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

Voltage Monitoring Relays

For More Information…
on common faults and how to fix them, visit
Littelfuse.com/MotorProtection

CP5 SERIES

Single-Phase Current Monitor

Description

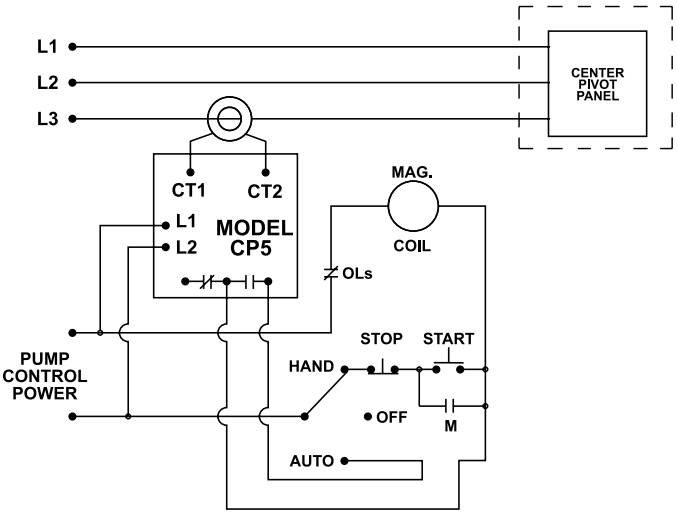
The CP5 Series are undercurrent monitors designed to monitor one leg of a 3-phase system. It is commonly used as a tower monitor on center pivot irrigation systems to detect stalled or jammed towers to prevent over watering.

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

Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

Specifications

Input Characteristics

Nominal Input Voltage	
CP5115	115VAC
CP5460	460VAC
Frequency	50*/60Hz

Functional Characteristics

Operating Points	
Trip Level	0-5 Amps
Trip Delay	0-10 minutes
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")
Weight	1 lb. (16 oz., 453.59 g)
Mounting Method	#8 screws

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

Ordering Information

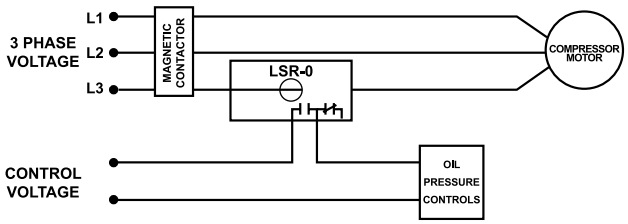
MODEL	LINE VOLTAGE
CP5115	115VAC
CP5460	460VAC

LSR-0

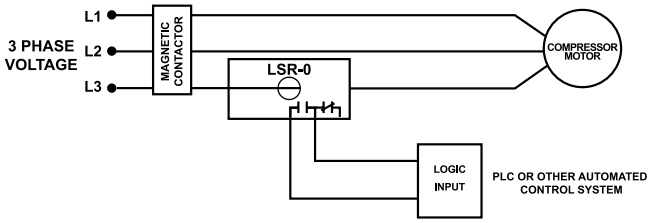
Self-Powered Load Sensor/Low-Cost Proof Relay

Wiring Diagram

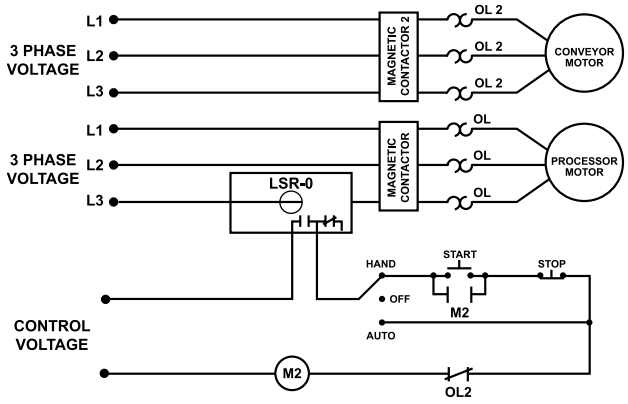
TYPICAL WIRING DIAGRAM FOR REFRIGERATION AND OIL FAILURE CONTROL



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	Fixed, 15A (max.)*
Turn-off Threshold	2.5A (min.)
Power	Induced from conductor
Isolation	600VAC rms
Output Characteristics	
Relay Output Rating:	
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 in.-lbs.
Safety Marks	
CSA, CSA-NRTL/C	(File #46510)
CE	
Dimensions	**H** 42.42 mm (1.67"); **W** 58.42 mm (2.3"); **D** 90.43 mm (3.56")
Weight	0.35 lb. (5.6 oz., 158.76 g)
Mounting Method	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.

LSR-XXX SERIES

Load Sensor

Description

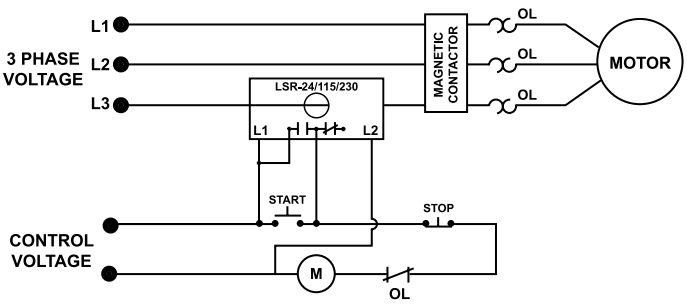
The LSR-xxx Series load sensors use current levels to determine feed rates, tool wear, loss of prime on pumps, mixer viscosity and all types of overload and underload conditions. They may also be used to stage pump motors, chillers and other machinery. These devices combine a current transformer (CT) 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 single-phase or 3-phase applications up to 100hp.

Features

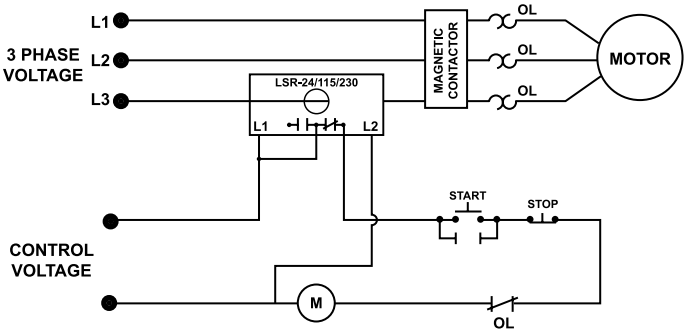
- Can monitor current of motors up to 100Hp
- Fine adjustment with 20-turn pot
- Status LEDs

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR LOAD LOSS DETECTION



TYPICAL WIRING DIAGRAM FOR OVERLOAD DETECTION



For dimensional drawing see: Appendix, page 511, Figure 14.

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 in.-lbs.
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.

Ordering Information

MODEL	LINE VOTAGE
LSR-24	24VAC
LSR-115	115VAC
LSR-230	230VAC

LSRU SERIES

Load Sensor

Description

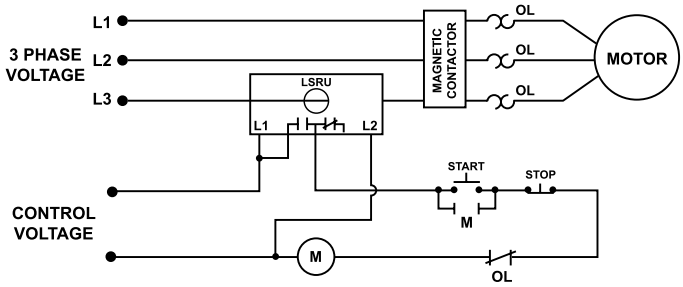
The LSRU Series is a microcontroller-based family of load sensors. The LSRU family of products employ three basic types of control logic: motor control logic, alarm logic and feed control logic.

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.

Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 14.

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

Ordering Information

See next page.

LSRU SERIES

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-OT-1.5	115VAC	0-10A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-OT-2	115VAC	5-25A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-OT-3	115VAC	25-100A	Motor control logic with overcurrent trip, adj trip delay (0.5-60s)
LSRU-115-OR-1.5	115VAC	0-10A	Motor control logic with overcurrent trip, adj restart delay (0.5-300s, manual)
LSRU-115-OR-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-OU-1.5	115VAC	0-10A	Motor control logic with overcurrent and undercurrent trip
LSRU-115-OU-2	115VAC	5-25A	Motor control logic with overcurrent and undercurrent trip
LSRU-115-OU-3	115VAC	25-100A	Motor control logic with overcurrent and undercurrent trip

PART # KEY

O = Overcurrent Trip
U = Undercurrent Trip
T = Adj. Trip Delay (0.5-60 seconds)
R = Adj. Restart Delay (0.5-300 seconds, Manual)
E = Adj. Extended Restart Delay (2-300 minutes, Manual)

1.5 = 0-10 Amps
2 = 5-25 Amps
3 = 25-100 Amps

Specifications

Functional Characteristics

Isolation	600VAC rms
Power	2 Watts
Motor Acceleration Time	2 seconds
When not selected as an option:	
Fixed Trip Delay	0.5 second
(-AL, -FC)	1 second
Fixed Restart Delay	1 second
(-AL only)	as soon as current is within limits
(-FC only)	0.5 second

Input Characteristics

Control Power	24VAC or 115VAC

Output Characteristics

Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC

General Characteristics

Temperature Range	-40° to 70°C (-40° to 158°F)
Wire Size	#12-24AWG
Hole Size	0.725" diameter
Terminal Torque	7 in.-lbs.
Safety Marks	
CSA, CSA-NRTL/C	(File #46510)
CE	
Dimensions	**H** 42.42 mm (1.67"); **W** 58.42 mm (2.3"); **D** 90.43 mm (3.56")
Weight	0.5 lb. (8 oz., 226.8 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.

LSRX / LSRX-C SERIES

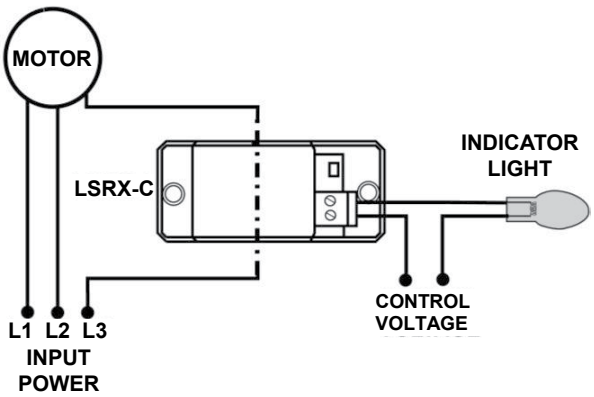
Self-Powered Load Sensor, Low-Cost Proof Relay

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.

Wiring Diagram



For dimensional drawing see: Appendix, page 511, Figure 13.

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	5-200A Continuous
Minimum Pull-in Current	4.5A (typical), 7.0A (max)*
Power	Induced from AC conductor

Output Characteristics

Relay Output Rating (SPST - Form A)	
Pilot Duty	480VA @ 240VAC, B300
General Purpose	5A @ 240VAC
Electrical Life	$1x10^5$
Mechanical Life	$1x10^7$
Maximum Conductor Diameter	0.7 in.
Output Terminals	
LSRX	0.25" quick-connect fast-ons
LSRX-C	depluggable screw terminals
Torque Rating	3.0 in.-lbs.

Ordering Information

MODEL	DESCRIPTION
LSRX	Fast-on terminal
LSRX-C	Depluggable screw terminals
LSRX-OEM	Fast-on terminals, 10 pack

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 air
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

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.

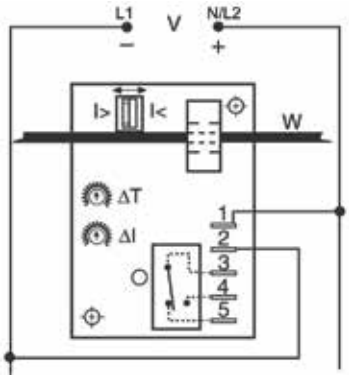
Operation

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.

Wiring Diagram



V = Voltage
I> = Overcurrent
I< = Undercurrent
W = Insulated Wire Carrying Monitored Current

Relay contacts are isolated.

For dimensional drawing see: Appendix, page 513, Figure 34.

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

Ordering Information

See next page.

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.

