories



P1004-13, P1004-13-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of

Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

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THD7 SERIES



Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



VTP(X)(X) Plug-on Adjustment Module

Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in resistance values from $5K\Omega$ to $5M\Omega$.

Selection Table for VTP Plug-on Adjustment Accessory

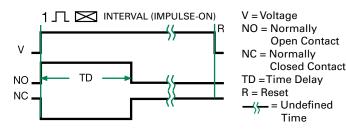
Time Delay	VTP P/N
1 - 1-100s	VTP5G
2 - 10-1000s	VTP5K
3 - 0.1-10m	VTP5N
4 - 1-100m	VTP5P
5 - 10-1000m	VTP5R

Selection Guide

R _T Selection Chart							
	Desired Time Delay*						
Seco	onds		Minutes		11		
1	2	3	4	5	Megohm		
1	10	0.1	1	10	0.0		
10	100	1	10	100	0.5		
20	200	2	20	200	1.0		
30	300	3	30	300	1.5		
40	400	4	40	400	2.0		
50	500	5	50	500	2.5		
60	600	6	60	600	3.0		
70	700	7	70	700	3.5		
80	800	8	80	800	4.0		
90	900	9	90	900	4.5		
100	1000	10	100	1000	5.0		

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T

Function Diagrams



Specifications

Time Delay				
Туре	Digital integrated circuitry			
Range	1s - 1000m in 5 adjustable ranges or fixed			
Repeat Accuracy	±0.5% or 20ms, whichever is greater			
Tolerance				
(Factory Calibration)	≤ ±10%			
Recycle Time	After timino	g: ≤150ms; During tim	ina: ≤ 350ms	
Time Delay vs Temp.		j		
& Voltage	$\leq \pm 2\%$			
Input	= = = 70			
Voltage	24, 120, or 2	230VΔC		
Tolerance	±20%			
AC Line Frequency	50/60 Hz			
Output	30/00 112			
Туре	Solid state			
Form		during timing		
Rating	Output	Steady State	Inrush**	
nating	A	6A	60A	
	B	10A	100A	
	C	20A	200A	
Effective Voltage Drop	0	ZUA	200A	
(VLine-VLoad)	Input	Effective Dr	'nn	
(VEINC VEGUU)	24VAC	≤ 3V	op	
	120VAC	≤ 3V ≤ 3V		
	230VAC	≤ 5V ≤ 5V		
Minimum Load Current	100mA	≤ 0 V		
Protection	TUUTIA			
Circuitry	Encapsulate	he		
Dielectric Breakdown		/IS terminals to moun	ting surface	
Insulation Resistance	≥ 100 MΩ		ting surface	
Mechanical	= 100 1012			
Mounting **	Surface mo	unt with one #10 (M5	T N R) SCIEN	
		(2"); W 50.8 mm (2");		
0	H 50 8 mm		r	
Dimensions				
Dimensions	D 38.4 mm	(1.51")	nect terminal	
Dimensions Termination	D 38.4 mm		nnect terminals	
Dimensions Termination Environmental	D 38.4 mm	(1.51")	nnect terminals	
Dimensions Termination Environmental Operating/Storage	D 38.4 mm 0.25 in. (6.3	(1.51") 15 mm) male quick con	nnect terminals	
Dimensions Termination Environmental Operating/Storage Temperature	D 38.4 mm 0.25 in. (6.3 -40° to 60°	(1.51″) 15 mm) male quick col C / -40° to 85°C	nnect terminals	
Dimensions Termination Environmental Operating/Storage	D 38.4 mm 0.25 in. (6.3 -40° to 60°	(1.51") 5 mm) male quick con C / -40° to 85°C re, non-condensing	nnect terminals	

DELAY-ON-BREAK O = OutputL = LoadTD = Time Delay ΤD R = Reset

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Time

TIME DELAY RELAYS

12



TS2 / TS6 SERIES

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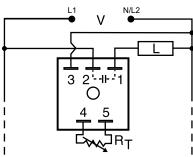


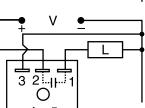
TS2



TS6

Wiring Diagram





For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

L = Load R_T is used when external

V = Voltage

adjustment is ordered.

Note: TS6 is not reverse polarity protected.

Description

The TS2 Series is designed for 24, 120 or 230VAC and the TS6 Series is designed for 12 or 24VDC. These series are capable of controlling load currents of up to 1A steady state, 10A inrush. Encapsulated circuitry and the reliability of a $\pm 2\%$ repeat accuracy make the TS2 and TS6 ideal for cost sensitive applications.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 10%
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Rated for operation up to 75°C	Can be used in the harshest environments

P1023-6 Mounting bracket

Accessories



P1004-XX (fig. A), **P1004-XX-X** (fig. B) **Versa-Pot** Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE		MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
TS22120	24VAC	Fixed	20s	n/a		TS2424	120VAC	External	5 - 600s	n/a
TS2223	24VAC	External	2 - 180s	n/a		TS6116P	12VDC	Fixed	6s	Positive
TS2412	120VAC	Fixed	2s	n/a		TS6122P	12VDC	External	0.5 - 20s	Positive
TS24130	120VAC	Fixed	30s	n/a		TS6123P	12VDC	External	2 - 60s	Positive
TS2421	120VAC	External	0.05 - 3s	n/a		TS6321P	24VDC	External	0.05 - 3s	Positive
TS2422	120VAC	External	0.5 - 60s	n/a		TS6323P	24VDC	External	2 - 180s	Positive
TS2423	120VAC	External	2 - 180s	n/a						
16 1 16 6 1 11										

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TS2 / TS6 SERIES



Accessories



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick

connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



VTP(X)(X) Plug-on Adjustment Module Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in

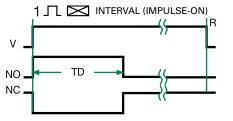
resistance values from 5K Ω to 5M Ω .

Selection Table for VTP Plug-on Adjustment Accessory

TS6 12VDC					
_		Versa-Pot (pe	otentiometer)		
Time Delay	VTP P/N	Fig. A P/N	Fig. B P/N		
1 - 0.05-1s	VTP2A	P1004-16	P1004-16-X		
2 - 0.5-20s	VTP2E	P1004-16	P1004-16-X		
3 - 2-60s	VTP2F	P1004-16	P1004-16-X		
4 - 5-120s	VTP2H	P1004-16	P1004-16-X		

TS2 & TS6 All Other Voltages						
		Versa-Pot (po	otentiometer)			
Time Delay	VTP P/N	Fig. A P/N	Fig. B P/N			
1 - 0.05-3s	VTP4B	P1004-12	P1004-12-X			
2 - 0.5-60s	VTP4F	P1004-12	P1004-12-X			
3 - 2-180s	VTP4J	P1004-12	P1004-12-X			
4 - 5-600s	VTP5N	P1004-13	P1004-13-X			

Function Diagram



Selection Guide

	R _T Selection Chart				
Des	sired Ti	me De	lay*	Вт	
	Sec	conds			
1	2	3	4	Megohm	
0.05	0.5	2	5	0.0	
0.5	10	30	60	0.5	
1.0	20	60	120	1.0	
	24VD0	C or AC	ONLY†	•	
1.5	30	90	180	1.5	
2.0	40	120	240	2.0	
2.5	50	150	300	2.5	
3.0	60	180	360	3.0	
			420	3.5	
			480	4.0	
			540	4.5	
			600	5.0	

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T † 1 Megohm max for 12 VDC Units

Specifications

Dielectric Breakdown

Insulation Resistance

Mechanical

Dimensions

Termination

Environmental

Temperature Humidity

Operating/Storage

Mounting

Time Delay Type Analog circuitry Range 12VDC 0.05 - 120s in 4 adjustable ranges or fixed $(1 M\Omega max. R_T)$ **Other Voltages** 0.05 - 600s in 4 adjustable ranges or fixed **Repeat Accuracy** ±2% or 20ms, whichever is greater Tolerance (Factory Calibration) $\leq \pm 10\%$ Time Delay vs Temp. & Voltage $\leq \pm 10\%$ **Reset Time** ≤ 150ms Input Voltage 12 or 24VDC: 24 or 20VAC Tolerance ±15% DC Ripple 10% $DC \le 1W$: $AC \le 2VA$ **Power Consumption** Output Type Solid state Form NO, closed during timing Maximum Load Current 1A steady state, 10A inrush at 60°C $DC \simeq 1.0V @ 1A; AC \simeq 2.5V @ 1A$ Voltage Drop Protection Circuitry Encapsulated Polarity TS6 is not reverse polarity protected

Encapsulated TS6 is not reverse polarity protected \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing \approx 2.4 oz (68 g)

Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

Weight



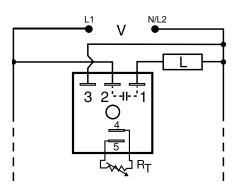
TSD2 SERIES

IntervalTimer

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

12 TIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TSD2411S	120VAC	Fixed	1s
TSD24145S	120VAC	Fixed	45s
TSD241600S	120VAC	Fixed	600s
TSD2434	120VAC	Onboard	1 - 100m

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The TSD2 Series is designed for more demanding commercial and industrial applications where small size and accurate performance are required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.1% of the time delay. The TSD Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 100 hours are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output is energized during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1%, + / -1% time delay accuracy
Extended temperature range	Rated to 75°C operating temperature to withstand high heat applications.
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



R_T is used when external adjustment

is ordered.

P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AWG 14/16) Female Quick Conne These 0.25 in. (6.35 mn

Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

F1015-18 Screw ac all modul connect

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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TSD2 SERIES



Accessories



C103PM (AL) DIN Rail

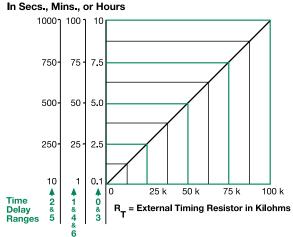
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

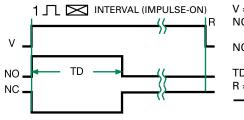


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases

When selecting an external RT, add the tolerances of the timer and the RT

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagaram



V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD = Time Delay R = Reset ے Undefined Time

Specifications

Time Delay

Range Repeat Accuracy Tolerance (Factory Calibration) **Reset Time** Time Delay vs. Temperature & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Type Form **Maximum Load Current Off State Leakage Current Voltage Drop** Protection Circuitry **Dielectric Breakdown Insulation Resistance**

Mechanical Mounting Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight

0.1s - 100h in 7 adjustable ranges or fixed ±0.1% or 20ms, whichever is greater

≤ ±1% ≤ 150ms $\leq \pm 1\%$

24, 120, or 230VAC ±20% 50/60 Hz $\leq 2VA$

Solid state NO, closed during timing 1A steady state, 10A inrush at 60°C ≃ 5mA @ 230VAC ≅ 2.5V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface ≥ 100 MΩ

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21")

0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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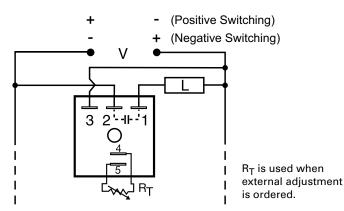
TSD6 SERIES

IntervalTimer

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

12 LIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	SWITCHING MODE
TSD6113SP	12VDC	Fixed	3s	Positive
TSD61115SP	12VDC	Fixed	15s	Positive
TSD6113SN	12VDC	Fixed	3s	Negative
TSD6310.8SN	24VDC	Fixed	0.8s	Negative
TSD631380SP	24VDC	Fixed	380s	Positive
TSD6320P	24VDC	External	0.1 - 10s	Positive

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Description

The TSD6 Series offers total solid-state, interval timing for 12 or 24VDC applications. This series provides either negative or positive switching. The TSD6 Series is designed for more demanding commercial and industrial applications where small size and accurate performance is required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.1% of the time delay. The TSD6 Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 100 hours are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Interval)

Upon application of input voltage, the time delay begins. The output energizes during the time delay. At the end of the time delay, the output de-energizes and remains de-energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and the output.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1%, + / -1% time delay accuracy
Extended temperature range	Rated to 75°C operating temperature to withstand high heat applications.
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

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TSD6 SERIES



Accessories



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

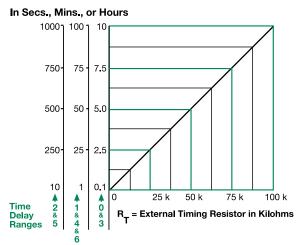
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

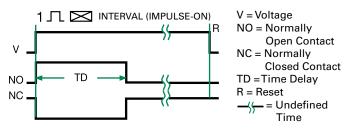


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external RT, add the tolerances of the timer and the RT

for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



Specifications

Time Delay Range 0.1s - 100h in 7 adjustable ranges or fixed **Repeat Accuracy** ±0.1% or 20ms, whichever is greater Tolerance (Factory Calibration) $\leq \pm 1\%$ **Reset Time** ≤ 150ms **Time Delay vs. Temperature** & Voltage $\leq \pm 1\%$ Input 12 or 24VDC Voltage Tolerance $\pm 15\%$ **DC Ripple** ±10% **Power Consumption** $\leq 1W$ Output Type Form **Maximum Load Current Off State Leakage Current** ≃ 1mA ≅ 1.0V @ 1A **Voltage Drop** Protection Circuitry Encapsulated **Dielectric Breakdown Insulation Resistance** $\geq 100 \text{ M}\Omega$ Polarity Mechanical Mounting Dimensions **D** 30.7 mm (1.21") Termination

terminals Environmental **Operating/Storage** Temperature Humidity Weight

Solid state, positive or negative switching NO, closed during timing 1A steady state, 10A inrush at 60°C \geq 2000V RMS terminals to mounting surface Units are reverse polarity protected Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2");

0.25 in. (6.35 mm) male quick connect

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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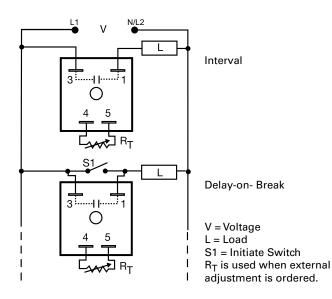
TSD7 SERIES

Interval/Delay-on-BreakTimer



5 4 EXTERNAL ADJUSTMENT

Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

Description

The TSD7 Series utilizes only two terminals connected in series with the load. Interval timing mode period is achieved by using a small portion of the AC sine wave allowing sufficient voltage for circuit operation. It can be used as an interval timer to control or pulse shape the operation of contactors, solenoids, relays, and lamp loads. The TSD7 Series can be wired to delay on the break of a switch for energy saving fan delays.

Operation (Interval)

Upon application of input voltage, the output energizes and the time delay begins. The output remains energized throughout the time delay. At the end of the time delay, the output de-energizes and remains de-energized until power is removed.

Reset: Removing input voltage resets the time delay and the output.

Operation (Delay-on-Break)

Upon closure of SW1, the load is energized and the timer is reset (zero volts across its input terminals). Opening SW1 reapplies input voltage to the timer, the load remains energized and the time delay begins. At the end of the time delay, the output de-energizes. If SW1 is open when power is applied, the load will energize for the time delay then de-energize.

Reset: Reclosing SW1 resets the timer.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, + / -1% time delay accuracy
Extended temperature range	Rated to 75°C operating temperature to withstand high heat applications
Compact, low cost design	Allows flexibility for OEM applications
1A steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Two terminal series load connections	Provides quick and easy installation for new or existing systems

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY		MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TSD7412S	120VAC	Fixed	2s		TSD761120S	230VAC	Fixed	120s
TSD7414M	120VAC	Fixed	4m		TSD761180S	230VAC	Fixed	180s
TSD7421	120VAC	External	1 - 100s		TSD7611S	230VAC	Fixed	1s
TSD7423	120VAC	External	0.1 - 10m		TSD7621	230VAC	External	1 - 100s
TSD7424	120VAC	External	1 - 100m					

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Accessories



P1004-13, P1004-13-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting Bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



P1023-20 DIN Rail Adapter

C103PM (AL) DIN Rail

(91.4 cm) length.

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

35 mm aluminum DIN rail available in a 36 in.



VTP(X)(X) Plug-on Adjustment Module Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in

resistance values from $5K\Omega$ to $5M\Omega$. Selection Table for VTP Plug-on Adjustment Accessory

		,	
Time Delay	VTP P/N	Time Delay	VTP P/N
1 - 1-100s	VTP5G	4 - 1-100m	VTP5P
2 - 10-1000s	VTP5K	5 - 10-1000m	VTP5R
3 - 0.1-10m	VTP5N		

Selection Guide

R _T Selection Chart							
	Desired	Time D)elay*	B-			
Second	s	Minut	es	1.1			
1	2 3	4	5	Megohm			
1	10 0.	1 1	10	0.0			
10 1	00	1 10	100	0.5			
20 2	00 :	2 20	200	1.0			
30 3	00 :	3 30	300	1.5			
40 4	00	4 40 400					
50 5	00	5 50 500					
60 6	00	6 60 600					
70 7	00	7 70 700					
80 8	00	8 80 800					
90 9	00	9 90	900	4.5			
100 10	00 1	D 100	1000	5.0			

20% for tolerance of unit and the RT.

Specifications

Time Delay Туре Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency** Output Туре Form **Maximum Load Current Minimum Load Current** Effective Voltage Drop (VLine-VLoad)

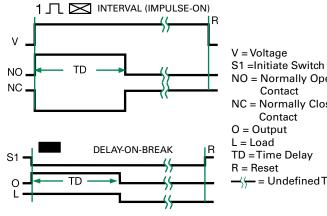
Protection

Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical Mounting Dimensions

Termination

Environmental **Operating/Storage** Temperature Humidity Weight

Function Diagrams



Digital integrated circuitry 1s - 1000m in 5 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 10\%$ ≤ 400ms $\leq \pm 2\%$

24, 120, or 230VAC ±20% 50/60 Hz

Solid state NO, closed during timing 1A steady state, 10A inrush at 45°C 40mA

Input	Effective Drop
24VAC	3V
120VAC	4V
230VAC	6V

Encapsulated ≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

NO = Normally Open NC = Normally Closed

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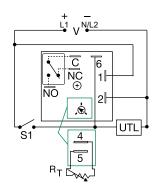


KRD9 SERIES

(∈¶"®



Wiring Diagram



. . . .

V = Voltage S1 = Initiate Switch C = Common, Transfer Contact UTL = Untimed Load (optional)

A knob is supplied for adjustable units, or R_T terminals 4 & 5 for external adjust. See external adjustment vs time delay chart. The untimed load is optional. Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KRD9 Series microcontroller timing circuit provides excellent repeat accuracy and stability. Cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Retriggerable Single Shot)

Function Type A (Output Initially De-energized): Input voltage must be applied prior to and during timing. When the initiate switch is closed, (momentary or maintained) the output energizes and the time delay starts. On completion of the delay, the output de-energizes. The unit will time out if S1 remains in the open or closed position for the full time delay. Reclosing the initiate switch resets the time delay and restarts timing; the output remains energized. The output will not energize if the initiate switch is closed when input voltage is applied.

Function Type B (Output Initially Energized): Upon application of input voltage, the output energizes and the time delay starts. At the end of the time delay, the load de-energizes. The unit will time out if S1 remains in the open or closed position for the full time delay. Closing (re-closing) the initiate switch resets the time delay and restarts timing; the output remains energized.

Reset: The time delay and the output are reset when input voltage is removed.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 5%
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated circuitry	Protects against shock, vibration, and humidity

P1023-6 Mounting bracket

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	FUNCTION TYPE
KRD9120B	12VDC	Onboard	0.1 - 10s	Energized
KRD92115MA	24VAC/DC	Fixed	15m	De-energized
KRD92115MB	24VAC/DC	Fixed	15m	Energized
KRD9220B	24VAC/DC	Onboard	0.1 - 10s	Energized
KRD93115MA	24VDC	Fixed	15m	De-energized
KRD9423B	120VAC	Onboard	0.1 - 10m	Energized

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Microcontroller based with watchdog circuitry

0.1s - 1000m in 6 adjustable ranges or fixed

±0.5% or 20ms, whichever is greater

< 40ms; < 750 operations per minute

12, 24 or 110VDC; 24, 120 or 230VAC

 $\leq \pm 5\%$

 $\leq \pm 5\%$

-15% - +20%

-20% - +10%

SPDT

250VAC

Encapsulated

D 30.7 mm (1.21")

 $\geq 100 \text{ M}\Omega$

 $AC \le 2VA; DC \le 2W$

Isolated relay contacts

10A resistive @ 125VAC; 5A resistive @ 230VAC & 28VDC;

≥ 1500V RMS input to output

Mechanical - 1 x 107; Electrical - 1 x 105

DC units are reversed polarity protected

H 50.8 mm (2.0"); **W** 50.8 mm (2.0");

Surface mount with one #10 (M5 x 0.8) screw

0.25 in. (6.35 mm) male guick connect terminals

1/4 hp @ 125VAC

≤ 150ms

Accessories

KRD9 SERIES



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

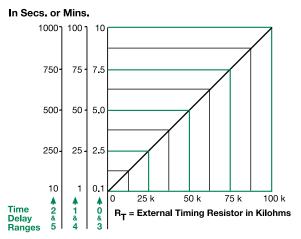
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay



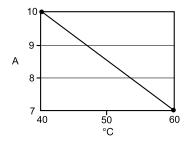
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the tie delay increases

When selecting an external R_T, add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn RT. For 1 to 100 S use a 100 K ohm RT.

Output Current/Ambient Temperature



Specifications

Time Delay

Туре Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **12VDC & 24VDC/AC** 110VDC, 120 or 230VAC AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output

Туре Form Rating (at 40°C)

Max. Switching Voltage Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting

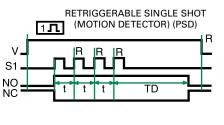
Dimensions

Termination **Environmental**

Operating/Storage Temperature Humidity Weight

-40° to 60° C / -40° to 85° C 95% relative, non-condensing ≈ 2.6 oz (74 g)

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally **Closed Contact** = Incomplete Time Delay TD = Time Delay R = Reset

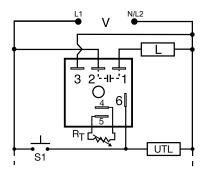
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TSD94110SB

Retriggerable Single-ShotTimer



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Specifications

Time Delay Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time** Time Delay vs. Temp. & Voltage **Initiate Timing** Input **Operating Voltage** Tolerance Output Type Form Rating

Voltage Drop Protection

Transient Dielectric Insulation Resistance Microcontroller circuitry Factory fixed 10s ±0.5%

V = Voltage L =Timed Load

S1 = Initiate Switch

UTL = Optional Untimed Load

R_T is used when external

adjustment is ordered.

±1% 300ms max.

±2% 16ms max. AC

120 volts AC ±15%

Solid State Normally open 1 ampere steady state, 10 amperes inrush at 55°C AC 2.5 volts typical at 1 ampere

Protected 1500 volts RMS 100 megohms minimum 4.4

Description

The TSD94110SB retriggerable single-shot timer is designed for a variety of applications. Its digital circuit provides long or short delays with accuracy and stability over a wide voltage and temperature range. It is the ideal timer for pulse-train monitoring of programmable controllers, or any system requiring motion detection.

Operation A Type

Power must be applied to input at all times prior to and during timing. Upon closure of initiate switch (momentary or maintained) the load is energized and the time delay is started. On completion of the delay period the load is de-energized. Should the initiate switch be reclosed during timing, the delay will be reset to zero and restarted.

Operation B Type

Upon application of input power, the load is energized and a time delay is started. At the end of the time delay, the load is de-energized. Should the initiate switch be closed or reclosed during timing, the delay is reset to zero and restarted.

Features & Benefits

- Excellent Pulse Train Monitor
- Totally Solid State and Encapsulated
- Microcontroller Circuitry
- Fast Reset to Zero During Timing
- Excellent Accuracy and Reliability
- DC Units are Reverse Polarity Protected

Mechanical Mounting Termination

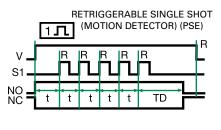
Package Dimensions

Environmental

Operating/Storage Temperature Humidity Weight Surface mount with one #8 or #10 screw 0.25 in. (6.35 mm) male quick connect terminals Molded housing with encapsulated circuitry H 50.80 mm (2.00"); W 50.80 mm (2.00"); D 30.70 mm (1.21")

-40°C to 60°C / -40°C to 85°C 95% relative, non-condensing Approx. 2.4 oz (68 g)

Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact t = Incomplete Time Delay TD = Time Delay R = Reset

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112 TIME DELAY RELAYS

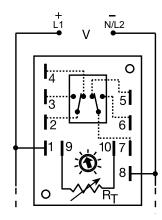
ERD3425A







Wiring Diagram



A knob, or terminals 9 &10 are only included on adjustable units.

Relay contacts are isolated.

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 25.

Description

Econo-Timers are a combination of digital electronics and a reliable electromechanical relay. DPDT relay output for relay logic circuits, and isolation of input to output voltages. Cost effective for OEM applications, such as duty cycling, drying, washing, signaling, and flashing.

Operation (Recycling - ON Time First)

Upon application of input voltage, the output relay energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output relay energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.

Features & Benefits

FEATURES	BENEFITS
Digital integrated circuitry	Repeat Accuracy + / - 0.5%, Factory calibration + / - 10%
Isolated, 10A, DPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-16, P1004-16-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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ERD3425A

Time Delay Relays Dedicated — Recycle

Selection Guides

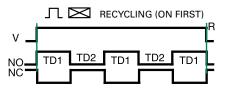
	R _T Selection Chart						
	Des	sired Ti	me De	lay*		B-	
		Sec	onds			1.1	
1	2	3	4	5	6	Megohm	
0.1	0.1	0.1	0.2	0.3	0.6	0.0	
0.19	0.6	1	1.7	3	6	0.1	
0.28	1.1	2	3.2	6	12	0.2	
0.37	1.6	3	4.7	9	18	0.3	
0.46	2.1	4	6.2	12	24	0.4	
0.55	2.6	5	7.7	15	30	0.5	
0.64	3.0	6	9.2	18	36	0.6	
0.73	3.5	7	10.7	21	42	0.7	
0.82	4.0	8	12.2	24	48	0.8	
0.91	4.5	9	13.7	27	54	0.9	
1.0	5.0	10	15	30	60	1.0	

 * When selecting an external R_{T} add at least 20% for tolerance of unit and the R_{T}

R _T Selection Chart							
	Desire	d Time	Delay*		D_		
		Minutes	-		TT.		
7	8	9	10	11	Megohm		
0.1	0.1	0.2	1	10	0.0		
0.6	1	1.7	10	50	0.1		
1.1	2	3.2	20	100	0.2		
1.6	3	4.7	30	150	0.3		
2.1	4	6.2	40	200	0.4		
2.6	5	7.7	50	250	0.5		
3.0	6	9.2	60	300	0.6		
3.5	7	10.7	70	350	0.7		
4.0	8	12.2	80	400	0.8		
4.5	9	13.7	90	450	0.9		
5.0	10	15	100	500	1.0		

* When selecting an external R_T add at least 20% for tolerance of unit and the R_T.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay Type Range

Adjustment Repeat Accuracy Tolerance (Factory Calibration) Reset Time Time Delay vs Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 120VAC/DC & 230VAC AC Line Frequency Output Type

Form Rating

Life

Protection Isolation Voltage Insulation Resistance Polarity Mechanical Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Weight Digital integrated circuitry 0.1s - 500m in 11 adjustable ranges 0.1s - 1000m fixed Knob, external adjust, or fixed ±0.5%

≤ ±10% ≤ 150ms

≤±2%

12, 24, or 120VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% 50/60 Hz

Isolated relay contacts DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/240VAC Mechanical - 1 x 10⁷; Electrical - 1 x 10⁶

 \geq 1500V RMS input to output \geq 100 $M\Omega$ DC units are reverse polarity protected

Surface mount with two #6 (M3.5 x 0.6) screws H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 43.2 mm (1.7") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 65°C / -40° to 85°C ≅ 5.7 oz (162 g)

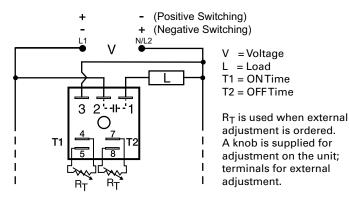
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ESDR SERIES



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



Description

The ESDR Series offers independent time adjustment of both delay periods. Adjustment options include fixed, onboard or external adjust. The ESDR is recommended for air drying, automatic oiling, life testing, chemical metering and automatic duty cycling. This series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable, solid-state timer is required. The factory calibration for fixed time delays is < \pm 5%. The repeat accuracy, under stable conditions, is 0.1% of the selected time delay. This series is designed for input voltages of 12VDC to 230VAC in five ranges. Time delays of 0.1 seconds to 1000 minutes are available in six ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Recycling - ON Time First)

Upon application of input voltage, the output energizes and the T1, ON time begins. At the end of the ON time, the output de-energizes and the T2, OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.

Features & Benefits

FEATURES	BENEFITS		
Microcontroller based	Repeat Accuracy + / -0.1%, Factory calibration + / - 5%		
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.		
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity		
ON/OFF recycling with independent adjustment of both time periods	Separate on and off timing settings are knob adjustable for added flexibility		
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications		

Ordering Information

See next page.

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ESDR SERIES

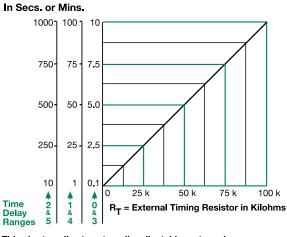
Time Delay Relays Dedicated — Recycle

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	T1 ON TIME	FIRST DELAY	T2 OFF TIME	SWITCHING MODE
ESDR120A0P	12VDC	Onboard	0.1 - 10s	On time	0.1 - 10s	Positive
ESDR120B3P	12VDC	Onboard	0.1 - 10s	Off time	0.1 - 10m	Positive
ESDR123B4P	12VDC	Onboard	0.1 - 10m	Off time	1 - 100m	Positive
ESDR125A5P	12VDC	Onboard	10 - 1000m	On time	10 - 1000m	Positive
ESDR221A2	24VAC	Onboard	1 - 100s	On time	10 - 1000s	n/a
ESDR320A0P	24VDC	Onboard	0.1 - 10s	On time	0.1 - 10s	Postitive
ESDR320A3P	24VDC	Onboard	0.1 - 10s	On time	0.1 - 10m	Positive
ESDR420A0	120VAC	Onboard	0.1 - 10s	On time	0.1 - 10s	n/a
ESDR420A1	120VAC	Onboard	0.1 - 10s	On time	1 - 100s	n/a
ESDR420A4	120VAC	Onboard	0.1 - 10s	On time	1 - 100m	n/a
ESDR420B1	120VAC	Onboard	0.1 - 10s	Off time	1 - 100s	n/a
ESDR420B4	120VAC	Onboard	0.1 - 10s	Off time	1 - 100m	n/a
ESDR421A1	120VAC	Onboard	1 - 100s	On time	1 - 100s	n/a
ESDR421A4	120VAC	Onboard	1 - 100s	On time	1 - 100m	n/a
ESDR423A3	120VAC	Onboard	0.1 - 10m	On time	0.1 - 10m	n/a
ESDR423A4	120VAC	Onboard	0.1 - 10m	On time	1 - 100m	n/a
ESDR424A1	120VAC	Onboard	1 - 100m	On time	1 - 100s	n/a
ESDR450A1	120VAC	External	0.1 - 10s	On time	1 - 100s	n/a

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External Resistance vs. Time Delay

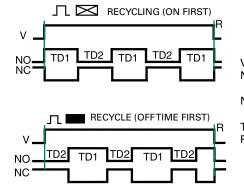


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external ${\sf R}_{\sf T}$, add the tolerances of the timer and the ${\sf R}_{\sf T}$ for the full time range adjustment.

 $\mbox{Examples:}\ 1\ to\ 50\ S\ adjustable\ time\ delay, select\ time\ delay\ range\ 1\ and\ a\ 50\ K\ ohn\ R_T.$ For 1 to 100 S use a 100 K ohn $R_T.$

Function Diagrams



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

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TIME DELAY RELAYS

ESDR SERIES



Specifications

Time Delay Range **Repeat Accuracy** Tolerance (Factory Calibration) Time Delay vs Temp. & Voltage **Reset Time** Input Voltage Tolerance **Power Consumption** AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ Output Туре **Maximum Load Current OFF State Leakage Current** Voltage Drop

0.1s - 1000m in 6 adjustable ranges or fixed ±0.1% or 20ms, whichever is greater

 $\leq \pm 5\%$ $\leq \pm 2\%$ ≤ 150ms 12 or 24VDC; 24, 120, or 230VAC ±20% $AC \le 2VA; DC \le 1W$ Solid state 1A steady state , 10A inrush at 60°C $AC \cong 5mA @ 230VAC; DC \cong 1mA$

AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A

Protection

Circuitry **Dielectric Breakdown Insulation Resistance** Polarity Mechanical Mounting Dimensions

Termination **Operating/Storage** Temperature Humidity Weight

Encapsulated ≥ 2000V RMS terminals to mounting surface \geq 100 M Ω DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

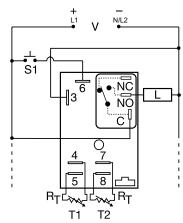


HRDR SERIES

(€¶\®



Wiring Diagram



NO = Normally Open S1 = Reset Switch C = Common, Transfer Contact L = Load

Terminals 4 & 5 and/or 7 & 8 are only included on externally adjustable units. Relay contacts are non-isolated. R_T is included when external adjustment is ordered. Terminal 6 is included when Bypass/Reset is selected.

For dimensional drawing see: Appendix, page 512, Figure 17.

Description

The HRDR Series combines an electromechanical relay and microcontroller timing circuitry. It offers 12 to 230V operation in five ranges and factory fixed, onboard or externally adjustable time delays with a repeat accuracy of $\pm 0.5\%$. The high switching capacity of the output contacts allow for direct control of heavy loads like compressors, pumps, motors, heaters and lighting. A bypass/reset switch option allows operator to interrupt normal recycling sequence and energize output relay. An excellent choice for OEM applications.

Operation (Recycling with Reset Switch)

Upon application of input voltage, the ON time T1 begins and output relay energizes. At the end of the ON time, the output relay de-energizes and the OFF time T2 begins. At the end of the OFF time, the output relay energizes and the cycle repeats as long as input voltage is applied. Some recycling timers have the OFF time as the first delay.

Reset: Removing input voltage resets output and time delays, and returns sequence to the first delay.

Bypass/Reset Switch: Closing the normally open bypass/reset switch energizes the output relay and resets the time delays. Opening the switch restarts recycling operation with the first delay.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%
Compact, low cost design	Allows flexibility for OEM applications
Isolated, 30A, SPDT, NO output contacts	Allows direct operation of heavy loads: compressors, pumps, blower moters, heaters.
Encapsulated	Protects against shock, vibration, and humidity
Independent adjustment of On and Off delays	Provides greater flexibility of timing options
Bypass/Reset switch option	Allows operator to interrupt the timing sequence and energize the output relay

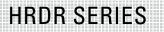
Ordering Information

MODEL	INPUT VOLTAGE	EXTERNAL ADJUSTMENT	T1 ON TIME	OPERATING SEQUENCE	T2 OFF TIME	BYPASS / RESET OPTION
HRDR121A4R	12VDC	Both time onboard adj	1 - 100s	On time first	1 - 100m	Yes
HRDR321A4R	24VDC	Both time onboard adj	1 - 100s	On time first	1 - 100m	Yes
HRDR322B2R	24VDC	Both time onboard adj	10 - 1000S	Off time first	10 - 1000S	Yes
HRDR330A0R	24VDC	Both time external adj	0.1 - 10s	On time first	0.1 - 10s	Yes
HRDR331A1	24VDC	Both time external adj	1 - 100s	On time first	1 - 100s	No
HRDR411SB30MR	120VAC	Both times fixed	1s	Off time first	30m	Yes
HRDR431A1R	120VAC	Both times external adj	0.1 - 100s	On time first	0.1 - 100s	Yes

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Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



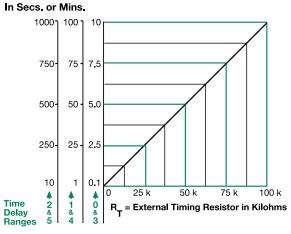
C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay



This chart applies to externally adjustable part numbers.

