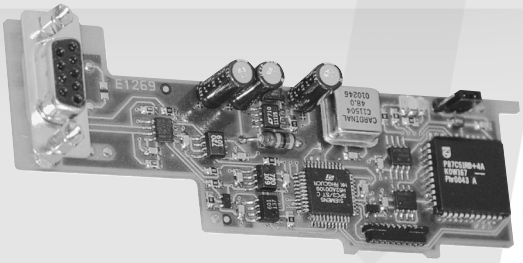
ACCESSORIES



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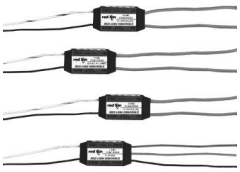
QUICK Specs

Accessories

	POWER SUPPLIES			SIGNAL CONVERSION
	DIN RAIL	**APS**	**MLPS**	**VCM / TCM / LCM**
				
Description	DIN Rail Mounted, 1 Amp, 2 Amp and 4 Amp	Plug-in Socket, 12 VDC and 24 VDC	Micro-line Power Supply	Signal Converter Modules
Dimensions	99 mm (H) x 115 mm (D) 23 mm (W) (1 Amp) 45 mm (W) (2 Amp) 68 mm (W) (4 Amp)	90 mm (H) x 61 mm (W) x 51 mm (D) w/socket	47 mm (H) x 68 mm (W)	12 mm (H) x 18 mm (W) x 39 mm (D) 6" leads
Input	N/A	N/A	N/A	4 to 270 VAC (VCM) 115 VAC (TCM) 3 to 28 VDC (LCM)
Output	24 VDC @ 1, 2 and 4 Amps	Unregulated 12 VDC (APS) Unregulated 24 VDC with 20 mA Current Sources (APSIS)	12 VDC (MLPS1) 24 VDC (MLPS2)	NPN O. C. (VCM, TCM) +3 V Bi-Polar (LCM)
Recommended Application	General Use	General Use	For use with CUB4, CUB5, and DT8 Models, Model Dependent	N/A
Power Source	85 to 264 VAC 90 to 350 VDC	115 VAC 230 VAC	85 to 250 VAC	Powered from signal (VCM, TCM) 5 to 28 VDC (LCM)
Page Number	Page 943	Page 945	Page 949	Page 951

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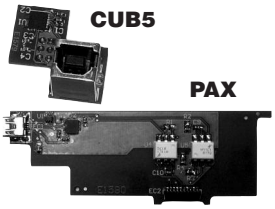
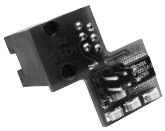
QUICK Specs

Accessories

	RELAYS	LABEL KITS	OPTION MODULES	
	RLY		USB PROGRAMMING	CUB5 COMMS
				
Description	Solid State Relays	Label Kits for PAX Analog, PAX Lite, and LPAX Displays	USB Programming Cards for CUB5 and PAX Series	CUB5 Comms Module, RS485
Dimensions	Model Dependent	N/A	N/A	N/A
Input	Control Rating 4 to 28 VDC, Model Dependent	N/A	N/A	N/A
Output	Output Rating 0 to 45 Amp or 48 to 660 VAC, Model Dependent	N/A	N/A	RS485
Recommended Application	Allows low level DC control signal to switch high level AC current or voltage devices	Display engineering units on specific meters	Programming only	Provides communication from the CUB5 Meters
Power Source	N/A	N/A	N/A	N/A
Page Number	Page 954	Page 960	Page 962/968	Page 964

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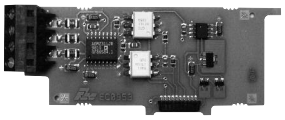
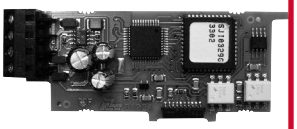
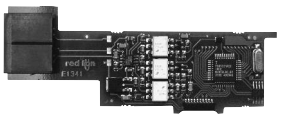
Accessories

OPTION MODULES

	PAX COMMS	PAX DEVICENET	PAX MODBUS	PAX PROFIBUS
				
Description	PAX Comms Module, RS232/485	PAX Comms Module, DeviceNet	PAX Comms Module, Modbus	PAX Comms Module, Profibus
Dimensions	N/A	N/A	N/A	N/A
Input	N/A	N/A	N/A	N/A
Output	RS232/485	DeviceNet	Modbus	Profibus
Recommended Application	Provides communication from the PAX Meters	Provides communication from the PAX Meters	Provides communication from the PAX Meters	Provides communication from the PAX Meters
Power Source	N/A	N/A	N/A	N/A
Page Number	Page 970	Page 975	Page 979	Page 985

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QUICK Specs

Accessories

OPTION MODULES

	PAX SETPOINT	PAX ANALOG
		
Description	PAX Setpoint Module	PAX Analog Output Module
Dimensions	N/A	N/A
Input	N/A	N/A
Output	Dual Form C Quad Form A Quad Sinking Quad Sourcing	4 to 20 mA or 0 to 10 VDC
Recommended Application	Provides setpoint outputs from the PAX Meters	Provides analog retransmitted output from the PAX Meters
Power Source	N/A	N/A
Page Number	Page 989	Page 991

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MODEL PSDR - 24 V POWER SUPPLIES @ 1, 2, or 4 A

DESCRIPTION

The compact PSDR power supplies are industrial input voltage supplies with primary switched-mode regulator technology. They feature low output ripple and adjusted output voltage from 22.5 to 28.5 VDC. The output is electronically protected against overloads and short circuits.