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	0s
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	0s
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	0s
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	0s
ECSL40AC	Undercurrent	120VAC	0.5 - 5A	0.150 - 7s	1s
ECSL40B	Undercurrent	120VAC	0.5 - 5A	0.5 - 50s	0s
ECSL40BH	Undercurrent	120VAC	0.5 - 5A	0.5 - 50s	6s
ECSL41A	Undercurrent	120VAC	2 - 20A	0.150 - 7s	0s
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	6s
ECSL61AH	Undercurrent	230VAC	2 - 20A	0.150 - 7s	6s
ECSL6HAC	Undercurrent	230VAC	5 - 50A	0.150 - 7s	1s

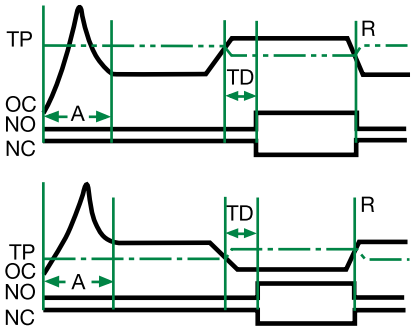
If you don't find the part you need, call us for a custom product 800-843-8848

ECS SERIES

Specifications

Sensor	
Type	Toroidal through hole wiring
Mode	Over or undercurrent, switch selectable on the unit or factory fixed
Trip Point Range	0.5 - 50A in 3 adjustable ranges or fixed
Tolerance	
Adjustable	Guaranteed range
Fixed	0.5 - 25A: 0.5A or ±5% whichever is less; 26 - 50A: ±2.5%
Maximum Allowable Current	Steady – 50A turns; Inrush – 300A turns for 10s
Trip Point Hysteresis	≅ ±5%
Trip Point vs. Temperature	±5%
Response Time	≤ 75ms
Frequency	45/500 Hz
Type of Detection	Peak detection
Trip Delay	
Type	Analog
Range	
Adjustable	0.150 - 7s; 0.5 - 50s (guaranteed ranges)
Factory Fixed	+/- 10%
Delay vs. Temperature	±15%
Sensing Delay on Startup	Factory fixed 0 - 6s: +40%, -0%
Input	
Voltage	24 , 120, or 230VAC; 12 or 24VDC
Tolerance	
12VDC & 24VDC/AC	-15 - 20%
120 & 230VAC	-20 - 10%
AC Line Frequency	50/60 Hz
Output	
Type	Electromechanical relay
Form	Isolated, SPDT
Rating	10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC
Life	Mechanical – 1 x 10^6 ; Electrical – 1 x 10^5
Protection	
Circuitry	Encapsulated
Isolation Voltage	≥ 2500V RMS input to output
Insulation Resistance	≥ 100 MΩ
Mechanical	
Mounting	Surface mount with two #6 (M3.5 x 0.6) screws
Dimensions	**H** 88.9 mm (3.5"); **W** 63.5 mm (2.5"); **D** 44.5 mm (1.75")
Termination	0.25 in. (6.35 mm) male quick connect terminals (5)
Environmental	
Operating/Storage Temperature	-40° to 60°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 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

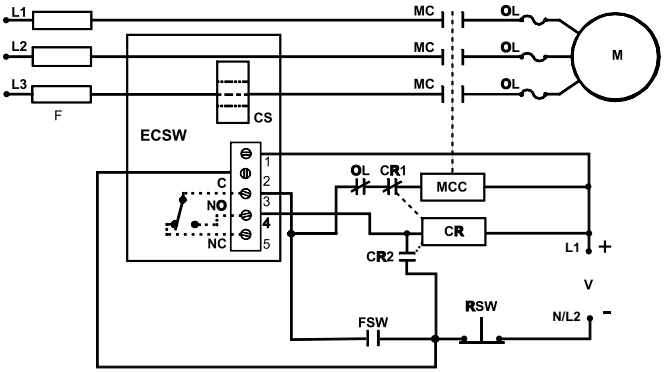
ECSW SERIES

Current Sensors

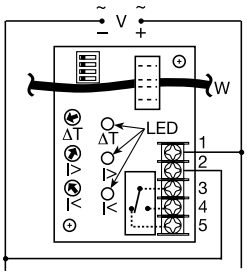
Description

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.

Wiring Diagram



MC = Motor Contactor
M = Motor
F = Fuses
OL = Overload
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.

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

Ordering Information

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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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 de-energizes, 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.

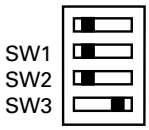
Typical Pump or Fan Protection Circuit Operation

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 de-energized (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

ON ↔ OFF



	Not Used
SW1	Latched
SW2	Zero I
SW3	Output - Normally Energized

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

Specifications

Sensor

Type	Toroid, through hole wiring for up to #4 AWG (21.1 mm^2) THHN wire
Mode	Over & undercurrent trip points (window current sensing)
Trip Point Range	0.5 - 50A in 3 adjustable ranges
Tolerance	Guaranteed range
Maximum Allowable Current	Steady - 50A turns; Inrush - 300A turns for 10s
Time Point vs Temp. & Voltage	±5%
Response Time	≤ 75ms
Frequency	45/500 Hz
Type of Detection	Peak detection
Zero Current Detection	< 250mA turns typical

Time Delay

Range	0.15 - 50s in 2 adjustable ranges or 0.1 - 50s fixed
Tolerance	Adjustable: guaranteed range; Fixed: ±10%
Sensing Delay On Start Up	Fixed ≅ 0.1 - 6s in 1s increments
Tolerance	+40% -0%
Delay vs. Temp. & Voltage	±15%

Input

Voltage	24, 120, or 230VAC; 12 or 24VDC
Tolerance	
12VDC & 24VDC/AC	-15% - 20%
120 & 230VAC	-20% - 10%
AC Line Frequency	50/60 Hz

Output

Type	Electromechanical relay
Mode: Switch Selectable	
ON	Energized during normal operation, de-energized after a fault
OFF	De-energized during normal operation, energizes during a fault
Form	Isolated, SPDT
Rating	10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/2 hp @ 250VAC
Life	Mechanical - 1 x 10^6; Electrical - 1 x 10^5
Latch	
Type	Electrical
Reset	Remove input voltage
Function	Switch selectable latching function

Protection

Surge	IEEE C62.41-1991 Level A
Circuitry	Encapsulated
Isolation Voltage	≥ 2500V RMS input to output
Insulation Resistance	≥ 100 MΩ

Mechanical

Mounting	Surface mount with two #6 (M3.5 x 0.6) screws
Dimensions	**H** 88.9 mm (3.5"); **W** 63.5 mm (2.5"); **D** 44.5 mm (1.75")
Termination	0.197 in. (5 mm) terminal blocks for up to #12 (3.2 mm^2) AWG wire

Environmental

Operating/Storage Temperature	-40° to 60° C/-40° to 85° C
Humidity	95% relative, non-condensing
Weight	≅ 6.4 oz (181 g)

TCS SERIES

Current Sensor

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.

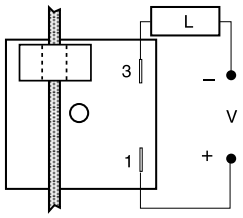
Operation

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.

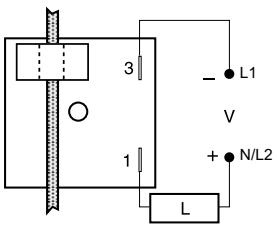
Normally Closed: When the current through the toroid is equal to or greater than the actuate current, the output opens. When the current is reduced below 95% of the actuate current, the output closes. To increase sensitivity, multiple turns may be made through the TCS's toroidal sensor. The trip point 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.

Wiring Diagram

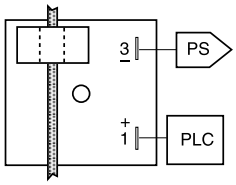
POSITIVE SWITCHING



NEGATIVE SWITCHING

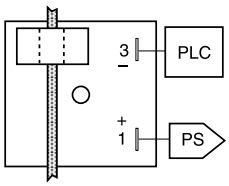


SINKING



L = Load
V = Voltage
PS = Power Supply
PLC = PLC Digital Input Module

SOURCING



Monitored AC conductor must be insulated.

For dimensional drawing see: Appendix, page 513, Figure 35.

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

Accessories

P1023-6 Mounting bracket
The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

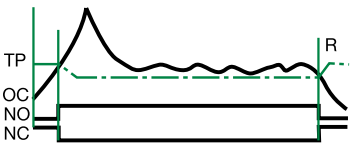
P1015-64 (AWG 14/16)
Female Quick Connect
These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief.

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.

Function Diagram



TP = Trip Point
OC = Monitored Current
NO = Normally Open Output
NC = Normally Closed Output
R = Reset

Specifications

Sensor

Type	Toroid, through hole wiring, alternating current, monitored wire must be properly insulated
Current to Actuate	Adjustable: - 2 - 20A, guaranteed range Fixed: - 2 - 45A, +0/-20%
Reset Current	≅ 95% of the actuate current
Maximum Allowable Current	Steady - 50A turns Inrush - 300A turns for 10s
Actuate Current vs. Temp. & Voltage	≤ ±5%
Response Times	Overcurrent - ≤ 200ms Undercurrent - ≤ 1s
Burden	< 0.5VA

Output

Type	Solid state
Form	NO or NC
Rating	1A steady, 10A inrush
Voltage	AC - 24 to 240VAC +10/-20% DC - 3 to 50VDC
Voltage Drop	AC NO & NC - ≅ 2.5V DC NO & NC - ≅ 1.2V

Protection

Circuitry	Encapsulated
Dielectric Breakdown	≥ 2000V RMS terminals to mounting surface
Insulation Resistance	≥ 100 MΩ

Mechanical

Mounting	Surface mount with one #10 (M5 x 0.8) screw
Dimensions	**H** 50.8 mm (2"); **W** 50.8 mm (2"); **D** 44.5 mm (1.75")
Termination	0.25 in. (6.35 mm) male quick connect terminals (2)
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm2) THHN wire

Environmental

Operating/Storage Temperature	-20° to 60°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 2.6 oz (74 g)

TCSA SERIES

Current Transducers

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.

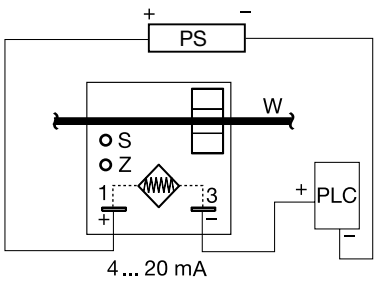
Operation

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)

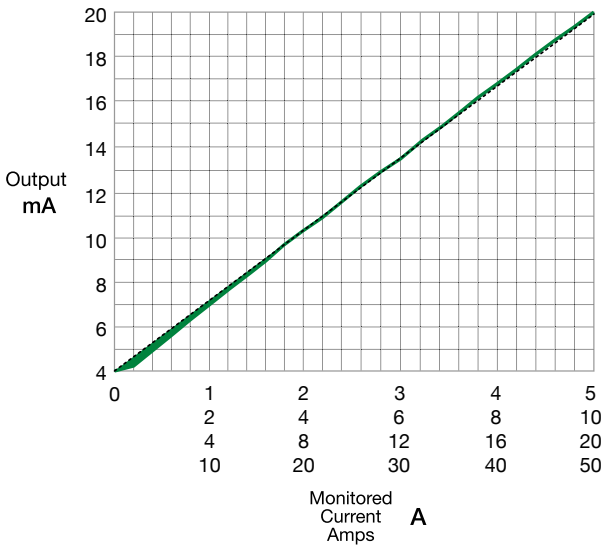
Select a 2VA, 0 to 5A output CT, rated for the current to be monitored. Select TCSA5. Pass one of the CT's secondary wire leads through the TCSA's toroid. Connect the CT's secondary leads together.

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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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

TCSA SERIES

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.

Specifications

Sensor

Type	Toroid, through hole wiring, alternating current, monitored conductor must be properly insulated
Monitored AC Current Ranges	0 - 50A
4 Factory Calibrated Ranges	0 - 5A, 0 - 10A, 0 - 20A, or 0 - 50A
Factory Calibration	≤±2% of full scale
Maximum Allowable Current	Steady – 50A turns; Inrush – 300A turns for 10s
Repeat Accuracy	≤±0.25% of full scale under fixed conditions
Response Time	≅ 300ms
Burden	≤ 0.5VA
AC Line Frequency	
0 - 20A / 21 - 50A	20 - 100Hz / 30 - 100Hz
Temperature Coefficient	±0.05%/°C

Output

Type: Series Connection	Current directly proportional to monitored current
Range	4 - 20mA
Sensor Supply Voltage*	10 to 30VDC
Momentary Voltage	40VDC for 1m
Zero Adjust	≅ 3.75 - 4.25mA
Span Adjust	18mA - 22mA
Adjustment	Mini-screw, 25-turn potentiometer

Protection

Dielectric Breakdown	≥ 2000V RMS terminals to mounting surface
Insulation Resistance	≥ 100 MΩ
Polarity	Units are reverse polarity protected

Mechanical

Mounting	Surface mount with one #10 (M5 x 0.8) screw
Dimensions	**H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 44.5 mm (1.75")
Termination	0.25 in. (6.35 mm) male quick connect terminals
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm^2) THHN wire

Environmental

Operating/Storage Temperature	-30° to 60°C/-40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 2.4 oz (68 g)

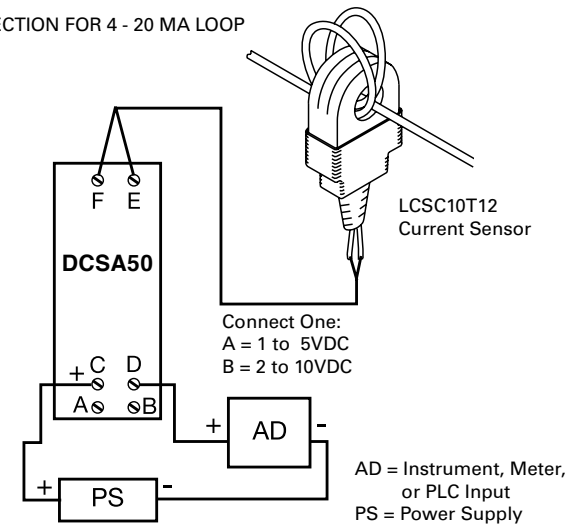
*Minimum loop-power supply voltage equals the minimum sensor voltage 10VDC plus the voltage drop developed across all the other loop devices at 20mA.