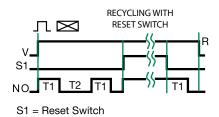
The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

time delay increases. When selecting an external RT, add the tolerances of the timer and the RT for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Specifications

opcomouti	0110			
Time Delay				
Range		100ms - 1000m in 6 adjustable ranges or fixed		
Repeat Accuracy		±0.5% or 20ms, whichever		
Tolerance			io groutor	
(Factory Calibra	tion)	+5%		
•	(1011)			
Reset Time		≤ 150ms		
Time Delay vs Te	mp.			
& Voltage		≤ ±2%		
Input				
Voltage		12 or 24VDC; 24, 120, or 23	OVAC	
Tolerance				
12VDC & 24VDC		-15% - 20%		
24 to 230VAC		-20% - 10%		
AC Line Frequenc		50/60 Hz		
Power Consumpt	ion	$AC \le 4VA; DC \le 2W$		
Output				
Туре		Electromechanical relay		
Form		SPDT, non-isolated		
Ratings		SPDT-NO	SPDT-NC	
General Purpose	125/240VAC	30A	15A	
Resistive	125/240VAC		15A	
	28VDC	20A	10A	
Motor Load	125VAC	1 hp*	1/4 hp**	
	240VAC	2 hp**	1 hp**	
1.4.	240VAG		тир	
Life		Mechanical - 1 x 10 ⁶ ;	**0.000	
		Electrical - 1 x 10 ⁵ , *3 x 10 ⁴	*, ^^b,UUU	
Protection				
Surge		IEEE C62.41-1991 Level A		
Circuitry		Encapsulated		
Dielectric Break	lown	≥ 2000V RMS terminals to	mounting surface	
Insulation Resist	ance	100 110	-	
Polarity		\geq 100 M Ω DC units are reverse polari	ty protected	
Polarity Mechanical		\geq 100 MΩ DC units are reverse polari	ty protected	
Mechanical		DC units are reverse polari		
Mechanical Mounting		DC units are reverse polari Surface mount with one #1	0 (M5 x 0.8) screw	
Mechanical		DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm	0 (M5 x 0.8) screw	
Mechanical Mounting Dimensions		DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5")	10 (M5 x 0.8) screw n (2");	
Mechanical Mounting Dimensions Termination		DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm	10 (M5 x 0.8) screw n (2");	
Mechanical Mounting Dimensions Termination Environmental		DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5")	10 (M5 x 0.8) screw n (2");	
Mechanical Mounting Dimensions Termination Environmental Operating/Storag	e	DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5")	10 (M5 x 0.8) screw n (2");	
Mechanical Mounting Dimensions Termination Environmental	e	DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5")	10 (M5 x 0.8) screw n (2″); ick connect terminals	
Mechanical Mounting Dimensions Termination Environmental Operating/Storag Temperature	e	DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5") 0.25 in. (6.35 mm) male qui	IO (M5 x 0.8) screw n (2″); ick connect terminals C	
Mechanical Mounting Dimensions Termination Environmental Operating/Storag Temperature Humidity	e	DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5") 0.25 in. (6.35 mm) male qui -40° to 60°C / -40° to 85°C 95% relative non-condensi	IO (M5 x 0.8) screw n (2″); ick connect terminals C	
Mechanical Mounting Dimensions Termination Environmental Operating/Storag Temperature	e	DC units are reverse polari Surface mount with one #1 H 76.7 mm (3"); W 51.3 mm D 38.1 mm (1.5") 0.25 in. (6.35 mm) male qui	IO (M5 x 0.8) screw n (2″); ick connect terminals C	

Function Diagram



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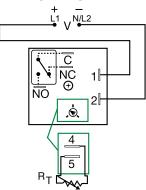


KRD3 SERIES

$C \in \mathfrak{M} \otimes$



Wiring Diagram



V = Voltage C = Common, Transfer Contact NO = Normally Open NC = Normally Closed

A knob is supplied for adjustable units, or RT terminals 4 & 5 for external adjust. See external adjustment vs time delay chart.

Relay contacts are isolated.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OPERATING SEQUENCE
KRD3420A	120VAC	Onboard knob	0.1 - 10s	On time first
KRD3421A	120VAC	Onboard knob	1 - 100s	On time first
KRD3434A	120VAC	External	1 - 100m	On time first

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Description

The KRD3 Series measures only 2 in. (50.8 mm) square.Its solid-state timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRD3 Series is a cost effective approach for OEM applications that require small size, isolation, reliability, and long life.

Operation (Recycling Flasher - ON Time First)

Upon application of input voltage, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to T1 ON time.

Features & Benefits

FEATURES	BENEFITS
Compact, low cost design measuring 2 in. (50.8mm) square	Provides greater flexibility for OEM applications and reduces component and labor costs
Microcontroller based	Repeat Accuracy + / -0.5%, Factory calibration + / - 5%
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer

recommended for remote time delay adjustment.



The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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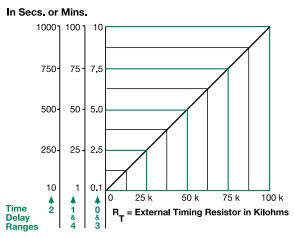
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KRD3 SERIES



External Resistance vs. Time Delay

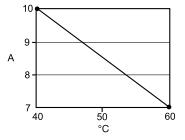


This chart applies to externally adjustable part numbers.

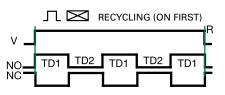
The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

When selecting an external RT, add the tolerances of the timer and the RT for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Output Current/Ambient Temperature



Function Diagram



V = Voltage NO = Normally**Open Contact** NC = Normally**Closed Contact** TD1,TD2 = Time Delay R = Reset

Specifications

Time Delay	
Range	0.1s - 100m in 5 adjustable ranges or fixed
Repeat Accuracy	±0.5% or 20ms, whichever is greater
Tolerance	
(Factory Calibration)	$\leq \pm 5\%$
Reset Time	≤ 150ms
Time Delay vs Temp.	
& Voltage	$\leq \pm 5\%$
Input	
Voltage	12, 24 or 110VDC; 24, 120, or 230VAC
Tolerance	
12VDC & 24VDC/AC	-15% - 20%
110VDC, 120 or 230VAC	-20% - 10%
AC Line Frequency/DC Ripple	50/60 Hz / ≤ 10%
Power Consumption	$AC \le 2VA; DC \le 2W$
Output	
Туре	Isolated relay contacts
Form	SPDT
Rating (at 40°C)	10A resistive @ 125VAC;
	5A registive @ 220V/AC & 20V/DC.

Max. Switching Voltage

Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity

Weight

30VAC 5A resistive @ 230VAC & 28VDC; 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105 Encapsulated

 \geq 1500V RMS input to output \geq 100 M Ω DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

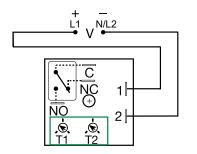
-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.6 oz (74 g)



KRDR SERIES



Wiring Diagram



V = Voltage C = Common NO = Normally Open NC = Normally Closed T1 = OFF Time T2 = ON Time

A knob is supplied for adjustable units.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLT.	ADJUST.	T2 ON TIME	FIRST DELAY	T1 OFF TIME
KRDR115MB25M	12VDC	Fixed	5m	Off time	25m
KRDR120A0	12VDC	Adjustable	0.1 - 10s	On time	0.1 - 10s
KRDR121A1	12VDC	Adjustable	1 - 100s	On time	1 - 100s
KRDR320B0	24VDC	Adjustable	0.1 - 10s	Off time	0.1 - 10s
KRDR321A4	24VDC	Adjustable	1 - 100s	On time	1 - 100m
KRDR321B4	24VDC	Adjustable	1 - 100s	Off time	1 - 100m
KRDR420A3	120VAC	Adjustable	0.1 - 10s	On time	0.1 - 10m
KRDR421A4	120VAC	Adjustable	1 - 100s	On time	1 - 100m
KRDR424A0	120VAC	Adjustable	1 - 100m	On time	0.1 - 10s
KRDR424A4	120VAC	Adjustable	1 - 100m	On time	1 - 100m
KRDR440.5SA0	120VAC	On time fixed	0.5s	On time	0.1 - 10s

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Description

The KRDR Series is a compact time-delay relay measuring only 2 in. (50.8 mm) square. Its solid-state timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRDR Series is a cost effective recycling timer for OEM applications that require small size, isolation, reliability, and long life.

 $(\in \mathfrak{R})$

Operation (Recycling - ON Time First)

Upon application of input voltage, the output relay energizes and the T2 ON time begins. At the end of the ON time, the output de-energizes and the T1 OFF time begins. At the end of the OFF time, the output relay energizes and the cycle repeats as long as input voltage is applied

Reset: Removing input voltage resets the output and the time delays, and returns the sequence to the ON time.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the T1 OFF time begins. At the end of the OFF time, the T2 ON time begins and the load energizes. At the end of the ON time the load de-energizes, and the cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to the OFF time.

Features & Benefits

FEATURES	BENEFITS
Compact design and independent adjustment of ON and OFF times	Provides greater flexibility for OEM applications and reduces component and labor costs
Microcontroller based	Repeat Accuracy + / - 0.5%, Factory calibration + / - 5%
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages
Encapsulated	Protects against shock, vibration, and humidity

Accessories



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

strain relief. connect terminals.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick

C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter



Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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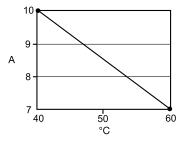
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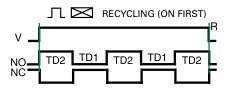


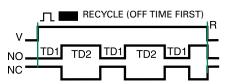
KRDR SERIES

Output Current/Ambient Temperature



Function Diagrams





V = Voltage NO = Normally Open Contact NC = Normally Closed Contact T1 = OFF Time T2 = ON Time R = Reset

Specifications

Time Delay	
Range	0.1s - 1000m in 6 adjustable ranges or fixed
Repeat Accuracy	±0.5 % or 20ms, whichever is greater
Tolerance	
(Factory Calibration)	$\leq \pm 5\%$
Reset Time	≤ 150ms
Time Delay vs Temp.	
& Voltage	$\leq \pm 5\%$
Input	
Voltage	12, 24 or 110VDC; 24, 120 or 230VAC
Tolerance	
12VDC & 24VDC/AC	-15% - 20%
110VDC & 120 or 230VAC	-20% - 10%
AC Line Frequency/DC Ripple	50/60 Hz / ≤ 10%
Power Consumption	$AC \le 2VA; DC \le 2W$
Output	
Туре	Isolated relay contacts
Form	SPDT
Rating (at 40°C)	10A resistive @ 125VAC;
	5A resistive @ 230VAC & 28VDC;

Max. Switching Voltage Life (Operations)

Protection

Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

۱C; C & 28VDC; 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105

Encapsulated ≥ 1500V RMS input to output $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 g)



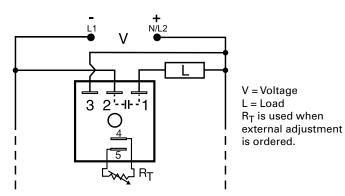
Recycling Flasher

KSD3 SERIES

(€¶¶®



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSD3 Series Digi-Timer is a cost effective approach for ON/OFF recycling applications. The on time is equal to the off time. An adjustment of the R_T will change the time delays of both on and off times. This series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable, solid-state timer is required. The factory calibration for fixed time delays is within 5% of the target time delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. This series is designed for popular AC and DC voltages. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Recycling Flasher - ON Time First)

Upon application of input voltage, the output energizes and the T1, ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the ON time.

Operation (Recycling Flasher - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of the ON time the load de-energizes, and the cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and time delays and the sequence to the OFF time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.5%, + / -5% time delay accuracy
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories

P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P1023-6 Mounting bracket The 90° orientation of mountin

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

Ordering Information

-				
MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY	OPERATING SEQUENCE
KSD3120A	12VDC	External	0.1 - 10s	ON time first
KSD3310.1SA	24VDC	Fixed	0.1s	ON time first
KSD3415MA	120VAC	Fixed	5m	ON time first
KSD3432A	120VAC	Onboard	10 - 1000s	ON time first

If you don't find the part you need, call us for a custom product 800-843-8848

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Accessories



P1015-64 (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter

Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



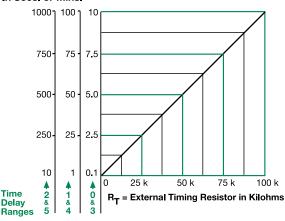
C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay





This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases

When selecting an external R_T , add the tolerances of the timer and the R_T for the full time range adjustment.

 $\mbox{Examples:}\ 1\ to\ 50\ S\ adjustable\ time\ delay,\ select\ time\ delay\ range\ 1\ and\ a\ 50\ K\ ohn\ R_T.$ For 1 to 100 S use a 100 K ohn $R_T.$

Specifications

Time Delay Range **Repeat Accuracy** Tolerance (**Factory Calibration**) **Reset Time** Time Delay vs. Temperature & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Type **Maximum Load Current OFF State Leakage Current Voltage Drop DC** Operation Protection Circuitry **Dielectric Breakdown** Insulation Resistance

Polarity **Mechanical**

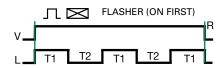
Mounting Dimensions

Termination

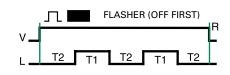
Environmental

Operating/Storage Temperature Humidity Weight

Function Diagrams



ON time plus OFF time equals one complete flash.



0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

 $\leq \pm 5\%$ ≤ 150ms

 $\leq \pm 10\%$

24 or 120VAC; 12 or 24VDC ±20% 50/60 Hz $AC \le 2VA; DC \le 1W$

Solid state 1A steady state, 10A inrush at 60°C AC ≈ 5mA @ 230VAC; DC ≈ 1mA AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A Negative switching only

Encapsulated \geq 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

> V = Voltage L = Load

T1 = ONTime

T2 = OFFTime T1 ≅T2 R = Reset

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 q)

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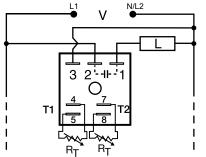


KSDR SERIES

(€¶\`®



Wiring Diagram



V = Voltage L = Load

R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	T1 ON TIME	FIRST DELAY	T2 OFF TIME
KSDR40A0	120VAC	0.1 - 10s	On time	0.1 - 10s
KSDR42A4	120VAC	10 - 1000s	On time	1 - 100m

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Description

The KSDR Series offers independent time adjustment of both delay periods. The KSDR Series is recommended for air drying, automatic oiling, life testing, chemical metering, and automatic duty cycling. This series is designed for general purpose commercial and industrial applications where a small, cost effective, reliable, solid-state timer is required. The factory calibration for fixed time delays is within \pm 5% of the target delay. The repeat accuracy, under stable conditions, is 0.5% of the selected time delay. This series is designed for input voltages of 24, 120 or 230VAC. Time delays of 0.1 seconds to 1000 minutes are available in 6 ranges. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Recycling - ON Time First)

Upon application of input voltage, the output energizes and the T1, ON time begins. At the end of the ON time, the output de-energizes and the T2, OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to T1 ON time.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2 OFF time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / -0.5%, Factory calibration + / - 5%
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Wide operating temperature range: -40° to 75°C	Reliable in demanding commercial and industrial applications
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications





Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



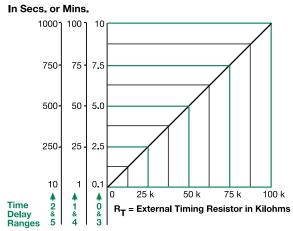
C103PM (AL) DIN Rail

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

35 mm aluminum DIN rail available in a 36 in.

External Resistance vs. Time Delay

(91.4 cm) length.



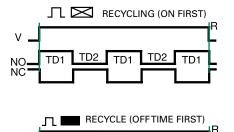
This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the ${\sf R}_{\sf T}$ terminals; as the resistance increases the tie delay increases.

When selecting an external R_{T} add the tolerances of the timer and the R_{T} for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagrams



TD

0.1s - 1000m in 6 ranges

TD1

V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

TD1

TD2

Time Delay

v

NO

NC

Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Туре Rating **Voltage Drop OFF State Leakage Current** Protection Circuitry **Dielectric Breakdown** Insulation Resistance Mechanical Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight ≤ ±5%
 ≤ 150ms
 ≤ ±10%
 24, 120, or 230VAC
 ±20%
 50/60 Hz
 ≤ 2VA

±0.5% or 20ms, whichever is greater

Solid state 1A steady state, 10A inrush at 60°C $\approx 2.5V @ 1A$ $\approx 5mA @ 230VAC$

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing \approx 2.4 oz (68 g)

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Time Delay Relays Dedicated — Recycle

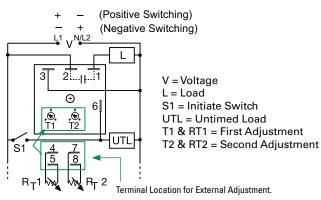
Solid State Timer

KSPD SERIES

(€¶\®



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KSPD Series is a factory programmed module available with 1 of 12 standard dual functions. The time delays can be factory fixed, externally or onboard adjustable, or a combination of fixed and adjustable. The 1A steady, 10A inrush rated solid-state output provides 100 million operations, typical. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KSPD Series is a cost effective approach for OEM applications that require small size and long life.

Features & Benefits

FEATURES	BENEFITS			
Microcontroller based	Repeat Accuracy + / - 0.5%			
Compact design	Allows flexibility for OEM applications			
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.			
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity			

Accessories



P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer

recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

C103PM (AL) DIN Rail 35 mm aluminum DIN ra

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Ordering Information

•						
MODEL	INPUT	ADJUSTMENT 1	TIME DELAY 1	ADJUSTMENT 2	TIME DELAY 2	FUNCTION
KSPDA2222RXE	24 to 240VAC	Onboard	1-100s	Onboard	1-100s	Recycling/On Time First
KSPDP110M18SRXE	12 to 120VDC positive switching	Fixed	10 mins	Fixed	8s	Recycling/On Time First

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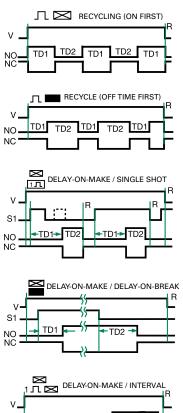
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KSPD SERIES



Function Diagrams



NO

NC

TD2

V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay

Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time Initiate Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance AC Line Frequency/DC Ripple **Power Consumption** Output Туре Rating **Voltage Drop OFF State Leakage Current** Protection Circuitry **Dielectric Breakdown Insulation Resistance** Polarity **Mechanical** Mounting

Dimensions

Operating/Storage Temperature Humidity Weight

Microcontroller circuitry 0.1s - 1000h in 9 adjustable ranges or fixed (to 999) ±0.5% or 20ms, whichever is greater $\leq \pm 2\%$ ≤ 150ms \leq 20ms; \leq 1500 operations per minute $\leq \pm 2\%$ 12 to 120VDC; 24 to 240VAC $\leq \pm 15\%$ 50/60Hz / ≤ 10%

Solid-state output 1A steady, 10A inrush for 16ms AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A AC ≈ 5mA @ 230VAC; DC ≈ 1mA

 $AC \le 2VA; DC \le 1W$

Encapsulated

 \geq 100 M Ω

Termination

Environmental

DC units are reverse polarity protected Surface mt. with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2");

≥ 2000V rms terminals to mounting surface

D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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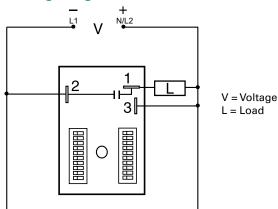


RS SERIES

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 17.

Ordering Information

Description

The RS Series is a solid-state, encapsulated, recycling timer designed for tough industrial environments. It is used by many testing labs as a life cycle tester; by others as a cycle controller. The RS Series has separate DIP switch adjustments for the on delay and the off delay. These make accurate adjustment possible the first time, every time. Time delays of 0.1 seconds to 1023 hours are available in 4 ranges.

Operation (Recycling - ON Time First)

Upon application of input voltage, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the ON time.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the OFF time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / -0.1%, Setting accuracy + / - 2%
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
ON and OFF time delay settings	Independent adjustment provides greater timing flexibility
DIP switch adjustment	Provides first time setting accuracy

	•								
MODEL	INPUT VOLTAGE	FIRST DELAY	T1 ON TIME	T2 OFF TIME	MODEL	INPUT VOLTAGE	FIRST DELAY	T1 ON TIME	T2 OFF TIME
RS1A11	12VDC	On time	0.1 - 102.3s in 0.1s increments	0.1 - 102.3s in 0.1s increments	RS4A22	120VAC	On time	0.1 - 102.3m in 0.1m increments	0.1 - 102.3m in 0.1m increments
RS2B44	24VAC	Off time	1 - 1023h in 1h increments	1 - 1023h in 1h increments	RS4A24	120VAC	On time	0.1 - 102.3m in 0.1m increments	1 - 1023h in 1h increments
RS4A11	120VAC	On time	0.1 - 102.3s in 0.1s increments	0.1 - 102.3s in 0.1s increments	RS4A33	120VAC	On time	1 - 1023m in 1m increments	1 - 1023m in 1m increments
RS4A12	120VAC	On time	0.1 - 102.3s in 0.1s increments	0.1 - 102.3m in 0.1m increments	RS4B12	120VAC	Off time	0.1 - 102.3s in 0.1s increments	0.1 - 102.3m in 0.1m increments
RS4A13	120VAC	On time	0.1 - 102.3s in 0.1s increments	1 - 1023m in 1m increments	RS6A13	230VAC	On time	0.1 - 102.3s in 0.1s increments	1 - 1023m in 1m increments

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Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P1015-64 (AWG 14/16)

Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

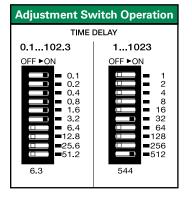
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



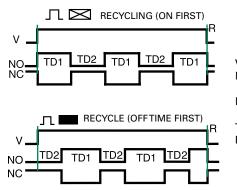
P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Adjustment Switch Operation



Function Diagrams



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay Range*

Repeat Accuracy Setting Accuracy **Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance AC Line Frequency/DC Ripple **Power Consumption** Output Type **Maximum Load Current OFF State Leakage Current Voltage Drop** Protection Circuitry **Dielectric Breakdown**

Insulation Resistance Polarity **Mechanical**

Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

0.1 - 102.3s in 0.1s increments 0.1 - 102.3m in 0.1m increments 1 - 1023m in 1m increments 1 - 1023h in 1h increments ±0.1% or 20ms, whichever is greater $\leq \pm 2\%$ or 20ms, whichever is greater ≤ 150ms $\leq \pm 2\%$

12, or 24VDC; 24, 120, or 230VAC ±20% $50/60 \text{ Hz} / \le \pm 10\%$ $AC \leq 2VA: DC \leq 1W$

Solid state 1A steady state, 10A inrush at 60°C AC ≈ 5mA @ 230VAC; DC ≈ 1mA AC ≈ 2.5V @ 1A; DC ≈ 1V @ 1A

Encapsulated ≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw **H** 76.7 mm (3"); **W** 50.8 mm (2"); **D** 38.1 mm (1.5") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing $\approx 3.9 \text{ oz} (111 \text{ g})$

*For CE approved applications, power must be removed from the unit when a switch position is changed.

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TDR SERIES

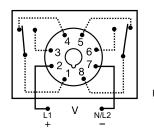
Relay Output, Recycling Time Delay Relay

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Wiring Diagram



Relay contacts are isolated

For dimensional drawing see: Appendix, page 512, Figure 23.

Description

The TDR Series of time-delay relays are comprised of digital circuitry and an isolated, 10A relay output. The ON and OFF delays are selected by means of two, ten position binary switches, which allow the setting of the desired delay to be precise every time.

Operation (Recycling - ON Time First)

Upon application of input voltage, the green LED glows, the output relay is energized, the red LED glows, and the T1 ON time begins. At the end of the ON time, the output de-energizes, the red LED turns OFF and the T2, OFF time begins. At the end of the OFF time, the output relay energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the green LED glows, the T1 OFF time begins, the load is OFF. At the end of the OFF time, the T2 ON time begins, the load energizes, and the red LED glows. At the end of the ON time the load de-energizes and the red LED turns OFF. The cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to the OFF time.

Features & Benefits

FEATURES	BENEFITS
ON & OFF time delay settings	Independent adjustment allows for greater flexibility
3 Time Ranges Available (0.1s to 2.8h)	Makes it versatile for use in many applications
Microcontroller based	Repeat Accuracy + / - 0.1% or 20 ms, whichever is greater; Setting Accuracy + / - 2% or 50 ms, whichever is greater
DIP switch adjustment	Provides first time setting accuracy
Isolated output contacts	Allows control of loads for AC or DC voltages
LED indication (select models)	Provides visual indication of relay status

Ordering Information

MODEL	INPUT VOLTAGE	LED	SEQUENCE	ON TIME (SEC)	OFF TIME (SEC)
TDR1A22	12VDC		ON time first	1-1023 in 1s increments	1-1023 in 1s increments
TDR2A23	24VAC	X	ON time first	1-1023 in 1s increments	10-10230 in 10s increments
TDR4A11	120VAC	X	ON time first	0.1-102.3 in 0.1s increments	0.1-102.3 in 0.1s increments
TDR4A12	120VAC	X	ON time first	0.1-102.3 in 0.1s increments	1-1023 in 1s increments
TDR4A13	120VAC	X	ON time first	0.1-102.3 in 0.1s increments	10-10230 in 10s increments
TDR4A22	120VAC	Х	ON time first	1-1023 in 1s increments	1-1023 in 1s increments
TDR4A23	120VAC	X	ON time first	1-1023 in 1s increments	10-10230 in 10s increments
TDR4A33	120VAC	X	ON time first	10-10230 in 10s increments	10-10230 in 10s increments
TDR4B22	120VAC	X	OFF time first	1-1023 in 1s increments	1-1023 in 1s increments
TDR4B23	120VAC	Х	OFF time first	1-1023 in 1s increments	10-10230 in 10s increments
TDR6A22	230VAC	X	ON time first	1-1023 in 1s increments	1-1023 in 1s increments

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TDR SERIES



Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.



PSC8 Hold-down Clips

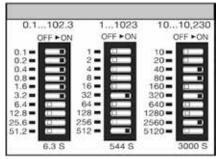
Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.



C103PM (AL) DIN Rail

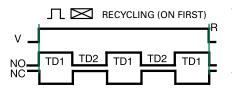
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

Binary Switch Operation



** For CE approved applications, power must be removed from the unit when a switch position is changed.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay Type Range**

Repeat Accuracy Setting Accuracy **Reset Time Recycle Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **12VDC & 24VDC/AC** 110 to 230VAC/DC AC Line Frequency/DC Ripple 50/60 Hz/<=10% **Power Consumption Input LED Indicator** Output Туре

Form Rating

Life Max. Switching Voltage Relay LED Indicator Protection Isolation Voltage Insulation Resistance Polarity Mechanical Mounting

Termination

Dimensions

Environmental Operating/Storage Temperature Weight ±0.1% or 20ms, whichever is greater ±2% or 50ms, whichever is greater ≤ 50ms ≤ 150ms ±5% 12, 24/28, or 110VDC; 24, 120, or 230VAC -15% - 20% -20% - 10% 50/60 Hz/<=10% ≤ 3.25W Green; on when input voltage is applied Electromechanical relay DPDT 10A resistive @ 120/240VAC & 28VDC;

Digital integrated circuitry

1 - 1023s in 1s increments

0.1 - 102.3s in 0.1s increments

10 - 10.230s in 10s increments

1/3 hp @ 120/240VAC Mechanical - 1 x 10^7 ; Electrical - 1 x 10^6 250VAC Red; ON when output relay energizes

 \ge 1500V RMS input to output \ge 100 M Ω DC units reverse polarity protected

Plug-in socket H 81.3 mm (3.2"); W 60.7 mm (2.39"); D 45.2 mm (1.78") Octal 8-pin plug-in

-20° to 65°C/-30° to 85°C ≅ 6 oz (170 g)

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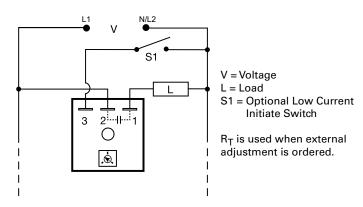


THD3C42A0

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The THD3C42A0 combines accurate timing circuitry with high power, solid-state switching. It can switch motors, lamps, and heaters directly without a contactor. The THD3C42A0 has equal on and off time delays. A single R_T sets both time delays. You can reduce labor, component cost, and increase reliability with these small, easy-to-use, Digi-Power timers.

Operation (Recycling Flasher - ON Time First)

Upon application of input voltage, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to T1 ON time.

Operation (Recycling Flasher - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2 OFF time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / -0.5%, Factory calibration + / - 1%
Compact, low cost design	Allows flexibility for OEM applications and reduces labor and component costs
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps, and heaters without a contactor
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Metalized mounting surface	Facilitates heat transfer in high current applications

Accessories

.....



Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1004-95, P1004-95-X Versa-Pot



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

www.littelfuse.com/thd3c42a0

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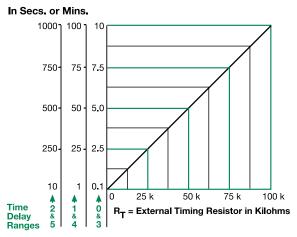
Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

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12 TIME DELAY RELAYS THD3C42A0



External Resistance vs. Time Delay



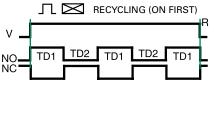
This chart applies to externally adjustable part numbers.

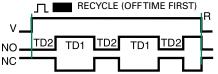
The time delay is adjustable over the time delay range selected by varying the resistance across the ${\sf R}_{\sf T}$ terminals; as the resistance increases the tie delay increases.

When selecting an external R_T add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

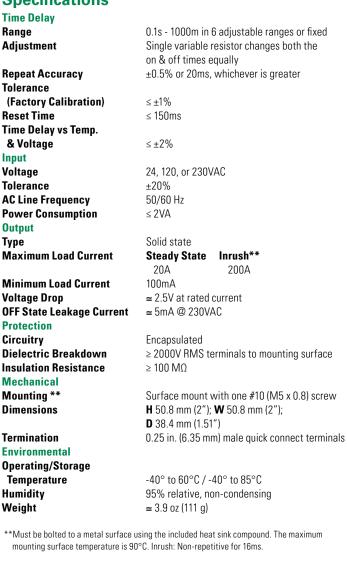
Function Diagrams





V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications



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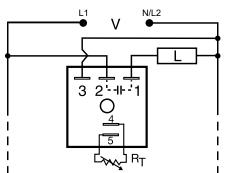


TSD3411S Recycling Timer

(€¶¶®®

US PATEAT 470 \$135 R_T 4 5 R_T = 100K Ω

Wiring Diagram



R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The TSD3411S is a solid-state ON/OFF recycling timer with the on time always equal to the off time. When time delay is changed by the R_T , both the ON and the OFF periods are changed. The TSD Series is designed for more demanding commercial and industrial applications where small size, and accurate performance is required. The factory calibration for fixed time delays is within 1% of the target time delay. The repeat accuracy, under stable conditions, is 0.1% of the time delay. The TSD3411S is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 100 hours are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Recycling Flasher - ON Time First)

Upon application of input voltage, the output energizes and the T1, ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the T1 ON time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat Accuracy + / - 0.1%, + / -1% time delay accuracy
Extended temperature range	Rated to 75°C operating temperature to withstand high heat applications.
Compact, low cost design	Allows flexibility for OEM applications
1A Steady solid-state output, 10A inrush	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



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TIME DELAY RELAYS

P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

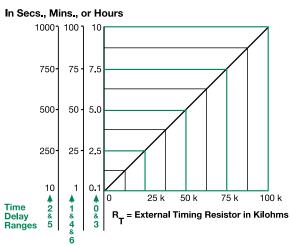
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TSD3411S



External Resistance vs. Time Delay

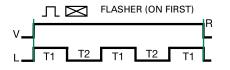


This chart applies to externally adjustable part numbers.

The time delay is adjustable over the time delay range selected by varying the resistance across the RT terminals; as the resistance increases the time delay increases.

time delay increases. When selecting an external RT, add the tolerances of the timer and the RT for the full time range adjustment. **Examples:** 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohm RT. For 1 to 100 S use a 100 K ohm RT.

Function Diagram



ON time plus OFF time equals one complete flash.

V = Voltage L = Load T1 = ONTime T2 = OFFTime T1 ≅T2 R = Reset

Specifications

Time Delay	
Range	0.1s - 100h in 7 adjustable ranges
Repeat Accuracy	±0.1% or 20ms, whichever is great
Tolerance	
(Factory Calibration)	≤ ±1%
Reset Time	≤ 150ms
Time Delay vs. Temperature	
& Voltage	≤ ±1%
Input	
Voltage	24, 120, or 230VAC
Tolerance	±20%
AC Line Frequency	50/60 Hz
Power Consumption	≤ 2VA
Output	
Туре	Solid state
Maximum Load Current	1A steady state, 10A inrush at 60°
Off State Leakage Current	≃ 5mA @ 230VAC
Voltage Drop	≅ 2.5V @ 1A
Protection	
Circuitry	Encapsulated
Dielectric Breakdown	≥ 2000V RMS terminals to mountir
Insulation Resistance	≥ 100 MΩ
Mechanical	
Mounting	Surface mount with one #10 (M5 x
Dimensions	H 50.8 mm (2"); W 50.8 mm (2");

Termination

Environmental

Operating/Storage Temperature Humidity Weight

ever is greater

rush at 60°C

ls to mounting surface

e #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

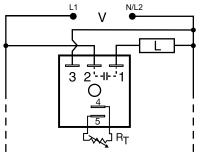
-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

TSDR SERIES

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Wiring Diagram



V = Voltage L = Load

 R_T is used when external adjustment is ordered. An onboard adjustment, or terminals 4 & 5 are only included on adjustable units.

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

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FIME DELAY RELAYS

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MODEL	INPUT VOLT.	ADJUST.	T1 ON TIME	FIRST DELAY	T2 OFF TIME
TSDR215SB18M	24VAC	Fixed	5s	Off time	18m
TSDR415SB18M	120VAC	Fixed	5s	Off time	18m
TSDR4412SA1	120VAC	On time fixed, off external	12s	On time	1 - 100s
TSDR442MA2	120VAC	On time fixed, off external	2m	On time	10 - 1000s
TSDR4430SA2	120VAC	On time fixed, off external	30s	On time	10 - 1000s
TSDR610.2SA0.2S	230VAC	Fixed	0.2s	On time	0.2s
TSDR6110SA30S	230VAC	Fixed	10s	On time	30s
TSDR612.5SA4.5S	230VAC	Fixed	2.5s	On time	4.5s
TSDR615SB18M	230VAC	Fixed	5s	Off time	18m
TSDR6412SA1	230VAC	On time fixed, off external	12s	On time	1 - 100s

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Description

The TSDR Series is an ON/OFF or OFF/ON recycling timing module designed to control metering pumps, chemical valves, flash lamps, or use in energy saving or duty cycling applications. The TSDR Series is designed for more demanding commercial and industrial applications where small size and accurate performance are required. The factory calibration for fixed time delays is < $\pm 5\%$. The repeat accuracy, under stable conditions, is 0.5% of the time delay. The TSDR Series is rated to operate over an extended temperature range. Time delays of 0.1 seconds to 1000 minutes are available. The output is rated 1A steady and 10A inrush. The modules are totally solid state and encapsulated to protect the electronic circuitry.

Operation (Recycling - ON Time First)

Upon application of input voltage, the output energizes and the T1, ON time begins. At the end of the ON time, the output de-energizes and the T2, OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the T1 ON time.

Operation (Recycling - OFF Time First)

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of the T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2 OFF time.

Features & Benefits

FEATURES	BENEFITS
Microcontroller based	Repeat accuracy +/- 0.5%, Factory calibration +/- 5%
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Wide operating temperature range: -40° to 75°C	Reliable in demanding commercial and industrial applications
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

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TSDR SERIES



Accessories



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

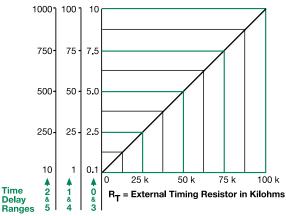


P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

External Resistance vs. Time Delay

In Secs, or Mins,

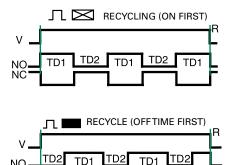


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T add the tolerances of the timer and the R_T for the full time range adjustment.

Examples:~1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagrams



V = Voltage NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay

NO

NC

Range **Repeat Accuracy** Tolerance (Factory Calibration) **Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Type **Maximum Load Current Off State Leakage Current** Voltage Drop Protection Circuitry **Dielectric Breakdown Insulation Resistance Mechanical** Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight

0.1s - 1000m in 6 adjustable ranges or fixed ±0.5% or 20ms, whichever is greater

24, 120, or 230VAC ±20% 50/60 Hz $\leq 2VA$ Solid state 1A steady state, 10A inrush at 60°C ≃ 5mA @ 230VAC ≅ 2.5V @ 1A

< +5%

 $\leq \pm 5\%$

≤ 150ms

Encapsulated ≥ 2000V RMS terminals to mounting surface > 100 MO

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

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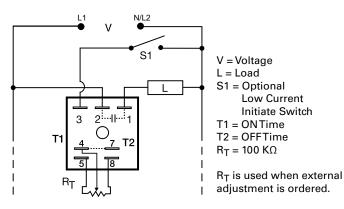
www.littelfuse.com/tsdr



PTHF4900DK



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 19.