DCSA SERIES

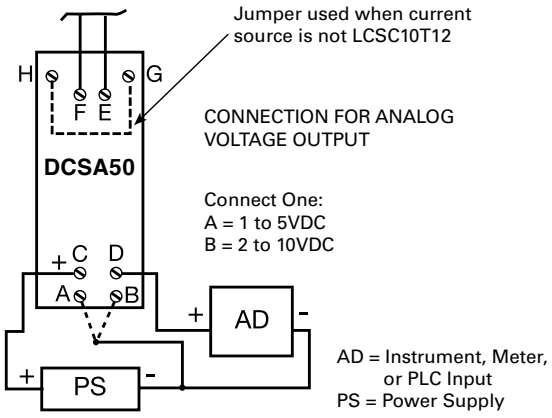
Current Transducers

Wiring Diagram

CONNECTION FOR 4 - 20 MA LOOP



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.

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

Specifications

Input

Ranges (without LCSC10T12 connected)	
4 factory calibrated ranges in mA AC	0 - 5mA, 0 - 10mA, 0 - 20mA, or 0 - 50mA AC
Factory calibration	±0.5% of full scale
Repeat Accuracy	±0.25% of full scale under fixed conditions
Response Time	≅ 300ms
Temperature Coefficient	±0.05%/°C
Input to Output	Not isolated

Output

Type	
Analog	Current directly proportional to input current
Range	4 - 20mA, or 1 to 5VDC or 2 to 10VDC
Supply Voltage*	10 to 30VDC
Momentary Voltage	40VDC for 1m
Zero Adjust	≅ 3.75 - 4.25mA
Span Adjust	18mA - 22mA
Adjustment	Mini-screw, multi-turn potentiometer

Protection

Dielectric Breakdown	≥ 2500V RMS terminals to mounting surface
Insulation Resistance	≥ 100 MΩ
Polarity	Units are reverse polarity protected

Mechanical

Mounting	DIN 1 & DIN 3 rail mounting
Termination	
Wire clamp	For 22 - 14AWG (.336 mm^2 ... 2.5 mm^2)

Environmental

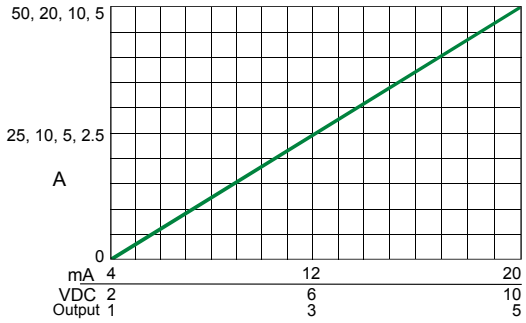
Operating/Storage Temperature	-30° to 60°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 1.6 oz (45.4 g)

Accessory - LCSC10T12 Toroidal Sensor

Number of Turns	1000
Nominal Output Current	
Full Range	0 - 50 mA
Maximum Allowable Current	Steady 50A turns; Inrush 300A turns for 10s
Burden	≤ 0.5 VA
Frequency	
0 - 20A / 21 - 50A	20/100 Hz / 30/100 Hz
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm^2) THHN wire
Weight	≅ 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.

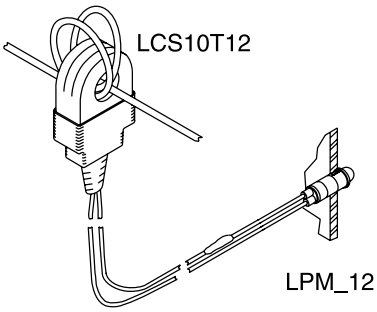
Monitored Current Amps Diagram



LCS10T12 / LPM SERIES

Current Indicators

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

Current Range 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 Current 50A turns continuous
AC Line Frequency 50/60Hz
DC Resistance of Current Limiter 65 Ω

Mechanical

Sensor Hole 0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm^2) THHN wire
Termination 12 in. (30.4 cm) wire leads

Environmental

Operating/Storage Temperature -40° to 60°C/-40° to 85°C
Weight LCS: ≅ 0.8 oz (23 g)
LPM: ≅ 0.2 oz (6 g)

50R SERIES

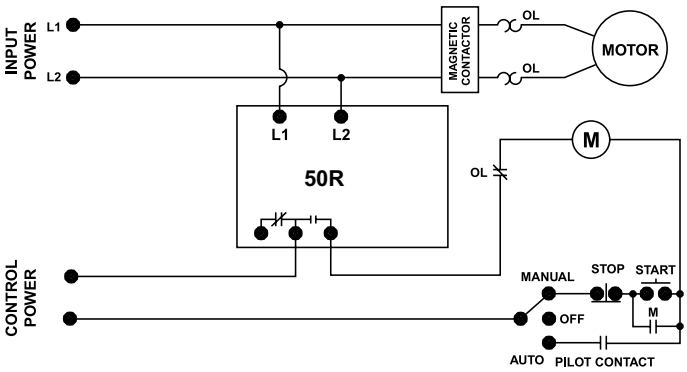
Single-Phase Voltage Monitor

Description

The 50R Series single-phase voltage monitor has a voltage-sensing 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.

Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

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

50R SERIES

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 seconds
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%

201-XXX-SP SERIES

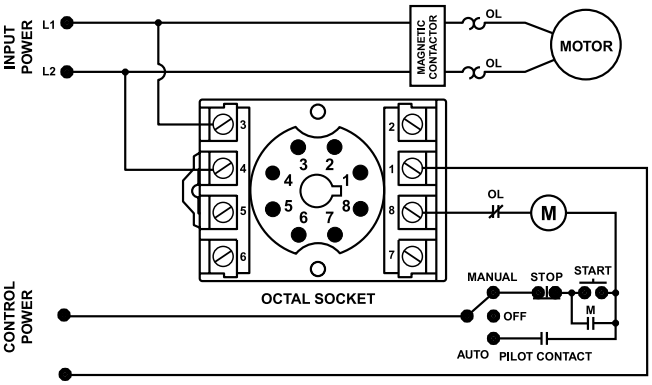
Single-Phase Voltage/Phase Monitor

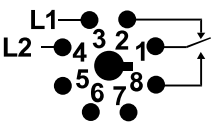
Description

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.

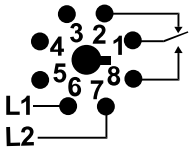
The unique microcontroller-based voltage and voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line 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.

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.

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.

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

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.

201-XXX-SP-DPDT SERIES

Single-Phase Voltage/Phase Monitor

Description

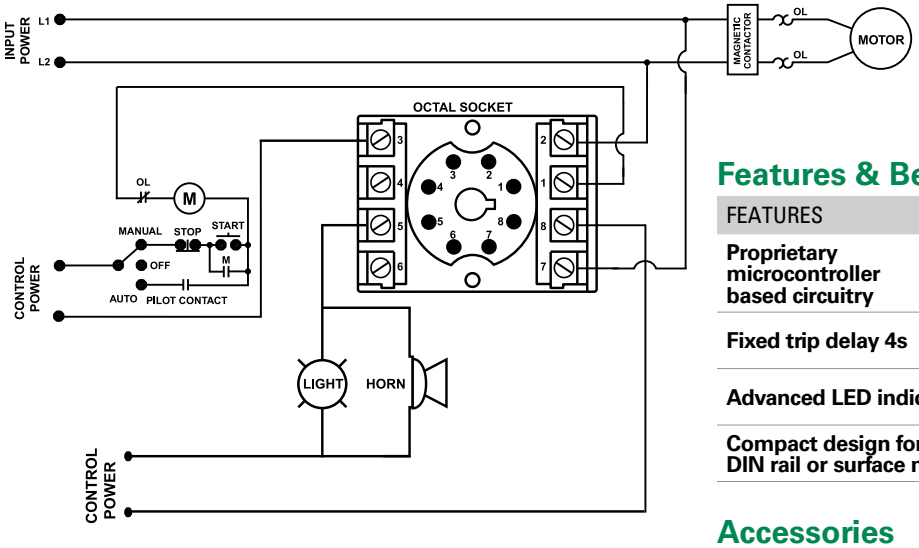
The 201-xxx-SP-DPDT Series is an 8-pin octal-base, plug-in voltage monitor designed to protect single-phase motors regardless of size. The 201-100-SP-DPDT is used on 95-120VAC, 50/60Hz motors to prevent damage caused by low voltage. The 201-200-SP-DPDT is used on 190-240VAC, 50/60Hz motors. The units 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.-lbs.

Wiring Diagram



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

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.

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

201-XXX-SP-DPDT SERIES

Specifications

Input Characteristics

Line Voltage:	
201-100-SP-DPDT	95-120VAC
201-200-SP-DPDT	190-240VAC
Frequency	50/60Hz

Functional Characteristics

Low Voltage (% of setpoint):	
Trip	90% +/-1%
Reset	93% +/-1%
Trip Delay Times:	
Low Voltage	4 seconds
Restart Delay Times:	
After a Fault or Complete Power Loss	2 seconds

Output Characteristics

Output Contact Rating (DPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC

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

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, 3.5kV input power and controls
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	0.65 lb. (10.4 oz., 294.84 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

202-200-SP SERIES

Single-Phase Voltage Monitor

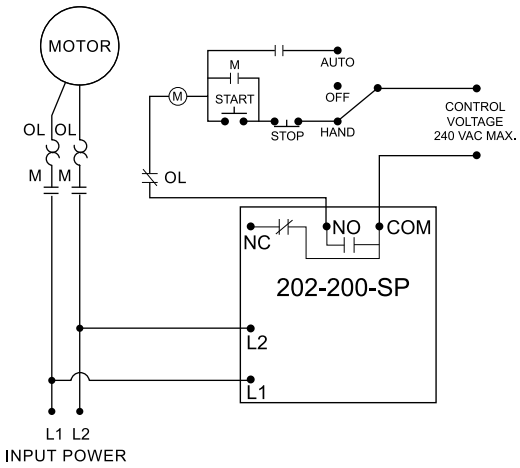
Description

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.

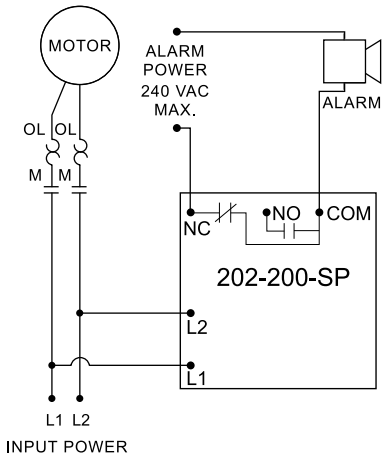
A unique microcontroller-based voltage-sensing circuit constantly monitors the voltage to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return 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.

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 202-200-SP
WITH MOTOR CONTROL



TYPICAL WIRING DIAGRAM FOR MODEL 202-200-SP
WITH ALARM CONTROL



For dimensional drawing see: Appendix, page 509, Figure 7.

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	50*/60Hz

Functional Characteristics

Low Voltage (% of setpoint)	
Trip	90%
Reset	93%
High Voltage (% of setpoint) (not available on -NHV model)	
Trip	110%
Reset	107%
Trip Delay Time:	
High and Low Voltage	4 seconds
Restart Delay Time:	
After a Fault or Complete Power Loss	Manual, 2-300 seconds adj.