Description

The PTHF4900DK can be used for a variety of applications from chemical metering, to temperature regulating, to energy management. The infinite adjustability from 1 to 99% provides accurate percentage on control over a wide factory fixed cycle period. When mounted on a metal surface, it can be used to drive solenoids, contactors, relays, or lamps, up to 20A steady, 200A inrush. The PTHF4900DK is the suggested replacement for the PT Series.

Operation (Percentage)

Upon application of input voltage, the output energizes and the T1 ON time begins. At the end of the ON time, the output de-energizes and the T2 OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied. Increasing the ON time decreases the OFF time. The total cycle period is equal to the ON time plus the OFF time. The total cycle period is factory fixed. ON time range is 1 to 99 percent of cycle period.

Reset: Removing input voltage resets the output and time delays, and returns the sequence to the T1 ON time.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat accuracy + / -0.5%, Factory calibration + / - 5%	
ON/OFF recycling percentage control 1 to 99%	Accurate control over a wide factory fixed cycle period	
Compact, low cost design	Allows flexibility for OEM applications and reduces component and labor costs	
High load currents up to 20A, 200A inrush	Allows direct operation of motors, lamps, and heaters without a contactor	
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	
Metalized mounting surface	Facilitates heat transfer in high current applications	

P1004-95, P1004-95-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.

Accessories

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P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

SIP.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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FIME DELAY RELAYS

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PTHF4900DK



Specifications

Time Delay

Туре **Range/External Adjustment Resistance Cycle Period Repeat Accuracy Cycle Period Tolerance** (Factory Calibration) **Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance **AC Line Frequency Power Consumption** Output Туре **Maximum Load Currents**

Voltage Drop OFF State Leakage Current Protection Circuitry Dielectric Breakdown Insulation Resistance External or onboard knob

Adjustable from 1 - 99% / R_T = 100 K Ω Fixed from 10s - 1000m ±0.5% or 20ms, whichever is greater

≤ ± 5% ≤ 150ms

≤ ±10%

120 or 230VAC ±20% 50/60 Hz ≤ 2VA

Solid state
Steady State
Inrush*

1A	10A
2.5V at rated c	urrent

≅ 2.5V at rated current ≅ 5mA @ 230VAC

Encapsulated \geq 2000V RMS terminals to mounting surface \geq 100 M Ω

Mechanical

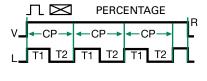
Mounting * Dimensions

Termination Environmental Operating/Storage Temperature Humidity Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 60°C / -40° to 85°C 95% relative, non-condensing 6, 10, 20A units: ≅ 3.9 oz (111 g)

*Units rated \ge 6A must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C. Inrush: Non-repetitive for 16ms.

Function Diagram



V = Input VoltageCP = Cycle PeriodL = LoadT1 = ONTimeT2 = OFFTimeR = Reset

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TDMB SERIES

Delay-on-Make/Delay-on-Break

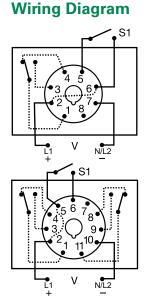








11-PIN



8-PIN OCTAL SPDT

V = Voltage S1 = Initiate Switch or Thermostat

Relay contacts are isolated.

11-PIN DPDT (P/N ends with D)

For dimensional drawing see: Appendix, page 512, Figure 23.

Ordering Information

MODEL	INPUT VOLTAGE	DELAY-ON- MAKE	DELAY-ON- BREAK	PLUG TYPE
TDMB411	120VAC	0.1 - 102.3s in 0.1s increments	0.1 - 102.3s in 0.1s increments	Octal (8-pin) SPDT
TDMB413D	120VAC	0.1 - 102.3s in 0.1s increments	10 - 10230s in 10s increments	11-pin DPDT
TDMB422	120VAC	1 - 1023s in 1s increments	1 - 1023s in 1s increments	Octal (8-pin) SPDT
TDMB422D	120VAC	1 - 1023s in 1s increments	1 - 1023s in 1s increments	11-pin DPDT
TDMB622	230VAC	1 - 1023s in 1s increments	1 - 1023s in 1s increments	Octal (8-pin) SPDT

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Description

The TDMB combines both delay-on-make and delay-on-break functions into one plug-in package. Selection of the time period is accomplished with dual switches, one for the on delay and the other for the off delay. SPDT or DPDT output options provide isolated, 10A switching capability.

Operation (Delay-on-Make/Delay-on-Break)

Input voltage must be applied at all times. The output relay is de-energized. Upon closure of the initiate switch, the green LED glows and the delay-on-make time delay (T1) begins. At the end of T1, the output relay energizes and the red LED glows. When the initiate switch opens, the green LED turns OFF and the delay-on-break time delay (T2) begins. At the end of T2, the output relay de-energizes and the red LED turns OFF.

Reset: Removing input voltage resets time delay and output. Opening the initiate switch during the delay-on-make delay, resets T1. Closing the initiate switch during the delay-on-break delay, resets T2.

Features & Benefits

FEATURES	BENEFITS
Digital circuitry	Repeat Accuracy + / - 0.1%, Setting accuracy + / - 2%
Isolated, 10A, SPDT or DPDT output contacts	Allows control of loads for AC or DC voltages
User selectable Delay-on-Make and Delay-on-Break time delay	Timing settings are independently adjustable for added flexibility
Industry standard octal plug connection	Eliminates need for special connectors
LED Indication	Provides visual indication of initiate, timing, and relay output status
DIP switch adjustment	Provides first time setting accuracy

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.

NDS-8 Octal 8-pin Socket

8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC8 hold-down clips.

NDS-11 11-pin Socket

11-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a 35 mm DIN rail. Uses PSC11 hold-down clips.

PSC8 or PSC11 Hold-down Clips

Securely mounts plug-in controls in any position. Provides protection against vibration. Use PSC8 with NDS-8 Octal Socket or PSC11 with NDS-11 Socket. Sold in sets of two.

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TDMB SERIES



Specifications

Time Delay Type Range**

Repeat Accuracy Setting Accuracy Reset Time Time Delay vs Temp. & Voltage Control LED Indicator Input Voltage

Tolerance 12VDC & 24VDC/AC 110 to 230VAC/DC

 AC Line Frequency/DC Ripple
 50/60 Hz / ≤ 10%

 Power Consumption
 AC ≤ 2VA; DC ≤ 2V

 Output
 AC

Type Form Rating

Life Max Switch

Max. Switching Voltage Relay LED Indicator

Protection

Insulation Resistance Polarity Isolation Voltage Mechanical Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Weight Microcontroller circuitry 0.1 - 102.3s in 0.1s increments 1 - 1023s in 1s increments 10 - 10,230s in 10s increments $\pm 0.1\%$ or 20ms, whichever is greater $\leq \pm 2\%$ or 50ms, whichever is greater $\leq 150ms$

 $\leq \pm 2\%$ Green; on when the initiate switch is closed

12 or 24VDC; 24, 120, or 230VAC; 24 to 240VAC/DC; 12 to 48VDC

-15% - 20% -20% - 10% 50/60 Hz / ≤ 10% AC ≤ 2VA; DC ≤ 2W

Electromechanical relay SPDT or DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 230VAC Mechanical - 1 x10⁷; Electrical - 1 x 10⁵ 250VAC Red; on when output relay energizes (not included on 12VDC units)

≥ 100M

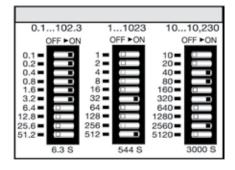
DC units are reverse polarity protected $\geq 1500V~RMS$ input to output

Plug-in socket H 81.3 mm (3.2"); W 60.7 mm (2.4"); D 45.2 mm (1.8") Octal 8-pin plug-in, magnal 11-pin plug-in

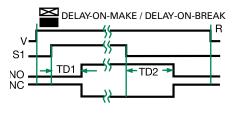
 -20° to 60° C / -30° to 85° C ≈ 6 oz (170 g)

** For CE approved applications, power must be removed from the unit when a switch position is changed.

Digi-Set Binary Switch Operation



Function Diagram



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD1,TD2 = Time Delay R = Reset $-\langle \rangle$ = Undefined Time

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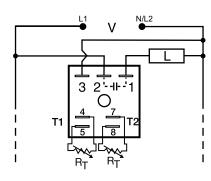


ESD52233 Delay-on-Make/Interval

$C \in \mathbb{R}$



Wiring Diagram



V = Voltage L = LoadT1 = Delay-on-Make time T2 = Interval delay time

R_T is the external adjustment component.

Note: Terminals 4, 5 and/or 7, 8 are included when external adjustment is ordered. A knob is included when onboard adjust is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The ESD5 Series is an accurate, solid-state, delayed interval timer. It offers a 1A steady, 10A inrush output and is available with adjustable or fixed time delays of 0.1 seconds to 1000 minutes in six ranges. Input voltages of 24, 120, or 230VAC are available. Encapsulation offers protection against shock and vibration. Adjustment options are factory fixed, onboard or externally adjustable. The repeat accuracy, under stable conditions, is 0.1%. The factory calibration of the time delay is ±5%.

Operation (Delayed Interval)

Upon application of input voltage, the T1 delay-on-make time delay begins and the output remains de-energized. At the end of this delay, the output energizes and the T2 interval delay begins. At the end of the interval delay period, the output de-energizes.

Reset: Removing input voltage resets the output and the time delays, and returns the sequence to the first delay.

Features & Benefits

FEATURES	BENEFITS
Compact, low cost design measuring 2 in. (50.8mm) square	Allows flexibility for OEM applications and reduces component and labor costs
Microcontroller based	Repeat Accuracy + / - 0.1%, Factory calibration + / - 5%
1A steady, 10A inrush solid-state output	Provides 100 million operations in typical conditions.
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



12

TIME DELAY RELAYS

P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob

Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



P1015-64 (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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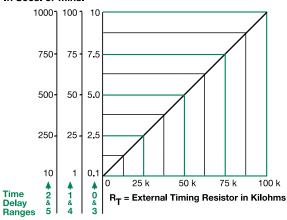
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External Resistance vs. Time Delay

In Secs. or Mins.

ESD52233

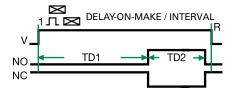


This chart applies to externally adjustable part numbers. The time delay is adjustable over the time delay range selected by varying the resistance across the R_T terminals; as the resistance increases the tie delay increases.

When selecting an external R_T add the tolerances of the timer and the R_T for the full time range adjustment.

Examples: 1 to 50 S adjustable time delay, select time delay range 1 and a 50 K ohn $R_T.$ For 1 to 100 S use a 100 K ohm $R_T.$

Function Diagram



V = Voltage NO = Normally **Open Contact** NC = Normally **Closed Contact** TD1,TD2 = Time Delay R = Reset

Specifications

Time Delay	
Range	0.1s - 1000m in 6
Repeat Accuracy	±0.1% or 20ms,
Tolerance	
(Factory Calibration)	$\leq \pm 5\%$
Reset Time	≤ 150ms
Time Delay vs Temp.	
& Voltage	$\leq \pm 2\%$
Input	
Voltage	24VAC
Tolerance	±20%
AC Line Frequency	50/60 Hz
Power Consumption	≤ 2VA
Output	
Туре	Solid state
Rating	1A steady state,
OFF State Leakage Current	≅ 5mA@230V/
Voltage Drop	≅ 2.5V @ 1A
Protection	
Circuitry	Encapsulated
Dielectric Breakdown	\geq 2000V RMS te
Insulation Resistance	≥ 100 MΩ
Mechanical	
Mounting	Surface mount v
Dimensions	H 50.8 mm (2");

Termination Environmental

Operating/Storage Temperature Humidity Weight

6 adjustable ranges or fixed whichever is greater

, 10A inrush at 60°C 'AC

erminals to mounting surface

with one #10 (M5 x 0.8) screw **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-40° to 75°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68g)

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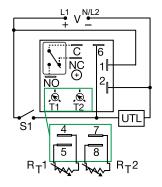
KRPD SERIES

Relay Output Timer

(€¶∭®

$\frac{1}{2} \frac{1}{2} \frac{1}$

Wiring Diagram



12

TIME DELAY RELAYS

V = Voltage C = Common, Transfer Contact NC = Normally Closed NO = Normally Open S1 = Initiate Switch UTL = Untimed Load

A knob is supplied for adjustable units or R_T terminals for external adjust. The untimed load is optional. S1 is not used for some functions.

For dimensional drawing see: Appendix, page 512, Figure 16.

Description

The KRPD Series is a factory programmed time delay relay available with 1 of 12 standard dual functions. The time delays can be factory fixed, onboard or externally adjustable or a combination of fixed and adjustable. The SPDT output relay contacts offer a full 10A rating with complete isolation. Its microcontroller timing circuit provides excellent repeat accuracy and stability. Encapsulation protects against shock, vibration, and humidity. The KRPD Series is a cost effective approach for OEM applications that require small size, isolation, accuracy and long life.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat Accuracy + / - 0.5%	
Compact design	Allows flexibility for OEM applications	
Isolated, 10A, SPDT output contacts	Allows control of loads for AC or DC voltages	
Encapsulated	Encapsulated to protect against shock, vibration, and humidity	

Accessories



P1004-95, P1004-95-X Versa-Pot

Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.

P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Ordering Information

•						
MODEL	INPUT	ADJUSTMENT 1	TIME DELAY 1	ADJUSTMENT 2	TIME DELAY 2	FUNCTION
KRPD215S190SMB	24VAC	Fixed	5s	Fixed	90s	Delay-on-Make/Delay-on-Break
KRPD417M113MRXD	120VAC	Fixed	7m	Fixed	13m	Recycling/Off Time First
KRPDA175S130SMI	24 to 240VAC/DC	Fixed	75s	Fixed	30s	Delay-on-Make/Interval
KRPDA2129RXE	24 to 240VAC/DC	Onboard	0.1 - 10s	Onboard	10 - 1000h	Recycling
KRPDD2121MB	12 to 48VDC	Onboard	0.1-10s	Onboard	0.1-10s	Delay-on-Make/Delay-on-Break
				•		

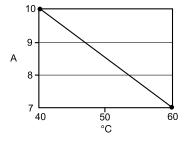
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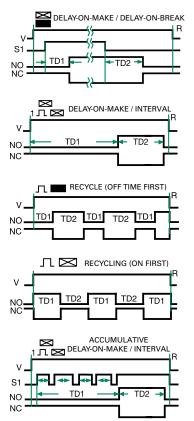
KRPD SERIES



Output Current/Ambient Temperature



Function Diagrams



V = Voltage S1 = Initiate Switch NO = Normally Open Contact NC = Normally Closed Contact TD1, TD2 = Time Delay R = Reset

Specifications

Time Delay	
Туре	Microcontroller circuitry
Range	0.1s - 1000h in 9 adjustable ranges or fixed
	(to 999)
Repeat Accuracy	±0.5% or 20ms, whichever is greater
Tolerance	
(Factory Calibration)	$\leq \pm 2\%$
Reset Time	≤ 150ms
Initiate Time	40ms; 750 operations per minute
Time Delay vs. Temperature	
& Voltage	$\leq \pm 2\%$
Input	
Voltage	12 to 48VDC; 24 to 240VAC/DC
Tolerance	
12 to 48VDC	-15% - 20%
24 to 240VAC/DC	-20% - 10%
AC Line Frequency/DC Ripple	50/60 Hz / ≤ 10%
Power Consumption	$AC \le 2VA; DC \le 2W$
Output	
Туре	Isolated relay contacts
Form	SPDT
Rating (at 40°C)	10A resistive @ 125VAC

Max. Switching Voltage Life (Operations) Protection Circuitry **Isolation Voltage Insulation Resistance** Polarity **Mechanical** Mounting

Dimensions

Termination **Environmental**

Operating/Storage Temperature Humidity Weight

≤±2% ≤ 150ms 40ms; 750 operations per minute ≤±2% 12 to 48VDC; 24 to 240VAC/DC -15% - 20% -20% - 10% 50/60 Hz / ≤ 10% $AC \le 2VA; DC \le 2W$ solated relay contacts SPDT 10A resistive @ 125VAC 5A resistive @ 230VAC & 28VDC 1/4 hp @ 125VAC 250VAC Mechanical - 1 x 107; Electrical - 1 x 105

Encapsulated \geq 1500V RMS input to output $\geq 100 \text{ M}\Omega$ DC units are reverse polarity protected

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connects

-40° to 60°C / -40° to 85°C 95% relative, non-condensing ≈ 2.6 oz (74 g)



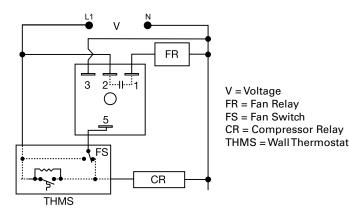
CT SERIES

Delay-on-Make/Delay-on-BreakTimer

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

12 IIME DELAY RELAYS

Ordering Information

MODEL	DELAY-ON-MAKE (FIXED SECONDS)	DELAY-ON-BREAK (FIXED SECONDS)
CT1S30	1	30
CT1S45	1	45
CT1S8	1	8
CT1S90	1	90
CT30S1	30	1
CT45S45	45	45
CT5S300	5	300

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Description

The CT Series combines a delay-on-make and delay-on-break time delay into one unit and may be used to control fan delays in heating and/or cooling equipment. The CT includes bypass circuitry to allow it to operate with cooling anticipators \geq 3000 ohms. It is designed to operate in 24VAC control circuits. Several CT modules may be combined to provide sequencing of any number of loads and sequencing off of the same loads, such as electric heating elements.

Operation (Delay-on-Make/Delay-on-Break)

Forced Air Heating or Air Conditioning (as shown): When the thermostat closes, the compressor relay is immediately energized. At the end of a fixed delay-on-make delay (T1), the fan relay is energized. When the thermostat opens, the compressor relay is de-energized and the delay-on-break delay is initiated. On completion of the fixed delay-on- break delay (T2) the fan relay is de-energized. If the thermostat is reclosed during the delay-on-break delay, the delay-on-break delay is reset and the fan relay remains energized. If the thermostat is closed when input voltage is applied, the delay-on-make delay (T1) begins as normal.

Reset: Removing input voltage resets the output and time delays.

Features & Benefits

FEATURES	BENEFITS
Delay-on-Make and Delay-on-Break in one unit	Simplifies wiring and installation, and optimizes efficiency of heating and cooling systems
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
Interconnectability with other CT modules	Combine modules to provide sequencing on of a number of loads and sequencing off of the same loads

Accessories



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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Accessories

CT SERIES



C103PM (AL) DIN Rail

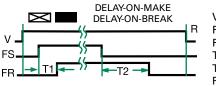
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

Function Diagram



V = Voltage FS = Fan Switch FR = Fan Relay T1 = Delay-on-Make T2 = Delay-on-Break R = Reset

Specifications

Time Delay Type Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time** Input Voltage

Tolerance **AC Line Frequency** Output Type Form Rating **Voltage Drop** Protection Circuitry **Dielectric Breakdown Insulation Resistance**

Mechanical Mounting

Dimensions

Termination

Environmental

Operating/Storage Temperature Humidity Weight Thermostat

±5% ±20% $\leq 300 \text{ms}$ 24VAC ±15% 50/60 Hz

Microcontroller

1 - 600s

Solid state NO 0.75A steady state, 5A inrush at 55°C ≅ 1.25V

Encapsulated ≥ 2000V rms terminals to mounting surface ≥ 100 MΩ

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 70°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g) Anticipator Resistor: \geq 3000 Ω



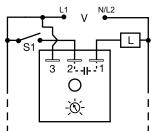
T2D120A15M

Lockout

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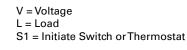
CECILWARE LS95A 1AMP MAX LS95A 1AMP MAX VOLTAGE 120-340 120-340 120-340 120-340 120-340 120-340 120-340 120-340 120-36 10-36 10-

Wiring Diagram





RANDOM START PLUS LOCKOUT



DELAY-ON-MAKE

For dimensional drawing see: Appendix, page 512, Figure 16.

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Description

The T2D Series provides protection against short cycling of compressors and other motors. At the end of each operation, a lockout delay prevents restarting the compressor or motor until the delay is completed. 24VAC models can be used with thermostats that include a cooling anticipator resistor. It can be connected in series with the load for delay-on-make operation.

Operation (Lockout with Random Start)

Connection #1: Upon application of input voltage, a random start time delay begins. At the end of this time delay, the output is energized.

Lockout Delay: Input voltage must be applied prior to and during timing. When the thermostat or initiate switch opens, the output de-energizes and the lockout time delay begins. At the end of the lockout delay, the output is energized allowing the load to immediately energize when the initiate switch or thermostat closes.

Connection #2: Upon application of input voltage and closure of initiate switch, the time delay begins. At the end of the time delay, the output is energized and remains energized until power is removed.

Reset: Removing power resets the output and the time delay.

Features & Benefits

FEATURES	BENEFITS	
Lockout delay	Prevents rapid cycling of compressor	
Random start delay	Prevents low voltage starting	
Analog circuitry	Repeat Accuracy + / - 1%	
Compact design	Allows flexibility for OEM applications	
1A steady, 10A inrush output	Provides 100 million operations in typical conditions.	
Totally solid state and fully encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration and humidity	

S1

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12

FIME DELAY RELAYS

3



P1023-6 Mounting bracket

connect terminals.

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick



P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

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C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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T2D120A15M



Specifications

Input

Voltage Tolerance AC Line Frequency Output Minimum Load Current Rating Voltage Drop Time Delay Initiate Time Type Lockout & Random Start Delays

Tolerance Repeat Accuracy Reset Time

Protection

Dielectric Breakdown Insulation Resistance Mechanical Mounting Dimensions

Termination

Environmental Operating/Storage Temperature Humidity Weight Cooling Anticipator (24VAC Units Only)

Minimum Cooling Anticipator \geq 3,000 Ω

120/230VAC in 2 ranges ±20% 50/60 Hz

24VAC - 100mA; 120/230VAC - 40mA 1A steady state, 10A inrush at 60°C \approx 2.5V @ 1A

After timing - 16ms Analog circuitry

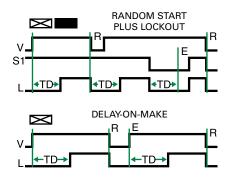
1s - 100m in 4 adjustable ranges or fixed Note: The lockout & random start delays are the same length. Adjustable: $\pm 30\%$; factory fixed: $\pm 30\%$ $\pm 1\%$ or 20ms, whichever is greater After timing - $\leq 16ms$; During timing - $\leq 200ms$

 \geq 2000V RMS terminals to mounting surface \geq 100 $M\Omega$

Surface mount with one #10 (M5 x 0.8) screw H 50.8 mm (2"); W 50.8 mm (2"); D 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.4 oz (68 g)

Function Diagram



V = Voltage S1 = Initiate Switch L = Load (CR) E = Ready TD = Time DelayR = Reset

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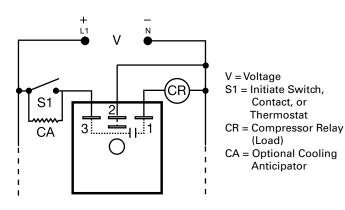


TA SERIES

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Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

12 LIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	TIME DELAY
TA12D1	12VDC	1m
TA12D2	12VDC	2m
TA24A0.5	24VAC	30s
TA24A3	24VAC	3m
TA24A5	24VAC	5m

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Description

The TA Series prevents rapid recycling of a compressor. A lockout delay is started when the thermostat opens, or input voltage is lost. Eliminates tripped circuit breakers or blown fuses caused by a locked rotor during short cycling. The TA will not allow the compressor to start when the line voltage is low. Chatter of the compressor relay is eliminated. Because of the fast initiate time, bounce of the thermostat will not be transmitted to the compressor relay coil. A 30 second delay provides anti-reversing protection for scroll compressors.

Operation (Lockout)

On initial closure of the S1, the compressor relay energizes immediately. When S1 opens or input voltage is interrupted, a lockout time delay is initiated. During this lockout time delay, the compressor relay cannot be energized. The low voltage (brownout) protection prevents energization of the compressor when the line voltage is low.

Reset: The lockout time delay cannot be reset. After the time delay is completed, the unit automatically resets.

Features & Benefits

FEATURES	BENEFITS	
Lockout delay	Prevents rapid cycling of compressor and eliminates nuisance service calls due to blown fuse or tripped breaker by locked rotor during short cycling	
Anti-reversing protection for scroll compressors	Extends life of equipment	
Brownout protection	Timer will not allow the compressor to start during low line voltage conditions	
Encapsulated	Protects against shock, vibration, and humidity	
1A solid state output	No moving parts to arc and wear out. Provides up to 100 million operations under typical conditions	

Accessories

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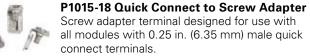
P1023-6 Mounting bracket The 90° orientation of mounting slots makes

installation/removal of modules quick and easy.



P1015-64 (AWG 14/16) Female Quick Connect

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.





(91.4 cm) length.

C103PM (AL) DIN Rail



P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

35 mm aluminum DIN rail available in a 36 in.

www.littelfuse.com/ta

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TA SERIES



Surface mount with one #10 (M5 x 0.8) screw

0.25 in. (6.35 mm) male quick connect terminals

H 50.8 mm (2"); **W** 50.8 mm (2");

-40° to 70°C / -40° to 85°C

95% relative, non-condensing

D 30.7 mm (1.21")

 $\approx 2.4 \text{ oz} (68 \text{ g})$

Specifications

Input

AC Line Frequency Impedance Output

Minimum Load Current Maximum Load Current Voltage Drop **Time Delay Initiate Time**

Lockout Time

Tolerance

Protection

Circuitry Low Voltage Protection Dielectric Breakdown **Insulation Resistance**

12 or 24VDC: 24VAC 50/60 Hz 450 Ω (anticipator by-pass)

75mA 1A at 60°C ≤ 1.25V

≅ 16ms Fixed 0.5, 1, 2, 3, or 5m -15% - 35%

Encapsulated ≅ 20V: 24VAC/DC; ≅ 9V: 12VDC

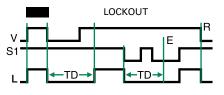
≥ 2000V RMS terminals to mounting surface $\geq 100 \text{ M}\Omega$

Mechanical Mounting

Dimensions

Termination **Environmental Operating/Storage** Temperature Humidity Weight Thermostat **Cooling Anticipator Resistor** \geq 1800 Ω

Function Diagram



- V = Voltage S1 = Initiate Switch L = Load (CR)
- E = Ready
- TD = Time Delay R = Reset

Voltage



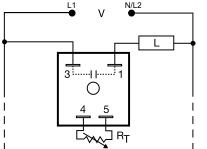
TAC1 SERIES

Delay-on-Make





Wiring Diagram



V = Voltage L = Load

Load may be connected to terminals 3 or 1. R_T is used when external adjustment is ordered.

For dimensional drawing see: Appendix, page 512, Figure 16.

12 LIME DELAY RELAYS

Ordering Information

MODEL	INPUT VOLTAGE	ADJUSTMENT	TIME DELAY
TAC1223	24VAC	External	2 - 180s
TAC1411	120VAC	Fixed	1s
TAC1412	120VAC	Fixed	2s
TAC1413	120VAC	Fixed	3s
TAC14164	120VAC	Fixed	64s

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Description

The TAC1 Series was designed to delay the operation of a compressor relay. It eliminates the possibility of relay chatter due to half-wave failure of the output. It connects in series with the load relay coil and provides a delay-on-make time delay each time input voltage is applied. It can be used for random start, anti-short cycling, sequencing, and many other applications. It is an excellent choice for all air conditioning and refrigeration equipment.

Operation (Delay-on-Make)

Upon application of input voltage, the time delay begins. The output is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.

Reset: Removing input voltage resets the time delay and output.

Features & Benefits

FEATURES	BENEFITS	
Analog circuitry	Repeat accuracy + / - 2%, Factory calibration + / - 20%	
0.5A steady state, 10A inrush	Provides 100 million operations in typical conditions.	
Connects in series with load relay coil Fail-safe design eliminates contactor chatter		
Meets UL 873	UL Recognized for air conditioning and refrigeration equipment	
Fully encapsulated	Protects against shock, vibration and humidity	

Accessories



P1004-XX, P1004-XX-X Versa-Pot Panel mountable, industrial potentiometer recommended for remote time delay adjustment.



P1023-6 Mounting bracket The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P0700-7 Versa-Knob Designed for 0.25 in (6.35 mm) shaft of Versa-Pot. Semi-gloss industrial black finish.



strain relief.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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Accessories



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.



VTP(X)(X) Plug-on Adjustment Module Mounts on modules with in-line adjustment terminals. Rated at 0.25W at 55°C. Available in

resistance values from $5K\Omega$ to $5M\Omega$.

Selection Table for VTP Plug-on Adjustment Accessory

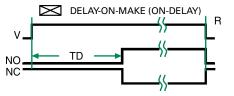
Time Delay	VTP P/N
1 - 0.05-3s	VTP4B
2 - 0.5-60s	VTP4F
3 - 2-180s	VTP4J
4 - 5-600s	VTP5N

Selection Guide

R _T Selection Chart				
Desired Time Delay*			B-	
	Sec	conds		1.1
1	2	3	4	Megohm
0.05	0.5	2	5	0.0
0.5	10	30	60	0.5
1.0	20	60	120	1.0
1.5	30	90	180	1.5
2.0	40	120	240	2.0
2.5	50	150	300	2.5
3.0	60	180	360	3.0
			420	3.5
			480	4.0
			540	4.5
			600	5.0

30% for tolerance of unit and the R_T.

Function Diagram



V = Voltage NO = Normally Open Contact NC = Normally **Closed Contact** TD = Time Delay R = Reset - = Undefined Time

Specifications

Time Delay

Туре Range **Repeat Accuracy** Tolerance (Factory Calibration) **Recycle Time**

Time Delay vs Temp.

& Voltage Input Voltage Tolerance **AC Line Frequency** Output Туре Form Rating **Voltage Drop**

Protection

Circuitry **Dielectric Breakdown Insulation Resistance Mechanical** Mounting

Operating/Storage Temperature Humidity Weight

Analog circuitry 0.05 - 600s in 4 adjustable ranges or fixed ±2%

±20% \leq 20ms after timing, during timing - 0.1% of time delay or 75ms, whichever is greater

 $\leq \pm 10\%$

24, 120, or 230VAC ±20% 50/60 Hz

Encapsulated

D 30.7 mm (1.21")

 $\geq 100 \text{ M}\Omega$

Solid state NO, open during timing 0.5A steady state, 10A inrush at 60°C 120 & 230VAC: ≈ 4.2V @ 0.5A 24VAC: ≈ 2.5V @ 0.5A

≥ 2000V RMS terminals to mounting surface

Surface mount with one #10 (M5 x 0.8) screw

0.25 in. (6.35 mm) male quick connect terminals

Dimensions Termination

Environmental

-40° to 80°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 q)

H 50.8 mm (2"); **W** 50.8 mm (2");

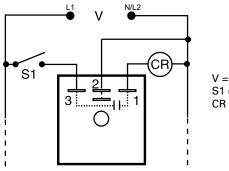


TL SERIES

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Wiring Diagram



V = Voltage S1 = Initiate Switch CR = Compressor or Control Relay

For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT VOLTAGE	LOCKOUT TIME	DELAY-ON-MAKE
TL120A5T	120VAC	5m	1s
TL230A5	230VAC	5m	No delay
TL24A5T	24VAC	5m	1s

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Description

The TL Series provides protection against short cycling of a compressor. At the end of each operation, or whenever power is lost, a lockout delay is initiated. This lockout delay prevents restarting of the compressor until the head pressure has equalized. Compressor relay chatter due to thermostat bounce is eliminated by use of optional one second delay-on-make. The TL Series should not be used with cooling anticipator resistors or solid-state switches. (See the TA Series).

Operation (Lockout)

Lockout: On initial closure of S1, the compressor relay energizes immediately (or after an optional 1s delay). When the S1 opens or input voltage is interrupted, the output opens and remains open for the lockout time delay. During this lockout time delay period, the compressor relay cannot be re-energized.

Reset: The lockout time delay cannot be reset. After the time delay is completed, the unit automatically resets.

Features & Benefits

FEATURES	BENEFITS
Lockout delay	Prevents rapid cycling of compressor and eliminates nuisance service calls due to blown fuse or tripped breaker by locked rotor during short cycling.
One second Delay-on-Make (models ending in T)	Eliminates contactor chatter due to thermostat bounce
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
1A steady, 10A inrush, solid state output	Provides 100 million operations in typical conditions

Accessories

P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P1015-64 (AWG 14/16)



Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail

35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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TL SERIES



Specifications

Input Voltage **AC Line Frequency** Tolerance Output

Minimum Load Current Maximum Load Current Inrush Current Voltage Drop

Time Delay

Initiate Time Lockout Time* Tolerance Option

Protection

Circuitry **Dielectric Breakdown Insulation Resistance**

24, 120, or 230VAC 50/60 Hz ±20%

 $\leq 40 m A$ 1A @ 24VAC; 0.5A @ 120 & 230VAC at 60°C 10A at 60°C 24VAC - 2.5V @ 1A 120 & 230VAC - 4.2V @ 0.5A

≅ 8ms Fixed 2, 3, or 5m -15% - 35% 1s delay-on-make eliminates contactor chatter due to thermostat bounce

Encapsulated ≥ 2000V RMS terminals to mounting surface \geq 100 M Ω

Mechanical

Mounting Dimensions

Termination **Environmental Operating/Storage** Temperature Humidity Weight

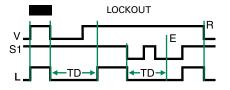
Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 70°C / -40° to 85°C 95% relative, non-condensing ≈ 2.4 oz (68 g)

*Power must be applied for at least 15 s to achieve a full lockout delay. Less than 15 s will result in proportionally shorter delay periods.

NOTE: Cooling anticipator resistor or leakage may cause erratic operation. See TA Series for use with 24VAC systems that include anticipator resistors or use solid-state switches.

Function Diagram



V = Voltage S1 = Initiate Switch L = Load (CR) E = Ready TD = Time Delay R = Reset



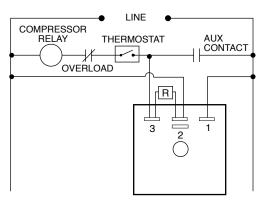
TSA141300

Anti-Short Cycle, Solid StateTimer





Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Specifications

12

Repeat Accuracy Tolerance **TIME DELAY RELAYS** Time Delay vs. Temperature Input Voltage Tolerance **AC Line Frequency** Output Type

Time Delay

Type

Maximum Load Current

Voltage Drop Protection

Transient **Dielectric Breakdown Insulation Resistance**

Factory fixed 5 minutes ± 5% under fixed conditions Factory calibration: ± 15% ± 10% max.

120 volts AC ± 20% of nominal 50/60 Hz

Solid State 1 ampere steady state, 10 amperes inrush at 60°C 2.5 volts typical at 1 ampere

Protected Greater than 1500 volts RMS 100 megohms min.

Description

The TSA141300 utilizes unique circuitry to provide random start and lockout delay in one small, rugged, inexpensive package. When connected as shown, the TSA141300 in a multiple unit situation, prevents all units from starting at one time with its random start feature. The TSA141300 also prevents the compressor from recycling rapidly which could result in a lock rotor condition. This lockout delay is initiated at the end of each operation of the compressor. A momentary loss of power would also initiate the lockout delay.

Operation

Random Start: With the thermostat closed, when line voltage is applied to system, a time delay is initiated. At the end of this delay, the compressor relay will be energized. (Random Start delay is equal to lockout delay.)

Anti-Short Cycle: At the end of each cycle, when the thermostat opens, a lockout delay is initiated which prevents re-energization of the compressor relay during this period. If the thermostat is closed after the time delay is completed, the compressor relay will energize Immediately.

Loss of Power: If there is a momentary loss of power, the lockout will again be initiated preventing the compressor relay from energizing for the duration of the delay.

Features & Benefits

 Lockout Delay—prevents rapid recycling of compressor in air conditioning, refrigeration, and heat pump equipment

terminals

D 30.70 mm (1.21")

- Random Start Delay—provides staggered start up of multiple units
- Fast response time
- All Solid State with Encapsulated Circuitry

Mechanical

Mounting Package Termination

Dimensions

Environmental

Operating/Storage Temperature Humidity

-40°C to +80°C/-40°C to +85°C 95% relative, non-condensing

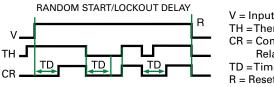
Surface mount with one #8 or #10 screw

0.25 in. (6.35 mm) male quick connect

H 50.80 mm (2.0"); **W** 50.80 mm (2.0");

Molded housing with encapsulated circuitry

Function Diagram



V = Input Voltage TH = Thermostat CR = Compressor Relay TD = Time Delay R = Reset

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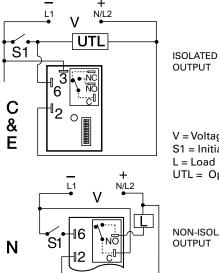
 $C \in \mathbb{R}$

HRV SERIES

Coin Counter



Wiring Diagram



V = Voltage S1 = Initiate Switch

UTL = Optional Untimed Load

NON-ISOLATED

For dimensional drawing see: Appendix, page 512, Figure 17.

Ordering Information

Description

The HRV combines the accuracy of microcontroller based circuitry with an electromechanical relay output. The HRV's switching capacity allows direct control of loads like compressors, pumps, motors, heaters, and lighting. The HRV "S" version provides a vend time after the selected number of initiate switch closures to start is reached. The HRV "A" version includes all of the "S" features and allows the total vend time to be extended for each additional initiate switch closure. The HRV is ideal for cost sensitive single coin or token vending machines. The electronic circuitry is encapsulated to protect against humidity and vibration.

Operation

Coin Totalizer & Vending Timer ("S" Version):

Input voltage must be applied prior to & during operation. When the total number of S1 initiate switch closures equals the number to start set on the lower 3 DIP switches, the load energizes and the vending time set on the upper 7 DIP switches begins. At the end of the vending time, the load de-energizes and the vending time is reset. Closing the initiate switch during vend timing will have no affect on vend time delay.

Accumulating Vending Timer ("A" Version):

Input voltage must be applied prior to and during operation. When the total number of S1 initiate switch closures equals the number to start set on the lower 3 DIP switches, the load energizes and the vending time starts. For every initiate switch closure, the HRV unit adds one time per coin period, as set on the upper 7 DIP switches, to the total vending time.

Operation Note: If S1 is closed when input voltage is applied, the output remains de-energized and the S1 counter remains at zero closures. At least one "vend time" and one "closures to start" DIP switch must be in the "ON" position for proper operation.

Reset: Removing input voltage resets the vend time delay, the S1 closure counter, and de-energizes the output relay.

Features & Benefits

FEATURES	BENEFITS	
Microcontroller based	Repeat accuracy + / - 0.1%, Setting accuracy 0 - 2%, or 50ms	
Encapsulated	Protects against shock, vibration, and humidity	
30A , 1Hp at 125VAC, normally open contacts	Allows direct control of loads like compressors, pumps, motors, and heaters without a contactor	
Switch selectable coin start	Allows user flexibility to select the number of coins to start vending cycle	
Coin switch can be connected to a counter	Provides user with accurate count of total number of coins collected	

MODEL	INPUT VOLTAGE	VEND TIME	MODE OF OPERATION	OUTPUT FORM & RATING
HRV11SC	12VDC	1 - 127s	Coin totalizer	30A SPDT, NO (isolated)
HRV24AC	24VAC	0.25 - 31.75m	Accumulating	30A SPDT, NO (isolated)
HRV41AE	120VAC	1 - 127s	Accumulating	30A SPDT, NO (isolated)
HRV41SE	120VAC	1 - 127s	Coin totalizer	30A SPDT, NO (isolated)
HRV42SE	120VAC	5 - 635s	Coin totalizer	30A SPDT, NO (isolated)
HRV43AE	120VAC	0.1 - 12.7m	Accumulating	30A SPDT, NO (isolated)
HRV43AN	120VAC	0.1 - 12.7m	Accumulating	30A SPDT, NO (non-isolated)
HRV43SE	120VAC	0.1 - 12.7m	Coin totalizer	30A SPDT, NO (isolated)
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HRV SERIES

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief. P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with

all modules with 0.25 in. (6.35 mm) male quick connect terminals.

35 mm aluminum DIN rail available in a 36 in.



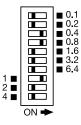
P1023-20 DIN Rail Adapter

C103PM (AL) DIN Rail

(91.4 cm) length.

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

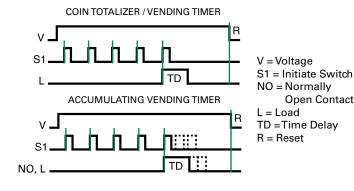
Switch Adjustment



Combine upper seven switches in "ON" position for vend time in minutes.

Combine lower three switches in "ON" position for number of closures to start.

Function Diagram



Count Functions/ Switch Type **Minimum Switch**

Specifications

Closure Time Minimum Switch Open (between closures) Time **Count Range to Start Maximum Counts** ("A" Version) Time Delay/Range *** Adjustment Setting Accuracy **Repeat Accuracy Reset Time** Time Delay vs Temp. & Voltage Input Voltage Tolerance 12VDC & 24VDC/AC 120 & 230 VAC AC Line Frequency/DC Ripple $50/60 \text{ Hz} / \le 10\%$ **Power Consumption** Output Type Form Ratings **General Purpose** 125/240VAC Resistive 125/240VAC 28VDC **Motor Load** 125VAC 240VAC Life Protection Surge Circuitry **Dielectric Breakdown Insulation Resistance** Mechanical

Termination **Environmental Operating/Storage** Temperature Humidity Weight

Mounting

Dimensions

Mechanical (counts on switch closure)

 $\geq 20 \text{ms}$

 $\geq 20 \text{ms}$ 1 - 7 counts

250

Adjustable 1s - 31.75m in 4 ranges 7 of a 10 position DIP switch 0% to +2% or 50ms, whichever is greater ±0.1% or 20ms, whichever is greater ≤ 150ms

 $\leq \pm 2\%$

12 or 24VDC; 24, 120, or 230VAC

-15% - 20% -20% - 10% $AC \le 4VA; DC \le 2W$

Electromechanical relay Isolated, SPDT or non-isolated, SPDT SPDT-NO SPDT-NC

30A 30A 20A

15A

15A

10A

1/4 hp** 1 hp* 2 hp** 1 hp** Mechanical - 1 x 106; Electrical - 1 x 10⁵, *3 x 104, ** 6,000

IEEE C62.41-1991 Level A Encapsulated ≥ 1500V RMS input to output on isolated units $\geq 100 \ M\Omega$

Surface mount with one #10 (M5 x 0.8) screw **H** 76.7 mm (3"); **W** 50.8 mm (2"); **D** 38.1 mm (1.5") 0.25 in. (6.35 mm) male guick connect terminals

-40° to 70°C / -40° to 85°C 95% relative, non-condensing ≅ 3.9 oz (111 g)

***For CE approved applications, voltage must be removed when a switch position is changed.

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Open Contact



FLASHERS & TOWER LIGHTING CONTROLS

Flashers for incandescent or LED lighting used with both alternating and non-alternating applications in the signaling, communications, and advertising industries. FAA approved versions for obstruction lighting control are available. Tower lighting illuminates communications towers, tall buildings, and bridges as required by FA regulation. Designs are also available for powered AM and FM towers.

Flashers

FSU1000 Series	
FS100 Series	Low Current Flasher
FS100 Series	Med Power Flasher 444
FS200 Series	
FS300 Series	
FS491	
FS500 Series	
SC3 / SC4 Series	Sequencing Controls

Tower and Obstruction Lighting Controls

Flasher & Incandescent Beacon Alarm Relay 457
Obstruction Lamp Alarm Relay458
Universal Lamp Alarm Relay 459
Universal Lamp Alarm Relay 461
Universal Lamp Alarm Relay
Photo Control

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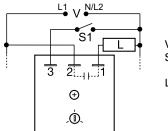
Flashers and Tower Lighting Controls Flashers

FSU1000 SERIES





Wiring Diagram



V = Voltage S1 = Optional low current switch L = Load

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information

MODEL	INRUSH RATING	LOAD RATING
FSU1000	10A	1A
FSU1003	60A	6A
FSU1004	100A	10A
FSU1005	200A	20A

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Description

The FSU1000 incorporates an onboard adjustable flash rate of 10 to 100 FPM and a universal input voltage in one device. Its circuitry is encapsulated and is capable of controlling loads of up to 20A. The versatility of the FSU1000 makes it ideal for applications where various flash rates and operating voltages are required.

Operation

When input voltage is applied to terminal 2 and the load (lamp), the load energizes steadily. When input voltage is applied to terminal 3, the output flashes.

Optional Low Current Switch (S1): This low current switch could be a limit switch or contact. While open, the operator sees the load (lamp) ON and operating. When the limit switch closes, the load (lamp) flashes to attract attention.

Features & Benefits

FEATURES	BENEFITS	
Universal input voltage 24 to 240VAC	Allows flexibility for a wide range of applications with one part	
Onboard adjustable flash rate	Provides flexibility for user to select flash rate between 10 - 100 FPM	
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity	
High output rating up to 20A, 200A inrush	Allows direct operation of high current loads without a contactor	

Accessories



P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

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FSU1000 SERIES



Specifications

Technical Data Operation

Flash Rate ON/OFF Ratio Input **Range/Frequency** Output Load Type **Maximum Load Rating** Inrush **Mechanical** Mounting* Dimensions FSU1000

FSU1003, FSU1004

Termination Protection Circuitry **Environmental Operating/Storage** Temperature Weight

ON/OFF recycling solid-state flasher (continuous duty) Adjustable 10 - 100 FPM **≅** 50%

24 to 240VAC / 50/60Hz

Inductive, resistive, or incandescent 1, 6, 10, or 20A steady state 10 times steady state current

Surface mount with one #10 (M5 x 0.8) screw

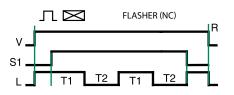
H 50.8 mm (2"); W 50.8 mm (2"); **D** 30.7 mm (1.21") **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals

Encapsulated

-20° to 60°C (240VAC +50°C) / -40° to 85°C 1A units: \approx 2.4 oz (68 g) \geq 6A units: \cong 3.9 oz (111 g)

*Units rated > 6A must be bolted to a metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C.

Flasher Function Diagram



V = Voltage S1 = Initiate Switch L = Load R = Reset T1 = ON Time T2 = OFF Time T1 ≅ T2



Flashers and Tower Lighting Controls Flashers

FS100 SERIES

Low Current Flasher



Description

The FS100 Series (low current) may be used to control inductive, incandescent or resistive loads. This series offers a 1A (fullwave) or a 2A (halfwave) steady state, 10A inrush solid-state output and may be ordered with an input voltage of 24 or 120VAC. The FS100 Series offers a factory fixed flash rate of 75 FPM or may be ordered with a fixed, custom flash rate ranging from 45 to 150 FPM. Ideal for OEM applications where cost is a factor.

Operation

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2.

Features & Benefits

FEATURES	BENEFITS
Compact Size: 38 x 23.9mm (1.5″ x 0.94″)	Ideal for OEM applications
Custom Flash Rates Available	Tailor to specific application: custom rates range from 45 to 150 FPM

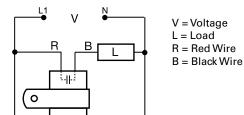
Accessories



P1023-2 "P" Clamp

Mounting Bracket Alum. 15/16

Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 25.

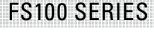
Ordering Information

MODEL	INPUT VAC	OUTPUT RATING A	OUTPUT TYPE AC	LOAD TYPE	FLASH RATE
FS126	120	1	Fullwave	Incandescent & Resistive	75 FPM
FS126-45	120	1	Fullwave	Incandescent & Resistive	45 FPM
FS126-60	120	1	Fullwave	Incandescent & Resistive	60 FPM
FS126RC	120	1	Fullwave	Incandescent, Resistive, & Inductive	75 FPM
FS126RC-45	120	1	Fullwave	Incandescent, Resistive, & Inductive	45 FPM
FS127	120	2	Halfwave	Incandescent & Resistive	75 FPM
FS146	24	1	Fullwave	Incandescent & Resistive	75 FPM
FS146RC	24	1	Fullwave	Incandescent, Resistive, & Inductive	75 FPM

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www.littelfuse.com/fs100Lowcurrent



Low Current Flasher



Specifications

Technical Data

Operation **Flash Rate** Custom Flash Rates Available From 45-150 FPM ±20% **ON/OFF** Ratio Input Voltage **AC Line Frequency** Output Output Load Type

Maximum Load Rating

Inrush **Mechanical** Mounting

Connection/Wires Dimensions Protection Circuitry **Environmental Operating/Storage** Temperature Humidity Weight

OFF/ON solid-state flasher (continuous duty) Factory fixed at 75 FPM ±20% **≃** 50%

24, 120VAC, ±15% 50/60Hz

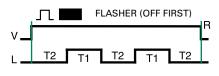
Fullwave AC or Halfwave rectified AC Incandescent, resistive, or inductive (Choose RC suffix for inductive loads) Fullwave: 1A steady state Halfwave: 2A steady state 10A

Removable mounting bracket, use one #8 (M4 x 0.7) screw 18 AWG (0.82mm2) wires 6 in. (15.2cm) H 38.1 mm (1.5"); W 23.9 mm (0.94")

Encapsulated

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 1.1 oz (31 g)

Flasher Function Diagram



V = Voltage R = Reset L = LoadT1 = ONTime T2 = OFFTime T1 ≅T2



Flashers

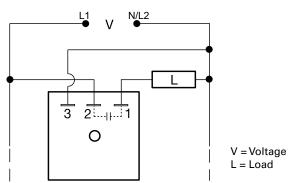
FS100 SERIES

Medium Power Flasher





Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

MODEL	INPUT	FLASH RATE
FS143	24VAC	90 FPM
FS152	120VAC	90 FPM
FS152-30	120VAC	30 FPM
FS152-60	120VAC	60 FPM
FS162	230VAC	90 FPM
FS162-30	230VAC	30 FPM

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Description

The FS100 Series (medium power) may be used to control inductive, incandescent, or resistive loads. Input voltages of 24, 120, or 230VAC are available. Fixed flash rates in stock range from 30, 50, 60, and 90 FPM, with custom flash rates ranging from 10 to 300 FPM. Encapsulation provides protection against shock, vibration, and humidity. This group of solid-state flashers has proven reliability with years of use throughout the world.

Operation

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2.

Features & Benefits

FEATURES	BENEFITS
3A steady, 30A inrush current	Provides direct control of inductive, incandescent, or resistive loads
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules quick and easy.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are

constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



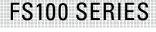
P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Medium Power Flasher



Specifications

Technical Data

Operation **Flash Rate Custom Flash Rates ON/OFF** Ratio Input

Voltage/Frequency Output

Load Type Output **Maximum Load Rating** Inrush

Mechanical

Mounting Dimensions

Termination

Protection Circuitry **Environmental Operating/Storage** Temperature Weight

OFF/ON solid-state flasher (continuous duty) Fixed at 90 FPM ±10% 10 - 300 FPM ±10% **≃** 50%

24, 120, or 230VAC ±15% / 50/60 Hz

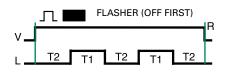
Inductive, resistive, or incandescent Fullwave AC, solid state, SPST 3A steady state 10 times steady state current

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

Encapsulated

-20° to 60°C / -40° to 85°C ≈ 2.2 oz (62 g)

Flasher Function Diagram



V = Voltage R = Reset L = LoadT1 = ONTime T2 = OFFTime

T1 ≅ T2



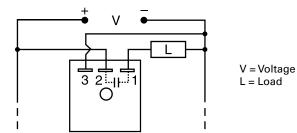
Flashers and Tower Lighting Controls Flashers

FS200 SERIES





Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

Ordering Information

	MODEL	INPUT	RATING	FLASH RATE
	FS219-45	12VDC ± 20%	3A	45 FPM
	FS224	24VDC ± 20%	3A	90 FPM
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Description

The FS200 Series may be used to control inductive, incandescent, or resistive loads. Factory fixed flash rate of 45 or 90 FPM or may be ordered with a fixed custom flash rate ranging from 10 to 180 FPM. Encapsulation provides protection against shock, vibration, and humidity. Uniform performance, high inrush current capability, and low RFI, make this series ideal for general industrial applications.

Operation

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2.

Features & Benefits

FEATURES	BENEFITS
3A steady, 30A inrush, SPST output contact	Provides direct control of inductive, incandescent, or resistive loads
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
High inrush current capability and low RFI	Ideal for general industrial applications

Accessories



P1023-6 Mounting bracket

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P1015-64 (AWG 14/16) **Female Quick Connect**

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



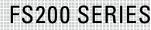
P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Specifications

Technical Data Operation **Flash Rate**

Custom Flash Rate ON/OFF Ratio Input Voltage Output Load Type **Maximum Load Rating OFF State Leakage Current** 12 & 24VDC Inrush **Mechanical** Mounting Dimensions

Termination Protection Circuitry **Environmental Operating/Storage** Temperature Weight

OFF/ON solid-state flasher (continuous duty) Fixed at 90 FPM ±10% 10 - 180 FPM **≃** 50%

12, 24, 36, 48, or 110VDC

Inductive, resistive, or incandescent 0.25 - 3A steady state

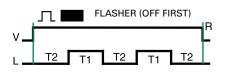
 $\leq 250 \ \mu A$ 10 times steady state current

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

Encapsulated

-20° to 60°C / -40° to 85°C ≈ 2.2 oz (62 g)

Flasher Function Diagram



V = Voltage R = Reset L = LoadT1 = ONTime T2 = OFFTime T1 ≅ T2

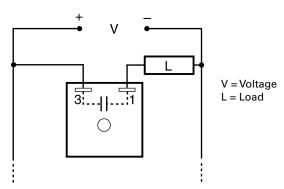
FS300 SERIES

Flashers and Tower Lighting Controls

Flashers



Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 16.

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Ordering Information

MODEL	INPUT	MAXIMUM CURRENT LOAD
FS312	12VDC ± 20%	2.5A
FS324	24VDC ± 20%	1.5A

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The FS300 Series of solid-state flashers were specifically designed to operate lamp loads. Their two-terminal series connection feature makes installation easy. The high immunity to line noise and transients makes the FS300 Series ideal for moving vehicle applications. All solid-state construction means reliability and long life. The FS300 Series offers a factory fixed flash rate of 75 FPM or may be ordered with a fixed, custom flash rate ranging from 60 to 150 FPM.

Operation

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until input voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2.

Features & Benefits

FEATURES	BENEFITS
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
High immunity to line noise and transients	Designed specifically for moving vehicle applications
High surge current capability (10 times steady state)	Direct operation of incandescent lamp loads
Two terminal series connection	Provides quick and easy installation for new or existing applications

Accessories

P1023-6 Mounting bracket

connect terminals.

The 90° orientation of mounting slots makes installation/removal of modules guick and easy.



P1015-64 (AWG 14/16) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide



strain relief. P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

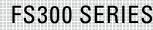


P1023-20 DIN Rail Adapter Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Specifications

Technical Data Operation

Flash Rate Custom Flash Rates ON/OFF Ratio Input Voltage Output Load Type **Maximum Load Rating** Inrush **Mechanical** Mounting Dimensions

Termination Protection Circuitry Environmental **Operating/Storage** Temperature Humidity Weight

OFF/ON recycling solid-state flasher (continuous duty) Fixed at 75 FPM ±10% 60 - 150 FPM **≃** 50%

12, 24, 36, 48, 72, & 110VDC

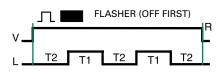
Incandescent or resistive 0.25 - 2.5A steady state 10 times steady state current

Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 30.7 mm (1.21") 0.25 in. (6.35 mm) male quick connect terminals

Encapsulated

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 2.2 oz (62 g)

Flasher Function Diagram



V = Voltage R = Reset L = Load T1 = ONTime T2 = OFFTime T1 ≅ T2

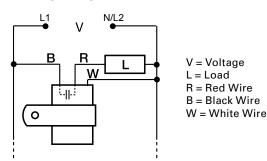


FS491

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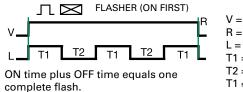


Wiring Diagram



For dimensional drawing see: Appendix, page 512, Figure 25.

Function Diagram



V = Voltage R = Reset L = Load T1 = ONTime T2 = OFFTime $T1 \cong T2$

Description

The FS491 is a low leakage AC flasher designed to control LED, or resistive loads. This product offers a solid-state output and accepts an input voltage of 120VAC to 240VAC. It offers a factory fixed flash rate of 75 FPM. The FS491 is the perfect solution for LED lamp flashing.

Operation

Upon application of input voltage, the output energizes and the ON time begins. At the end of the ON time, the output de-energizes and the OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and the flash sequence.

Features & Benefits

FEATURES	BENEFITS
Totally solid state	No moving parts to arc and wear out, up to 100 million operations under typical conditions
Fully encapsulated	Protects circuitry from shock, vibration and humidity
Extremely low leakage current	Ideal for use in LED lighting applications

Specifications

Technical Data Operation **Flash Rate ON/OFF** Ratio Input Voltage Tolerance **AC Line Frequency** Output Load Type Output **Maximum Load Rating** 120VAC to 240VAC Max. Load Leakage Current Voltage Drop Mechanical Mounting Dimensions Protection Surge Circuitry **Environmental Operating/Storage** Temperature Humidity Weight

ON/OFF solid-state flasher (continuous duty) Fixed at 75 FPM $\pm 20\%$ $\approx 50\%$

120 - 240VAC ± 15% 50/60Hz

LED or resistive Bridge Rectifier & FET

0.5A steady state; 5A inrush 250µA 2V typical

Surface mount with one #8 (M4 x 0.7) screw **Dia.** 23.9 mm (0.94"); **L** 38.1 mm (1.5")

IEEE C62.41 - 1991 Level A Encapsulated

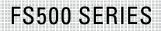
-20° to 60°C / -40° to 85°C 95% relative, non-condensing \approx 1.1 oz (31 g)

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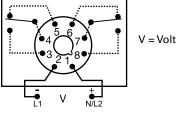






8-PIN

Wiring Diagram



V = Voltage

For dimensional drawing see: Appendix, page 512, Figure 24.

Ordering Information

MODEL	INPUT VOLTAGE
FS512	12VDC
FS524	24VAC/DC
FS590	120VAC/DC

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The FS500 Series flash rate is adjustable from 10 to 100 FPM. A locknut is provided to hold selected flash rate. The long-life electronic circuit combined with a guality electromechanical relay provides flexibility and reliability in most applications.

Operation

Upon application of input voltage, the output relay is energized and the ON time begins. At the end of the ON time, the output relay de-energizes and the OFF time begins. At the end of the OFF time, the output is energized and the cycle repeats as long as input voltage is applied.

Reset: Removing input voltage resets the output and the sequence.

Features & Benefits

FEATURES	BENEFITS
Solid-state circuitry with electromechanical relay	Long life circuitry at a reliable low cost
Industry standard octal plug connection	Eliminates need for special connectors
Adjustable flash rate	Provides flexibility for user to select flash rate between 10 - 100 FPM
10A, DPDT isolated output contacts	Allows control of loads for AC or DC voltages

Accessories



BZ1 Front Panel Mount Kit

Provides an easy method of through-the-panel mounting of 8- or 11-pin plug-in timers, flashers, and other controls.



NDS-8 Octal 8-pin Socket 8-pin 35mm DIN rail or surface mount. Surface mounted with two #6 screws or snaps onto a





Securely mounts plug-in controls in any position. Provides protection against vibration. Use with NDS-8 Octal Socket. Sold in pairs.



C103PM (AL) DIN Rail 35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

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FS500 SERIES

Flashers and Tower Lighting Controls

Flashers

Specifications

Technical Data Operation

Flash Rate

ON/OFF Ratio

Input **Input Voltage** Tolerance 12VDC & 24VDC/AC 120VAC/VDC & 230VAC **AC Line Frequency** Output

Load Type Form Rating

Mechanical

Mounting Dimensions

Termination Protection **Isolation Voltage** Polarity Environmental **Operating/Storage** Temperature Weight

ON/OFF recycling flasher with adjustable flash rate Adjustable from 10 - 100 operations per minute (guaranteed range) **≃** 50%

12VDC, 24VAC/DC, 120VAC/DC, 230VAC

-15% - 20% -20% - 10% 50/60Hz

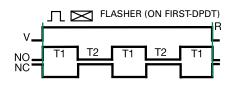
Electromechanical relay DPDT 10A resistive @ 120/240VAC & 28VDC; 1/3 hp @ 120/ 240VAC

Plug-in socket H 91.6 mm (3.62"); W 60.7 mm (2.39"); **D** 45.2 mm (1.78") Octal 8-pin plug-in

 \geq 1500V RMS input to output DC units are reverse polarity protected

-20° to 60°C / -30° to 85°C ≅ 5.8 oz (164 g)

Flasher Function Diagram



V = Voltage R = Reset T1 = ONTime T2 = OFFTime NO = Normally Open NC = Normally Closed

Sequencing Controls

SC3 / SC4 SERIES

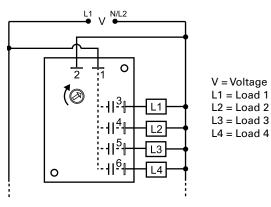
Chaser







Wiring Diagram



SC4 shown. For SC3, terminal 6 and load L4 are eliminated.

For dimensional drawing see: Appendix, page 513, Figure 28.

Description

The SC3/SC4 Series are solid-state 3 or 4 channel chasers designed for sequential three circuit flashing of incandescent lamp loads. Unlike electromechanical chasers, there are no contacts to arc, wear, and eventually fail.

Operation

Sequential 3 or 4 circuit flashing of incandescent loads with equal time delays for each load. Upon application of input voltage, Load 1 is energized. At the end of the time delay, Load 1 de-energizes and Load 2 energizes. At the end of the time delay, Load 2 de-energizes and Load 3 energizes. This cycle continues until input voltage is removed. The set time delay (rate) is the timing for the *whole cycle*, for all 3 loads (output contacts).

Reset: Removing input voltage resets the unit and cycle.

Features & Benefits

FEATURES	BENEFITS
Totally solid state and encapsulated	No moving parts to arc and wear out over time and encapsulated to protect against shock, vibration, and humidity
1A steady solid state output	Provides 100 million operations in typical conditions.

Accessories



P1015-13 (AWG 10/12), **P1015-64** (AWG 14/16), **P1015-14** (AWG 18/22) **Female Quick Connect** These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male quick connect terminals.

Ordering Information

•				
MODEL	INPUT VOLTAGE	RATING	CHANNEL	FLASH RATE
SC3120A	120VAC	1A	3 Sequential	Adjustable 30 - 30FPM
SC4120A	120VAC	1A	4 Sequential	Adjustable 30 - 30FPM

If you don't find the part you need, call us for a custom product 800-843-8848

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SC3 / SC4 SERIES

Flashers and Tower Lighting Controls Sequencing Controls

Specifications

Technical Data Operation

Rate Input Voltage AC Line Frequency Output Type Rating Mechanical Mounting

Termination Dimensions

Protection

Circuitry Dielectric Breakdown Insulation Resistance Environmental Operating/Storage Temperature Humidity Weight Sequential 3 circuit flashing of incandescent lamp loads. Fixed rate. *For sequential 4 circuit and adjustable rates, please contact the factory.* Fixed: 30 operations per minute (±10%)

120VAC ±15% 50/60 Hz

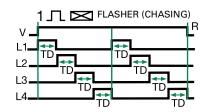
Solid state 1A steady state per output

Surface mount with two #6 (M3.5 x 0.6) screws 0.25 in. (6.35 mm) male quick connect terminals H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 31 mm (1.22")

Encapsulated $\geq 2000V$ RMS terminals to mounting surface $\geq 100~M\Omega$

-20° to 60°C / -40° to 85°C 95% relative, non-condensing ≅ 5.4 oz (153 g)

Flasher Function Diagram



SC4 shown. For SC3, L4 is eliminated and L1TD begins as soon as L3TD is completed. V = Voltage R = Reset L1, L2, L3, L4 = Lamps TD = Time Delay (all are equal)

Tower and Obstruction Lighting Controls



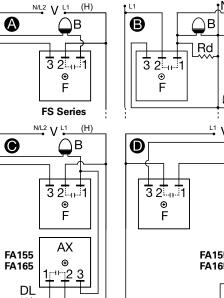
FA / FS SERIES

Ð *(FS155 & FA155 models only)





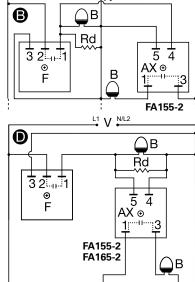
Wiring Diagram



V = Voltage N = Neutral B = Beacon DL = Dummy Load for Constant Line Loading Rd = 3.3 KΩ @ 5W for 120VAC; 8.5 KΩ @ 5W for 230VAC F = Flasher (FS155-30T, FS155-30RF, FS165-30T) AX = Auxiliary Unit (FA155, FA155-2, FA165, FA156-2)

For dimensional drawing see: Appendix, page 512, Figure 19.

Ordering Information



Accessories strain relief.

P1015-13 (AWG 10/12), P1015-64 (AWG 14/16), P1015-14 (AWG 18/22) Female Quick Connect These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide



P1015-18 Quick Connect to Screw Adapter Screw adapter terminal designed for use with all modules with 0.25 in. (6.35 mm) male guick connect terminals.

MODEL	INPUT VOLTAGE	WATTAGE	INRUSH RATING	DESCRIPTION
FA155	120VAC	2500W	200A	Auxiliary unit to provide constant line loading
FA155-2	120VAC	2500W	200A	Auxiliary unit for synchronized operating of additional beacons. Synchronized flashing of additional beacons on a 3 wire system
FA165	230VAC	5000W	200A	Auxiliary unit to provide constant line loading
FA165-2	230VAC	5000W	200A	Auxiliary unit for synchronized operating of additional beacons. Synchronized flashing of additional beacons on a 2 wire system
FS155-30RF	120VAC	2500W	200A	For high RF interference locations including AM hot towers
FS155-30T	120VAC	2500W	200A	Standard beacon flasher
FS165-30T	230VAC	5000W	200A	Standard beacon flasher

If you don't find the part you need, call us for a custom product 800-843-8848

Description

The FA/FS Series have proven their reliability through years of use on communication towers, smoke stacks, cooling towers, tall buildings, bridges and utility towers. The highest guality components are encapsulated in a rugged plastic housing with a molded-in heat transfer plate. The flash rate, ratio, and failsafe design meet FAA regulations. Zero voltage switching can increase lamp life up to ten times. The FS155-30RF includes superior RF filtering circuitry for use in high RF installations, including AM hot towers.

Operation

L2

FS Series - Flasher (OFF First)

FA Series - Auxiliary Modules

Upon application of input voltage, the T2 OFF time begins. At the end of the OFF time, the T1 ON time begins and the load energizes. At the end of T1, T2 begins and the load de-energizes. This cycle repeats until voltage is removed.

Reset: Removing input voltage resets the output and the sequence to T2.

Features & Benefits

FEATURES	BENEFITS	
Zero voltage switching	Delivers up to 10 times longer lamp life	
Encapsulated	Protects against shock, vibration, and humidity	
Metalized mounting surface	Facilitates heat transfer in high current applications	
Superior RF filtering circuitry (RF models only)	Ideal for AM hot towers and other high RF installations	
High inrush capability up to 200A	Will withstand the repetitive inrush current of incandescent beacons	



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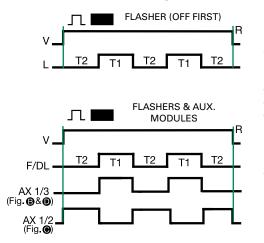


FA / FS SERIES

Flashers and Tower Lighting Controls

Tower and Obstruction Lighting Controls

Flasher Function Diagrams



V = Voltage R = Reset L = LoadT1 = ON Time T2 = OFF Time T1 ≅ T2 F = Flasher DL = Dummy Load AX = AuxillaryModule

Specifications

Operation

Flash Rate (FS Series Only) **ON/OFF** Ratio (FS Series Only) Voltage **AC Line Frequency Output Rating (Zero Voltage Switching) Inrush Current** Mounting* Dimensions

Termination Circuitry **Operating/Storage** Temperature Humidity Weight

Single & multiple beacon flashing with auxiliary modules 30 ±10 FPM

50 - 67% ON time; 33 - 50% OFF time 120 or 230VAC ±20% 50/60Hz

2500W @ 120VAC; 5000W @ 230VAC 200A peak for 1 cycle of AC line Surface mount with one #10 (M5 x 0.8) screw **H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 38.4 mm (1.51") 0.25 in. (6.35 mm) male quick connect terminals Encapsulated

-55° to 65°C / -55° to 85°C 95% relative, non-condensing ≅ 3.9 oz (111 g)

* Note: Must be mounted to metal surface using the included heat sink compound. The maximum mounting surface temperature is 90°C.

Tower and Obstruction Lighting Controls

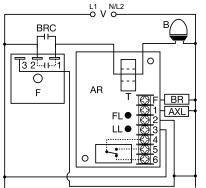


FB SERIES

Flasher & Incandescent Beacon Alarm Relay



Wiring Diagram



V = Voltage B = Beacon F = Flasher T = Toroid BRC = Flasher Bypass Relay Contacts AR = FB Alarm Relay BR = Bypass Relay Coil FL = Flasher Failure LED LL = Lamp Failure LED AXL = Lamp Alarm Relay Coil

NOTE: Flasher module may be located on either the line or load side of the toroidal sensor.

For dimensional drawing see: Appendix, page 514, Figure 47.

Ordering Information

MODEL	LINE VOTAGE	LAMP TYPE
FB120A	120VAC	Incandescent Beacon
FB230A	230VAC	Incandescent Beacon

If you don't find the part you need, call us for a custom product 800-843-8848

Specifications

Input Voltage FB120A FB230A AC Line Frequency Lamp Socket Voltage Alarm Outputs Type

Lamp Failure Detection

FB120A

FB230A

Trip Delays

Flasher Failure

Lamp Failure

120VAC ±15% 230VAC ±15% 50/60Hz ±10%; 50/60Hz

3 total - 1 relay, 2 solid state; One isolated SPDT relay rated 5A resistive Two solid-state line voltage outputs rated 0.5A steady, 5A inrush

For two 620W or 700W lamps For two 500W or 700W lamps

Fixed at 6s; -0/+40% Fixed at 10s; -0/+40%

Description

The FB Series is used to monitor the operation of one twolamp incandescent beacon and one beacon flasher (or auxiliary module). The flasher and lamps are monitored by sensing the flow of current in the circuit. If the lamp(s) or the flasher fail to operate properly, a solid-state output and an isolated SPDT relay energize. When connected to a site monitoring system, this unit provides the remote beacon monitoring protection required by the FAA/FCC. On a multiple beacon structure, one unit is required for each two-lamp incandescent beacon (one unit per beacon for LED beacons).

Operation

If one lamp in an incandescent beacon fails, the relay and solidstate lamp failure outputs energize after 10s. If the flasher fails in the ON or OFF condition, the relay and the solid-state flasher failure output energizes after 6s. If both failures occur, all three outputs energize after their trip delays.

Note: If both incandescent lamps fail, all three outputs will energize. The relay and solid-state flasher failure output energizes after 6s, and the solid-state lamp failure output energizes after 10s.

Features & Benefits

FEATURES	BENEFITS
Toroidal current sensing	Reliable low cost monitoring of the flasher and lamps through built-in CT and provides isolatio n from the monitored circuit
Failsafe beacon monitoring	Alarm monitors for failed incandescent lamps in addition to flasher function
One isolated, 5A, SPDT alarm output plus two, 1A, solid-state line voltage alarm outputs	When connected to a site monitoring system, it provides the remote beacon monitoring protection required by the FAA / FCC.
Fixed trip delays for flasher (6s) and lamp (10s) failures	Prevents nuisance alarms

LEDs Lamp Failure (Red) Flasher Failure (Red) Protection Circuitry Mounting Dimensions

Termination

Environmental Operating/Storage

Temperature Weight Glows when one or both lamps fail Glows when the flasher fails

Encapsulated Surface mount with two #6 (M3.5 x 0.6) screws H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 44.5 mm (1.75") 7 position barrier block for 20 AWG (0.5 mm²) to 14 AWG (2.5 mm²) wire

-55° to 60°C / -55° to 85°C ≅ 7 oz (198 g) 13

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Flashers and Tower Lighting Controls Tower and Obstruction Lighting Controls

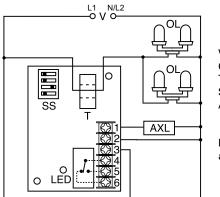
SCR490D

Obstruction Lamp Alarm Relay

C€ ∰



Wiring Diagram



V = Voltage OL = Obstruction Lamps T = Toroid SS = Selector Switch AXL = Auxiliary Load/Alarm

Relay contacts are isolated.

For dimensional drawing see: Appendix, page 514, Figure 47.

Description

The SCR490D is used to provide remote monitoring of steady burning incandescent marker and obstruction lighting. Four onboard switches allow operator programming for lighting systems with two through nine lamps on a single AC circuit. The SCR490D uses a toroidal sensor and electronic circuitry to sense the failure of one or more lamps.

Operation

When a lamp fails, the SCR490D senses a decrease in current flow. Then, after a fixed time delay, it transfers to its alarm mode. In alarm mode, the LED indicator, the output relay (SPDT isolated contacts), and a non-isolated solid-state output are energized. Replacement of the failed lamps resets the alarm outputs and the LED indicator. To prevent false alarm signals, power must be applied to the SCR490D at the same time that lamps are energized.