Output Characteristics

Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC

General Characteristics

Temperature Range	-40° to 70°C (-40° to 158°F)
Trip & Reset Accuracy	±1%
Repeatability	±0.5%
Input to Output Dielectric	1480 Vrms (min.)
Termination	0.25" male quick connect
Maximum Input Power	5 W
Relative Humidity	95%, non-condensing
Transient Protection	IEC 61000-4-5, ±4kV
Safety Marks	
UL, UL Recognized	UL508 (File #E68520)
Dimensions	**H** 63.5 mm (2.5"); **W** 63.5 mm (2.5"); **D** 35.56 mm (1.4")
Weight	0.5 lb. (8 oz., 226.8 g)
Mounting Method	1/4" socket head cap screw (customer supplied)

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

460-XXX-SP SERIES

Single-Phase Voltage Monitor

Description

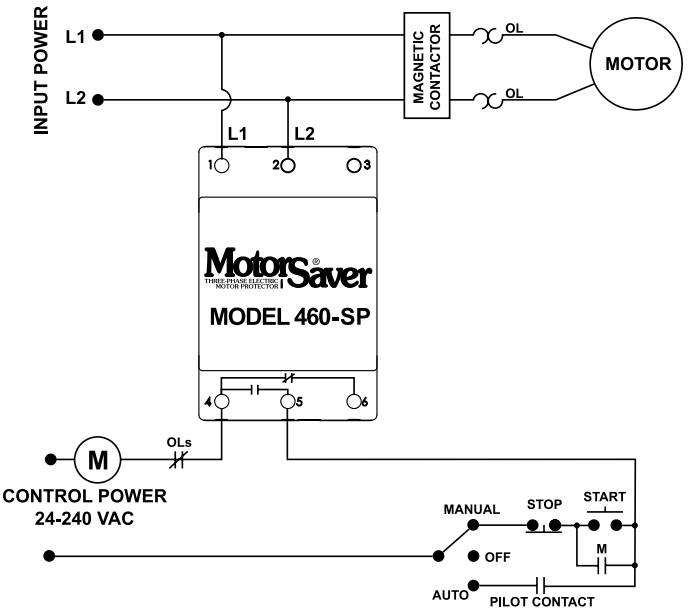
The 460-100-SP is used on 95-120VAC, 50*/60Hz single-phase motors and the 460-200-SP is used on 190-240VAC, 50*/60Hz single-phase motors to protect them from damaging high and low voltage conditions. An adjustment knob allows the user to set a 1-500 second restart delay. The variable restart delay is 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

Wiring Diagram



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

Ordering Information

MODEL	LINE VOTAGE
460-100-SP	95-120VAC
460-200-SP	190-240VAC

460-XXX-SP SERIES

Specifications

Input Characteristics

Line Voltage	
460-100-SP	95-120VAC
460-200-SP	190-240VAC
Frequency	50*/60Hz

Functional Characteristics

Low Voltage (% of setpoint):	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Trip Delay Time	
Low or High Voltage	4 seconds fixed
Restart Delay Time	
After a Fault	1-500 seconds adjustable
After a Complete Power Loss	1-500 seconds adjustable

Output Characteristics

Output Contact Rating (1 Form C)	
Pilot Duty	480VA @ 240VAC, B300
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	6 W
Class of Protection	IP20, NEMA 1 (finger safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	4.5 in.-lbs.
Wire Type	Stranded or solid 12-20 AWG, one per terminal

Standards Passed

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, 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)

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

102A SERIES

3-Phase Voltage/Phase Monitor

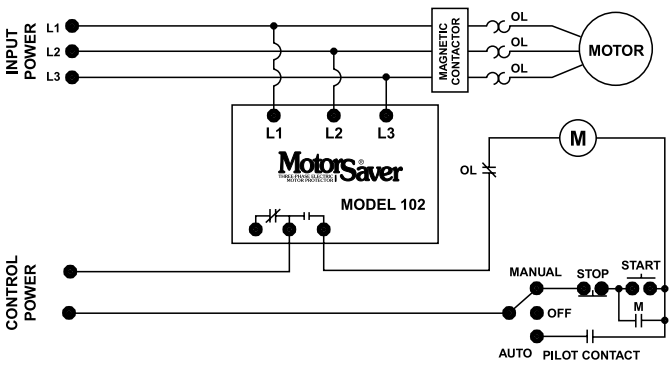
Description

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.

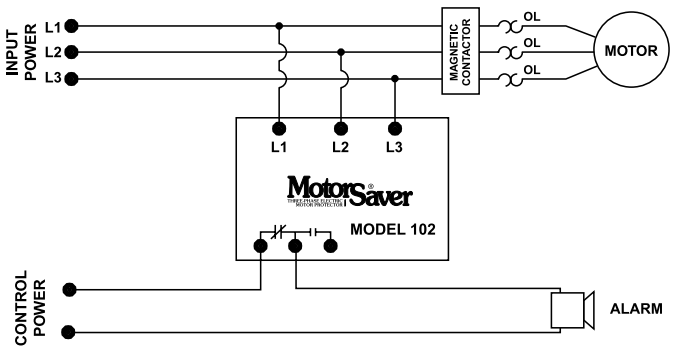
A unique microcontroller-based voltage and phase-sensing circuit constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels. The Model 102A includes advanced single LED diagnostics. Five different light patterns distinguish between faults and normal conditions.

Wiring Diagram

102 WITH MOTOR CONTROL



102 WITH ALARM CONTROL



For dimensional drawing see: Appendix page 509, Figure 6.

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)

102A SERIES

Specifications

Frequency	50*/60Hz
Functional Characteristics	
Low Voltage (% of setpoint)	
Trip	90%
Reset	93%
Voltage Unbalance (NEMA)	
Trip	6%
Reset	4.5%
Trip Delay Time	
Low/High Voltage	4 seconds (standard)
Unbalance & Phasing Faults	2 seconds
Restart Delay Time	
After a Fault	2 seconds (standard)
After a Complete Power Loss	2 seconds (standard)
Output Characteristics	
Output Contact Rating (SPDT - 1 Form C)	
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)
Trip & Reset Accuracy	±1%
Maximum Input Power	5 W
Terminal	
Torque	7 in.-lbs.
Wire Size	12-18AWG
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Fast Transient Burst	IEC 61000-4-4, Level 3, 4kV input, 2kV input/output
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** 74.4 mm (2.93"); **W** 133.9 mm (5.27"); **D** 74.9 mm (2.95")
Weight	1.05 lbs. (16.8 oz., 476.27 g)
Mounting Method	#8 screws

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

201A SERIES

3-Phase Voltage/Phase Monitor

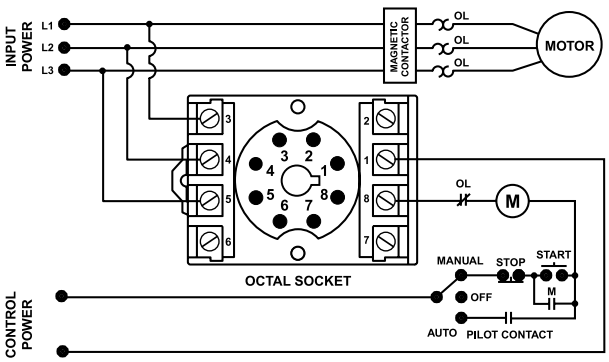
Description

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.

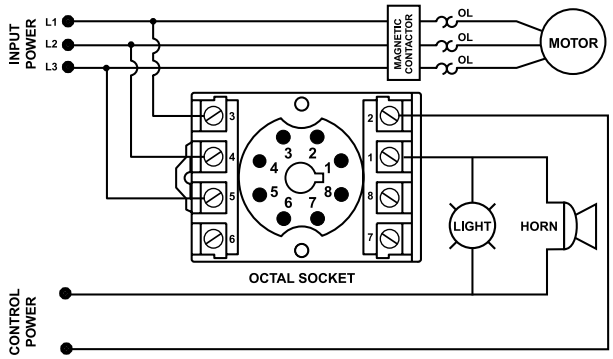
This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the 201A's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels for a specified restart delay time.

Wiring Diagram

201A WITH MOTOR CONTROL



201A WITH ALARM CONTROL



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

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

201A SERIES

Specifications

Frequency	50/60Hz
Functional Characteristics	
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
Voltage Unbalance (NEMA)	
Trip	6%
Reset	4.5%
Optional High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Trip Delay Time	
High/Low Voltage Fault	4 seconds
Unbalance & Phasing Faults	2 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	
Temperature Range	-20° to 70°C (-4° to 158°F)
Trip & Reset Accuracy	±1%
Maximum Input Power	5 W
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	12 in.-lbs. (for OT08-PC socket)
Wire Gauge	12-22 AWG solid or stranded
Transient Protection (Internal)	2500V for 10 ms

Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency Immunity (RFI), Radiated	150MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV input power & controls
Surge	
Immunity 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 (OT08PC 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** (with socket) 104.78 mm (4.13")
Weight	0.7 lbs. (11.2 oz., 317.51 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.

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!

201A-AU SERIES

3-Phase Voltage/Phase Monitor

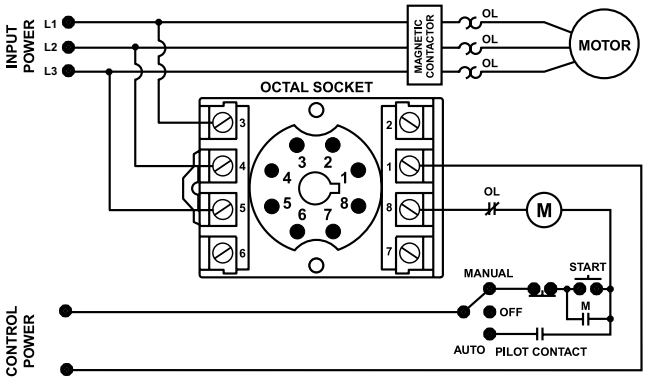
Description

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.

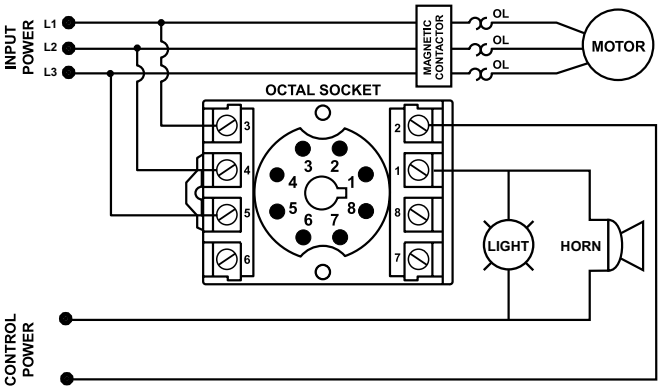
This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the 201A-AU's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to acceptable levels for a specified amount or restart delay time (or manual reset).

Wiring Diagram

201A-AU WITH MOTOR CONTROL



201A-AU WITH ALARM CONTROL



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

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

Specifications

Frequency	50/60Hz
Functional Characteristics	
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip Setting Minus 1% (5-8%) Trip Setting Minus 0.5% (2-4%)
Trip Delay Time	
High, Low and Unbalanced Voltage	1-30 seconds adjustable
Single-Phasing Faults	1 second fixed
Restart Delay Time	
After a Fault	Manual, 1-500 seconds adj.
After a Complete Power Loss	Manual, 1-500 seconds adj.
Output Characteristics	
Output Contact Rating (1-Form C)	
Pilot Duty	480VA @ 240VAC, B300
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)
Trip & Reset Accuracy	±1%
Maximum Input Power	5 W
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	12 in.-lbs. (for OT08-PC socket)
Wire Gauge	12-22 AWG solid or stranded

Standards Passed	
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, 3.5kV 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 (OT08PC octal socket required)	UL508 (File #E68520)
CE	IEC 60947-6-2
Enclosure	Polycarbonate
Dimensions	**H** 44.45 mm (1.75"); **W** 60.325 mm (2.375"); **D** 104.775 mm (4.125") (with socket)
Weight	0.7 lb. (11.2 oz., 317.51 g)
Mounting Method	DIN rail or surface mount (plug in to OT08PC socket)
Socket Available	OT08PC (UL Rating 600V)

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!

201-XXX-DPDT SERIES

3-Phase Voltage/Phase Monitor

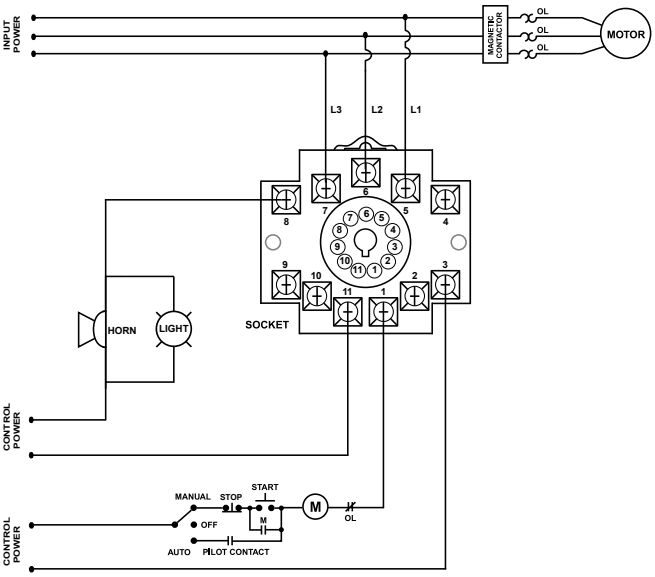
Description

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.

Wiring Diagram



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

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

201-XXX-DPDT SERIES

Specifications

Input Characteristics

Line Voltage	
201-100-DPDT, 201-100-DPDT-60mS	95-120VAC
201-200-DPDT, 201-200-DPDT-60mS	190-240VAC
Frequency	50/60Hz

Functional Characteristics

Low Voltage (% of setpoint)	
Trip	90% +/-1%
Reset	93% +/-1%
Voltage Unbalance	
Trip	6%
Reset.	4.5%
Trip Delay Times	
Low Voltage	4 seconds
Unbalance, Phasing Faults	2 seconds
Models with -60ms option	0.5 second
Restart Delay Times	
After a Fault or Complete Power Loss	2 seconds
Models with -60mS option	60 milliseconds

Output Characteristics

Output Contact Rating (DPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	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)
Mounting Method	DIN rail or surface mount (plug in to OT11PC socket)
Socket Available	Model OT11PC (UL Rated 300V)

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.-lbs.

202 SERIES

3-Phase Voltage/Phase Monitor

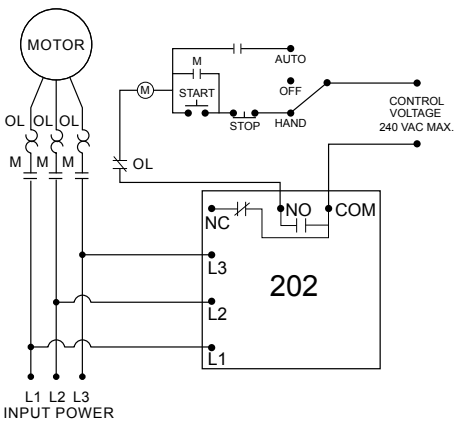
Description

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.

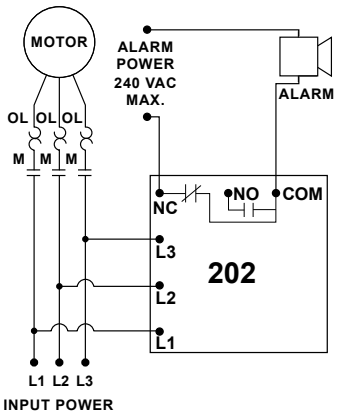
This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power 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.

Wiring Diagram

202 WITH MOTOR CONTROL



202 WITH ALARM CIRCUIT



For dimensional drawing see: Appendix, page 509, Figure 7.

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	Quick 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

202 SERIES

Specifications

Frequency	50*/60Hz
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 seconds
Unbalance & Phasing Faults	2 seconds
Restart Delay Time	
After a Fault	Manual, 2-300 seconds adj.
After a Complete Power Loss	Manual, 2-300 seconds adj.

Output Characteristics	
Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC
General Characteristics	
Temperature Range	-40° to 70°C (-40° to 158°F)
Trip & Reset Accuracy	±1%
Repeatability	±0.5%
Maximum Input Power	5 W
Relative Humidity	95%, non-condensing
Transient Protection	IEC 61000-4-5, ±4kV
Hi-potential Test	Meets UL508 (2x rated V+1000V for 1 minute)
Termination	0.25" male quick connect
Safety Marks	
UL Recognized	UL508 (File #E68520)
Dimensions	**H** 63.5 mm (2.5"); **W** 63.5 mm (2.5"); **D** 35.56 mm (1.4")
Weight	0.5 lb. (8 oz., 226.8 g)
Mounting Method	1/4" socket head cap screw (customer supplied)

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

250A SERIES

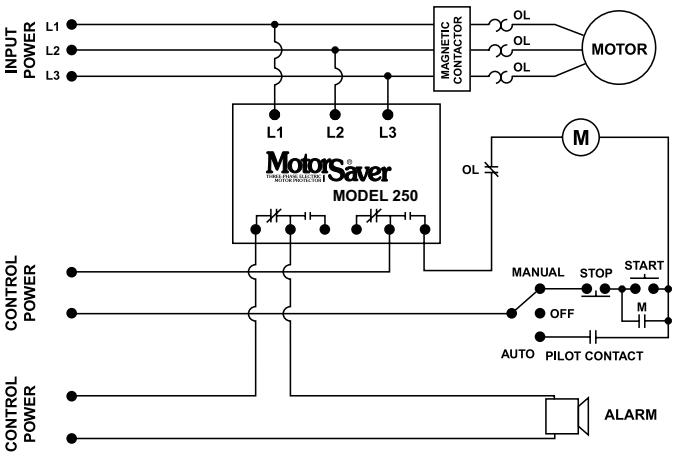
3-Phase Voltage/Phase Monitor

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.

Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

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

MODEL	LINE VOLTAGE	% OF SETPOINT				DESCRIPTION
		LOW VOLTAGE TRIP	LOW VOLTAGE RESET	HIGH VOLTAGE TRIP	HIGH VOLTAGE RESET	
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.

250A SERIES

Specifications

Frequency	50*/60Hz Low Voltage
Functional Characteristics	
Voltage Unbalance (NEMA)	
Trip	6%
Reset	4.5%
Trip Delay Time	
Low Voltage, High Voltage	4 seconds
Unbalance, Phasing Faults	2 seconds
Restart Delay Time	
After a Fault or Complete Power Loss	Manual, 2-300 seconds adj.
Output Characteristics	
Output Contact Rating (DPDT - 2 Form C)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC
Temperature Range	-40° to 70°C (-40° to 158°F)
Trip & Reset Accuracy	±1%
Maximum Input Power	5 W
Relative Humidity	Up to 95% non-condensing per IEC 68-2-3
Terminal Torque	7 in.-lbs.
Wire Size	12-18AWG
Transient Protection (Internal)	IEC 61000-4-5;1995 ±6kV
Approvals	
UL	UL508 (File #E68520)
CSA	CSA 22.2 No. 14 (File#46510)
CE	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	1.02 lb. (16.32 oz., 462.66 g)
Mounting Method	#8 screws

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

350 SERIES

3-Phase Voltage/Phase Monitor

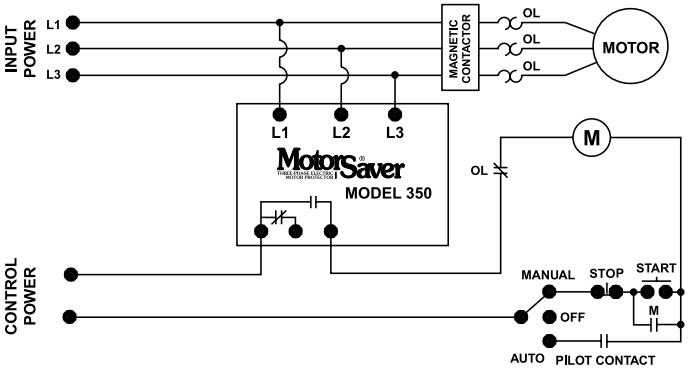
Description

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.

Wiring Diagram



For dimensional drawing see: Appendix page 509, Figure 6.

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.

350 SERIES

Specifications

Input Characteristics

Line Voltage	
350200	190-240VAC
350400	380-480VAC
350600	475-600VAC
Frequency	50*/60Hz

Functional Characteristics

Low Voltage (% of setpoint)	
Trip	90%
Reset	93%
Voltage Unbalance (NEMA)	
Trip	6%
Reset	4.5%
Trip Delay Time:	
Low Voltage	4 seconds
Unbalance & Phasing Faults	2 seconds
Restart Delay Time	
After a Fault	2 seconds
After a Complete Power Loss	2 seconds

Output Characteristics

Output Contact Rating	
SPDT (350200)	
Pilot Duty	480VA @ 240VAC
General Purpose	15A
SPDT (350-400, 350-600)	470VA @ 600VAC
DPDT (-6 Option)	1-10A General Purpose 480VA @ 240VAC Pilot Duty 1-15A General Purpose 480VA @ 240VAC Pilot Duty 1hp @ 240VAC
DPDT (-8 Option)	2-15A General Purpose 480VA @ 240VAC Pilot Duty 1hp @ 240VAC

General Characteristics

Ambient Temperature Range	
Operating	-40° to 70°C (-40° to 158°F)
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%.

355 SERIES

3-Phase Voltage/Phase Monitor

Description

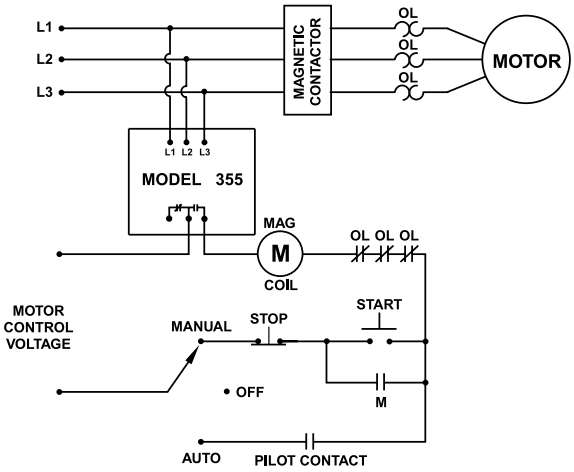
The 355 Series is a 3-phase voltage monitor with adjustable trip and restart delay, adjustable voltage unbalance and multiple diagnostic lights. It is perfect for heavy-duty applications that need both protection and simple user-friendly diagnostics. Applications include pump panels, commercial HVAC, 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.

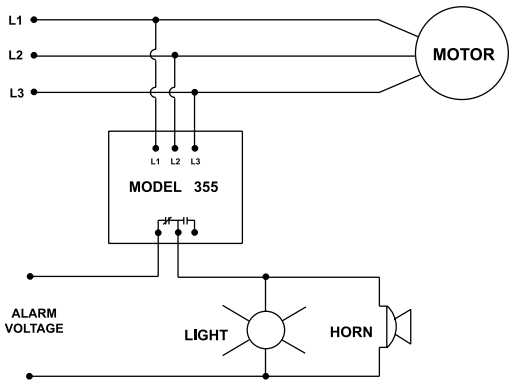
The 355200 is equipped with a heavy-duty 10A general purpose SPDT relay. The 355400 and 355600 are equipped with a 470VA @ 600VAC pilot duty SPDT relay. A high voltage (600V) DPDT relay output option is available with the 400V model.

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 355 WITH MOTOR CONTROL



TYPICAL WIRING DIAGRAM FOR MODEL 355 WITH ALARM CONTROL



For dimensional drawing see: Appendix page 509, Figure 6.

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

Ordering Information

MODEL	LINE VOTAGE	DESCRIPTION
355200	190-240VAC	SPDT
355400	380-480VAC	SPDT
3554005	380-480VAC	DPDT
355600	475-600VAC	SPDT

355 SERIES

Specifications

Input Characteristics

Line Voltage	
355200	190-240VAC
355400	380-480VAC
355600	475-600VAC
(Specify voltage range)	
Frequency	50*/60Hz

Functional Characteristics

Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip setting minus 1%
Trip Delay Time:	
Low & High Voltage and Unbalance	2-30 seconds adjustable
Single-phasing Faults (>25% UB)	2 seconds
Restart Delay Time	
After a Fault or Power Loss	Manual, 2-300 seconds adj.

Output Characteristics

Output Contact Rating	
SPDT (355200)	
Pilot Duty	480VA at 240VAC
General Purpose	10A
SPDT (355400, 355600)	
Pilot Duty	470VA @ 600VAC
DPDT (-5 Option)	
Pilot Duty	470VA @ 600VAC

General Characteristics

Temperature Range	
Operating	-40° to 70°C (-40° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Repeat Accuracy	
Fixed Conditions	±0.1%
Maximum Input Power	6 W
Terminal	
Torque	7 in.-lbs.
Wire Size	12-18AWG
Transient Protection (Internal)	2500V for 10 ms
Safety Marks	
UL	UL508 (File #E68520)
Dimensions	**H** 74.42 mm (2.93"); **W** 133.86 mm (5.27"); **D** 74.93 mm (2.95")
Weight	0.94 lb. (15.04 oz., 426.38 g)
Mounting Method	#8 screws

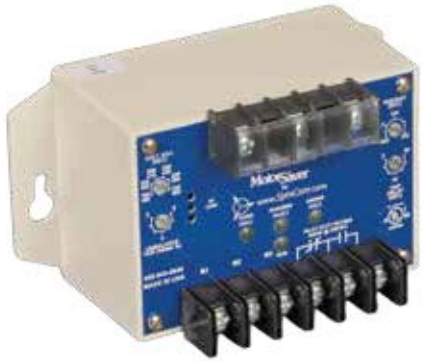
Special Options

Option 5 - DPDT Relay

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

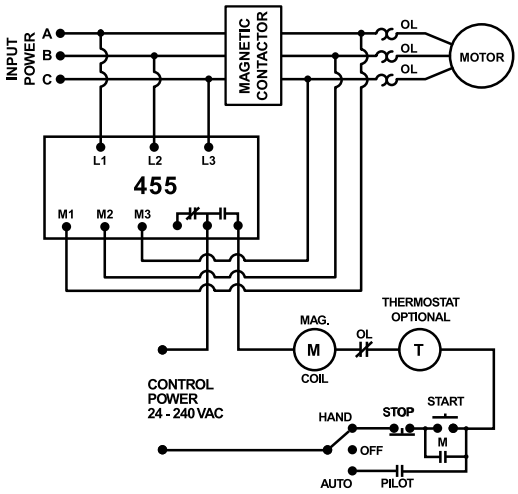
455 SERIES

3-Phase Voltage/Phase Monitor

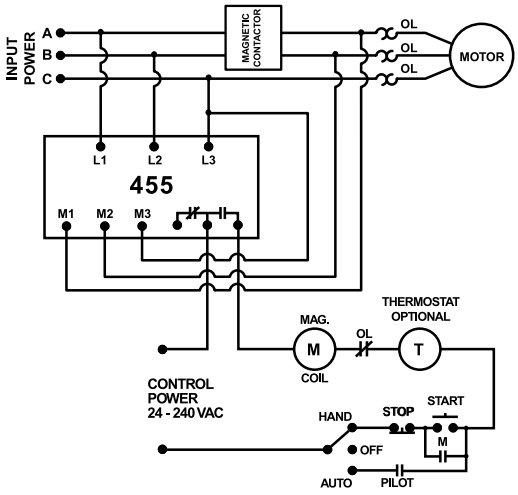


Wiring Diagram

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
A hand-held diagnostic tool designed for use with Littelfuse® 455 equipped with an infrared LED transmitter

Informer IR Kit-36
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.