Features & Benefits

FEATURES	BENEFITS
Toroidal current sensing	Reliable low cost monitoring of incandescent marker and obstruction lighting through built-in CT which also provides isolation from the lighting circuit
Monitors 2 - 9 lamps	Senses failed obstruction lamps on a single AC circuit
Isolated, 10A, SPDT alarm output plus one 1A, solid-state line voltage alarm output	Provide alarm indication and can also be used for remote monitoring of the lighting system
Fixed trip delay (6s)	Prevents nuisance alarms

Specifications

Operation

Number of Lamps Lamp Wattage Rated Lamp Voltage Monitored Voltage Trip Delay Voltage AC Line Frequency Tolerance 120VAC Line Voltage Output (Solid State Rated) Isolated Alarm Output

Mounting Dimensions

Termination

Circuitry Operating/Storage Temperature Humidity Weight 2 - 9 (selectable) 116W, incandescent lamps 120 or 130VAC (selectable) 120VAC ±3% ≅ 6s fixed 120VAC 50/60Hz - 20% - 10%

 \leq 125W to operate a spare lamp or alarm 10A @ 120VAC or 30VDC resistive; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC Surface mount with two #6 (M3.5 x 0.6) screws H 88.9 mm (3.5"); W 63.5 mm (2.5"); D 44.5 mm (1.75") Screws with captive clamps for up to 14 AWG (2.45 mm²) wire Encapsulated

-55° to 65°C / -55° to 85°C 95% relative, non-condensing ≅ 6.8 oz (193 g)

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Tower and Obstruction Lighting Controls



SCR SERIES

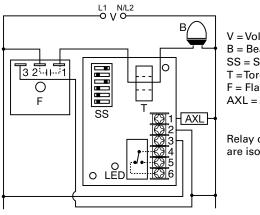
Universal Lamp Alarm Relay





Wiring Diagram

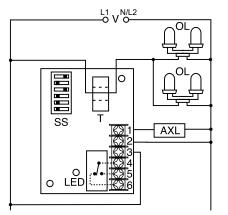
BEACON LAMP CONNECTION DIAGRAM



V = Voltage B = Beacon Lamps SS = Selector Switch T = Toroid F = Flasher AXL = Auxiliary Load/Alarm

Relay contacts are isolated.

OBSTRUCTION LAMP CONNECTION DIAGRAM



V = Voltage SS = Selector Switch T = Toroid AXL = Auxiliary Load/Alarm OL = Obstruction Lamps

Relay contacts are isolated.

Description

The SCR series is a universal lamp alarm relay designed to sense the failure of flashing or steady incandescent beacon lamps or steady side lights. The toroidal current sensor provides isolation and allows monitoring of more than one line at a time. The SCR Series energizes when one or more lamps fail. It will monitor the operation of one to four side lights and up to four beacon lamps.

Operation

When a lamp fails, the SCR Series senses a decrease in current flow. After a fixed time delay, the LED glows and the two alarm outputs energize. The outputs and the LED are reset when the failed lamps are replaced and the current returns to the nominal setting, or when the input voltage is removed. The SCR will sense an open flasher, it will not sense a continuously ON flasher (see FB Series).

Features & Benefits

FEATURES	BENEFITS	
Toroidal current sensing	Provides isolation from the lighting circuit and allows monitoring of multiple lines simultaneously	
Monitors 1-4 side lights or up to 4 beacon lamps	Senses failed incandescent flashing beacon or steady obstruction lamps	
Isolated, 10A, SPDT alarm output plus one 1A, solid-state line voltage alarm output	Provides alarm indication and can also be used for remote monitoring of the lighting system	
Fixed trip delay (6s)	Prevents nuisance alarms	
Switch selectable number, voltage, and wattage of lamps	User selectable to meet wide application needs with one relay	

Ordering Information

MODEL	INPUT	LAMP TYPE
SCR430T	120VAC	Incandescent
SCR630T	230VAC	Incandescent

If you don't find the part you need, call us for a custom product 800-843-8848

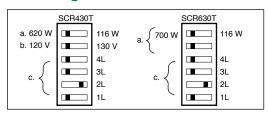
For dimensional drawing see: Appendix, page 514, Figure 47.



SCR SERIES

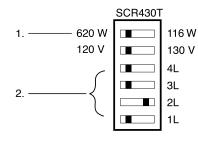
Flashers and Tower Lighting Controls Tower and Obstruction Lighting Controls

Selection Range



- a. Lamp Wattage Select the lamp wattage of the lamps in use.
- b. Lamp Voltage Select the lamp voltage shown on the lamp (SCR430T)
- c. Lamps ON Select the number of lamps on during normal operation. Only one lamp switch at a time may be transferred to the right.

Programming Example



Example Shown: SCR430T-620 watts at 120 VAC lamps, two lamps are ON during normal operation.

STEP

- 1. Select lamp wattage: 116 or 620 watts
- 2. Select the number of lamps ON (1 thru 4) during normal operation. Only one lamp switch may be ON (RIGHT) at any time.

Specifications

Operation

Operation				
Lamp Monitoring				
Capacity (in lamps)	100W	116W	620W	700W
SCR430T 120VAC Lamps	4	4	4	n/a
SCR630T 230VAC Lamps	n/a	4	n/a	4
Time Delay				
Trip Delay	Factory f	ixed ≅ 6s		
Input	,			
Input Voltage/Tolerance	SCR430	F - 120VAC ±1	0%	
	SCR630	[- 230VAC ±1	10%	
AC Line Frequency	50/60Hz			
Output	,	te a spare la	mp or alarm	
Line Voltage Output				
(Solid-state Rated)	< 125W	@ 120VAC		
(,		@ 240VAC		
Isolated Alarm Output (SPDT)	10A @ 240VAC or 30VDC resistive;			
			2 hp @ 250VA	
Mechanical	.,p C	.2017.007.172		•
Mounting	Two #6 (M3.5 x 0.6) s	crews	
Dimensions		,	63.5 mm (2.5").
		ım (1.75″)	2010 1111 (210	,,
Termination			clamps for up	to 14 AWG
	(2.45 mm	•	siampo ioi ap	
Protection	(. ,		
Circuitry	Encapsu	lated		
Environmental				
Operating Temperature	-55° to 6	5°C		
Weight	≅ 6.8 oz			
	⇒ 0.0 0L			

Tower and Obstruction Lighting Controls



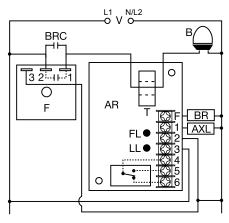
FB9L

Universal Lamp Alarm Relay

CE



Wiring Diagram



V = Voltage B = Beacon F = Flasher BRC = Flasher Bypass Relay Contacts T = Toroid AR = FB Alarm Relay BR = Bypass Relay Coil FL = Flasher Failure LED LL = Lamp Failure LED AXL = Lamp Alarm Relay Coil

NOTE: Flasher module may be located on either the line or load side of the toroidal sensor.

For dimensional drawing see: Appendix, page 513, Figure 31.

Description

The FB9L is a universal lamp alarm relay designed to sense the failure of flashing LED beacon lamps. It will monitor the operation of one to eight beacons connected to a single flasher and/or auxiliary modules and the operation of the flasher. The FB9L output relay energizes when one or more lamps fail. All monitored lamps must be the same wattage and voltage. The 0.5A solid-state output energizes when a flasher failure is sensed.

Operation

When a LED beacon lamp fails, the FB9L senses a decrease in current flow. After a 10s lamp failure trip delay, the isolated SPDT (4-5-6) and non-isolated SPNO (3-1) relay contacts energize. These contacts are used to indicate a beacon failure has occurred. The "L" onboard LED indicator flashes green during the trip delay and glows red after the output relay energizes. Connected to a site monitoring system, it provides remote beacon monitoring required by FAA-AC No: 150/5345-43E.

The FB9L also monitors the operation of the flasher. If the flasher remains in the ON or OFF condition for more than 6s the solid-state output energizes and the "F" flasher failure, onboard LED glows red. This output is normally used to energize an external flasher bypass relay. The contacts of the bypass relay are used to route voltage around the failed flasher and to indicate an alarm condition.

Note: In a single flasher, single beacon system, if the beacon lamp fails, zero current flow is detected. This will cause the flasher failure output to energize after 6s and then the beacon failure outputs after 10s. This is normal operation and can be expected anytime zero current is flowing through the monitored conductor.

Features & Benefits

FEATURES	BENEFITS
Self calibrating	Saves time at installation. No fine adjustment required.
Failsafe beacon monitoring	Alarm monitors for failed LED lamps in addition to flasher function
Number of beacons monitored is switch selectable for up to 8	User selection allows quick set up and easy adaption to multiple applications
Universal voltage 120 to 230VAC	Meets wide application requirements
Isolated, 10A, SPDT alarm output contacts	Provides remote beacon monitoring when connected to a site monitoring system, which is required by the FAA

Accessories



35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.



P1023-20 DIN Rail Adapter

C103PM (AL) DIN Rail

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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Specifications

Sensors

FB9L

Calibration Range (total all Lamps) **Absolute Max Current** (total all Lamps) **Single Lamp Current Trip Delay Flasher Failure** Lamp Failure Input Input Voltage/Tolerance **AC Line Frequency** Output Line Voltage Output (SPNO)

Solid-State Line Voltage Output (F) Mechanical Mounting Dimensions

Termination

FAA-AC No.

LEDs

Power/Timing/Lamp Failure (Bi-color) **Flasher Failure (Red)** Protection Circuitry **Environmental Operating/Storage** Temperature Weight

150mA - 8.0A

15A max. (may not calibrate above 8A) 150mA - 8.0A (total all lamps $\leq 8.0A$)

Fixed at 6s; -0/+40% Fixed at 10s; -0/+40%

120 to 230VAC / ±15% 50/60Hz To operate a spare lamp or alarm 5A @ 240VAC or 30VDC resistive; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC Isolated Alarm Output (SPDT) 10A @ 240VAC or 30VDC resistive; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC

0.5A steady; 5A inrush

One #10 (M5 x 0.8) screw H 76.7 mm (3"); W 50.8 mm (2"); **D** 41.7 mm (1.64") IP20 screw terminals for up to 14 AWG (2.45 mm²) wire or two 16 AWG (1.3 mm²) wires

Glows red when one or more lamps fail Glows red when the flasher fails

Encapsulated

-40° to 60°C / -40° to 85°C ≅ 3.9 oz (111 q) 150/5345-43E

Indicator Table

L	Green	Input ON & Calibrated
L	Green Flashing	Trip Delay
L	Red	Lamp Failure
L	Red/Green Flashing	Calibrating
L	Red Flashing	Not Calibrated
F	Red	Flasher Failure

www.littelfuse.com/fb9L

Tower and Obstruction Lighting Controls



SCR9L

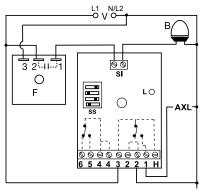
Universal Lamp Alarm Relay

CE

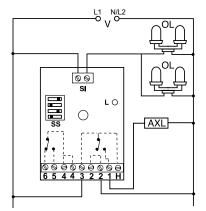


Wiring Diagram

BEACON LAMP CONNECTION DIAGRAM



OBSTRUCTION LAMP CONNECTION DIAGRAM



V = Voltage B = Beacon Lamps SS = Selector Switch L = LED Indicator F = Flasher AXL = Auxiliary Load/Alarm OL = Obstruction Lamps SI = Sensor Input

- H = "3" Spare AC Hot
- Connection (2A max.)

Description

The SCR9L is a universal lamp alarm relay designed to sense the failure of flashing or steady LED beacon lamps or obstruction lamps. The SCR9L energizes when one or more lamps fail. It will monitor the operation of one to eight beacon or obstruction lamps. All monitored lamps must be the same wattage and voltage. When connected to a site monitoring system, it provides the remote lamp monitoring protection required by the FAA-AC No: 150/5345-43E.

Operation

When a lamp fails, the SCR9L senses a decrease in current flow. After a 10s trip delay, the onboard LED glows and the two alarm outputs energize. The outputs and the LED are reset when the failed lamps are replaced and the unit is recalibrated. The SCR9L will sense an open flasher, it will not sense a continuously ON flasher (see FB Series). Removing input voltage de-energizes the output and the LED's. It does not change the calibration.

Features & Benefits

FEATURES	BENEFITS
Self calibrating	Designed for use with all types of LED beacon and obstruction lamps
Failsafe beacon monitoring	Relay will also provide an alarm signal on a failed flasher (open)
Number of lamps monitored is switch selectable up to 8	User selection allows quick set up and easy adaption to multiple applications
Universal voltage 120 to 230VAC	Designed for use in most applications
Isolated, 10A, SPDT alarm output contacts	Provides remote beacon monitoring when connected to a site monitoring system, as is required by the FAA
LED indication	Provides visual relay status of operation, alarm, trip delay, and calibration
Fully encapsulated	Protects against shock, vibration, and humidity

Accessories

C103PM (AL) DIN Rail



35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-20 DIN Rail Adapter

Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

For dimensional drawing see: Appendix, page 513, Figure 31.

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Calibration

SCR9L

Alarm relays must be calibrated at initial installation and when LED lamps are replaced. Due to LED lamp aging, recalibration is recommended every 12 months.

- 1. Remove input voltage
- 2. Move calibration switch to off position
- 3. Re-apply input voltage
- 4. LED will flash red to indicate the unit is ready for calibration
- Visually inspect structure's lighting to make sure all lamps and flashers (if used) are operating properly
- 6. Remove input voltage
- 7. Adjust lamp selector switches for the correct number of lamps to be monitored (see adjustment diagram below)
- 8. Re-apply input voltage
- 9. LED should flash red
- 10. Move calibrate switch to ON position
- 11. The LED will alternate flashing red and green
- 12. LED will glow steady green within 30 secs. Calibration is complete

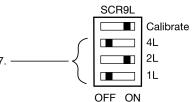
Calibration Failed

If the LED double blinks red, calibration failed. Remove input voltage and repeat steps 6-8.

Notes:

- a. Monitoring a mixture of LED beacons and LED obstruction lamps is not possible with the SCR9L.
- b. This alarm relay is not designed to monitor incandescent lamps.
- c. Applying input voltage when the calibrate switch is in the OFF position, erases the previous calibration settings. The LED will flash Red. The output relays are OFF and the unit will not sense lamp failures.
- d. Only one temperature compensated LED beacon can be monitored with this product. A combination of temperature compensated and standard LED beacons cannot be monitored.

Adjustment Example



Example Shown: SCR9L two lamps are ON during normal operation.

Indicator Table

L	Green	Input ON & Calibrated
L	Green Flashing	Trip Delay
L	Red	Lamp Failure
L	Red/Green Flashing	Calibrating
L	Red Flashing	Not Calibrated

Specifications Sensors

Calibration Range (total all Lamps) Absolute Max Current (total all Lamps) Single Lamp Current Time Delay Trip Delay Input Input Voltage/Tolerance AC Line Frequency Output Line Voltage Output (SPNO)

Isolated Alarm Output (SPDT)

Auxilliary Input Voltage (H) Mechanical Mounting Dimensions

Termination

Protection Circuitry Environmental Operating / Storage Temperature Weight 150mA - 8.0A

15A max. (may not calibrate above 8A) 150mA - 8.0A (total all lamps < 8.0A)

Factory fixed ≅10s

120 to 230VAC ±15% 50/60Hz To operate a spare lamp or alarm 5A @ 240VAC or 30VDC resistive; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC 10A @ 240VAC or 30VDC resistive; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC \leq 2A @ 230VAC

One #10 (M5 x 0.8) screw H 76.7 mm (3"); W 51.3 mm (2.02"); D 41.7 mm (1.64") IP20 screw terminals for up to 14 AWG (2.45 mm²) wire or two 16 AWG (1.3 mm²) wires

Encapsulated

-40° to 60°C / - 40° to 85°C ≅ 3.9 oz (111 g)

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Tower and Obstruction Lighting Controls

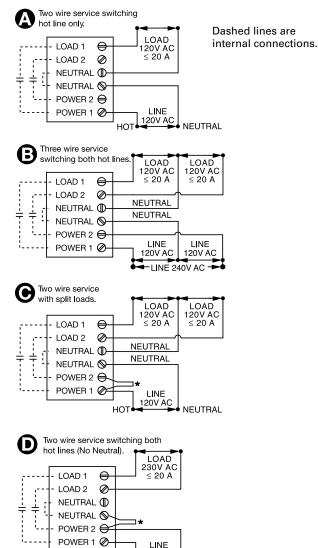


PCR SERIES

Photo Control



Wiring Diagram



Description

The PCR Series of photo controls is a combination of precision electronic circuitry, electromechanical output, and unique molded plastic housing. Designed and built to meet the demands of the most rigorous requirement of tower and obstruction lighting control, each unit is factory calibrated to meet FAA and FCC specifications. Electronic circuit, output contactor, and terminal block are all contained within front plastic housing. Edge support molded into the bottom edge of housing allows easy wiring of new and existing installations. Available with or without cast aluminum junction box.

Operation

When the amount of light sensed falls below the actuation level for energization, the output relay energizes. Conversely, when the amount rises above the actuation level for de-energization, the output relay de-energizes.

Features & Benefits

FEATURES	BENEFITS	
ABS plastic housing with gasket seal	Withstands outdoor environmental hazards and protects circuitry from moisture damage	
Two 20A relay contacts	Allows direct control of a lighting circuit without a separate contactor	
Fixed time delay	Eliminates contact chatter	
Reliable photo sensor	Provides automatic lighting circuit operation from dusk to dawn	

Ordering Information

		INPUT		REPLACES	
	MODEL		DESCRIPTION	Hughey & Phillips	Crouse Hinds
	PCR10	120VAC	Photo Control without aluminum box	n/a	n/a
	PCR11	120VAC	Photo Control without aluminum box	PC800 120V	PEC52010
	PCR12	230VAC	Photo Control with aluminum box	n/a	n/a
	PCR13	230VAC	Photo Control with aluminum box	PC800 240V	PEC52010-1

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*Customer Supplied Jumper

For dimensional drawing see: Appendix, page 514, Figure 45.

230V AC



PCR SERIES

Flashers and Tower Lighting Controls Tower and Obstruction Lighting Controls

Specifications

Indication	LED indicates power is applied
Light Actuation Levels	
(Factory Calibrated)	Energized: ≤ 35 fc
	De-energized: \geq 60 fc
Voltage	120VAC or 230VAC
AC Line Frequency	50/60Hz
Tolerance	
120 & 230VAC	-20% - 10%
Output Rating	Two SPST NO 20A contacts
	1 hp @ 120VAC
	2.5 hp @ 240VAC
Termination	Screw terminals for up to #8 (M4 x 0.7)
	AWG wire
Dimensions	H 159.51 mm (6.28"); W 127 mm (5.0");
	D 131.75 mm (5.19")
Mounting	ABS plastic housing with gasket seal. Multiple
	knockout holes for optional mounting to
	Crouse Hinds or Hughey & Phillips cast
	aluminum electrical boxes.
Operating/Storage	
Temperature	-40° to 60°C / -55° to 85°C



ACCESSORIES

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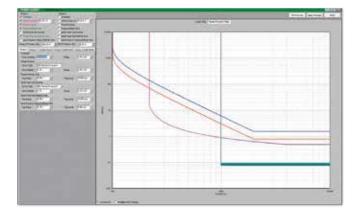
For More Information... on Retrofits, Panel Mount Adapters and more accessories, visit

Littelfuse.com/relayaccessories

ACCESSORIES



SOFTWARE



Protection Relays and Alarm Systems are supplied with free software. The software simplifies programming and allows the user to save setpoint files and reuse them for similar applications.

The software gives the ability to change parameters and see the impact on the protection time current curves. It also allows another device curve to be entered to view simple coordination.

SOFTWARE				
Product		Features	Accessory For	
Solutions-M Relay Interface Software		Provides the ability to configure and monitor Modbus networks. The features include data logging, real-time data monitoring and fault and event monitoring. Devices can be added and configured manually or the software can scan an existing network to identify devices which can be used as is or reconfigured by the user. Setpoints for each device can be uploaded and downloaded for easy monitoring and reconfiguration.	RS485 TCP/IP networks MotorSaver and PumpSaver Devices	
SE-COMM-RIS Relay Interface Software		Provides remote access to metering, control, data logging, and programming features. Setpoints can be accessed individually, downloaded as a file, and protective curves can be plotted. Metered data can be observed or logged for later study.	FPU-32 FPS MPS MPU-32	
SE-FLASH Firmware Update Utility		Used to update relay firmware to add new features.	FPU-32 FPS MPS MPU-32 EL731	
SE-MON330 Relay Interface Software	- VFX	Used to receive data from the SE-330. It displays relay set points and measured values, and features data logging of information at a selectable interval.	SE-330 SE-330AU SE-330HV	
VMPU Virtual Motor Protection Relay		Allows the user to scroll through the MPU-32 Motor Protection Relay menu.	MPU-32	
VMPS Virtual Motor Protection System		Allows the user to scroll through the MPS Motor Protection System menu.	MPS	
VFPU Virtual Feeder Protection Relay		Allows the user to scroll through the FPU-32 Feeder Protection Relay menu.	FPU-32	
MPU-32 Tutorial MPU-32 Online Self-Training Tutorial		Online Self-Training tutorial for MPU-32 programming.	MPU-32	

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ACCESSORIES

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ELECTRICAL



PGA-1100 . Diode Logic Uni			Used in installations v and more than one Lit		AF0500 D1000	Accessory Fo D0920	r PGR-8800
P1004-XX Versa-Pot PART NUMBER P1004-199 P1004-174 P1004-175 P1004-175 P1004-17 P1004-16 P1004-15 P1004-14 P1004-12 P1004-13	-(X) WITH WIRE LEADS WITH VIRE LEADS P1004-95-X P1004-16-X P1004-12-X	VALUE 50kΩ 100KΩ 200KΩ 100kΩ 500kΩ 1MΩ 1.5MΩ 2MΩ 3MΩ 5MΩ	The shaft is slotted for serrated for slip-proof Versa-Knob or Lock Sh two 8 in. (20.3 cm) wir (clockwise increase) a	ote time delay adjustment. r screwdriver adjustment and finger adjustment. Accepts aft. May be ordered with	Consult compatil P1004-17 PHS Ser P1004-16 Series: P1004-15 & P1004- Series:	74 & P1004-175: ies 6 & P1004-16-X: ERDM ERDI ERD TRS TS1 TS6 5, P1004-14, P1004- -12-X: ORB ORM ORS TRB TRM TRS	3 TRB TRM 13, P1004-12, TAC1 THD
P0700-7 Versa-Knob	(d for 0.25 in (6.35 mm) shaft iss industrial black finish.		P1004-XX-(X)
P0700-8 Lock Shaft						P1004-XX-(X)
P1004-9 P1004-31 Mini-Pot PART NUMBER P1004-9 P1004-10 P1004-31	VALUE 500kΩ 1MΩ 3MΩ	i,	time delay adjustment the timer's center hole mini-mount bracket fo Adjustment by screwd ordered with two 3 in. pot (clockwise increas	ial potentiometer for remote . The shaft extends through for easy panel mounting. Use r standup mounting of timer. Iriver or mini-knob. May be (7.6 cm) wires soldered to e) and female quick connect ds by adding suffix -X to end of 0.25W at 55°C Linear 300° ±5° ±10%	Series:	TAC1 TS1 TS4 TS6 TSU2000	TS2 TSD7
P0700-21 Mini-Knob		8		d for 0.25 in (6.35 mm) shaft iss industrial black finish.		P1004-XX-(X)

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Accessories Electrical

ELECTRICAL

			ELEC	TRICAL ACC	ESSORIES		
	Product			Feature	s		Accessory For
P0200-19 Heat Sink Comp 2 grams P0200-20 Heat Sink Comp 100 grams			consisting of pr month shelf life	imarily zinc oxi e (EOD date on h current, plate	teat sink compound ide and having a 12 the label). P0200-19 ed 2 x 2 in. (50.8 x 00-20 mounts	Any 2 x 2 in. or flasher.	(50.8 x 50.8 mm) plated time
P1015-18 Quick Connect Screw Adaptor	100		modules with 0).25 in. (6.35 m als. Screw terr	ned for use with all m) male quick minal accepts ring	male quick Consult the	th 0.25 in. (6.35mm) connect terminals. individual datasheet to ompatibility.
P1015-13 P1015-64 P1015-14 Female Quick Connect Termina	als				ale terminals are barrel to provide		vidual datasheet to ompatibility.
P0400 Time Adjustmen	nt Dials	*					
PART NUMBER	RANGE	INCREMENTS					
P0400-12	0.05 - 1s	0.1s	Dials for use w	ith remote Ver	sa-Pot and panel	P1004-9	P1004-10 P1004-12
P0400-86	0.1 - 10m	1m	mounted Mini-I	Pot. Reverse so	creen printed on clear		P1004-16 P1004-3
P0400-82	0.1 - 10s	1s	plastic to avoid	i damage to pri	inted image.	P1004-95	
P0400-17	1 - 30s	5s					
P0400-83	1 - 60s	10s					
P0400-83 P0400-27	1 - 60s 0 - 10	10s MRD*					
P0400-27	0 - 10						
	0 - 10		adjustment terr	ninals. Rated a	dules with in-line It 0.25W at 55°C. from 5K Ω to 5MΩ		
P0400-27 Multiplier Referen VTPXX /TP	0 - 10 ce Dial		adjustment terr	ninals. Rated a	at 0.25W at 55°C.		
P0400-27 *Multiplier Referen VTPXX /TP Mart NUMBER VTPOE	0 - 10 ce Dial	MRD*	adjustment terr Available in res	ninals. Rated a istance values R _T VALUE 2ΜΩ	it 0.25W at 55°C. from 5K Ω to 5MΩ		
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER	0 - 10 ce Dial R _T VALUE	MRD*	adjustment terr Available in res PART NUMBER	ninals. Rated a istance values R _T VALUE	tt 0.25W at 55°C. from 5K Ω to 5M Ω RANGE	Series: TAC	1 THD7 THOM TS1
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTPOE	0 - 10 ce Dial	MRD*	Adjustment terr Available in res PART NUMBER VTP3L	ninals. Rated a istance values R _T VALUE 2ΜΩ	tt 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m	Series: TAC TS2	
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTP0E VTP1B	0 - 10 ce Dial R _T VALUE 250kΩ 0.5MΩ	MRD*	 adjustment terr Available in res PART NUMBER VTP3L VTP4B 	ninals. Rated a istance values R _T VALUE 2ΜΩ 3ΜΩ	tt 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m 0.05 - 3s		
P0400-27 *Multiplier Referen VTPXX PART NUMBER VTP0E VTP1B VTP1C	0 - 10 ce Dial R_T VALUE 250kΩ 0.5MΩ 0.5MΩ	MRD*	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F 	ninals. Rated a istance values R_T VALUE 2ΜΩ 3ΜΩ 3ΜΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m 0.05 - 3s 0.5 - 60s		
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTP0E VTP1B VTP1C VTP1D	0 - 10 cce Dial R_T VALUE 250kΩ 0.5MΩ 0.5MΩ 0.5MΩ	MRD* Image: Constraint of the second seco	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F VTP4J 	ninals. Rated a istance values R_T VALUE 2ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ 0.1 - 4m 0.05 - 3s 0.5 - 60s 2 - 180s		
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTP0E VTP1B VTP1C VTP1D VTP2A	0 - 10 cce Dial Rr VALUE 250kΩ 0.5MΩ 0.5MΩ 1.ΜΩ	MRD*	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F VTP4J VTP4P 	ninals. Rated a istance values R _T VALUE 2ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ 0.1 - 4m 0.05 - 3s 0.5 - 60s 2 - 180s 1 - 100m		
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTP0E VTP1B VTP1C VTP1D VTP2A VTP2C	0 - 10 cce Dial R_T VALUE 250kΩ 0.5MΩ 0.5MΩ 0.5MΩ 1MΩ 1MΩ	MRD* RANGE 0.5 - 20s 0.05 - 3s 0.1 - 10s 0.05 - 1s 0.01 - 10s	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F VTP4J VTP4P VTP5G 	ninals. Rated a istance values R _T VALUE 2ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ 5ΜΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m 0.05 - 3s 0.5 - 60s 2 - 180s 1 - 100m 1 - 100s		
P0400-27 *Multiplier Referen VTPXX VTP PART NUMBER VTP0E VTP1B VTP1C VTP1D VTP2A VTP2C VTP2E	0 - 10 cce Dial R_T VALUE 250kΩ 0.5MΩ 0.5MΩ 0.5MΩ 1.MΩ 1.MΩ 1.MΩ	MRD* ARNGE 0.5 - 20s 0.05 - 3s 0.1 - 10s 0.5 - 10s 0.05 - 1s 0.1 - 10s 0.5 - 20s	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F VTP4J VTP4J VTP4P VTP5G VTP5K 	ninals. Rated a istance values R _T VALUE 2ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ 3ΜΩ 5ΜΩ 5ΜΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m 0.05 - 3s 0.5 - 60s 2 - 180s 1 - 100m 1 - 100s 10 - 1000s		
P0400-27 *Multiplier Referen VTPXX PART NUMBER VTP0E VTP1B VTP1C VTP1D VTP2A VTP2C VTP2E VTP2F	0 - 10 cce Dial R_T VALUE 250kΩ 0.5MΩ 0.5MΩ 0.5MΩ 1MΩ 1MΩ 1MΩ 1MΩ	MRD* Image: Constraint of the second seco	 adjustment terr Available in res PART NUMBER VTP3L VTP4B VTP4F VTP4J VTP4J VTP4P VTP5G VTP5K VTP5N 	ninals. Rated a istance values 2MΩ 3MΩ 3MΩ 3MΩ 3MΩ 5MΩ 5MΩ 5MΩ	at 0.25W at 55°C. from 5K Ω to 5MΩ RANGE 0.1 - 4m 0.05 - 3s 0.5 - 60s 2 - 180s 1 - 100m 1 - 100s 10 - 1000s 0.1 - 10m		

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ELECTRICAL



			ELEC	TRICAL AC	CESSORIES	3			
	Product			Featur	es			Accessory	For
LPSIM0032 Indicating Fuse F LPSIM0032 Non-indicating Fi	Holder Z		Littelfuse POWF optimum protec Midget-Style fu	tion to perso	nnel for Cla		Series:	PLMU P	LMU PLM LR PLS VW WVI
OKLKOO2.1 Midget Fuse (2 A	-		10 x 38 fast act current-limiting				FH3P	LPSM003ZXIE	D LPSM0
			The VRM6048 a monitor to moni						
	⊔le 575VAC 1 L1 2 (+) L2	→ 460VAC L1 L2 (+) L3 Voltage Monito	Adjustment Package Mounting Termination Operating Storage Humidity Voltage *The VRM6048 mu monitor is disconne	is 575VA(and adjus monitor for Molded h encapsula Surface n (M5 x 0.8 be DIN Ra P1023-20 Screw ter wire clam AWG wirr -40° to 70 -40° to 81 95% relat Input 600VAC 575VAC 550VAC	minals with ps for up to e. p°C 5°C iive, non-corr Ou 48 46 44 d as shown. If f	s shown voltage peration. / ne #10 w. May using captive No.12 densing ttput* 0VAC 0VAC 0VAC 0VAC	Series:	PLM PLR PLS TVM TVV (manufacture December	ed after
V150LA10 LA Varistor	ар		The V150LA10A suppressor, is a is designed to b power lines. Th very little moun	radial leade e operated c is UL recogni	d varistors (I ontinuously	MOVs) that across AC	Any of a	ur products th 150 VAC or 2	
			MAX IMPULSE	VARISTOR V	OLTAGE AT	PEAK CLAMP	WAVE DISC		
PRODUCT	MAX. OPERA	TING VOLTAGE	CURRENT 80.20 µs	1MA DC TES	T CURRENT	WITH 80.20 µs	WAVE	CAPACITANCE	DIAMETER
PRODUCT	MAX. OPERA AC (V)	TING VOLTAGE DC (V)		1MA DC TES MIN. (V)	T CURRENT MAX. (V)	WITH 80.20 μs V _C (V)	WAVE 1 _{PK} (A)	CAPACITANCE	

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GR MODULES, HIGH-TENSION COUPLERS, & RELAY TESTERS

GROUND-REFERENCE MODULES				
Product		Features	Accessory For	
SE-GRM024 Ground Reference Module	1	Connects the SE-601 relay to an ungrounded 24 Vdc bus.	SE-601	
SE-GRM048 Ground Reference Module	i i i i i i i i i i i i i i i i i i i	Connects the SE-601 relay to an ungrounded 48 Vdc bus.	SE-601	
SE-GRM125 Ground Reference Module	Filme	Connects the SE-601 relay to an ungrounded 125 Vdc bus.	SE-601	
SE-GRM250 Ground Reference Module	e Finne	Connects the SE-601 relay to an ungrounded 250 Vdc bus.	SE-601	
SE-GRM500 Ground Reference Module		Connects the SE-601 relay to an ungrounded 500 Vdc bus.	SE-601	
SE-GRM780 Ground Reference Module		Connects the SE-601 relay to an ungrounded 780 Vdc bus.	SE-601	
SE-GRM1000 Ground Reference Module		Connects the SE-601 relay to an ungrounded 1000 Vdc bus.	SE-601	

HIGH-TENSION COUPLERS					
Product	Features	Accessory For			
PGH-5000 High Tension Couplers	Allows 5-kV systems to be connected to relay.	PGR-6100 PGR-3200			
PGH-6000 High Tension Couplers	Allows 6-kV systems to be connected to relay.	PGR-6100 PGR-3200			

PROTECTION RELAY TESTERS					
Product		Features	Accessory For		
		Tests the current pickup level ground-fault protection. Tests the entire ground-fault circuit.	Any Relay on Substations, MCCs, Central Distribution Panels, Switchboards, and Test Benches		
SE-400 Ground-Fault-Relay Test Unit		Tests the current pickup level, time delay and coordination of ground-fault protection. Tests the entire ground-fault circuit.	Any Relay on Substations, MCCs, Central Distribution Panels, Switchboards, and Test Benches		

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INPUT MODULES & METERS



Product		Features	Accessory For
MPS-RTD Temperature Input Module	Ø., in .	Provides 8 programmable inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.	MPU-32 MPS
MPS-DIF Differential Current Module		Adds motor differential protection, compatible with core balance and summation current transformer connections.	MPU-32 MPS
MPU-CIM Current Input Module		Interface between current transformers and MPU-32 or FPU-32 series relays. Reduces potential for open CT hazard.	MPU-32 FPU-32
PGA-LS10 Point Sensor	, Contraction of the second se	Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Local LED continually displays sensor health or trip state.	PGR-8800 AF0500
PGA-LS20 Fiber-Optic Sensor	0	Used to detect light and coordinate with current detection to eliminate nuisance tripping. 8 m (26.2 ft) active; 10 m (32.8 ft) total.	PGR-8800 AF0500
PGA-LS30 Fiber-Optic Sensor	0	Used to detect light and coordinate with current detection to eliminate nuisance tripping. 18 m (59 ft) active; 20 m (66 ft) total	PGR-8800 AF0500
A0200/A0300 Light Sensor	15	Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m halfsphere. Available in both 180° and 360°.	D0920
A0220 Arc Detecting Point Sensor		Line-of-sight light sensor detects an arc as small as 3 kA within a 2-m half-sphere. Available with 10 or 15 m cable. For full datasheet and ordering information, see pg. 80	AF0500 D0920 PGR-8800 D1000
LCSC10T12 Toroidal Current Sensor	\mathbf{Q}	Remote monitoring of currents up to 50A. Inner diameter 9.14 mm (0.36")	DCSA Series

REMOTE INDICATION & METERS					
Product	Features	Accessory For			
RK-105 Remote Indication and Reset Assembly (1) CSE us	Panel-mounted remote indication and reset with NEMA 1 rating.	SE-105 SE-107			
RK-105I Remote Indication Assembly	Panel-mounted remote indication with NEMA 1 rating.	SE-105 SE-107			
RK-102 Industrial Remote Indication and Reset Kit	Panel-mounted remote indication and reset, standard 22 mm mounting, with NEMA 4 and NEMA 13 rating.	SE-105 SE-107			
RK-132 Industrial Remote Indication and Reset Kit	Panel-mounted remote indication and reset, standard 22 mm mounting, with NEMA 4 and NEMA 13 rating.	SE-134C SE-135 SE-145			
RK-325 Remote Indication and Reset Assembly (1) c(1) us	Panel-mounted remote indication and reset with NEMA 1 rating.	SE-325			

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ACCESSORIES

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METERS & SENSING RESISTORS

	REMOTE INDICATION & METERS	
Product	Features	Accessory For
RK-325I Remote Indication Assembly	Panel-mounted remote indication with NEMA 1 rating.	SE-325
RK-302 Remote Indication and Reset Kit	Panel-mounted remote indication and reset, standard 22 mm mounting with NEMA 4 and NEMA 13 rating.	SE-325
RK-332 Remote Indication and Reset Kit	Panel-mounted remote indication and reset, standard 22 mm mounting with NEMA 4 and NEMA 13 rating.	SE-330 SE-330AU SE-330HV
PGA-0500 Analog % Current Meter	Panel-mounted analog meter displays ground-fault current as a percentage of the set point.	SE-601 SE-701 PGR-4300 SE-703 PGR-6100 SE-704
PGA-0510 Analog Ohm Meter	Panel-mounted analog ohmmeter displays insulation resistance from 0 $\boldsymbol{\Omega}$ to infinity.	PGR-3200 PGR-6100 PGR-6101-120

SENSING RESISTORS					
Product		Features	Accessory	For	
ER-600VC (PGE-600V) Sensing Resistor		Used on systems up to 1 kV. (Continuous duty)	SE-330 SE-330AU	SE-325	
SE-MRE-600 Enclosure		Used in outdoor enclosures. (ER-600VC ordered separately)	ER-600V	'C	
ER-5KV (PGE-05KV) Sensing Resistor () c@us		Used on systems up to 5 kV. (Continuous duty)	SE-330 SE-330AU	SE-325	
ER-5WP (PGE-05WV) Sensing Resistor		Used on systems up to 5 kV, includes weather-protected terminals for use in outdoor enclosures. (Continuous duty)	SE-330 SE-330AU	SE-325	
ER-15KV (PGE-15KV) Sensing Resistor 🕀 c@1us	-	Used on systems up to 15 kV. (Non-continuous duty)	SE-330 SE-330AU	SE-325 SE-330HV	
ER-25KV (PGE-25KV) Sensing Resistor		Used on systems up to 25 kV. (Non-continuous duty)	SE-330 SE-330AU	SE-325 SE-330HV	
ER-35KV (PGE-35KV) Sensing Resistor		Used on systems up to 35 kV. (Non-continuous duty)	SE-330 SE-330HV	SE-330AU	
ER-72KV (PGE-72KV) Sensing Resistor	4	Used on systems up to 72 kV. (Non-continuous duty)	SE-330H	V	

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REMOTE INDICATION & MONITORING

		REMOTE INDICATORS & MONITORS	
Product		Features	Accessory For
RM1000 RM1000-3R RM1000 NEMA 4 Motor-monitoring Device	CLOSS CO.	Motor-monitoring device to be used in conjunction with the 777 family of products (excluding the P1 Series), 77C family of products, and the 601 voltage monitors, via Modbus protocol with a communications module. The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring. For full datasheet, see pg. 246	777 Series 77C Series 601 Series
RM2000 RM2000CBM+ RM2000-RTDW Motor-monitoring Device		Motor-monitoring device to be used in conjunction with the 777 family of products (excluding the P1 Series), 77C family of products and the Model 601 voltage monitors, via Modbus protocol with a communications module. The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring. For full datasheet, see pg. 248	777 Series 77C Series 601 Series
INFORMER Remote diagnostic tool	0.00	Hand-held diagnostic tool designed for use with single-phase pump relays. The Informer uses an infrared receiver to access information sent from the relay which can be helpful for troubleshooting the system. Comes with IR Kit-12 (12" long). For full datasheet, see pg. 250	111P 111-Insider-P 111P-ENCL 231-Insider-P 232-Insider 233P-1.5 233P-ENCL 233P-1.5-ENCL 234-P 235P 235P-ENCL 235P
IR Kit-36 (36" long) Informer Fiber Optic Kit	Å	Use with the Informer. Simply attaches to the face of the unit to provide remote diagnostics without opening the panel.	LSRX1 111-Insider-P 455 LSRX-C 231-Insider-P
INFORMER-MS Remote diagnostic tool		Hand-held diagnostic tool designed for use with the Littelfuse 455 Series. The Informer-MS uses an infrared receiver to read valuable information transmitted from the 455, which can be helpful for troubleshooting the system For full datasheet, see pg. 252	455 Series
OL-RESET Remote Reset Module	Marsian B. asa Marsia Marsia Marsia Marsia Marsia Marsia Marsia Marsia Marsian Marsian Marsian Marsian Marsian Marsian Marsian Marsian Marsian Marsia	Allows the 777 line of motor and pump relay products to be manually reset without opening the panel door. Simply connect the module to the 777 communication port, connect a wire to each of the two applicable pins on the OL-RESET and to a normally-open push-button switch (sold separately). Mount the push-button switch in a convenient location.	777 Series
777-MRSW Manual Remote Reset Kit (24" long)	PE	Allows the 777 line of motor and pump relay products to be manually reset without opening the panel door. Simply connect the 9-pin adapter to the 777 communication port and mount the push-button switch in a convenient location.	777 Series
M500 Electronic Megohmmeter		Automatic, portable, battery-powered insulation tester. This unit inexpensive alternative to costly swing needle megohmmeters. T resistance values of motors, generators and transformers up to 1 the condition of insulation on the zone scale. Its compact design great diagnostic tool for motor rewind shops, electrical maintena	he M500 measures insulation 000 megohms at 500VAC, indicating and ease of use makes the M500 a

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Expertise Applied Answers Delivered

Accessories Communication

COMMUNICATION ADAPTERS & MODULES

		COMMUNICATION ADAPTERS	
Product		Features	Accessory For
RS485-RS232 Converter with cable & plug		Allows RS485 devices to be connected to a PC via the RS232 (serial) port. The converter provides convenient terminal blocks for making signal and DC power supply connections. An optional power supply may be required for laptops or other computers with low power serial ports, or for very large networks. Pre-wired for easy installation on the RS485MS-2W module.	RS485MS-2W
RS485-USB Converter with cable & plug/RS232:USB		Allows RS485 devices to be connected to a PC via the USB port. The converter provides convenient terminal blocks for making signal and DC power supply connections. An optional power supply may be required for laptops or other computers with low power serial ports, or for very large networks. Pre-wired for easy installation on the RS485MS-2W module.	RS485MS-2W
AC700-CUA Communications Adapter		Optical network-interface and firmware-upgrade communication adapter. Field-installed.	EL731
		COMMUNICATION MODULES	
Product		Features	Accessory For
RS485MS-2W Communication Module	2-1-1-	This module is required when the RM1000, RM2000 or other Modbus capable device is used with 77X-type products. For full datasheet, see pg. 254	Series: RM1000 77X RM2000
CIO-DN-P CIO-120-DN-P Communication link to PLC/ SCADA/monitoring systems		Convenient and cost-effective Devicenet [™] interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a Devicenet [™] network. For full datasheet, see pg. 257	777 Series
CIO-EN Communication link to PLC/ SCADA/monitoring systems		The CIO-EN Module (non-POE) is a convenient and cost- effective Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network. For full datasheet, see pg. 260	777 Series
CIO-MB CIO-120-MB Communication link to PLC/ SCADA/monitoring systems		Convenient and cost-effective Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network. For full datasheet, see pg. 255	777 Series
CIO-777-PR Communication link to PLC/ SCADA/monitoring systems	STUTUTU A.C	Convenient and cost-effective Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network. For full datasheet, see pg. 259	777 Series ending in P, -P, or -P2
CIO-601CS-DN-P1	outinta.	Convenient and cost-effective DeviceNet [™] device capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet [™] network.	601-CS-D-P1
COM 4-20 Communication link to PLC/ SCADA/monitoring systems	Party Since 4 and a construction 4 and a construction (a) a construction (b) a construction (c) a constructi	Send a 4-20mA signal proportional to the output power. It can also be used to send the input power by setting the efficiency setting on the 777-AccuPower monitor to one. This module allows communication to a PLC with an analog input and no Modbus input. For full datasheet, see pg. 261	777-AccuPower

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TERMINATIONS & ADAPTERS



TERMINATIONS & ADAPTERS					
Product		Features	Acces	sory For	
1N5339B Termination Device		5 W axial-lead ground-check termination. Included with SE-105 and SE-107.	-	105 107	
Stud-Mount Termination Assembly	- 161-	50 W ground-check termination that is robust and compact for submersible pumps. Wire lead simplifies installation. (Replacement for 1N4553B)		105 107	
SE-TA6 UL Termination Assembly	and a second sec	50 W ground-check termination with convenient mounting holes and screw terminals.		105 107	
SE-TA6A (PGA-0T6A) UL Termination Assembly c us	Time and the second	Temperature compensated 50 W ground-check termination with convenient mounting holes and screw terminals.	SE	105 107 134C	
SE-TA6A-WL	N I	Temperature compensated 50 W ground-check termination with convenient mounting holes and screw terminals.	SE	105 107 134C	
SE-TA6ASF-WL Small-Format Termination Assembly with Wire Leads	Q	Temperature compensated 12 W ground-check termination, ideal for use in cable-coupler end caps and submersible pumps. Mounting holes and wire leads.	SE	105 107 134C	
SE-TA12A (J) Termination Assembly	terrer and the second	Temperature compensated 50 W ground-check termination with convenient mounting holes and screw terminals.	-	135 145	
SE-TA12ASF-WL Small-Format Termination Assembly with Wire Leads		Temperature compensated 12 W ground-check termination, ideal for use in cable-coupler end caps and submersible pumps. Mounting holes and wire leads.		135 145	
SE-TA12A-WL		Temperature compensated 50 W ground-check termination with convenient mounting holes and screw terminals.		135 145	
SE-TA12A SE-TA12B Termination Assemblies		Used together to allow an SE-134C to monitor a splitter box and two cables.	SE-	134C	
PPI-600V Parallel Path Isolator		Parallel ground-path rejection for ground-check monitors. Eliminates intermachine arcing and prevents stray DC currents from flowing in a monitored ground wire.	SE-105 SE-134C	SE-107 SE-135	
RK-13 Relay Interface Module		Separate ground-fault and ground-check indication contacts for the SE-105, and separate ground-fault and resistor-fault contacts for the SE-325. Used to provide output to a PLC and operate standard pilot lights. Complete with conformally coated circuit boards.	SE	105 107 325	
SE-485-DIN Industrial RS-485 to RS-232 Converter		Industrial network quality RS-485 to RS-233 serial converter. DIN-rail mounted, 24 Vdc required.		PS PS	
SE-485-PP Port-Powered Serial Converter		Converts an RS-485 signal to an RS-232 signal. Used for set-point programming and updating flash memory. 115.2 kbit/s maximum transfer rate.	MPU-32 FPU-32	MPS FPS	
CA-945 Serial Connector Adapter Kit	2	Connects an RJ45 to a 9-pin serial connector. Includes 1.5 m cable and plug-in adapter.		U-32 J-32	
SE-ICUSB232 USB to RS-232 Converter		Connects a 9-pin serial cable to a USB port.	SE-330 SE-330AU SE-485-PP	CA-945 SE-330HV SE-485-DI	

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LIQUID LEVEL PROBES & PROBE HOLDERS

	LIQUID LEVEL CONTROL ELECTRODES	
Product	Features	Accessory For
LLP-24 Liquid Level Probe	Threaded stainless steel probe measuring 24 in. (61 cm) long. Designed for use with PHST-38QTN liquid level control electrodes.	PHST-38QTN
PHST-38QTN Probe Holder PO700-409 Protective Boot Image: Construction of the state of	Designed for use with all conductive liquid level controls. Composed of insulators and metal parts made of number 300 series stainless steel. These internally conductive probe holders are designed for a maximum steam pressure of 240 PSI; 400° F maximum. Maximum voltage from electrode to ground. PHST-38QTN is UL 353 Recognized.	Series: LLC1 LLC2 LLC4 LLC5 LLC6 LLC8 PC-XXX-LLC-CZ PC-XXX-LLC-GM 460-15-100-LLS

CT SELECTION GUIDE

			PRODUCT	GROUND-FAULT CT	GROUND-FAULT TRIP LEVEL (or insulation level)	PHASE CTS	PAGE #			
		Γ	SE-601	No CTs required	1-20 mA	N/A	-			
			PGR-3100	No CTs required	Indication only	N/A	-			
Ξz			PGR-3200	No CTs required	Warnings at 30 k Ω & 50 k $\Omega,$ Alarm at 10 k Ω	N/A	_			
ND-FAI Tectio	÷			CT200 Series	10-198 A		480			
GROUND-FAULT Protection			SE-701/SE-703	EFCT Series	50 mA-4.95 A	N/A	480			
				SE-CS30 Series	300 mA-29.7 A		480			
			SE-704	SE-CS30 Series	10 mA-5 A	N/A	480			
			EL731	EFCT Series	30-5,000 mA AC and DC	N/A	480			
JND- Jctor Oring		Γ	SE-105/SE-107	CT200 Series	0.5-4 A	N/A	480			
GROUND- Conductor Monitoring			SE-134C/SE-135	SE-CS10 Series	0.5-12.5 A	N/A	480			
		Γ		CT200 Series	12-200 A		480			
IANCE	*		SE-330	EFCT Series	100 mA-5 A	N/A	480			
RESISTANCE Grounding	7			SE-CS30 Series	600 mA-30 A		480			
			SE-325	CT200 Series	0.5-4 A	N/A	480			
		Γ		CT200 Series	10-200 A		480			
			MPU-32*	EFCT Series	50 mA-5 A	N/A	480			
				SE-CS30 Series	300 mA-30 A		480			
۹.	£_			CT200	10-200 A		480			
OR & PUM	MOTOR & PUMP Protection	8	MPS*	EFCT Series (5-A Primary)	50 mA-5 A	1-A, 5-A Secondary CTs	480			
TOM Pr				SE-CS30 Series (30-A Primary)	300 mA-30 A		480			
						MPU-32-X69X-PMA16	Existing CTs can be used or same as MPU-32.			480
		L	MPS-469X-PMA24	Existing CTs can be used or same as MPS.			480			
				CT200 Series	10-200 A		480			
			FPU-32*	EFCT Series	50 mA-5 A	1-A, 5-A Secondary CTs	480			
"NO				SE-CS30 Series	300 mA-30 A		480			
FEEDEI	FEEDER PROTECTION			CT200	10-200 A		480			
÷			FPS*	EFCT Series (5-A Primary)	50 mA-5 A	1-A, 5-A Secondary CTs	480			
тŠ		L		SE-CS30 Series (30-A Primary)	300 mA-30 A		480			
ARC-FLASH Protection	۶		PGR-8800 †	N/A	N/A	5-A Secondary CTs (optional)	480			

Note: See page 502 for additional information on CT selection. See page 482 for CT sizing chart.

*Phase CTs should be selected with a primary rating of 100-300% of rated current to maintain specified accuracy. ‡Select a CT with a primary rating approximately equal to the system's rated current.

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CURRENT TRANSFORMERS

CURRENT TRANSFORMERS					
Product	Features	Inner Diameter		Accessory F	or
CT200 (PGC-2056) Current Transformer	Detects phase current or ground-fault current (200-A primary)	56 mm (2.20")	FPS MPU-32 SE-330	FPU-32 PGR-8800 SE-325	MPS SE-105/107 SE-701
CT200L (PGC-2089) Current Transformer	Detects phase current or ground-fault current (200-A primary)	89 mm (3.50")	FPS MPU-32 SE-107	FPU-32 PGR-8800 SE-701	MPS SE-105
EFCT-26 (PGC-3026) Ground-Fault Current Transformer	Sensitive current transformer used to detect ground-fault current (5-A primary)	26 mm (1.02")	EL731 MPS SE-701	FPS MPU-32	FPU-32 SE-330
EFCT-1 (PGC-3082) Ground-Fault Current Transformer	Sensitive current transformer used to detect ground-fault current (5-A primary)	82 mm (3.23")	EL731 MPS SE-701	FPS MPU-32	FPU-32 SE-330
EFCT-2 (PGC-3140) Ground-Fault Current Transformer	Sensitive current transformer used to detect ground-fault current (5-A primary)	140 mm (5.50")	EL731 MPS	FPS MPU-32	FPU-32 SE-701
EFCT-1FC (PGC-31FC) Flux Conditioner	Fits in the EFCT-1 window to reduce saturation and prevent false operation due to large surge currents	70 mm (2.75")		EFCT-1	
SE-CS10-2.5 (PGC-4064) Current Sensor	Detects ground-fault current	64 mm (2.50")	SE-134C	SE-135	SE-145
SE-CS10-4 (PGC-4108) Current Sensor	Detects ground-fault current	108 mm (4.25")	SE-134C	SE-135	SE-145
SE-CS10-6 (PGC-4160) Current Sensor	Detects ground-fault current	160 mm (6.31")	SE-134C	SE-135	SE-145
SE-CS10-8 (PGC-4210) Current Sensor	Detects ground-fault current	210 mm (8.25")	SE-134C	SE-135	SE-145
SE-CS30-26 (PGC-5025) () Ground-Fault Current Transformer () () III () () () () () () () () () () () () ()	Current Transformer for low-level ground faults, flux conditioner is standard (30-A primary)	25 mm (0.98")	FPS MPU-32 SE-330	FPU-32 PGR-6100 SE-701	MPS PGR-6101 SE-704
SE-CS30-70 (PGC-5060) Ground-Fault Current Transformer	Current Transformer for low-level ground faults, flux conditioner is standard (30-A primary)	60 mm (2.36")	FPS MPU-32 SE-330	FPU-32 PGR-6100 SE-701	MPS PGR-6101 SE-704
SE-CS30-4 (PGC-5095) Ground-Fault Current Transformer	Current Transformer for low-level ground faults, flux conditioner is standard (30-A primary)	95 mm (3.74")	FPS MPU-32 SE-330	FPU-32 PGR-6100 SE-701	MPS PGR-6101 SE-704
SE-CS30-5 (PGC-5130) Ground-Fault Current Transformer	Current Transformer for low-level ground faults, flux conditioner is standard (30-A primary)	130 mm (5.12")	FPS MPU-32 SE-330	FPU-32 PGR-6100 SE-701	MPS PGR-6101 SE-704
SE-CS30-8 (PGC-5200) Ground-Fault Current Transformer	Current Transformer for low-level ground faults, flux conditioner is standard (30-A primary)	200 mm (7.87")	FPS MPU-32 SE-330	FPU-32 PGR-6100 SE-701	MPS PGR-6101 SE-704
SE-CS40-6 Current Sensor	Detects ground-fault current	160 mm (6.31″)	SE-135	SE-145	

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14 ACCESSORIES

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INSTRUMENTATION & METERING TRANSFORMERS



Donut Style

Foot Mounted

Ordering Information

•		
DONUT MODEL	WINDOW	CURRENT RATIO
CT-0050-D10	1.0"	50:5
CT-0075-D10	1.0"	75:5
CT-0100-D10	1.0"	100:5
CT-0150-D10	1.0"	150:5
CT-0200-D10	1.0"	200:5
CT-0300-D10	1.0"	300:5
CT-0200-D20	2.0"	200:5
CT-0300-D20	2.0"	300:5
CT-0400-D20	2.0"	400:5
CT-0500-D20	2.0"	500:5

FOOTED MODEL	WINDOW	CURRENT RATIO
CT-0050-F10	1.0"	50:5
CT-0100-F10	1.0"	100:5
CT-0150-F10	1.0"	150:5
CT-0200-F10	1.0"	200:5
CT-0300-F10	1.0"	300:5
CT-1200-F15	1.5"	1200:5
CT-0150-F20	2.0"	150:5
CT-0200-F20	2.0"	200:5
CT-0300-F20	2.0"	300:5
CT-0400-F20	2.0"	400:5
CT-0600-F20	2.0"	600:5
CT-0400-F30	3.0"	400:5
CT-0800-F30	3.0"	800:5

Description

Littelfuse offers a wide array of instrument rated current transformers in 1-3 inch diameter opening. Voltage class: 600V BIL rating: 10kV

Dimensional Drawing

DONUT STYLE



2RL





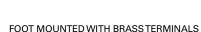




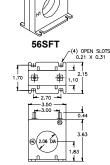


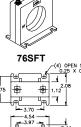


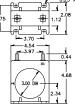
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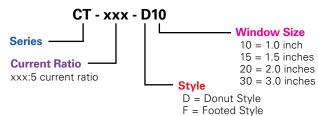
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Part Numbering System



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INSTRUMENTATION & METERING TRANSFORMERS

	INSTRUMENTATION AND METERING TRANSFORMERS						
Product		Features	Inner Diameter	A	Accessory For		
CT-XXXX-DXX Series Donut Style Transformer		Littelfuse offers a wide array of instrument rated current transformers in 1-3 inch diameter opening. For full datasheet and ordering information, see page 481.	25.4 - 76.2 mm (1 - 3")	Series: 777 ECSW LSRU TCSA	DCSA EC LSR-0 LS LSRX TC LCSC10T12	SR-XX	
CT-XXXX-FXX Series Footed Style Transformer	E	Littelfuse offers a wide array of instrument rated current transformers in 1-3 inch diameter opening. For full datasheet and ordering information, see page 481.	25.4 - 76.2 mm (1 - 3")	Series: 777 ECSW LSRU TCSA	DCSA EC LSR-0 LS LSRX TC LCSC10T12	SR-XX	

Current Transformer Sizing Chart

Conductor	Window Siz	e (Inner Diameter in mm)				
Size		Number of Conductors				
(AWG/kcmil)	1	3	4	6	8	12
12	4	8	9	11	13	15
10	6	10	11	14	16	19
8	7	12	14	17	20	24
6	9	15	18	22	25	31
4	11	19	22	28	32	39
3	13	22	25	31	36	44
2	14	25	28	35	40	49
1	16	28	32	39	45	55
1/0	18	31	36	44	51	62
2/0	20	35	40	49	57	69
3/0	23	39	45	55	64	78
4/0	25	44	51	62	72	88
250	28	48	55	67	78	95
350	33	56	65	80	92	113
500	39	67	78	95	110	135
750	48	82	95	117	135	165
1000	55	95	110	135	156	191

Installation Instructions:

When installing the Zero-Sequence CTs, ensure the following:

- 1. Only the load carrying conductors pass through the center of the CT. This means L1 + N for 1-phase and L1 + L2 + L3 for 3-phase.
- 2. The power conductors pass through the center of the CT and are preferably bound together to keep the conductors uniformly spaced.
- 3. The power conductors pass perpendicular to the CT and, where practical, continue perpendicular to the CT on both sides of the CT for 3".
- 4. The power conductors should not be installed in a way that allows them to run along the side edges of the CT.
- 5. Where practical, locate the CT away from noise-generating devices such as transformers, frequency converters, etc.



PMA SERIES

Panel Mount Adapters - Retrofits

Example Shown: PMA-3



Example of a panel mount adapter (PMA-3). Relay is for illustrative purposes only and must be purchased separately from adapter plate. For more information on our complete offering of panel mount adapters see the following page.

Description

A variety of protection relay retrofit adapter plates are available for the products listed below. These adapter plates simplify the process of updating electromechanical or poorly functioning existing relays. Consult factory if you have a specific product to replace that is not featured. Adapters are available in either plate style for panel mounting or drawout style depending on the relay being replaced.

Motor, feeder and ground-fault protection upgrades are available for electromechanical or solid state relays that are nearing the end of their life.

Features & Benefits

FEATURES	BENEFITS
Mounting	Fits in existing mounting holes and panel openings
Multiple adapter sizes	Plate style or drawout style adapters are available to fit various outdated relays

Adapter Plates

RELAY TO REPLACE	PANEL MOUNT	NEW RELAY
AB BULLETIN 1406	PMA-14	MPS
FPL-GFRM	PMA-6	SE-701/SE-704
GE S1	PMA-9	MPU-32/FPU-32
GE LODTRAK III	PMA-10	MPU-32
	PMA-13	MPS
GE MULTILIN 169, 269, or 369	PMA-16	MPU-32
	PMA-16	FPU-32
GE MULTILIN 469	PMA-24	MPS
GE MULTILIN P4A	PMA-15	MPU-32/FPU-32
GEC/MCGG	PMA-3	SE-701/SE-704
GE & WESTINGHOUSE FT-11	PMA-12	MPU-32
P&B GOLDS	Contact Factory	FPU-32
WESTINGHOUSE CO9 & CO11	Contact Factory	FPU-32

For a complete list of the Littelfuse Panel Mount Adapter Plates please see next page.

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PANEL-MOUNT ADAPTERS

	PANEL MOUNT ADAPTERS		
Product			sory For
PMA-2 Adapter Plate	Used when replacing the AB Bulletin 1406.	MP	U-32
PMA-3 Adapter Plate	Used when replacing GEC/MCGG ground-fault relays. Requires PMA-55 or PMA-60.	SE-704	SE-701
PMA-4 Adapter Plate	Used when replacing the Multilin 139/239.	MP	U-32
PMA-6 Adapter Plate	Used when replacing FPL-GFRM ground-fault relays. Requires PMA-55 or PMA-60.	SE	701
PMA-7 Adapter Plate	Used when replacing the GE Lodtrak II.	MP	U-32
PMA-8 Adapter Plate	Used when replacing an Atkinson Omser II with an SE-130-Series Monitor.	SE-134C	SE-135
PMA-9 Adapter Plate	Used when replacing relays in the GE S1 Case. Requires PMA-55 or PMA-60.	MPU-32	FPU-32
PMA-10 Adapter Plate	Used when replacing the GE Lodtrak III.	MP	U-32
PMA-12 Adapter Plate	Used when replacing GE and Westinghouse FT-11 relays.	MPU-32	
PMA-13 Adapter Plate	Used when replacing the GE Multilin 169, 269, or 369.	MPS	
PMA-14 Adapter Plate	Used for rough cutouts and when replacing the AB Bulletin 1406.	м	PS
PMA-15 Adapter Plate	Used for rough cutouts and when replacing the GE Multilin P4A.	MPU-32	FPU-32
PMA-16 Adapter Plate PMA-16-RTDB Mounting Bracket	The PMA-16 mounting plate is used when replacing the GE Multilin 169, 269, and 369 relays. The PMA-16-RTDB is a mounting bracket for the optional MPS-RTD Temperature Input Module.	MPU-32	FPU-32
PMA-17 Adapter Plate	Used when replacing Sprecher & Schuh Cet 4.	MP	U-32
PMA-18 Adapter Plate	Used when replacing Sprecher & Schuh Cet 3.	MP	U-32
PMA-21 Adapter Plate	Used when replacing an ABB RACIF.	FPL	J-32
PMA-23 Adapter Plate	Custom mounting plate for FPU-32 to replace 3 Westinghouse C0 relays.	FPU	J-32
PMA-24 Adapter Plate	Used when replacing the GE Multilin 469.	М	PS
PMA-55 Adapter Plate	Used to panel mount the SE-601 and SE-701.	SE-601 PGR-4300	SE-701 SE-704
PMA-60 Adapter Plate	Used to panel mount the relay; IP 53 and NEMA 3 rating, tamper resistant.	SE-601 PGR-4300	SE-701 SE-704
MPU-32-SMK Surface-Mount Kit	Used to surface mount the MPU-32 or FPU-32.	MPU-32	FPU-32

Note: Relays are not included with the PMA-Series Panel Mount Adapters.

DIN-RAIL & MOUNTING ADAPTERS



DIN RAIL & MOUNTING ADAPTERS		
Product	Features	Accessory For
C103PM (AI) DIN Rail	 Industry standard 35 mm aluminum or steel DIN rail. C103PM aluminum rail is available in a 36 in. (91.4 cm) length. 	Can be used with all DIN-rail compatible units.
AC700-SMK Mount Adapter	DIN-rail and Surface-mount adapter for back-plane mounting.	EL731
D0050 Polos	Plastic clip allowing DIN-rail mounting of the PGR-8800 and AF0500 Arc-Flash Relay.	AF0500 PGR-8800
P1023-20 DIN Rail Mount Adaptor	Allows any 2 x 2 in. (50.8 x 50.8 mm) or 2 x 3 in. (50.8 x 76.2 mm) module to be mounted on a 35 mm DIN type rail. Comes complete with mounting hardware (one #10 - 24 x 1.00 screw and one #10 - 24 x 1.25 screw) for 0.75 in. (19 mm) and 1 in. (25.4 mm) thick modules.	Consult the individual datasheet to determine part compatibility.
P0500-178 Surface Mount Adapter	P0500-178 is surface mountable with 2 Quick Mount Fasteners.	ASXX/DSXX Series Timers
P0500-179 DIN Rail Mount Adapter	P0500-179 snaps onto DIN Rail.	ASXX/DSXX Series Timers

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BRACKETS & CLIPS

BRACKETS & CLIPS		
Product	Features Accessory For	
BZ1 Front Panel Mount Kit $\int_{r=1}^{19+/-02} \int_{r=1}^{r=1} \int_{r=1}^{19+/-02} \int_{r=1}^{r=1} \int_{r=1}^{10} \int_$	Provides an easy method of through-the-panel mounting of 8-pin or 11-pin plug-in timers, flashers, and other controls. May be mounted in panels up to 0.125 in. (3.2 mm) thick. Includes two clamps and two screws.	Series: ARP FS500 LLC4 LLC5 LLC6 PLM PLMU PLR PLS PRLM TDB TDBH TDBL TDI TDIH TDIL TDM TDMB TDMH TDML TDR TDS TDSH TDSL TRB TRDU TRM TRS TRU
P1023-6 P1023-7 Mounting Brackets	Provides a convenient method of mounting modules. The 90° orientation of mounting slots makes installation/removal of modules quick and easy. Made from steel with a cadmium surface finish.PART NUMBERMOUNTING HOLE SIZEMOUNTING METHODP1023-60.19 in. (4.8 mm)#8 (M4 x 0.7) screwP1023-70.25 in (6.35 mm)Mini-Pot	Used on many 2" x 2" timers. Refer to individual series datasheet to determine if this accessory is compatible.
PSCRB8 Hold-down Brackets	Designed for use with P1011-6 socket. Securely mounts 8-pin plug-in controls in any position, and provides protection against vibration. Sold in pairs.	P1011-6
PSC8 PSC11 Hold-down Clips	Securely mounts plug in controls in any position. Also provides protection against vibration. Select the PSC8 for use with NDS-8, or the PSC11 for use with NDS-11 sockets. Sold in pairs.	NDS-8 Socket NDS-11 Socket
P1023-2 P Clamp	Removable P clamp bracket for mounting MSM Series timers and FS100 and FS400 Series flashers.	Timers Series: MSM Flasher Series: FS100 FS400

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ENCLOSURES & WATERTIGHT COVERS

ENCLOSURES			
Product		Features	Accessory For
NGRM-ENC NGR Monitor Control Panel		NEMA 4 painted steel control panel, complete with the SE-325 or SE-330, and a fused 600/480:120 V PT for relay control power. Suitable for indoor or outdoor mounting, CSA certified. When NGR Monitor is back-plane mounted, 22-mm NEMA 4 indicators and reset button are included. Please contact factory for additional information. For full datasheet and ordering information, see pg. 67	SE-325 SE-330
NEMA-3R-LA Enclosure	V	Metal NEMA-3R electrical box with lenses for viewing the single-phase PumpSaver [®] status lights. H 6.0" x W 6.0" x D 4.0"	Single-Phase PumpSaver®
RM-1000-ENCL Enclosure		Steel enclosure for protecting the RM1000 from weather and vandalism. Protects from UV, hail, and it seals to keep rain from contacting the RM1000 connections. The enclosure also features a built-in padlock tab (padlock not included). H 6.4" x W 6.3" x D 1.7"	RM1000

Product		Features	Access	ory For
MPU-16A-Y92A-96N Watertight Cover		Watertight cover for outdoor applications.	MPU FPU	
SE-IP65CVR-G Watertight Cover	伊	Watertight cover. Tamper-resistant. IP65 protection.	SE-134C SE-330 SE-330HV	SE-135 SE-330AU SE-400
SE-IP65CVR-M Watertight Cover		Watertight cover. Tamper-resistant. IP65 protection.	MI FF	-
SE-MRE-600 Moisture-Resistant Enclosure Kit		Protects the connection terminals from snow and rain in outdoor applications.	ER-600VC ER-1000HV	

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SOCKETS

SOCKETS			
Product	Features	Accessory For	
OT08PC Octal Socket 8-Pin	8-pin 35mm DIN rail or surface mount octal socket. Rated at 10A @ 600VAC and has pressure clamp terminals.	AWG 12 to 22 (3.2 to 0.33 mm²) wire sizes. Consult individual datasheet for compatibility	
NDS-8 Octal Socket 8-Pin Screw terminals with captive wire clamps	8-pin 35mm DIN rail or surface mount octal socket. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. A spring mechanism allows easy removal. Uses PSC8 hold-down clips.	Up to two #14 AWG (2.45 mm ²) wire size Series: ARP FS500 LLC4 LLC5 PRLM TDB TDBH TDBL TDI TDIH TDIL TDM TDMB TDMH TDML TDR TDS TDSH TDSL TRDU TRM TRS TRU	
P1011-6 Octal Socket 8-Pin	8-pin surface mount socket with binder head screw terminals. Rated at 10A @ 600VAC. UL Listed combination when used with TDM, TDB, TDS Series timers. Uses PSCRB8 hold-down brackets.	Series: ARP FS500 LLC4 LLC5 PRLM TDB TDM TDMB TDR TDS TRB TRDU TRM TRS TRU	
OT11PC Magnal Socket 11-Pin	Magnal Sockets are for plug-in units	11-pin Plug-in units Series: ARP LLC6 TDB TDBH TDBL TDMB TDS TDSH TDSL TRB TRDU TRM TRS TRU	
SD12-PC Rectangle Socket 12-pin	12-pin surface Rectangle Socket.	ACBC-120	
NDS-11 11-pin Magnal Socket Screw terminals with captive wire clamps	11 pin 35 mm DIN rail or surface mount socket. Rated at 10A @ 300VAC. Surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail. A spring mechanism allows easy removal. Uses PSC11 hold-down clips.	AWG 12 to 22 (3.2 to 0.33 mm ²) wire sizes Series: ARP LLC6 TDB TDBH TDBL TDMB TDS TDSH TDSL TRB TRDU TRM TRS TRU	

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For More Information... and to download our Protection Relay Overview, visit www.littelfuse.com/TechnicalCenter PROTECTION OVERVIEW

©2017 Littelfuse Protection Relays & Controls 489 Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com Active Power–Measured in kW. In a diesel generator application, it is the power produced by the engine.

Alarm Level–A setting on a protection relay at which an LED or output contact operates.

Alarm Relay Contact–An output of a relay that acts as a switch and is typically connected to a visual or audible alarm.

Analog Output–A discrete, continually variable 0-1 mA, 4-20 mA, or 0-5 Vdc signal from a protection relay used to pass information to a device or controller.

Apparent Power–The vector sum of the active and reactive power.

Arc Flash Hazard–A dangerous condition associated with the possible release of energy caused by an electric arc.

Arc Flash Risk Assessment–A study investigating a worker's potential exposure to arc flash energy, conducted for the purpose of injury prevention and to determine safe work practices, arc flash boundary, and the necessary types of personal protective equipment (PPE).

Arc Flash Suit–A complete arc-rated clothing and equipment system covering the entire body, except for hands and feet.

Arc Flash Boundary–When an arc flash hazard exists, the boundary is an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

Arc Rating–The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of break open threshold (EBT) (Should a material system exhibit a break open response below the ATPV value). Arc rating is reported as either ATPV or EBT, whichever is the lower value.[^]

Asynchronous Motor–A motor in which the speed of the rotor is not the same as the connected system frequency.

Charging Current–System charging current is the current that will flow into the grounding connection when one phase of an ungrounded system is faulted to ground. Although not physically connected to ground, electrical conductors and the windings of all components are capacitively connected to ground. Consequently, a small current will flow to ground from each phase. This current does not occur at any particular location; rather, it is distributed throughout the system just as the capacitance to ground is distributed throughout the system.

Conformal Coating–A Silicone coating used to protect circuit boards from pollutants, corrosion, mildew, etc.

Core-Balance Current Transformer–See Earth-Fault Current Transformer.

Current Transformer (CT)–A transformer that produces a current in its secondary circuit in a known proportion to current in its primary circuit.

CT Verification–A continuous check of CT continuity to verify connection.

CT Saturation–A condition that occurs when a CT cannot maintain a secondary current proportional to a relatively large primary current.

CT Local Saturation–A condition where the magnetic flux is not evenly distributed throughout the CT. A resulting secondary current could be induced when no ground fault is present; it may lead to the false operation of a protective relay. This could occur if conductors are not centered in a CT window.

CT Saturation Compensation–A feature in which a protective relay can recognize that a CT is saturated and compensate for the condition in order to maintain service.

Data Logging–Collecting and storing information in a format that can be reviewed for trending, troubleshooting, and reporting.

De-energized–Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

DFT-See Discrete Fourier Transform.

Differential Module–An accessory for the MPU-32 Motor Protection Relay and MPS Motor Protection System to add phasedifferential protection.

Digital Harmonic Filter–The use of digital signal-processing techniques such as a discrete Fourier Transform to eliminate the measurement of harmonic components. With regard to ground-fault detection, this allows for a setting below the background noise level.