455 SERIES

Specifications

Frequency	50*/60Hz
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip setting minus 1%
Trip Delay Time	
Low & High Voltage and Unbalance	2-30 seconds adjustable
Single-phasing Faults (>25% UB)	2 seconds fixed
Restart Delay Time	
After a Fault	Manual, 2-300 seconds adj.
After a Complete Power Loss	Manual, 2-300 seconds adj.
After a Motor Shut-down	Manual, 2-300 seconds adj.
Output Characteristics	
Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A
High Voltage Relay (-480R)	
Pilot Duty	470VA @ 600VAC

General Characteristics	
Ambient Temperature Range	
Operating	-40° to 70°C (-40° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
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%.

460 SERIES

3-Phase Voltage Monitor

Description

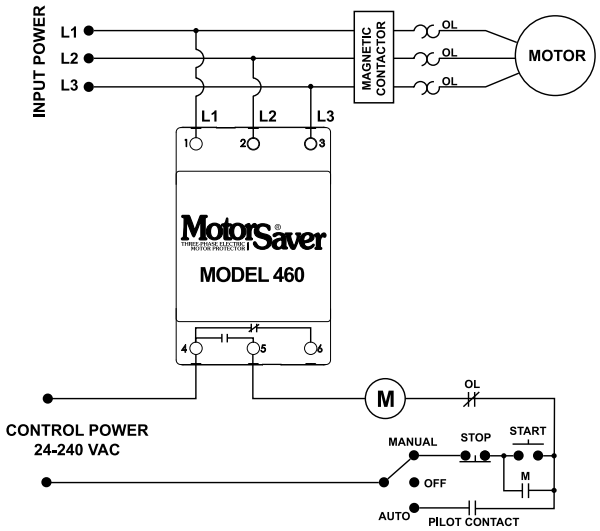
The 460 is a 3-phase voltage monitor that protects 190-480VAC or 475-600V, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically senses line voltage.

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.

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 460 WITH MOTOR CONTROL



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

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

Ordering Information

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-OEM	190-480VAC	Bulk package of 460, 20 units
460L-OEM	190-480VAC	Bulk package of 460-L, 20 units

460 SERIES

Specifications

Frequency	50/60Hz
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip setting minus 1% (5-8%) Trip setting minus 0.5% (2-4%)
460L	6% UB fixed (4.5% reset)
Trip Delay Time	
Low, High and Unbalanced Voltage	1-30 seconds adjustable
460L	4 seconds fixed
Single-Phase Faults (>25% UB)	1 second fixed
Restart Delay Time	
After a Fault	1-500 seconds adjustable
After a Complete Power Loss	1-500 seconds adjustable
Output Contact Rating	
Form C	
Pilot Duty	480VA @ 240VAC, B300
General Purpose	10A @ 240VAC
Form A & Form B	
Pilot Duty	360VA @ 240VAC, B300
General Purpose	8A @ 240VAC

Ambient Temperature Range	
Operating	-20° to 70°C (-4° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Maximum Input Power	6 W
Class of Protection	IP20, NEMA 1 (finger safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	4.5 in.-lbs.
Wire Type	Stranded or solid 12-20 AWG, one per terminal
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
RFI, Radiated	150 MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV 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 minute)
Safety Marks	
UL	UL508 (File #E68520)
CE	IEC 60947-6-2
Enclosure	Polycarbonate
Dimensions	**H** 88.9 mm (3.5"); **W** 52.9 mm (2.08"); **D** 59.69 mm (2.35")
Weight	0.7 lb. (11.2 oz., 317.51 g)
Mounting Method	35 mm DIN rail or Surface Mount (#6 or #8 screws)
460-MR (manual reset)	External NO pushbutton required.

601 SERIES

3-Phase Voltage & Frequency Monitor

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:

- low voltage
- high voltage
- voltage unbalance
- low frequency
- high frequency
- RS485 address
- trip delay for voltage/ frequency faults
- 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)

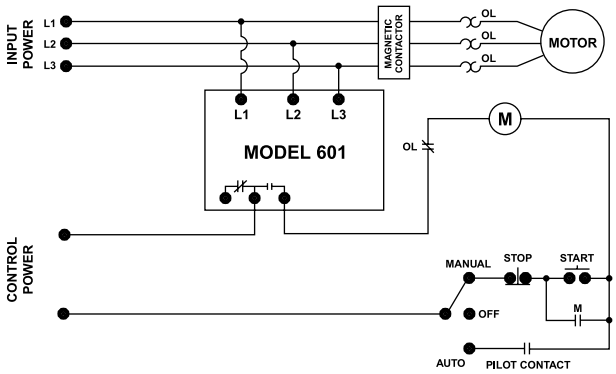
Six (6) parameters are viewable while the motor is running:

- 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.

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

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

601 SERIES

Accessories

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	50/60Hz
Functional Characteristics	
Programmable Operating Points	
LV - Low Voltage Threshold	170V (450V*) - HV Setting
HV- High Voltage Threshold	LV Setting - 528V (660V*)
VUB - Voltage Unbalance Threshold	2-15% or off
LF - Low Frequency Threshold	35Hz - HF Setting
HF - High Frequency Threshold	LF Setting - 75Hz
TD1 - Trip Delay for Voltage/Unbalance/ Frequency Faults	1-50 seconds
TD2 - Trip Delay for Single-Phase Faults	1-50 seconds
RD1 - Rapid-Cycle Timer	0, 2-500 seconds
RD2 - Restart Delay After All Faults	2-500 seconds
#RF - Type of Restart	Manual or Automatic
ADDR - RS-485 Address	A01-A99
Fixed Reset Points	
Overvoltage Reset	97% of HV Setting
Low Voltage Reset	103% of LV Setting
Voltage Unbalance Reset	UB Setting -1%
Low Frequency Reset	LF Setting +0.6Hz
High Frequency Reset	HF Setting -0.6Hz
Output Characteristics	
Output Contact Rating	
Pilot Duty	480VA @ 240VAC
General Characteristics	
Temperature Range	-20° to 70°C (-4° to 158°F)
Accuracy	
Voltage	±1%
Timing	5% ±1 second
Repeatability	
Voltage	±0.5%
Maximum Input Power	5 W
Transient Protection (Internal)	2500 V for 10 ms
Safety Marks	
UL	UL508 (File #E68520)
CSA	C22.2 No. 14 (File #46510)
CE	IEC 60947-6-2
Dimensions	**H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05")
Weight	1.2 lbs. (19.2 oz., 544.31 g)
Mounting Method	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

601-CS-D-P1

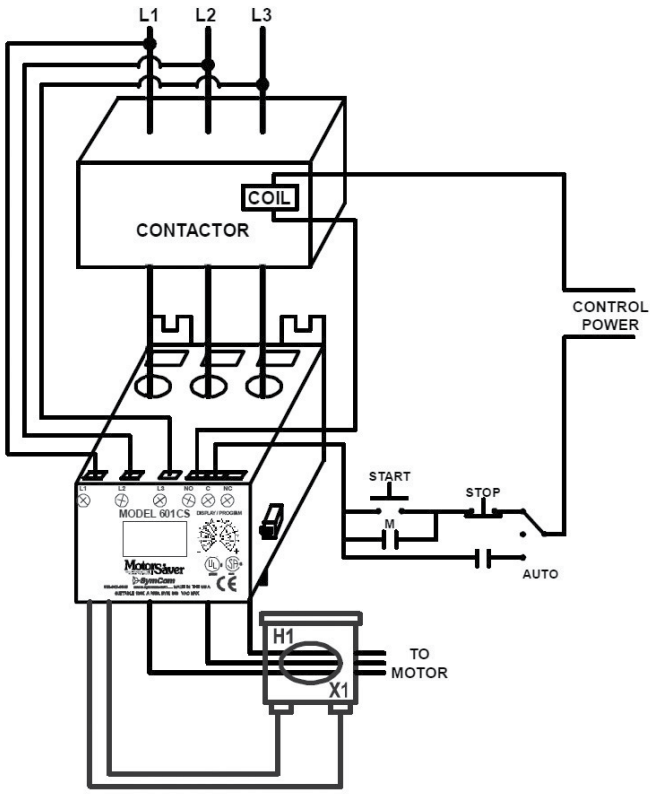
3-Phase Power Monitor

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).

Wiring Diagram



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

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 DeviceNet™ interface device capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet™ network.

601-CS-D-P1

Specifications

Input Characteristics

Line Voltage	200-480VAC
Frequency	50/60Hz
Motor Full Load Amp Range	0.5-175A (direct) 176-800A (CTs required)
Input Ground Fault Current	0.5-10A

Output Characteristics

Output Contact Rating (SPDT)	
Pilot Duty	480VA @ 240VAC
General Purpose	10A @ 240VAC
Expected Life	
Mechanical	1 x 10^6 operations
Electrical	1 x 10^5 operations at rated load

General Characteristics

Ambient Temperature Range	
Operating	-20° to 70°C (-4° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Accuracy at 25° C (77° F)	
Voltage	+/-1%
Current	+/-3% (<175A direct)
GF Current	+/-3%
Repeatability	
Voltage	+/-0.5% of nominal voltage
Current	+/-1% (<175A direct)
Maximum Input Power	10 W
Pollution Degree	3
Class of Protection	IP20
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	7in.-lbs.

Standards Passed

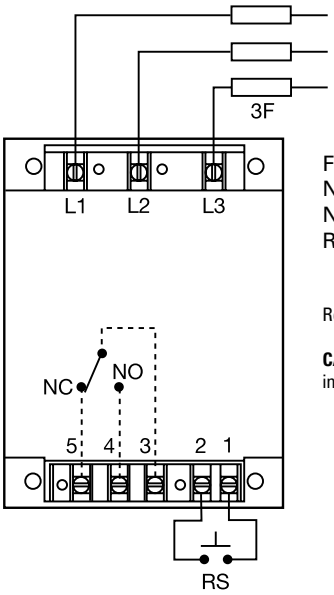
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency Immunity, Conducted	IEC 61000-4-6, Level 3 10V
Radio Frequency Immunity, Radiated	IEC 61000-4-3, Level 3, 10 V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV input power
Short Circuit Rating	100kA rms, SYM, 600VAC max.
Surge Immunity IEC	IEC 61000-4-5, Level 3, 2kV 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
High Potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Safety Marks	
UL	UL508 (File #E68520)
CE	IEC 60947-1, IEC 60947-5-1
Max Conductor Size (with insulation)	0.65"
Dimensions	**H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05")
Weight	1.2 lbs. (19.2 oz., 544.31 g)
Mounting Method	Surface mount (4 - #8 screws) or DIN rail mount

WVM SERIES

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.

Wiring Diagram



F = Fuses
NO = Normally Open
NC = Normally Closed
RS = Optional Remote Reset Switch

Relay contacts are isolated.

CAUTION: 2 amp max fast acting fuses must be installed externally in series with each input. (3)

For dimensional drawing see: Appendix, page 513, Figure 29.

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.

Ordering Information

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

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WVM SERIES

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 ≤20KΩ 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		
Type	3-phase delta or wye with no connection 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	
Overvoltage, Undervoltage, & Voltage Unbalance		
Overvoltage Trip Point	109-113% of adjusted voltage	
Reset Voltage	-2% of trip point	
Undervoltage Trip Point	88-92% of adjusted voltage	
Reset Voltage	+2% of trip point	
Voltage Unbalance	Adjustable from 2-10%*	
Trip Delay	Adjustable from 0.25 - 30s ±15%	
Phase Loss	≥ 15% unbalance	
Response Time	≤ 200 ms	
Random Start Delay Range	3 - 15s	
Reset (Restart) Delay		
Low Range	0.25-64s ±15%	
Normal Range	6-300s ±15%	
High Range	0.25-64m ±15%	
Fault Memory		
Type	Nonvolatile RAM	
Capacity	Stores last 10 faults	
Status Indicators	6 LEDs provide existing status & memory readout *Note: 50% of operating line voltage must be applied to L1 & L2 for operation of status indicators*	
Output		
Type	Electromechanical relay	
Form	Isolated, SPDT	
Rating	10A resistive @ 250VAC; 6A inductive (0.4 PF) @ 250VAC	
Life	Mechanical - 1 x 10^7	
Protection		
Phase Reversal/Failure	ASME A17.1 Rule 210.6	
Motors and Generators	NEMA MG1 14:30, 14:35	
Surge	IEEE 62.41-1991 Level B	
Isolation Voltage	≥ 2500V RMS input to output	
Mechanical		
Mounting	Surface with 2 or 4 #8 (M4 x 0.7) screws	
Dimensions	**H** 175.3 mm (6.9"); **W** 111.8 mm (4.4"); **D** 61.0 mm (2.4")	
Termination	Screw terminals with captive wire clamps for up to #12 AWG (3.2 mm^2) wire	
Environmental		
Operating/Storage Temperature	-40° to 65°C / -40° to 85°C	
Weight	≅ 25 oz (709 g)	

* Unbalance reset is 90% of the unbalance setting (i.e. VUB at 5% reset is 4.5%)

DLMU SERIES

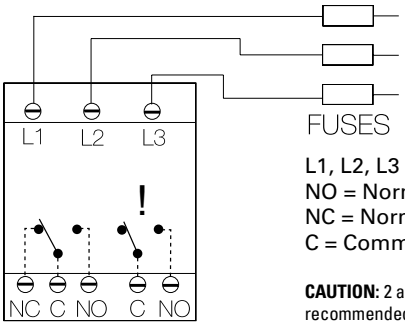
Description

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

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 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.

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

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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 — 3-phase delta or wye with no connection to neutral

Operating Voltage

200-480VAC

Range	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

600VAC

AC Line Frequency — 50/60 Hz automatically detected
Phase Loss — ≥ 25% unbalance
Response Time — ≤200ms

Undervoltage & Voltage Unbalance

Type — Voltage detection with delayed trip & automatic reset

Overvoltage
TripVoltage — 109 - 113% of the adjusted line voltage
Reset Voltage — ≅ -3% of the trip voltage

Undervoltage
Trip Voltage — 88 - 92% of the adjusted line voltage
Reset Voltage — ≅ +3% of the trip voltage
Voltage Unbalance — Adjustable 2 - 10% or specify fixed unbalance of 2 - 10% in 1% increments
Reset on balance — ≅ -0.7% unbalance

Trip Delay
Active On — Over/undervoltage, voltage unbalance, over/under frequency
Range — Adjustable from 1 - 30s or specify fixed delay 1 - 30s in 1s increments
Tolerance — ± 15%

Restart Delay
Range — Adjustable from 0.6 - 300s; if no restart delay is selected a 0.6s initialization delay applies
Tolerance — ± 15%
Over/Under Frequency — ±4%; Reset ±3%; 50/60 Hz
Phase Sequence — A, B, C, L1, L2, L3
Response Time -Phase Reversal & Phase Loss — ≤200 ms
Reset — Automatic

Output
Type — Isolated Electromechanical Relay
Form C — Isolated, SPDT
Form C Rating — 10A resistive @ 240VAC; 8A resistive @ 277VAC; NO-1/4 hp @ 120VAC; 1/3 hp @ 240VAC

Form A — Isolated, NO, SPST
Form A Rating — 2A @ 277VAC
Life — Mechanical - 1 x 10^6; Electrical - 1 x 30^3

DLMU SERIES

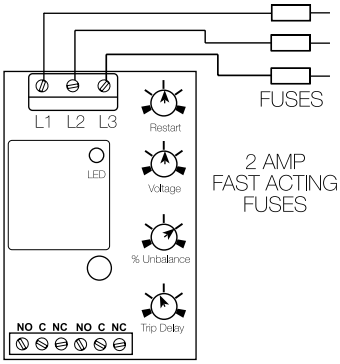
Protection	
Phase Reversal/Failure	ASME A17.1 Rule 210.6
Motors and Generators	NEMA MG1 14:30, 14:35
Surge	IEEE C62.41-1991 Level B
Isolation Voltage	≥ 2500V RMS input to output
Mechanical	
Mounting	Surface mount with 2 #8 (M4 x 0.7) screw or snap on 35mm DIN Rail *Note: 0.25 in.(6.35 mm) spacing between units or other devices is required*
Dimensions	**H** 110 mm (4.33"); **W** 75 mm (2.95"); **D** 50 mm (1.97")
Termination	Screw terminals with captive wire clamps for up to #14 AWG (2.5 mm^2) wire
Terminal Torque	4.4 in.-lbs.
Environmental	
Operating/Storage Temperature	-40° to 60°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 8.6 oz (244 g)

HLMU SERIES

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.

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.

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

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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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.

P1023-20 DIN Rail Adapter
Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

HLMU SERIES

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

Type	3-phase delta or wye with no connection to neutral
Operating Voltage	
200 - 480VAC	

Range	Voltage Adj. Range	Frequency
240	200-240VAC	50 or 60Hz
380	340-420VAC	50Hz
480	400-480VAC	60Hz

Line Voltage Max.	550VAC
AC Line Frequency	50/60 Hz automatically detected
Phase Loss	≥ 25% unbalance
Response Time	≤200ms

Undervoltage & Voltage Unbalance

Type	Voltage detection with delayed trip & automatic reset
Overvoltage	
Trip Voltage	109 - 113% of the adjusted line voltage
Reset Voltage	≅ -3% of the trip voltage
Undervoltage	
Trip Voltage	88 - 92% of the adjusted line voltage
Reset Voltage	≅ +3% of the trip voltage
Voltage Unbalance	
Trip Setpoint	Adjustable 2 - 10% or specify fixed unbalance of 2 - 10% in 1% increments
Reset on Balance	≅ -0.7% unbalance
Trip Delay	
Active On	Over/undervoltage, voltage unbalance, over/under frequency
Range	Adjustable from 1 - 30s or specify fixed delay 1 - 30s in 1s increments
Tolerance	± 15%
Restart Delay	
Range	Adjustable from 0.6 - 300s; if no restart delay is selected a 0.6s initialization delay applies
Tolerance	± 15%
Over/Under Frequency	±4%; Reset ±3%; 50/60 Hz
Phase Sequence	A, B, C, L1, L2, L3
Response Time-Phase Reversal & Phase Loss	≤200 ms
Reset	Automatic

Output

Type	Isolated Electromechanical Relay
Form	DPDT
Rating	10A resistive @ 240VAC; 8A resistive @ 277VAC; NO-1/4 hp @ 120VAC; 1/3 hp @ 240VAC
Life	Mechanical - 1 x 10^6 Electrical (at 10A) - DPDT - 1 x 30^3

Protection

Phase Reversal/Failure	ASME A17.1 Rule 210.6
Motors and Generators	NEMA MG1 14:30, 14:35
Surge	IEEE C62.41-1991 Level B
Isolation Voltage	≥ 2500V RMS input to output
Circuitry	Encapsulated

Mechanical

Mounting	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*
Dimensions	**H** 76.7 mm (3.0"); **W** 50.8 mm (2.0"); **D** 41.7 mm (1.64")
Termination	Screw terminal connection up to 12 AWG (3.3 mm^2) wire

Environmental

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

PLMU11

Voltage Monitor

8-PIN

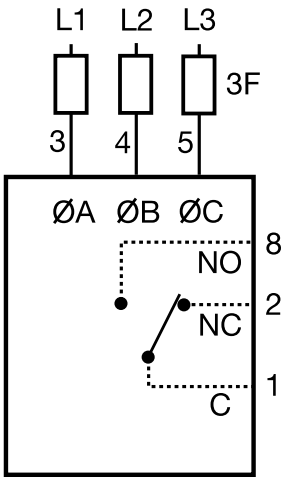
Description

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.

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.

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

PLMU11

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

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	3-phase delta or wye with no connection to neutral
Line Voltage	200 to 480VAC ±15%, 50/60 Hz ±2 Hz
Adjustable Voltage Ranges (Automatic Range Selection)	200 to 240VAC, 50/60 Hz 340 to 420VAC, 50 Hz 400 to 480VAC, 60 Hz
Maximum Voltage	552VAC
Phase Sequence	ABC
Power Consumption	≤ 5W

Overvoltage, Undervoltage, & Voltage Unbalance

Type	Voltage detection with delayed trip and automatic reset
Overvoltage & Undervoltage	
Undervoltage Trip Point	88 - 92% of adjusted line voltage
Reset Voltage	+2% of trip voltage
Overvoltage Trip Point	109 - 113% of adjusted line voltage
Reset Voltage	-2% of trip voltage
Voltage Unbalance Trip Point	Adjustable from 2 - 10%
Reset on Balance (%)	

Selected Unbalance	2	3	4	5	6	7	8	9	10
Reset	1.5	2.5	3.5	4.5	5.4	6.3	7.2	8.1	9

Trip Delay Range	Adjustable from 0.25 - 30s
Severe Unbalance - 2X Selected Unbalance	0.25 - 2s; disabled when the trip delay is less than 2s
Random Start Delay	≅ 0.6s
Phase Reversal & Phase Loss Trip Time	≤ 150ms
Phase Loss Setpoint	≥ 15% unbalance
Reset Type	Automatic
Output Type	Energized when voltages are acceptable
Type	Electromechanical relay
Form	Isolated, SPDT
Rating	10A resistive @ 240VAC; 1/4 hp @ 125VAC; 1/3 hp @ 250VAC; max. 277VAC
Life	Mechanical - 1 x 10^6 ; Electrical - 1 x 10^5

Protection

Surge	IEEE C62.41-1991 Level B
Isolation Voltage	≥ 2500V RMS input to output

Mechanical

Mounting*	Plug-in socket rated 600VAC
Termination	Octal 8-pin plug-in
Dimensions	**H** 77.0 mm (3.03"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78")

Environmental

Operating/Storage Temperature	-40° to 60°C / -40° to 85°C
Weight	≅ 8.6 oz (244 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

PLM SERIES

Voltage Monitor

8-PIN

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.

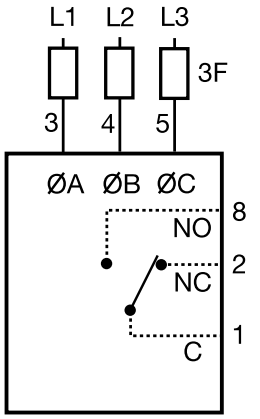
Operation

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.

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.

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

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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PLM SERIES

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

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: 3-phase delta or wye with no connection to neutral

Operating Voltage

Model	Adj. Line Voltage Range	Line Voltage Max
240	200-240VAC	270VAC
380	360-430VAC	480VAC
480	400-480VAC	530VAC

AC Line Frequency: 50/100 Hz
Phase Sequence: ABC
Power Consumption: ≅ 2W for 240V units
≅ 3W for 380 - 480V units

Low Voltage & Voltage Unbalance

Type: Voltage detection with delayed trip & automatic reset

Low Voltage
Trip: 88 - 92% of adjusted line voltage
Reset Voltage: Plus 3% of trip voltage

Voltage Unbalance
Trip: Factory fixed from 4 - 8%
Reset on Balance: -0.7% unbalance typical

Trip Delay
Range: Factory fixed from 2 - 20s
Tolerance: ±15%

Phase Reversal & Phase Loss

Response Time: ≤ 200ms
Phase Loss: > 35% unbalance
Reset: Automatic

Output

Type: Electromechanical relay
Form: Isolated, SPDT
Rating: 10A resistive @ 240VAC, 277VAC max; 1/2 Hp @ 240VAC; 1/4 Hp @ 120VAC
Life: Mechanical - 1 x 10^7; Electrical - 1 x 10^5

Protection

Surge: IEEE C62.41-1991 Level B
Isolation Voltage: ≥ 2500V RMS input to output

Mechanical

Mounting*: 8-pin plug-in socket rated 600VAC
Dimensions: **H** 81.3 mm (3.2"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78")

Environmental

Operating/Storage Temperature: -40° to 60°C / -40° to 85°C
Weight: ≅ 4.4 oz (125 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

TVW SERIES

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

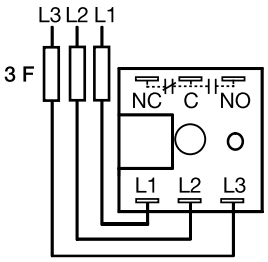
Upon application of line voltage, the restart delay begins. The output is de-energized during restart delay. Under normal conditions, the output energizes after the restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for the complete trip delay period before the output de-energizes. 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.

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.

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

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

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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.

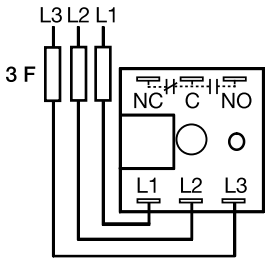
VRM6048 Voltage Reduction Module
Allows the voltage monitor to monitor a 3-phase 550 to 600VAC Line.