Discrete Fourier Transform–A mathematical algorithm used to extract a single frequency, such as the fundamental frequency, from a signal.

Earth Leakage-See Leakage Current.

Earth-Fault Current Transformer–A current transformer used to measure low-level ground-fault current.

Electrical Hazard–A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrical Safety–Recognizing hazards associated with the use of electrical energy and taking precautions so hazards do not cause injury or death.

Electrically Safe Work Condition–An electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Fail-Safe Mode (also known as Undervoltage or UV)– An output relay is energized during normal (not tripped) operation. If the protection relay loses supply voltage, the system will trip or

alarm. (Also see **Non-Fail-Safe**.) **Fault Current**–A current that flows when a phase conductor is faulted to another phase or ground.

Feeder–All circuit conductors between the service equipment or other power-supply source and the load or branch-circuit overcurrent device.



Feeder Protection-Overcurrent or overvoltage devices installed on a feeder circuit to interrupt the supply in the event of a fault.

Flux Conditioner–A ring of magnetically permeable material inserted in an earth-fault current transformer window; used to reduce local saturation.

Fundamental Frequency–In an alternating-current power system, the frequency of the generated voltage. In North America this is typically 60 Hz (60 cycles per second).

Ground Check Conductor–An insulated conductor in a trailing cable used to assist in monitoring continuity of the ground conductor. Typically designed to be the smallest conductor, it is the first to break connection when cable couplers are disconnected.

Ground-Check Loop–A circuit that includes a ground-check conductor, a ground-check termination device, and a ground conductor.

Ground-Check Termination–A device installed at the load end of a ground-check loop.

Ground-Continuity Monitor–A protection relay that continuously monitors a ground-check loop and trips if the loop opens or shorts.

Ground Fault–An unintentional contact between a phase conductor and ground or equipment frame. The words "ground" and "earth" are used interchangeably.

Ground-Fault Current–A current that returns to the supply neutral through a ground-fault and ground-return path.

Ground-Fault Current Transformer–See Earth-Fault Current Transformer.

Ground-Fault Relay–A protection relay designed to detect a phase-to-ground fault on a system and trip or alarm when the condition exceeds its pickup setting for longer than its time delay.

Ground-Fault Protection–The use of a ground-fault relay or indication system in order to interrupt the supply or alarm personnel in the event of a ground fault.

Ground Reference Module–A resistor network that limits ground-fault current and provides a system reference for a DC ground-fault relay.

Harmonic Filter–A device or method to remove or ignore non-fundamental frequency components of a signal.

Harmonic Frequency–Harmonic-frequency components (voltage and current) are multiples of the fundamental frequency and, in a power system, can be considered noise. Harmonicfrequency components are often present with the use of adjustable-speed drives.

High-Resistance Grounding–Using a neutral-grounding resistor to limit the current to a low level. Typically, High-Resistance Grounding limits ground-fault current to 25 A or lower. (Also see Low-Resistance Grounding.)

High Tension Coupler–An accessory used to isolate system voltage from a protective relay.

I²t (I squared t)–Thermal capacity, or used thermal capacity. With regard to motor protection, thermal capacity is used to measure and describe motor heating in terms of current (I). This method is more accurate than temperature sensing because of temperature-sensor placement and the time delay inherent in temperature measurement.

IEEE Device Numbers–The devices in switching equipment are referred to by numbers, according to the functions they perform. These numbers are based on a system which has been adopted as standard for automatic switchgear by the IEEE. This numbering system is used on connection diagrams, in instruction literature, and in specifications.

Incident Energy–The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm2).

Incident Energy Analysis–Used to predict the incident energy of an arc flash for a specified set of conditions.

Insulation Monitoring–Monitoring the resistance from phase to ground to detect insulation breakdown on a system.

Insulation Resistance–A measurement of the ability of an insulator, such as a cable jacket, to prevent current flow when a voltage is applied; typically measured in megaohms (M Ω). Insulation resistance change can be monitored to predict failure.

Inverse-Time Overcurrent Protection–A method by which time-to-trip of a protective device, such as an overcurrent or ground-fault relay, decreases as the magnitude of the fault increases.

Leakage Current–Low-level ground-fault current, typically measured in milliamperes (mA).

Low-Resistance Grounding–A Resistance-Grounding System that allows high currents to flow during a ground fault. Typically, 100 A and higher is considered Low-Resistance Grounding. (Also see **High-Resistance Grounding**.)

LSIG Protection–An acronym for Long-time, Short-time, Instantaneous overcurrent, and Ground-fault protection; a term often used to describe protection required for a power-distribution feeder, or a protection relay with these functions.

Motor Protection–Technology designed to ensure that a motor operates within its rated thermal capacity in order to maximize its service life.

Neutral-Grounding Resistor (NGR)–A current-limiting resistor connecting the power-system neutral to ground.

N.C. Contact (Normally Closed Contact)–A relay contact that is closed when the relay is not energized.

N.O. Contact (Normally Open Contact)–A relay contact that is open when the relay is not energized.

Non-Fail-Safe Mode (also known as Shunt Trip or SH)-

An output relay is energized and contacts change state when a trip occurs. If the protective device loses supply voltage, the system can continue to operate but will not be protected. (Also see **Fail-Safe Mode**.) 15

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Non-Volatile Memory–Data is retained when power is removed.

Nuisance Trip-A false operation of a protective relay.

Phase Current–Current present in a phase conductor.

Phase-Current Transformer–A current transformer installed so that current from one phase conductor flows in its primary winding. With regard to motor protection, feeder protection, and metering in a three-phase system, three current transformers are typically used to measure phase currents.

Phase-Differential Protection–Protection designed to detect low-level winding-to-winding and winding-to-ground failures in an AC motor.

Phase Voltage–The voltage measured between a phase conductor and ground, or another phase.

Power factor (cos\phi)-The relation between the active power [kW] and apparent power [kVA].

Primary Rating (for CTs)–The current rating of the primary side of a current transformer. For example, the first number in the ratio 500:5 is the primary rating. 500 A of primary current flowing through the CT will produce 5 A of current out of the secondary terminals.

Pulsing Ground-Fault Systems–Modulating the groundfault current on a resistance-grounded system using a contactor to short out part of the NGR elements (or to open one of two NGRs connected in parallel). This technique is used to locate ground faults by tracing the pulsing ground-fault current to the source of the fault.

Online or Offline Monitoring–Monitoring system parameters such as insulation integrity when the system is energized or de-energized, respectively.

Open-CT Hazard–An open-circuited CT secondary which can develop a dangerously high voltage when primary current is present.

Reactive Power–Measured in kVAR. The power used for magnetization of asynchronous alternators, motors and transformers, coils etc. The amount of reactive power has no effect on the torque of the prime mover (e.g. diesel engine). Therefore the reactive power has no effect on the engine. It is however very important for the alternator, as the total load on he alternator is the vector sum of active and reactive load.

Relay (1)—An electrical switch that opens and closes a contact (or contacts) under the control of another circuit. Typically an electromagnet.

Relay (2)–A device that receives inputs, compares them to set points, and provides outputs based upon that comparison.

Relay Operating Mode–Method of operation used for undervoltage or shunt-trip breakers. (Also see Fail-Safe Mode, Non-Fail-Safe Mode.)

Resistance-Grounded System–An electrical system in which the transformer or generator neutral is connected to ground through a current-limiting resistor. (Also see **Solidly Grounded System**, **Ungrounded System**.) **Reverse Power**–An active power [kW] fed into a generator that thus is working as an electric motor, turning the prime mover. As this would damage the prime mover (e.g. an internal combustion engine), reverse power relays are used in applications where generators run in parallel with each other or with the utility. These relays detect the amount and direction of the power, and in case of excessive reverse power, disconnect the generator breaker.

Ride-Through Time–The amount of time a protection relay can maintain operation during a supply voltage loss.

RTD (Resistance Temperature Detector)–A device that experiences a linear change in resistance with a change in temperature. It is used to provide temperature metering. Common RTDs are 100 Ω platinum, 100 Ω nickel, 120 Ω nickel, and 10 Ω copper.

Sensitive Ground-Fault Protection–Protection designed to accurately detect low-level ground-fault current.

Shock Hazard–A dangerous condition associated with possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

Solidly Grounded System–An electrical system in which the neutral point of a wye-connected supply transformer is connected directly to ground. (Also see **Resistance-Grounded System**, **Ungrounded System**.)

Switchgear, Arc-Resistant–Equipment designed to withstand the effects of an internal arcing fault and that directs the internally released energy away from the employee.

Time Delay–A setting on a protection relay that determines the time between the fault detection and relay operation.

Trailing Cable–A power cable used to supply electrical power to mobile equipment. They typically contain three phase conductors, two ground conductors, and a pilot wire (also known as a ground-check conductor).

Trip Level–A setting on a protection relay at which an LED or output contact operates.

Trip Relay Contact–An output of a relay that acts as a switch and is typically connected to an undervoltage-release or shunt-trip coil of a circuit breaker.

Trip State-The state of the output contact during a relay trip.

True RMS–"Root-Mean-Square" calculation used to derive an average current or voltage value in a waveform.

Ungrounded System–An electrical system in which no point of the system is intentionally grounded, such as a delta-connected supply transformer.

Zero-Sequence Current Transformer–See Earth-Fault Current Transformer.

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I. INTRO TO PROTECTION RELAYS

What is a protection relay?

- Inputs and Settings
- Processes
- Outputs

How do protection relays solve electrical problems?

- Stage 1 Early stages of a failure
- Stage 2 During a failure
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IV. RESISTANCE GROUNDING CONVERSION

I. INTRODUCTION TO PROTECTION RELAYS

What is a Protection Relay?

A protection relay is a smart device that receives inputs, compares them to set points, and provides outputs. Inputs can include current, voltage, resistance, or temperature. Outputs can include visual feedback in the form of indicator lights and/or an alphanumeric display, communications, control warnings, alarms, and turning power off and on. A diagram is shown below.

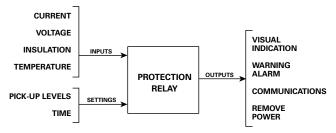


FIGURE 1

Protection relays can be either electromechanical or electronic/microprocessor-based. Electromechanical relays consist of mechanical parts that require routine calibration to stay within intended tolerances. Microprocessor-based or electronic relays provide quick, reliable, accurate, and repeatable outputs. Using an electronic or microprocessorbased relay instead of an electromechanical design provides numerous advantages including improved accuracy, additional functions, reduced maintenance, smaller space requirements and lower life-cycle costs.

Inputs

A relay needs information from the system to make a decision. These inputs can be collected in a variety of ways. In some cases, the wires in the field can be connected directly to the relay. In other applications, additional devices are needed to convert the measured parameters to a format that the relay can process. These additional devices can be current transformers, potential transformers, high-tension couplers, RTDs, or other devices.

Settings

Many protection relays have adjustable settings. The user selects settings (pick-up levels) that allow the relay to make a decision. The relay compares the inputs to these settings and responds accordingly.

Processes

Once the inputs are connected and the settings are made, the relay compares these values and makes a decision. Depending on the need, different types of relays are available for different functions.

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Outputs

A relay can have several ways of communicating that a decision has been made. Typically the relay will operate a switch (relay contact) to indicate that an input has surpassed a setting, or the relay can provide notification through visual feedback such as a meter or LED. One advantage of many electronic or microprocessor-based relays is an ability to communicate with a network or a PLC.

As an example, a thermostat can be evaluated using the diagram in *Figure 1*. The input that is measured is temperature and the input device is the temperature sensor. The user sets the desired temperature setting (pick-up level). The relay measures the existing air temperature and compares it to the setting. The outputs can be used to provide controls (turning an air conditioner or furnace on and off) and visual indication on the thermostat display.

How Do Protection Relays Solve Electrical Problems?

Similar to how the thermostat solves the problem of automating the control of the air conditioner or furnace in a home, protection relays can solve electrical problems.

The purpose of the protection relay is to detect a problem, ideally during its initial stage, and to either eliminate or significantly reduce damage to personnel and/or equipment.

The following stages illustrate how an electrical problem develops:

Stage 1: When conductors with good insulation are exposed to fault initiators such as moisture, dust, chemicals, persistent overloading, vibration or just normal wear, the insulation will slowly deteriorate. Such small changes will not be immediately obvious until the damage is severe enough to cause an electrical fault. Relays can detect that a problem is developing by identifying slight deviations in current, voltage, resistance, or temperature. Due to the small magnitude in change, only a sophisticated device such as a sensitive protection relay or a monitor can detect these conditions and indicate that a problem may be developing, before any further damage occurs.

Stage 2: As the problem becomes more severe, further changes take place such as insulation breakdown, overheating, or overvoltage. Since the change from normal to abnormal is great, traditional devices can be used to interrupt power. Protection relays can also be used to provide additional protection by detecting the fault contributors (overheating, overvoltage, etc.) not possible with fuses and circuit breakers.

Stage 3: At this point, the problem has occurred and caused damage. Different types of protection relays and monitors can reduce or eliminate damage because they detect problems in advance of traditional devices.

As an example, if a facility is continually resetting circuit breakers, replacing fuses, or repairing equipment and cannot locate the problem, they may be experiencing overcurrents. If this is the case, the user can install a protection relay that has an overcurrent feature. The relay measures the current (input) and allows the user to program limits (settings). The settings typically are more sensitive than the fuses or circuit breakers. Once these limits are exceeded, the relay will operate an internal switch (relay contacts). The user has the option to use the switch to turn on a light (alarm indication) or remove power (trip) before greater problems occur. The user can use the alarm indication to help identify the faulty equipment prior to the traditional fuse or circuit breaker clearing the fault.

II. RELAY APPLICATION

Ground-Fault Protection

The primary purpose of grounding electrical systems is to provide protection against electrical faults. However, this was not common practice until the 1970's. Until then, most commercial and industrial systems were ungrounded. Although ungrounded systems do not cause significant damage during the first ground fault, the numerous disadvantages associated with ground faults resulted in a change to the grounding philosophy. There are other advantages for a grounded system, such as reduction of shock hazards and protection against lightning.

Electrical faults can be divided into two categories: phase-tophase faults and ground faults. Studies have shown that 98% of all electrical faults are ground faults (Source: Woodham, Jack, P.E. " The Basics of Grounding Systems" May 1, 2003 <http://www.ecmweb.com/mag/electric_basics_ grounding_systems_2/index.html>). While fuses can protect against phase-to-phase faults, additional protection, such as protection relays, are typically required to protect against ground faults.

Definition of Ground Fault

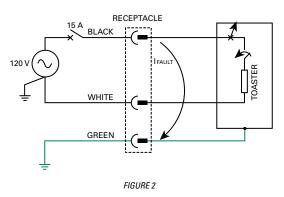
A ground fault is an inadvertent contact between an energized conductor and ground or the equipment frame. The return path of the fault current is through the grounding system and any equipment or personnel that becomes part of that system. Ground faults are frequently the result of insulation breakdown. It's important to note that damp, wet, and dusty environments require extra diligence in design and maintenance. Since contaminated water is conductive, it exposes degradation of insulation and increases the potential for hazards to develop.

Table 1 shows the leading initiators of electrical faults.

% OF ALL FAULTS
22.5%
18.0%
14.5%
12.1%
9.0%
7.0%

TABLE 1





As an example, in the toaster circuit above, the black or hot wire is shorted to the metal casing of the toaster. When the circuit closes, all or part of the current is channeled through the toaster frame and then through the green ground wire. When sufficient current flows (typically $6 \times 15 A = 90 A$), the circuit breaker will open. A protection relay could be installed to detect currents as low as 10 mA, which would open the circuit breaker at a significantly lower level, hence, much quicker than the traditional circuit breaker.

Although the example above shows a solidly grounded single-phase circuit, the philosophy is the same on three-phase circuits discussed later. Relays and monitors are specifically designed to look for the leading initiators shown in *Table 1* by detecting low-level changes in current, voltage, resistance or temperature.

DC Systems

Direct current (DC) systems have positive and negative buses. If either bus is intentionally grounded, then it is referred to as a grounded system. If neither bus is grounded, then it is referred to as an ungrounded DC system. A ground fault on a DC system may cause damage to the source as well as in the field.

If the system is ungrounded, then it is possible to use a ground-fault relay by installing a ground-reference module between the two buses to establish a neutral point (see *Figure 3*). The ground-fault relay uses this neutral point as a reference to detect low-level ground faults.

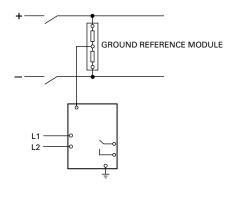


FIGURE 3

Ungrounded AC Systems

Ungrounded AC systems, as shown in *Figure 4*, were used where continuity of power was critical. For example, chemical plants or refineries involving processes that cannot be interrupted without extensive dollar or product loss may have an ungrounded system. However, experience has proven that these systems are problematic and are being replaced with resistance grounded systems. Two major problems with ungrounded systems are transient overvoltages and difficulty locating ground faults.

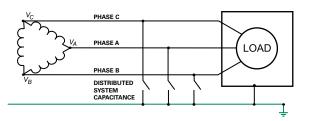


FIGURE 4

- An ungrounded system has no point in the system that is intentionally grounded (other than the normal bonding which is always present to connect the non-current-carrying metal parts to ground). Grounding occurs only through system capacitance to ground (as shown in *Figure 4*).
- Continuity of operation occurs because the system can operate with one phase faulted to ground.
- An intermittent or arcing fault can produce high transient overvoltages to ground. These voltages are impressed on the phase conductors throughout the system until the insulation at the weakest point breaks down. This breakdown can occur at any point in the electrical system, causing a phase-to-ground-to-phase fault.
- Although a ground fault can be detected or alarmed on the system, it is difficult to determine the location of the fault.

There are two methods used to detect ground faults on ungrounded systems. One method is to monitor the voltages between the phases and ground. As a ground fault develops, the faulted phase will collapse to ground potential, causing an indicator light to dim. The indicator lights on the unfaulted phases become brighter.

A second method to detect a ground fault is to measure the insulation resistance. As the insulation deteriorates, a relay continuously monitoring the insulation resistance can alarm at different levels for predictive maintenance. A visual indicator or meter can also be used.

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Solidly Grounded Systems

Due to the problem of ungrounded systems, a shift in philosophy occurred and designs moved from ungrounded to grounded systems. In most cases, the type of grounding system chosen was solidly grounded. A solidly grounded system is a system of conductors in which at least one conductor or point is intentionally grounded (usually the neutral point of transformer or generator windings). The problem with the direct connection is that ground-fault current can be excessive, causing Arc-Flash hazards, extensive equipment damage, and possible injury to personnel. A solidly grounded system cannot continue to operate with a ground fault.

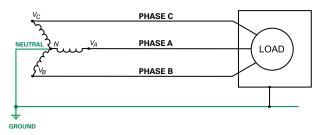


FIGURE 5

- In a solidly grounded system, the wye point (or neutral) of the power source is connected solidly to ground and offers a very stable system that maintains a fixed phase-to-ground voltage.
- The high ground-fault current is easy to detect with fuses, circuit breakers, or protection relays, allowing for selective tripping (tripping the faulted feeder and not the main feeder).
- When a ground fault occurs, high point-of-fault damage can quickly result since the energy available to the ground fault is only limited by the system impedance (which is typically very low).
- Due to excessive ground-fault current and Arc-Flash Hazards, the faulted feeder must be removed from service. This does not allow for continuous operation during a ground fault.

Figure 6 illustrates an example of the dangers associated with solidly grounded systems. In this example, a ground fault occurs and the overcurrent protection is set at 600 A.

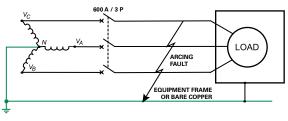


FIGURE 6

Assume that this ground-fault is not a bolted fault, but an arcing fault due to an insulation breakdown or a partial reduction of clearances between the line and ground.

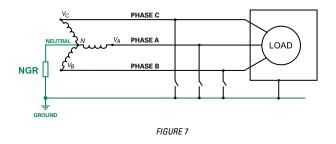
- Because of the arc resistance, fault current may be as low as 38% of the bolted-fault level. This can be in the range of a normal load or a slight overload.
- The fault current may be low enough that the overcurrent device (600-A circuit breaker) does not sense a fault, or may pick it up but not trip for a long time.
- The energy being supplied by the source is concentrated at the arc and could cause severe equipment damage very quickly. This energy release could cause a fire that in turn, could damage the premises and present an extreme hazard to personnel.

Aside from converting this solidly grounded system to resistance grounding, the best way to prevent damage is to detect low-level ground leakage prior to it becoming a ground fault. In order to accomplish this, the protection relay must be able to sense a low-level ground leakage without nuisance tripping.

In modern facilities, equipment often generates noise or harmonics that can interfere with a protection relay's ability to function properly. For example, the noise or harmonics may be higher than the desired ground-fault relay settings, causing the relay to falsely operate when there is no fault on the system. The protection relay must be able to filter out noise or harmonics to provide reliable protection.

Resistance-Grounded Systems

Resistance grounding solves the problems commonly associated with both ungrounded systems and solidly grounded systems. The name is derived from the addition of a resistor between the system neutral and ground (as shown in *Figure 7*). The specifications of the resistor are userdetermined to achieve a desired ground-fault current, which must be greater than the system capacitive charging current (explained later in this section).





- Transient overvoltages can be eliminated by correctly sizing the neutral-grounding resistor (NGR) to provide an adequate discharge path for the system capacitance.
- Continuity of operation with one ground fault is typically allowable when ground-fault current is ≤10 A.
- The NGR limits the available ground-fault current. This eliminates or minimizes point-of-fault damage (Arc-Flash Hazards) and controls the ground-fault voltage.
- Pulsing current can be used to locate ground faults when ground-fault current is ≤10 A. Pulsing current is created by using a shorting contactor to short out half of the resistance, causing the ground-fault current to double (usually one cycle per second). A hand-held zero-sequence meter is used to detect the fluctuating ground-fault current, and locate the ground fault.
- The only disadvantage of resistance grounding is that if the resistor fails, the system will become ungrounded. Resistor monitoring is recommended to protect against this.

A protection relay for resistance-grounded systems is used to detect a ground fault and to monitor the neutral-to-ground connection. It can be used to provide alarms or to trip the feeder from service upon the detection of a ground fault. The relay can provide a pulsing circuit that can be used to locate the ground fault. The relay can also alarm or trip if the neutral-to-ground path fails. For systems 5 kV and less, highresistance grounding can be used. High-resistance grounding typically limits the resistor current to 10 A or less. By doing so, the ground fault can remain on the system, given that the system is rated for the voltage shift.

For systems above 5 kV, neutral-grounding resistors are typically rated for 25 A or more, and ground-fault current is cleared within 10 s.

System Capacitive Charging Current

Although not physically connected to ground, electrical conductors and the windings of all components are capacitively connected to ground. Consequently, a small current will flow to ground from each phase. This current does not occur at any particular location; rather, it is distributed throughout the system just as the capacitance to ground is distributed throughout the system. For analysis, it is convenient to consider the distributed capacitance as lumped capacitance, as shown in *Figures 5, 6, 7, and 8.*

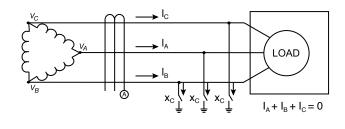


FIGURE 8

Even if the distributed capacitance is not balanced, the ammeter will read zero because all the current flowing through the CT window must return through the CT window.

System charging current is the current that will flow into the grounding connection when one phase of an ungrounded system is faulted to ground (see *Figure 9*). It can be measured as shown below if appropriate precautions are taken:

- If the fault occurs on the supply side of the CT, the sum of the currents in the CT window is not zero.
- Ammeter A will read the sum of the capacitive currents in the unfaulted phases. This value is the charging current of all the equipment on the load side of the CT.

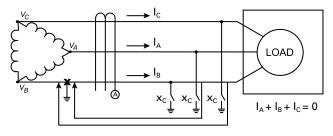


FIGURE 9

A single-line diagram of a three-feeder, resistance-grounded system with a fault on feeder 3 is shown in *Figure 10*.

- A CT (A1 and A2) on unfaulted feeders will detect the charging current of that feeder.
- A CT (A3) on a faulted feeder will detect the sum of the resistor current (I_R) and the charging currents $(I_1 + I_2)$ of the unfaulted feeders.

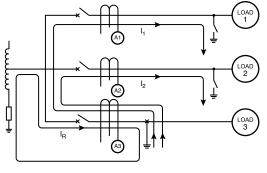


FIGURE 10

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Selective coordination in a resistance-grounded system can be achieved if the pick-up setting of each ground-fault relay is greater than the charging current of the feeder it is protecting. If the pick-up setting of a ground-fault relay is less than the charging current of the feeder it is protecting, it will trip when a ground fault occurs elsewhere in the system. This is known as sympathetic tripping. Sympathetic tripping can be avoided by choosing a relay pickup setting larger than the charging current from the largest feeder. If the relative size of the feeders can change, or if the advantage of using one operating value for all ground-fault relays in a system is recognized, then it is prudent to select a pick-up setting for all ground-fault relays that is larger than the system charging current.

In order to eliminate transient overvoltages associated with an ungrounded system, it is necessary to use a grounding resistor with a let-through current equal to or larger than the system charging current.

What is the minimum acceptable NGR current? Select a pickup setting for the ground-fault relays that exceeds the largest feeder charging current and multiply the operating value by an acceptable tripping ratio. Use the greater of this value or system charging current and select the next-largest available standard let-through current rating.

Resistor Monitors

As discussed in the resistance-grounded systems section, a failure in the neutral-to-ground path will lead to a dangerous situation. Some examples of failure are stolen wires, loose connections, corrosion, and broken resistor elements. The resistor monitor continuously monitors the path from system neutral to ground for a problem. When a problem occurs, the monitor provides an alarm.

Ground-Continuity Monitors

Ground-check monitors are used to detect problems in equipment ground conductors. The cable powering mobile equipment typically has an extra wire, or pilot wire, routed with the phase conductors. A monitor uses this pilot wire to send a signal to a terminating device in the equipment, where the signal is sent back on the cable ground conductor to the monitor. The monitor continuously monitors this loop for open or short circuits, indicating that a problem has occurred. The monitor provides an alarm for this condition.

As an example, portable loads are grounded via single or multiple conductors in a trailing cable. A ground fault on a portable load will cause fault current to flow through the ground conductors and all other ground-return paths. A hazardous touch voltage can develop when the ground conductor opens and a ground fault develops, assuming there is not enough current to trip a ground-fault relay. If the portable equipment has rubber tires or is not in good contact with earth, then a person who touches the equipment under fault conditions will become part of the ground-return path.

Motor Protection

Overview

Motors are a significant investment and often run critical processes. Motor protection relays are used to protect the windings from damage due to electrical faults and thermal overloads. Adequate motor protection not only prevents motor damage, but also ensures optimal process efficiency and minimal interruption. Cost recovery for protection is achieved by extending the life of the motor, preventing motor rewinds and reducing downtime.

Common Motor Problems

Overload and Overtemperature

Insulation breakdown is a common reason for motor failure. Windings in the motor are insulated with organic materials including epoxy and paper. Insulation degradation occurs when winding temperature exceeds its rating. The National Electrical Manufacturers Association (NEMA) states that the time-to-failure of organic insulation is halved for each 8 to 10°C rise above the motor insulation-class rating. This point is illustrated in *Figure 11*.

Solution: An I²t Thermal Model provides thermal-overload protection of motor windings during all phases of operation. By integrating the square of the current over time, a thermal model can predict motor temperature and react much quicker than embedded temperature devices. A thermal model takes into consideration the motor service factor, full-load current and class. A dynamic thermal model adjusts the time-to-trip depending on how much motor thermal capacity has been used. *Figure 12* illustrates the adjustment in trip time for different current levels at different levels of used thermal capacity (I²t).

A dynamic thermal model allows accurate protection of a motor and allows operations to get the maximum work out of a motor without sacrificing available life. If the motor is hot (high % used thermal capacity) it will trip more rapidly during an overload than if the motor is cold (0% used thermal capacity). In the event of a stall condition, when available motor torque is lower than the torque required by the load, the motor can be de-energized before it overheats.

Many old-technology electronic thermal overloads do not take into consideration the values of load current below the full-load current (FLA) pick-up value. Modern overload relays should model currents above and below the FLA pick-up current to achieve maximum output of the motor and maximum life of insulation.

On larger induction motors, blockage or loss of ventilation can cause motor hot spots that current-based protection cannot detect without the use of temperature sensors. Resistance temperature detectors (RTDs) are inexpensive devices installed between the stator windings during manufacturing and may be included on motor-end bearings.



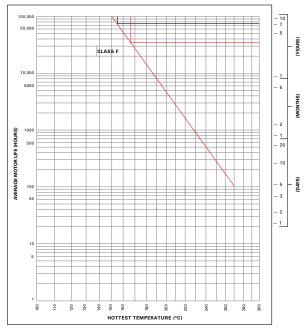


FIGURE 11

An RTD has a linear change in resistance over its rated temperature range. Using information from an RTD, motorprotection relays can provide protection for loss-of-ventilation, loss-of-cooling, or high-ambient-temperature.

The RTD temperature reading can also be used as an input to the thermal model to improve protection. When hotmotor compensation is enabled, the maximum stator-RTD temperature is used to bias the thermal model by increasing used I²t when the RTD temperature is greater than the thermal-model temperature.

Overcurrent, Jam and Undercurrent

Overcurrent faults, also referred to as short circuits, can cause catastrophic motor failures and fires. Overcurrents can be caused by phase-to-phase, phase-to-ground, and phase-toground-to-phase faults.

A mechanical jam, such as a failed bearing or load, can cause stalling and locked-rotor current to be drawn by the motor, resulting in overheating.

Undercurrent protection is loss-of-load protection and is required by some codes as a safety measure. A water pump that cavitates can be dangerous. The water typically provides pump cooling. Without the cooling water, case temperature can reach an extremely high value. If valves are opened under these conditions and cold water is allowed to reach red-hot metal parts, the resulting steam pressures can destroy the pump and pose a serious personnel hazard.

Solution: A multifunction motor protection relay has multiple trip and alarm settings for current protection. Overcurrent protection is typically set above locked rotor current and has a minimal delay time. Overcurrent protection may be used to

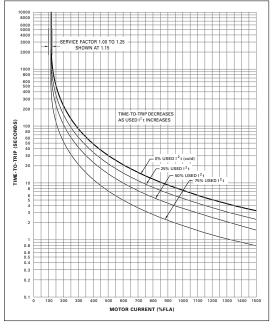


FIGURE 12

trip a breaker instead of a starter due to the high fault levels. Jam protection is set below overcurrent and has a slightly longer delay time. Jam protection prevents motor heating that would otherwise lead to an overload trip. Jam protection is enabled after the motor is running to avoid tripping on starting current. Undercurrent is set below full-load current to detect loss of load.

Under and Overvoltage

Overvoltages cause insulation stress and premature breakdown. Undervoltages, such as those caused by brownouts, can lead to increased motor heating. Torque developed by an electric motor changes as the square of the applied voltage. A 10% reduction in voltage results in a 19% reduction in torque. If the motor load is not reduced, the motor will be overloaded.

Solution: Under and overvoltage protection are features found in higher-end motor protection relays. Voltage protection can be used pro-actively to inhibit a start.

Ground Faults

Ground faults are the most common fault and can lead to more serious problems. Ground-fault protection, described elsewhere in this text, is an important consideration in motor loads.

Solution: The motor protection relay should be able to detect low-level ground-fault current when used on a resistance-grounded system.

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High-Resistance Winding Faults

Winding-to-winding and winding-to-ground failures inside the motor are difficult to detect using the phase and ground-fault CTs due to low magnitudes of current.

Solution: Differential protection in high-end motor protection relays use multiple CTs to compare the current entering and leaving the winding. If there is a difference in currents then leakage is occurring. This sensitive protection is used on very large or critical motors.

Current and Voltage Imbalance, Phase Loss, Phase Reverse

Older motor protection devices did not consider current imbalance and today it is often overlooked. Imbalance increases negative-sequence current which causes additional rotor heating.

Phase loss is also referred to as single phasing. When a phase loss occurs, negative-sequence current is equal to the positive-sequence current and imbalance is 100%. In this condition, one motor winding attempts to do the work of three, inevitably leading to overheating.

Phase reversal causes the negative-sequence current and voltage to be greater than the positive-sequence current and voltage. Voltage-based protection is advantageous to prevent a start with incorrect sequence. In some applications attempting to spin the motor backwards will result in damage to the load. An example of this is certain impeller designs in downhole pumps.

Solution: Modern motor protection relays use digital signal analysis to measure true-sequence components. These sequence components are used for thermal model calculations and take the extra heating into consideration. Voltage imbalance which drives current imbalance can be used as a start inhibit. Sequence components are also used for calculating imbalance, phase loss and phase reversal.

Motor Jogging

NEMA-designed motors are rated for two starts from cold and one start from hot per hour. Motor jogging refers to excessive starts and can cause overheating. The motor may not get up to full speed and the forced air cooling is not effective.

Solution: Since the thermal model accurately tracks the motor's used thermal capacity at all times, including during starts and between starts, the starts-per-hour feature may not be required.

It is included for compatibility with protection relays that do not have dynamic thermal-modeling capability.

Motor Protection and the NEC®

The NEC[®] requires the motor to be protected by overload devices against excessive heating due to overload and failure to start (Article 430 Section III). Article 430, Section IV also specifies the use of devices to protect against overcurrents such as short circuits and grounds. Both of these NEC[®] requirements and many additional functions can be met with the use of a multifunction motor protection relay.

Article 430.32 (A)(4) requires the use of a protection device having embedded temperature detectors that cause current to the motor to be interrupted when the motor attains a temperature rise greater than marked on the nameplate in an ambient temperature of 40°C for motors larger than 1500 hp.

The NEC defines minimum requirements and is intended to provide protection from fire. Protection relays can provide many enhancements above simple fire protection.

Communications

Network communications can be added to a motor protection relay to allow remote metering of currents, voltages and temperatures. Data logging is a useful feature for troubleshooting and comparing event sequences with process stages. Analysis of information can often show operational issues.

Arc-Flash Protection

The Consequences of Arc Flash

Arcing and arc flashes are uncontrolled, intense, luminous discharges of electrical energy that occur when electric current flows across what is normally an insulating medium. The most common cause of arc faults is insulation failure. These failures may be caused by defective or aging insulation material, poor or incorrect maintenance, dust, moisture, vermin, and human error (touching a test probe to the wrong surface or a tool slipping and touching live conductors).

Arc-Flash events are dangerous, and potentially fatal, to personnel. According to OSHA, industrial Arc-Flash events cause about 80% of electrically-related accidents and fatalities among qualified electrical workers. Even if personnel injuries are avoided, Arc Flash can destroy equipment, resulting in costly replacement and downtime.

Arc-Flash Safety Standards

NFPA 70E, Handbook for Electrical Safety in the Workplace. outlines the practices and standards that companies should follow to protect workers and equipment from Arc Flash and other electrical hazards. It specifies practices designed to make sure that an electrically safe work condition exists. In Canada, CSA Z462, Workplace electrical safety, specifies safe workplace practices. There are also various provincial regulations pertaining to electrical safety.

The NFPA 70E and the CSA Z462 hold both employers and their employees responsible for creating a workplace for electrical workers that is not just safe but puts in place the best possible processes and procedures that are fully understood, practiced and enforced for optimal results. Using Arc-Flash relays is one way to protect the functional reliability of the distribution board and at the same time comply with the requirements of NFPA 70E and CSA Z462.



Arc-Flash Mitigation

NFPA 70E goes into great detail on procedures to avoid electrical shock and Arc-Flash events. Sometimes, though, it's necessary to work on live circuits. For these cases, NPFA 70E specifies approach distances and use of personal protection equipment (PPE).

Current limiting fuses or current-limiting circuit breakers help protect against arc flashes. They allow only a certain amount of energy to pass before they open a circuit. Because an Arc Flash can draw a fraction of bolted-fault current, circuit breakers cannot be relied upon to distinguish between the arcing current and a typical inrush current.

High-resistance grounding (HRG) is another technique for protecting against arc flashes. If a phase faults to ground, then the resistance limits current to just a few amps; not enough to cause downtime by tripping the overcurrent protection device, and not enough to allow an Arc Flash. It is important to remember that while resistance grounding prevents Arc Flash from phase-toground shorts, it has no effect on phase-to-phase shorts.

Another way to mitigate the dangers of arc flashing is by redesigning the switchgear. Switchgear cabinets can be designed to contain and channel energy away from personnel during an Arc Flash.

Arc-Flash relays

Arc-Flash relays are microprocessor-based devices that use optical sensors to detect the onset of a flash. The sensors are strategically placed in various cubicles or drawers inside the switchboard.

Installing an Arc-Flash relay to rapidly detect developing arc flashes greatly reduces the total clearing time and the amount of energy released through an arcing fault. In turn, there is less damage to equipment and fewer and less severe injuries to nearby personnel.

Arc-Flash Relay Selection Criteria

When selecting an Arc-Flash relay, there are six important criteria: 1. Reaction time

- 2. Trip reliability
- 3. Avoidance of nuisance tripping
- 4. Sensor design and installation
- 5. Ease of use

Reaction Time

Since light is the earliest detectable indication that an Arc Flash is occurring, Arc-Flash relays use optical light sensors to detect the arc that is forming. The output of the light sensor is hard-wired to the Arc-Flash relay, which trips a circuit that interrupts the energy supply in the Arc.

The response time of an Arc-Flash relay is approximately 1-5 ms at light intensities of about 10,000 lux or higher. Within that time frame, the optical sensor output can actuate a switch or circuit breaker to cut off current feeding the arc. The overall current clearing time depends on the protection strategy used and the performance of the external switch or circuit breaker used. The breaker will typically take an additional 35-50 ms to open, depending on the type of breaker and how well it is maintained. The electronic output to turn on is a function of the type of output relay used. Solid-state outputs (for example, insulated gate bipolar transistors (IGBTs)) are much faster than electromechanical relays and can operate within 200 microseconds.

Trip Reliability

Reliable tripping is the most important characteristic of an Arc-Flash relay, because this ensures mitigation of an arcing fault. Two aspects of reliability should be considered: trip redundancy and system-health monitoring.

Redundant Tripping. Arc-Flash relays should offer a redundant tripping feature, which means it has both primary and secondary trip path logic. The primary path is controlled by the internal microprocessor and its embedded software, and works by activating the coil of the primary trip relay.

The redundant path typically uses a discrete solid-state device that does not go through the microprocessor. Any failure in the primary (microprocessor) path will cause the unit to automatically switch to its redundant path, which activates a shunt-trip relay without delay when a sensor input is above the light detection threshold.

An often overlooked advantage of a solid-state trip path compared to a microprocessor-based circuit is the reaction time when the relay is first powered up. Wiring mistakes, tools left in hazardous locations, and the regular stresses of powering up all contribute to the risk of an Arc Flash on power up. A microprocessor can require 200 ms or more before it is able to start scanning the optical sensors. However, a solid-state trip path can detect an Arc and send a trip signal in as little as 2 ms. In addition, there are fail- safe features that alert operators when, for example, the microprocessor fails.

Health monitoring. Health monitoring makes sure the system is in good operating condition and should extend from the light sensors to the output of the Arc-Flash relay trip circuitry. Health monitoring starts on the sensors. A signal is sent from the relay to the light sensors, where a test light is detected by the sensor and sent back to the relay. In the case of a fiber-optic sensor, this also verifies the entire length of the fiber is not pinched or broken. On-sensor health indication is critical in preventing maintenance work on equipment where protection is not working. It also has the added benefit of providing rapid fault location.

Following the path of a trip signal from the sensor, internal monitoring must also include the primary and redundant trip circuit. Low voltage across the IGBT indicates a wiring fault or an error in the trip coil, and a high voltage is a sign of an error in the IGBT switch, both of which are also reported and logged. The IGBT is also thermally protected against overloads, and will turn off if it overheats. However, the thermal protection has a 100 ms delay before acting, meaning that even a dangerously overheated coil will attempt to signal a trip before resuming thermal protection.

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Avoidance of Nuisance Tripping

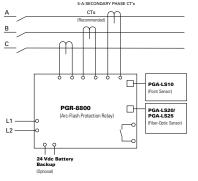
A typical Arc-Flash Relay system has an integrated three-phase current measurement function that detects and reacts to short circuit and overcurrent conditions. Although this is not a requirement for the system to operate, this option will increase the reliability of the system (minimize unwanted tripping).

If the microprocessor logic receives an input from a light sensor, it checks for a rapidly rising input from the current transformers. Two conditions need to be fulfilled before the trip is sent to the circuit breaker: a certain current flow that exceeds the normal operating current of the system (the threshold level is adjustable from 10-1000% of the full load current) and a signal from the arc-flash sensor, implying that the sensor has reacted to a high-intensity light source.

Sensor Design and Installation

Arc-Flash relay installations utilize multiple fixed-point light sensors near vertical and horizontal bus bars where arcing

faults are apt to occur in feeder switchgear cabinets. Sufficient numbers of sensors should be installed to cover all accessible areas, even if policy is to only work on de-energized systems. At least one sensor should have visibility to an arc fault if a person blocks another sensor's field of view. Light sensors may also be installed in other electrical cabinets and on panels that are



subject to routine maintenance and repairs.

A fiber-optic sensor, which have a 360° field of view for detecting light, allows more flexible positioning of the light sensing locations, as the fiber-optic strands can be looped throughout an enclosure or panel to cover challenging component layouts.

Easy to Use Hardware and Software

Another important factor to consider is ease of use. Some relays may require field assembly, calibration, or advanced configuration before installing. It is critical to consider those extra steps and the capabilities of the operators who will be using the devices. Often, very complicated devices can be misused because of incorrect



setup or configuration, which can defeat the purpose of the device altogether. A few Arc-Flash

> Relays have software that provides event logging. To make troubleshooting easier, this software should record the specific sensor that initiated the fault in the data records.

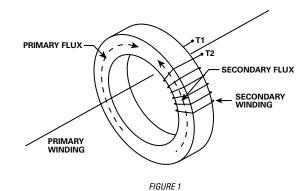
III. CT APPLICATION

Current Transformers (CTs)

A current transformer is defined as a transformer that produces a current in its secondary circuit that is in proportion to current in its primary circuit.

Although there are other types of CTs, only the window (or ring) type will be discussed here. Window-type CTs get their name from their design that consists of a ring-shaped core. This core is formed by a single length of strip ferromagnetic material tightly wound to form the ring-shaped core.

A CT operates on a principle of flux balance, as shown in *Figure 1*. If the primary winding is energized with the secondary circuit open-circuited, the transformer becomes an iron-cored inductor. The primary current generates a magnetic flux in the core as shown (flux direction can be determined by the right-hand rule). When the secondary winding is connected to a burden or is short circuited, current flows through the secondary winding creating magnetic flux in the core in opposition to the magnetizing flux created by the primary current. If losses are ignored, the secondary flux balances exactly to the primary flux. This phenomenon is known as Lenz's Law.



Lead Length

The secondary lead resistance of CTs cannot be ignored, particularly with low Volt-Amperes (VA) CTs. For example, let's look at an electronic overload relay.

The relay's CT input impedance or burden (Z_{_{\rm B}}) = 0.01 \ \Omega

The maximum current (I) = 10 A

The CT rating (P) = 5 VA

Now let's solve for the maximum length of #14 AWG leads that will result in a rated accuracy for a 10 A secondary current. Solving for maximum total impedance (Z_{τ}) :

$$\begin{split} \mathsf{P} &= \mathsf{I}^2 \mathsf{Z}_{\mathsf{T}} \\ \mathsf{Z}_{\mathsf{T}} &= \mathsf{P} \, / \, \mathsf{I}^2 = 5 \, / \, 10^2 = 0.05 \; \Omega \end{split}$$

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Solving for the maximum lead resistance (Z_w):

 $Z_T = Z_W + Z_B$

 $Z_{W} = 0.05 - 0.01 = 0.04 \Omega$

If we look up the #14 AWG resistance we find it equals 2.6 ohms/1000 ft

Therefore, lead length = Z_w / #14 AWG resistance Maximum lead length = (0.04 x 1000) / 2.6 = 15.4 ft

CT Installation

A CT should not be operated with its secondary opencircuited. If the secondary is opened when primary current is flowing, the secondary current will attempt to continue to flow so as to maintain the flux balance. As the secondary circuit impedance increases from a low value to a high value the voltage across the secondary winding will rise to the voltage required to maintain current flow. If the secondary voltage reaches the breakdown voltage of the secondary winding, the insulation will fail and the CT will be damaged. Furthermore, this situation presents a personnel shock hazard.

When a ring-type CT is used to monitor a single conductor or multiple conductors, the conductors should be centered in the CT window, as shown below in *Figure 2*, and should be perpendicular to the CT opening.

In some applications it is difficult or impossible to install the primary conductor through the CT window (example: existing bus bar structure). For these applications a split core CT is sometimes used. Performance of split core CTs may be less than that of solid core CTs.

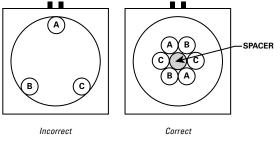


FIGURE 2

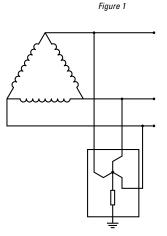
CT characteristics are normally specified at a single frequency such as 50 or 60 Hz. Therefore the question arises: What happens when CTs are used with variable frequency drives (VFDs)? For CTs that are linear to approximately 10x rated primary current at 60 Hz, the Volts/Hertz ratio is approximately constant. That is, for all other conditions held the same at 6 Hz, the CT will be linear to only 1x rated current and at 30 Hz the CT will be linear to 5x rated current. For a standard silicon-steel-core CT, the upper bandwidth frequency is approximately 5 kHz.

IV. RESISTANCE-GROUNDING CONVERSION

Convert Ungrounded to Resistance-Grounded Systems

Resistance grounding protects a system against transient overvoltages caused by intermittent ground faults and it provides a method to locate ground faults. (Transient overvoltages and inability to locate ground faults are the most common safety issues with ungrounded systems.)

Conversion of delta-connected or wye-connected sources with inaccessible neutrals require a zigzag transformer to derive an accessible neutral for connection to a neutral grounding resistor (NGR). The neutral is only used for the NGR and not for distribution. During normal operation the only current that flows in the zigzag transformer is an extremely small magnetizing current. When one phase is grounded, the NGR and the zigzag transformer provide a path for ground-fault current to flow.



Design Note 1: A zigzag conversion requires a three-phase connection to the existing power system, typically at the main transformer or switchgear. See *Figure 1*.

Design Note 2: The resistor let-through current must be greater than the system capacitive charging current *(see Section I).*

Design Note 3: Protection, coordination, and annunciation systems depend on the integrity of the NGR. NGR monitoring with an SE-330 or SE-325 is recommended.

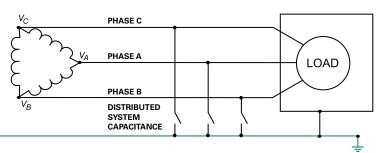
UNGROUNDED SYSTEM

Advantages

• Operation possible with one faulted phase

Disadvantages

- Ground faults are difficult to locate
- Transient overvoltages damage equipment



SOLIDLY GROUNDED SYSTEM

Advantages

- Eliminates transient overvoltages
- Selective tripping possible

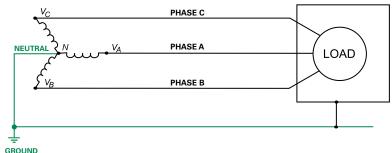
Disadvantages

- Costly point-of-fault damage
- Cannot operate with a ground fault
- Ground-fault Arc-Flash hazard
- Increased Arc-Flash risk

Disadvantages

• Failure of the neutral-grounding resistor renders current-

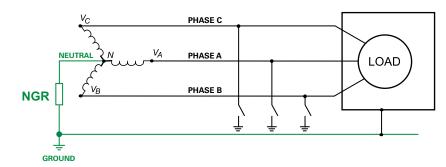
sensing ground-fault protection inoperative



RESISTANCE-GROUNDED SYSTEM

Advantages

- Reduced point-of-fault damage and Arc-Flash risk
- Eliminates transient overvoltages
- Simplifies ground-fault location
- Continuous operation with a ground fault
- Selective tripping possible
- No ground-fault Arc-Flash hazard



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PROTECTION OVERVIEW

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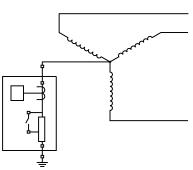
Convert Solidly Grounded to Resistance-Grounded Systems

Resistance grounding protects a system against Arc-Flash Hazards caused by ground faults and provides a method for continuous operation or an orderly shutdown procedure. (Ground faults are estimated to be 98% of all electrical faults.)

Since the neutral point of the power source is available, the solid connection between neutral and ground is replaced with a grounding resistor. This resistor limits ground fault current to a predetermined value, typically 5 A for 480 V systems (the system capacitive charging current is usually less than 3 A). By limiting the ground-fault current to 5 A or less, there are no Arc-Flash Hazards associated with ground faults. This allows for continuous operation during the first ground fault.

During a ground fault on a resistance-grounded (RG) system, a voltage shift occurs (the same shift experienced on ungrounded systems). The faulted phase collapses to ~0 V, the non-faulted phases rise to line-to-line voltage with respect to ground, and the neutral point rises to line-to-neutral voltage with respect to ground.





Design Note 1: An NGR conversion for a solidly grounded system requires a neutral connection to the existing power system, typically at the main transformer or switchgear. See *Figure 2*.

Design Note 2: The voltage shift requires equipment to be fully rated at line-to-line voltage with respect to ground. This may require TVSSs, VFDs, meters, etc. to be reconfigured or replaced.

Design Note 3: The voltage shift also restricts neutral distribution. The neutral typically cannot be distributed due to its potential rise during ground faults. Single-phase line-to-neutral-voltage loads must be served by a 1:1 isolation transformer or converted to line-to-line loads.

Design Note 4: The resistor let-through current must be greater than the system capacitive charging current (*see Section I*).

Design Note 5: Protection, coordination, and annunciation systems depend on the integrity of the NGR. Monitoring with an SE-330 or SE-325 NGR Monitor is recommended.

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IEEE DEVICE NUMBERS

- 1 Master Element
- 2 Time Delay Starting or Closing Relay
- 3 Checking or Interlocking Relay
- 4 Master Contactor
- 5 Stopping Device
- 6 Starting Circuit Breaker
- 7 Rate of Change Relay
- **8** Control Power Disconnecting Device
- 9 Reversing Device
- 10 Unit Sequence Switch
- 11 Multi-function Device
- 12 Overspeed Device
- 13 Synchronous-speed Device
- 14 Underspeed Device
- **15** Speed or Frequency, Matching Device
- 16 Data Communications Device
- 17 Shunting or Discharge Switch
- 18 Accelerating or Decelerating Device
- **19** Starting to Running Transition Contactor
- 20 Electrically Operated Valve
- $\ensuremath{\textbf{21}}\xspace$ Distance Relay
- 22 Equalizer Circuit Breaker
- 23 Temperature Control Device
- 24 Volts Per Hertz Relay
- 25 Synchronizing or Synchronism-Check Device
- 26 Apparatus Thermal Device
- 27 Undervoltage Relay
- 28 Flame Detector
- 29 Isolating Contactor or Switch
- 30 Annunciator Relay
- **31** Separate Excitation Device
- 32 Directional Power Relay

ANSI DEVICE NUMBERS

- AFD Arc Flash Detector
- **CLK** Clock or Timing Source
- **DDR** Dynamic Disturbance Recorder
- **DFR** Digital Fault Recorder
- **ENV** Environmental Data
- **HIZ** High Impedance Fault Detector

TYPICAL SUFFIXES

- A Alarm/Auxiliary Power
- AC Alternating Current
- **B** Battery/Blower/Bus
- BT Bus Tie C - Capacit

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PROTECTION OVERVIEW

- Capacitor/Condenser/Compensator/ Carrier Current/Case/Compressor
- DC Direct Current
- E Exciter

Note: Descriptions per IEEE Std C37.2-1996 *Suffix N is preferred when the device is connected in the residual of a polyphase circuit, is connected across broken delta, or is internally derived from the polyphase current or voltage quantities. The suffix

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- 33 Position Switch
- 34 Master Sequence Device
- **35** Brush-Operating or Slip-Ring Short-Circuiting Device
- 36 Polarity or Polarizing Voltage Devices
- 37 Undercurrent or Underpower Relay
- **38** Bearing Protective Device
- 39 Mechanical Condition Monitor
- 40 Field (over/under excitation) Relay
- 41 Field Circuit Breaker
- 42 Running Circuit Breaker
- 43 Manual Transfer or Selector Device
- 44 Unit Sequence Starting Relay
- **45** Abnormal Atmospheric Condition Monitor
- 46 Reverse-phase or Phase-Balance Current Relay
- 47 Phase-Sequence or Phase-Balance Voltage Relay
- 48 Incomplete Sequence Relay
- 49 Machine or Transformer, Thermal Relay
- **50** Instantaneous Overcurrent Relay
- 51 AC Inverse Time Overcurrent Relay
- 52 AC Circuit Breaker
- 53 Exciter or DC Generator Relay
- 54 Turning Gear Engaging Device
- 55 Power Factor Relay
- 56 Field Application Relay
- 57 Short-Circuiting or Grounding (Earthing) Device
- 58 Rectification Failure Relay
- 59 Overvoltage Relay
- 60 Voltage or Current Balance Relay
- 61 Density Switch or Sensor
- 62 Time-Delay Stopping or Opening Relay
- 63 Pressure Switch
- HMI Human Machine Interface
- HST Historian
- LGC Scheme Logic
- MET Substation Metering
- **PDC** Phasor Data Concentrator
- **PMU** Phasor Measurement Unit
- F Feeder/Field/Filament/ Filter/Fan
- G Generator/Ground*
- $\boldsymbol{\mathsf{M}}$ Motor/Metering
- N Network/Neutral*

G is preferred where the measured quantity is in the path of ground or, in the case of ground fault detectors, is the current flowing to ground.

- P Pump/Phase Comparison
- **R** Reactor/Rectifier/Room
- S Synchronizing/Secondary/Stainer/Sump/ Suction (Valve)

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Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

- 64 Ground (Earth) Detector Relay
- 65 Governor

70 - Rheostat

66 - Notching or Jogging Device

69 - Permissive Control Device

71 - Liquid Level Switch

72 - DC Circuit Breaker

74 - Alarm Relay

73 - Load-Resistor Contactor

76 - DC Overcurrent Relay

77 - Telemetering Device

79 - AC Reclosing Relay

82 - DC Reclosing Relay

84 - Operating Mechanism

87 - Differential Protective Relay

91 - Voltage Directional Relay

93 - Field Changing Contactor

94 - Tripping or Trip-Free Relay

POM - Power Quality Monitor

TCM - Trip Circuit Monitor

SOTF - Switch On To Fault

T - Transformer/Thyratron

U - Unit

RIO - Remote Input/Output Device RTU - Remote Terminal Unit/Data Concentrator

SER - Sequence of Events Recorder

TH - Transformer (High-voltage Side)

TL - Transformer (Low-voltage Side)

TT - Transformer (Tertiary-voltage Side)

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88 - Auxiliary Motor or Motor Generator

92 - Voltage and Power Directional Relay

80 - Flow Switch

81 - Frequency Relay

86 - Lockout Relay

89 - Line Switch

90 - Regulating Device

75 - Position Changing Mechanism

78 - Phase-Angle Measuring Relay

83 - Automatic Selective Control or Transfer Relay

85 - Communications, Carrier or Pilot-Wire Relay

67 - AC Directional Overcurrent Relay 68 - Blocking or "Out-of-Step" Relay



2.08

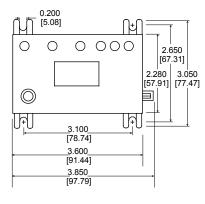
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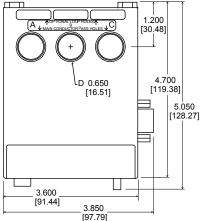
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DIMENSIONAL DRAWINGS

Figure 1





601; 601-CS-D-P1; 777; 777-ACCUPOWER; 777-KW/HP-P2; 77C; 77C-KW/HP

Figure 3 DEPLUGGABLE TERMINAL BLOCKS 0.830 [21.08] 10Base-T ETHERNET DBUS ┎ᡱ᠋┎╆╆╆╱╏╝╝╝ AD COMM. STATUS 3.000 [76.2] 2.300 [58.42] ∕∕}-SymCom... CIO-EN Series B ETHERNET **(E** Ð 0 REV. 00 \bigcirc \bigcirc 0 0 \bigcirc (Ģ 0.350 [8.89] 3.750 [95.25] 4.760 → 0.700
 [17.78]
 0.635 [16.129] [120.904] 0f 0.274 0.294 [7.47] 8 0.569 [14.45] 0.415 [10.54] 1.00 [25.4] Т 2.628 [66.75] 3.000 [76.2] ŧ 2.456 [62.38] 0.159 [4.038] 2.882 [73.20] 0.680 [17.27]) (Of

Figure 2

RS485MS-2W; COM 4-20

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2.900

[73.66]

2.16 [54.86]

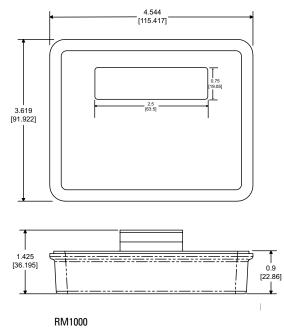
16

CIO-120-DN-P; CIO-DN-P; CIO-EN; CIO-MB; CIO-120-MB; CIO-777-PR

Measurements: inches (millimeters)

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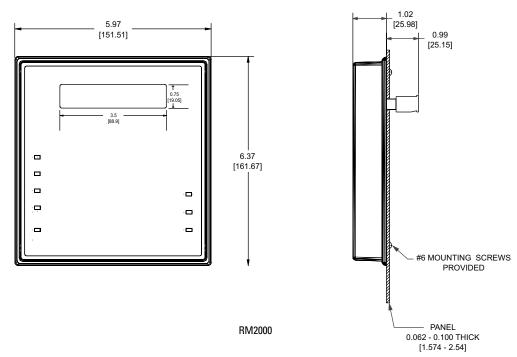
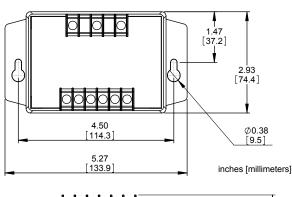
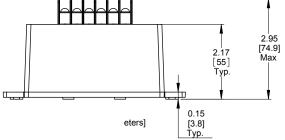




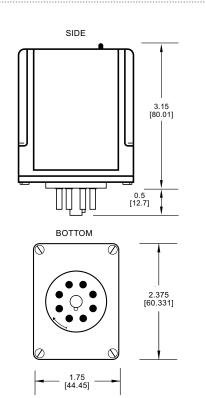
Figure 6



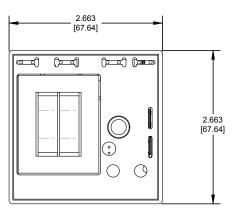


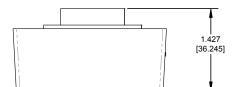
102A; 250A; 350; 355; 455; 50R; 50R-400-ALT; CP5; T10

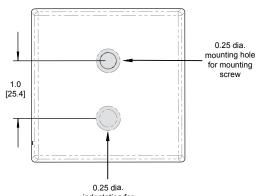
Figure 8



ACBC-120; ALT; ALT-XXX-X-SW; ISS-101; PC-XXX-LLC; 201-100-SLD; 201A; 201A-AU; 201A-9; 201-XXX-SP; 201-XXX-DPDT; 201-XXX-SP-DPDT







indentation for anti-rotation screw

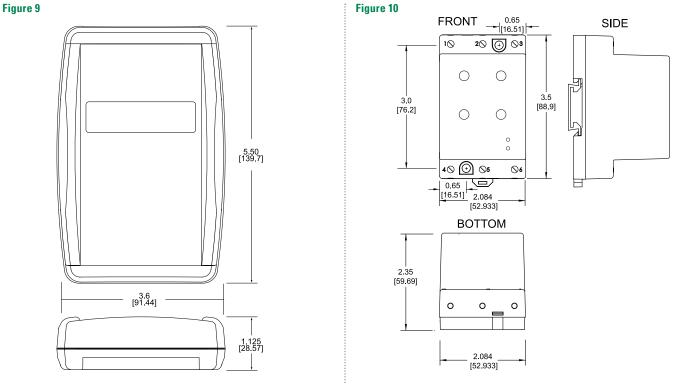
202; 202-200-SP

Measurements: inches (millimeters)



Appendix Dimensional Drawings

DIMENSIONAL DRAWINGS



460; 460-15-100-XXX; 460-XXX-SP; ISS-100; ISS-102; PC-102

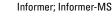
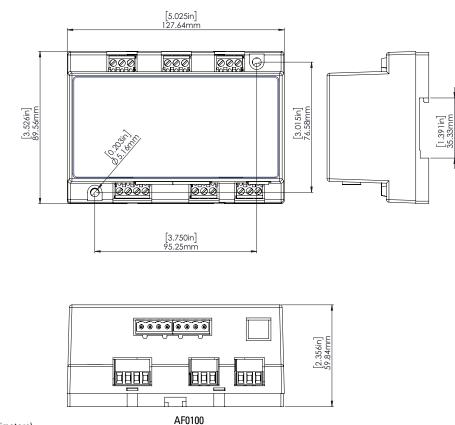


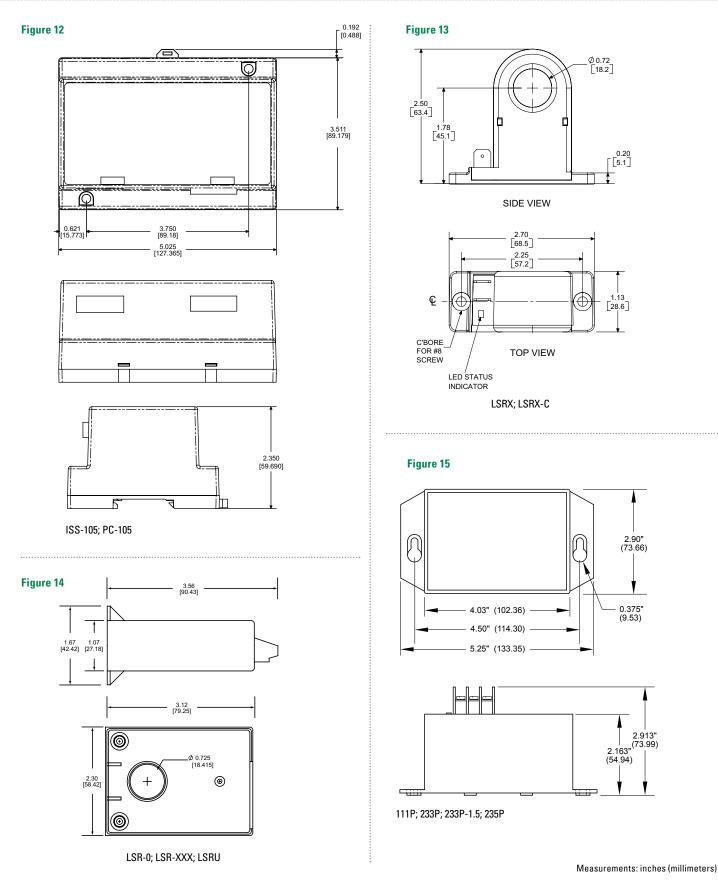
Figure 11



Measurements: inches (millimeters)

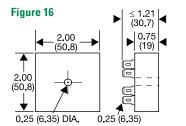
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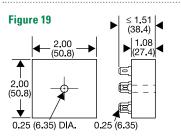


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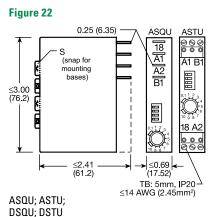
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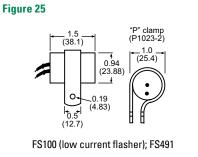
CT; ESD52233; ESDR; FS100 (medium power); FS200; FS300; KRD3; KRD9; KRDB; KRD1; KRDM; KRDR; KRDS; KRPD; KRP5; KSD1; KSD2; KSD3; KSDB; KSDR; KSDS; KSDU; KSPD; KSP5; KSPU; KVM; T2D120A15M; TA; TAC1; TDU; TDUB; TDU1; TDU5; TL; TMV8000; TS1; TS2; TS441165; TS6; TSA141300; TSB; TSD1; TSD2; TSD3411S; TSD6; TSD7; TSD94110SB; TSDB; TSDR; TSD5; TSS; TSU2000



FA; FS; FSU1000*; PHS*; PTHF4900DK*; SIR1; SIR2; SLR1*; TH1; THC; TCR9C; THD1B410.5S; THD2; THD3C42A0; THD7; THDB; THDS; THS *If unit is rated @ 1A, see Figure 16

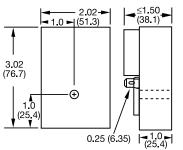


16



Measurements: inches (millimeters)

Figure 17



HLVA6123; HRDB; HRDI; HRDM; HRDR; HRDS; HRIS; HRPS; HRV; RS

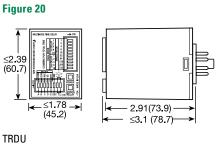
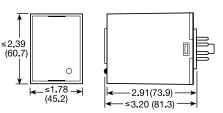


Figure 23



PLM; PLR; TDB; TDBH; TDBL; TDI; TDIH; TDIL; TDM; TDMB; TDMH; TDML; TDR; TDS; TDSH; TDSL

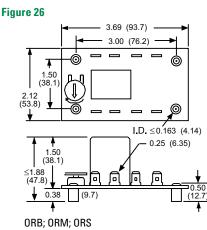
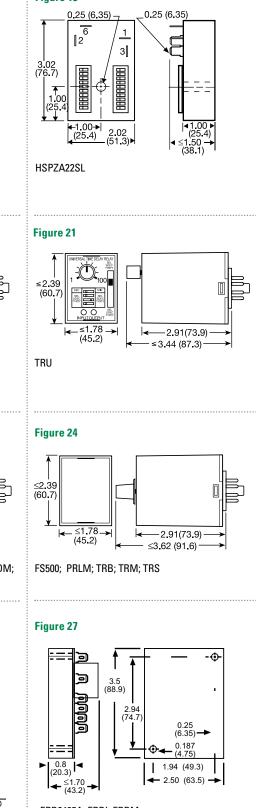


Figure 18



ERD3425A; ERDI; ERDM

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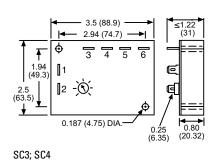
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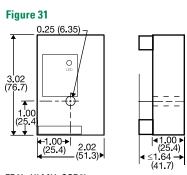


Figure 29

Figure 34

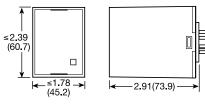






FB9L; HLMU; SCR9L





LLC4; LLC6; PLS

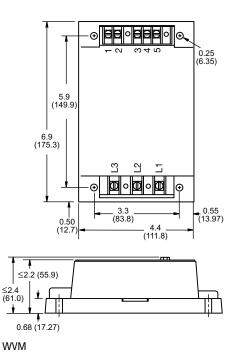
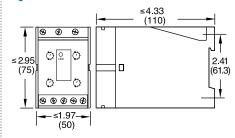
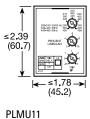


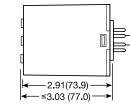
Figure 30



DLMU

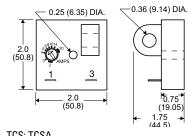
Figure 32





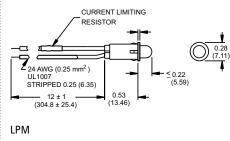
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Figure 35



TCS; TCSA

Figure 38



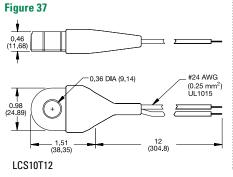
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Figure 36 0.71 (18) 2.44 (62) -2.75 (70) 10 01 2.85 (73) 1 2.56 (65) 2 1.12 (29) പപ 1.32 DCSA (34)

Measurements: inches (millimeters)

Ð 3.5 (88.9) 0.25 0 2.94 (74.7 θ 0 0.80 (20.3) ◀ 1.94 (49.3) ► 2.5 (63.5) 1.75 (44.5) ECS; ECSW (ECS has spade connectors and ECSW has terminal board)

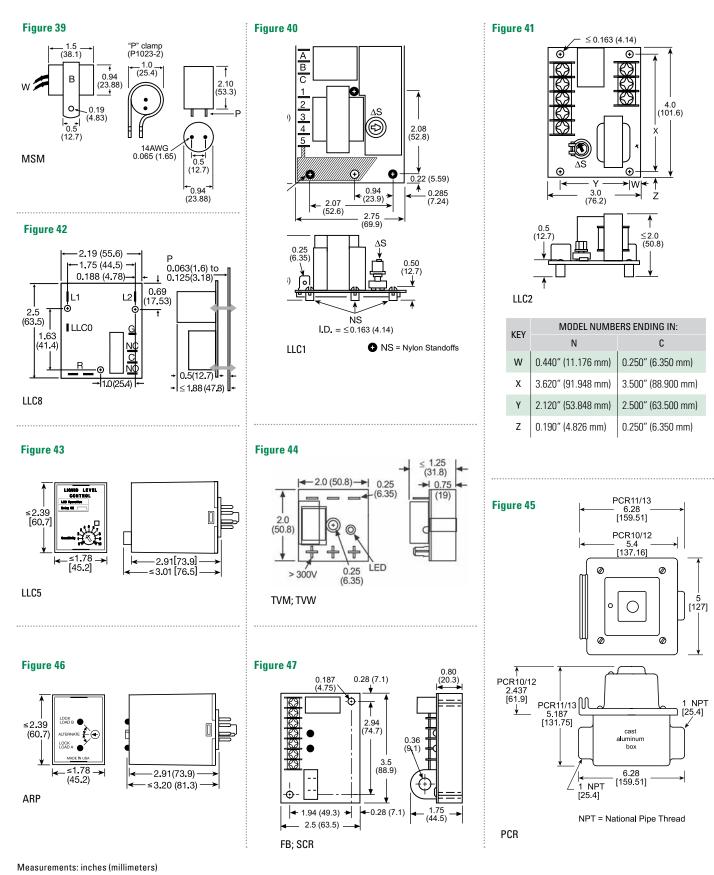
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Measurements: inches (millimeters)



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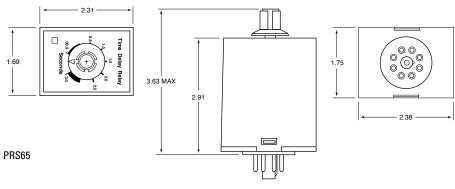
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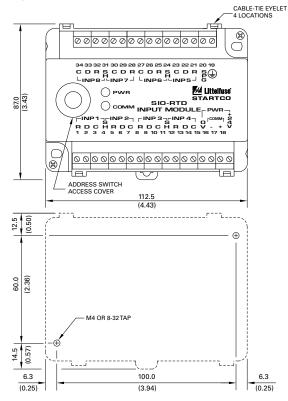
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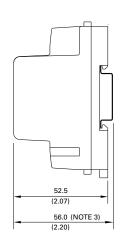
Figure 48



Measurements: inches

Figure 49





NOTES:

1. DIMENSIONS IN MILLIMETERS (INCHES).

MOUNTING SCREWS: M4 OR 8-32.
 OVERALL HEIGHT WHEN MOUNTED ON

3. OVERALL HEIGHT WHEN MOUNTED O DIN EN50022 35-mm x 7.5-mm TOP-HAT RAIL.

SIO-RTD-02-00

Measurements: inches (millimeters)

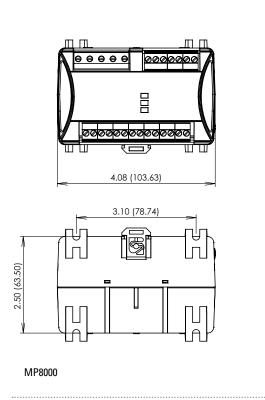
elfuse

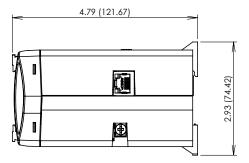
Expertise Applied | Answers Delivered

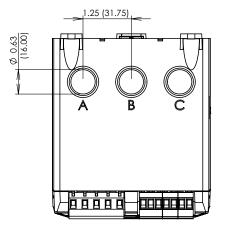
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Figure 50







Measurements: inches (millimeters)

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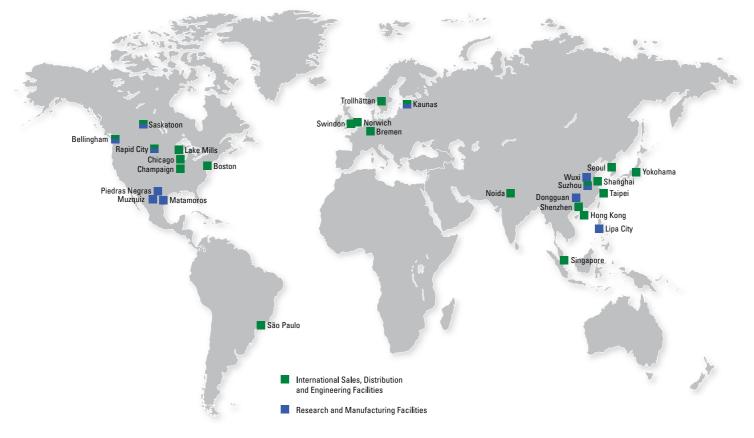
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