Specifications

Line Voltage	
Type	3-phase delta or wye with no connection to neutral
Input Voltage/Tolerance	208 to 480VAC in 4 ranges/-30% - 20%
AC Line Frequency	50 - 100 Hz
Phase Sequence	ABC
Power Consumption	Approx. 2W for 240V units Approx. 3W for 480V units
Overvoltage, Undervoltage, & Voltage Unbalance	
Overvoltage & Undervoltage	Voltage detection with delay trip & automatic reset
Undervoltage Trip Point	88 - 92% of the selected line voltage
Reset Voltage	≅ +3% of trip voltage
Overvoltage Trip Point	109 - 113% of the selected line voltage
Reset Voltage	≅ -3% of trip voltage
Trip Variation vs Temperature	≤ ±2%
Voltage Unbalance	Factory fixed, from 4 - 10%
Reset On Balance	≅ -0.7% unbalance
Trip Delay Range	Fixed from 0.2 - 100s ±15% or ±0.1s, whichever is greater
Restart Delay Range	Fixed from 0.4s - 999m ±15% or ±0.2s, whichever is greater
Phase Reversal & Phase Loss Response	≤ 200ms; automatic reset
Phase Loss	≥ 25% unbalance
Output	
Type	Isolated, SPDT
Rating	
208 to 240VAC (55°C)	10A resistive @ 125VAC, 5A @ 250VAC, 1/4 hp @ 125VAC
380 to 480VAC	10A resistive @ 240VAC, 1/4 hp @ 125VAC, 1/3 hp @ 250VAC, max. voltage 277VAC
Life	Mechanical - 1 x 10^6; Electrical - 1 x 10^5
Protection	
Phase Reversal/Failure	ASME A17.1 Rule 210.6
Motors and Generators	NEMA MG1 14:30, 14:35
Surge	IEEE C62.41-1991 Level B
Dielectric Breakdown	
208 to 240VAC	≥ 1500V RMS input to output terminals
380 to 480VAC	≥ 2500V RMS input to output terminals
Mechanical	
Mounting	Surface mount with one #8 (M5 x 0.8) screw
Dimensions	**H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 31.75 mm (1.25")
Termination	0.25 in. (6.35 mm) male quick connect terminals
Environmental	
Operating/Storage Temperature	-40° to 55°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 2.8 oz (79 g)

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

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

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	3-phase delta or wye with no connection to neutral
Input Voltage	208 to 480VAC
AC Line Frequency	50 - 100 Hz
Phase Sequence	ABC
Power Consumption	Approx. 2W for 240V units Approx. 3W for 480V units

Overvoltage, Undervoltage, & Voltage Unbalance

Overvoltage & Undervoltage	Voltage detection with delay trip & automatic reset
Undervoltage Trip Point	88 - 92% of the selected line voltage
Reset Voltage	≅ +3% of trip voltage
Overvoltage Trip Point	109 - 113% of the selected line voltage
Reset Voltage	≅ -3% of trip voltage
Trip Variation vs Temperature	≤ ±2%
Voltage Unbalance	Factory fixed from 4 - 10%
Reset On Balance	≅ -0.7% unbalance
Trip Delay Range	Fixed from 0.2 - 100s ±15% or ±0.1s, whichever is greater
Restart Delay Range	Fixed from 0.5s - 999m ±15% or ±0.2s, whichever is greater
Phase Reversal & Phase Loss Response	≤ 200ms; automatic reset
Phase Loss	≥ 25% unbalance

Output

Type	Isolated SPDT relay contacts
Rating	
208 to 240VAC (55°C)	10A resistive @ 125VAC, 5A @ 250VAC, 1/4 hp @ 125VAC
380 to 480VAC	10A resistive @ 240VAC, 1/4 hp @ 125VAC, 1/3 hp @ 250VAC, max. voltage 277VAC
Life	Mechanical - 1 x 10^6; Electrical - 1 x 10^5

Protection

Phase Reversal/Failure	ASME A17.1 Rule 210.6
Motors and Generators	NEMA MG1 14:30, 14:35
Surge	IEEE C62.41-1991 Level B
Dielectric Breakdown	
208 to 240VAC	≥ 1500V RMS input to output terminals
380 to 480VAC	≥ 2500V RMS input to output terminals

Mechanical

Mounting	Surface mount with one #8 (M5 x 0.8) screw
Dimensions	**H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 31.75 mm (1.25")
Termination	0.25 in. (6.35 mm) male quick connect terminals

Environmental

Operating/Storage Temperature	-40° to 55°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 2.8 oz (79 g)

PLR SERIES


8-PIN

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.

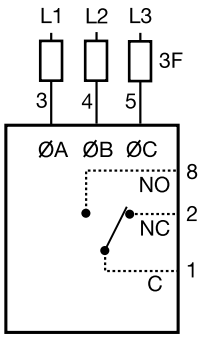
Operation

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.

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.

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

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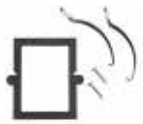
PLR SERIES

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.

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	3-phase delta or wye with no connection to neutral

Nominal Voltage	**Undervoltage Dropout Adj. Range**	**Line Voltage Max.**
120VAC	85 to 130VAC	143VAC
240VAC	170 to 240VAC	270VAC
380VAC	310 to 410VAC	480VAC
480VAC	350 to 480VAC	530VAC

AC Line Frequency	50/60Hz
Phase Sequence	ABC
Response Times	
Pull-in	≤ 400ms
Drop-out	≤ 100ms
Hysterisis	
Pull-in/Drop-out	≅ 2%
Output	
Type	Electromechanical relay, energized when all voltages are acceptable
Form	SPDT
Rating	5A resistive @ 240VAC, 1/4 Hp @ 120VAC
Maximum Voltage	250VAC
Protection	
Phase Reversal/Failure	ASME A17.1 Rule 210.6
Motors and Generators	NEMA MG1 14:30, 14:35
Surge	IEEE C62.41-1991 Level B
Isolation Voltage	
120 & 240VAC	≥ 1500V RMS input to output
380 & 480VAC	≥ 2500V RMS input to output
Mechanical	
Dimensions	**H** 81.3 mm (3.2"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78")
Mounting*	Plug-in socket
Termination	Octal 8-pin, plug-in
Environmental	
Operating/Storage Temperature	0° to 55°C / -40° to 85°C
Weight	≅ 6 oz (170 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

PLS SERIES

8-PIN

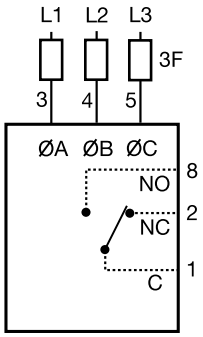
Description

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.

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 513, Figure 33.

Features & Benefits

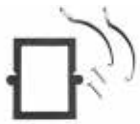
FEATURES	BENEFITS
Continuous monitoring	Cost effective protection of 3-phase equipment and operators from reverse rotation. Meets reverse rotation protection code requirements.
Universal motor compatibility	Designed to be compatible with motor overloads or other 3-phase equipment protection devices
Industry 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

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

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.

PLS SERIES

Specifications

Line Voltage

Type 3-phase delta or wye with no connection to neutral

Nominal Voltage	Minimum Voltage	Maximum Voltage
120VAC	95VAC	135VAC
208/240VAC	175VAC	255VAC
380/415VAC	310VAC	430VAC
440/480VAC	380VAC	500VAC

AC Line Frequency 50/60Hz
Phase Sequence ABC

Response Times

Pull-in ≤ 300ms
Drop-out ≤ 50ms

Output

Type Electromechanical relay, energized when the phase sequence is correct
Form Isolated SPDT
Rating
120 & 240VAC 10A resistive @ 240VAC
380 & 480VAC 8A resistive @ 240VAC
Maximum Voltage 250VAC

Protection

Isolation Voltage
120 & 240VAC ≥ 1500V RMS input to output
380 & 480VAC ≥ 2500V RMS input to output

Mechanical

Mounting* Plug-in socket
Dimensions **H** 81.3 mm (3.2"); **W** 60.7 mm (2.39"); **D** 45.2 mm (1.78")
Termination Octal 8-pin plug-in

Environmental

Operating/Storage Temperature -40°to 55°C / -40° to 85°C
Weight ≅ 6 oz (170 g)

*CAUTION: Select an octal socket rated for 600VAC operation.

HLVA6I23

Single-Phase Monitor

Description

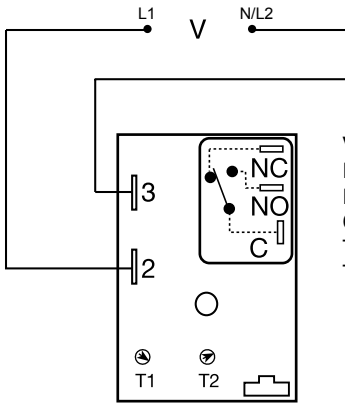
The HLVA6I23 is a single-phase undervoltage monitor designed to protect sensitive equipment from brownout or undervoltage conditions. Time delays are included to prevent nuisance tripping and short cycling. The 30A, 1hp rated, SPDT relay contacts allow direct control of motors, solenoids and valves. 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 de-energizes. 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.

Wiring Diagram



V = Voltage
NO = Normally Open
NC = Normally Closed
C = Common
T1 = Undervoltage Trip Point
T2 = Restart Delay

For dimensional drawing see: Appendix, page 512, Figure 17.

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

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.

C103PM (AL) DIN Rail
35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.

P1023-6 Mounting bracket
The 90° orientation of mounting slots makes installation/removal of modules quick and easy.

P1023-20 DIN Rail Adapter
Allows module to be mounted on a 35 mm DIN type rail with two #10 screws.

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.

HLVA6I23

Specifications

Input

Min & Max RMS Voltage	70 to 264VAC
AC Line Frequency	50/60 Hz
Power Consumption	AC ≤ 4VA

Undervoltage Sensing

Type	Peak voltage sensing
Ranges	
(4)	70 to 120VAC
(6)	170 to 220VAC
Pull-In Voltage	105% or trip point voltage
Trip Point Accuracy	± 3% of trip point

Time Delay

Restart Delays	3 - 300s adjustable
Trip Delay	1 - 20s fixed in 1s increments
Repeat Accuracy	±0.5% or 20ms, whichever is greater
Tolerance (Factory Calibration)	±5%
Reset Time	≤ 150ms
Time Delay vs. Temp. & Voltage	≤ ±10%

Output

Type	Electromechanical relay		
Form	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 10^6		
	Electrical - 1 x 10^5, *3 x10^4, **6,000		

Protection

Surge	IEEE C62.41-1991 Level A
Circuitry	Encapsulated
Isolation Voltage	≥ 1500V RMS input to output; isolated units
Insulation Resistance	≥ 100 MΩ

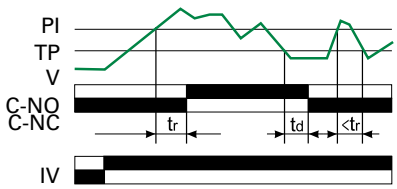
Mechanical

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 connects

Environmental

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

KVM SERIES

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.

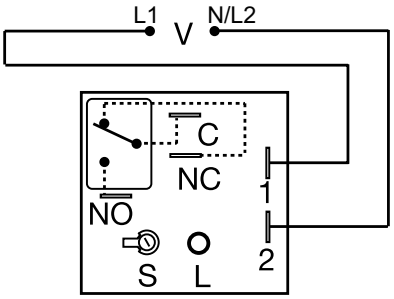
Operation

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

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.

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.

Ordering Information

MODEL	MAXIMUM LINE VOLTAGE	UNDERVOLTAGE SETPOINT
KVM4	132VAC	Adjustable, 78 to 99VAC
KVM6	264VAC	Adjustable, 156 to 199VAC

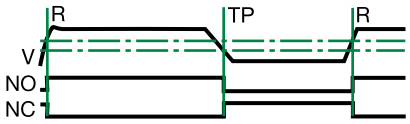
If you don't find the part you need, call us for a custom product 800-843-8848

KVM SERIES

Specifications

Line Voltage	
Type	Single phase
Input Voltage	110 to 120VAC or 220 to 240VAC
AC Line Frequency	50/60 Hz
Power Consumption	2.5W @ 132VAC; 4.5W @ 264VAC
Power Off Reset Time	≤ 150ms
Undervoltage Detection	
Undervoltage Setpoint	
KVM4	78 to 99VAC
KVM6	156 to 199VAC
Undervoltage Reset Point	
KVM4	Fixed at 104VAC
KVM6	Fixed at 209VAC
Repeatability	± 0.5% under fixed conditions ±1% over temperature range
Voltage Sensing Accuracy	±2% at 25°C
Output	
Type	Electromechanical relay
Form	SPDT
Rating	8A resistive @ 120VAC, 1/3 hp @ 120/240VAC
Life	Mechanical - 1 x 10^6; Electrical - 1x10^5
LED Indicator	Glows green when output is energized
Protection	
Surge	IEEE C62.41-1991 Level A
Circuitry	Encapsulated
Isolation Voltage	≥ 1500V RMS input to output
Insulation Resistance	≥ 100 MΩ minimum
Mechanical	
Mounting	Surface mount with one #10 (M5 x 0.8) screw
Dimensions	**H** 50.8 mm (2.0"); **W** 50.8 mm (2.0"); **D** 30.7 mm (1.21")
Termination	0.25 in. (6.35 mm) male quick connect terminals
Environmental	
Operating /Storage Temperature	-25 to 55°C / -40 to 85°C
Humidity	95% relative, non-condensing
Weight	2.6 oz (74 g)

Function Diagram



TP = Undervoltage Setpoint
R = Reset Point