The modules snap onto standard 35 mm flat DIN rails and use removable terminal blocks for easy wiring.

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SPECIFICATIONS

1. **POWER REQUIREMENTS**:
   Nominal Input Voltage: 100 to 240 VAC
   Input Voltage Range: 85 to 264 VAC or 90 to 350 VDC
   Current Consumption at nominal input voltage:
   PSDR0100: 0.5 A to 0.2 A @ 100 to 240 VAC, 0.4 to 0.1 A @ 90 to 350 VDC
   PSDR0200: 0.82 A to 0.33 A @ 100 to 240 VAC, 0.65 to 0.19 A @ 90 to 350 VDC
   PSDR0400: 1.8 A to 0.7 A @ 100 to 240 VAC, 1.3 to 0.4 A @ 90 to 350 VDC
2. **FREQUENCY**: 50 to 60 Hz
3. **INPUT RECOMMENDED BACKUP FUSE**:
   Power Circuit Breaker: 6 A or 10 A
   Characteristic: B (EN 60898)
4. **SURGE VOLTAGE PROTECTION**: Varistor
5. **POWER OUTPUT**: Nominal value of 24 VDC ±1%. Adjustable from 22.5 to 28.5 VDC via potentiometer
6. **EFFICIENCY AT 230 VAC AND NOMINAL VALUES**: > 80 %
7. **ENVIRONMENTAL CONDITIONS**:
   Operating Temperature Range: -25 to 60°C
   Storage Temperature: -40 to 85°C
   Humidity, no moisture condensation: 95 % at 25°C
   Vibration in acc. with IEC 68-2-6: < 15 Hz, amplitude ±2.5 mm; 15 Hz - 150 Hz, 2.3 g
   Shock in all directions acc. with IEC 68-2-27: 30 g
   Contamination in acc. with EN 50178: Degree of pollution 2
8. **STANDARDS AND CERTIFICATIONS**:

Electrical Safety (of information technology equipment)	EN 60950 / VDE 0805 c UL us UL Recognized UL 60 950
Industrial regulating devices	c UL us LISTED UL 508 listed
Electronic equipment for use in electrical power installations (surge voltage category III)	EN 50178 / VDE 0160
Limitation of output power	NEC Class 2
Safe isolation	VDE 0100-410
Protection against electric shock	DIN VDE 0106-101

CE In conformance with EMC guideline 89/336/EEC and low-voltage directive 73/23/EEC

EMC (Electromagnetic compatibility)
Immunity in accordance with EN 61000-6-2

Discharge of static electricity (ESD)	EN 61000-4-2 [2]	Housing > Level 3 Contact discharge: 8 kV Discharge in air: 8 kV
Electromagnetic HF field	EN 61000-4-3 [1]	Housing Level 3 Frequency/Field intensity: 80-1000 MHz / 10 V/m
Fast transients (Burst)	EN 61000-4-4 [2]	Input: 4 kV (Level 4) [4] Output: 2 kV (Level 3) [4] Signal: 1 kV (Level 2) [4]
Surge voltage capacities (Surge)	EN 61000-4-5 [2]	Input: 4 kV [4] / 2 kV [4] (Level 4) Output: 0.5 kV [4] / 0.5 kV [3] (Level 1) Signal: 0.5 kV [4] (Level 1)
Conducted disturbance	EN 61000-4-6 [1]	I/O/S: Level 3 Frequency/U_0: 0.15-80 MHz / 10 V
Voltage dips	EN 61000-4-11 [2]	Input: see mains buffering > 20 ms
Simulation mobile phones	ENV 50204	Frequency: 900 MHz, 1800 MHz Field intensity: 20 V/m

Noise emission according to EN 50081-2

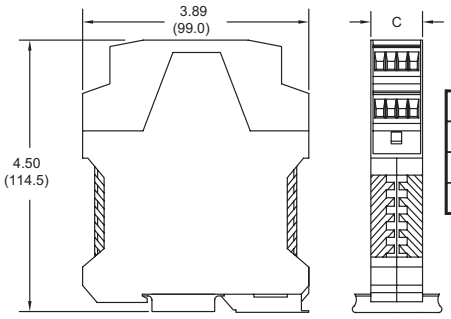
Emitted radio interference	EN 55011 (EN 55022) Class B [5]
Radio interference voltage	EN 55011 (EN 55022) Class B [5]

EN 55011 corresponds to CISPR11 / EN 55022 corresponds to CISPR22
EN 61000 corresponds to IEC 1000

[1] Criterion A:	Normal operating behavior within the defined limits.
[2] Criterion B:	Temporary impairment to operational behavior, that is corrected by the device itself.
[3] Symmetrical:	Conductor to conductor.
[4] Asymmetrical:	Conductor to ground.
[5] Class B:	Area of application industry and residential.

9. **ISOLATION VOLTAGE**: Input/Output 3 kVAC
10. **INSTALLATION POSITION**: On horizontal mounting rail according to EN 50022-35
11. **CONNECTIONS**: 24 to 14 AWG max. Torque 4.5 to 5.3 inch-lbs (0.5-0.6 Nm).
12. **MOUNTING**: Standard DIN rail top hat (T) profile rail according to EN50022 - 35 X 7.5 and 35 X 15. Can be mounted in rows with vertical Spacing > 5 cm or horizontally with no space.
13. **CONSTRUCTION**: Case body is black, high impact plastic. IP20 touch safe. Protection Class II.
14. **MTBF** (Mean Time Between Failure): >500000 h in acc. with IEC 1709 (SN 29500)
15. **WEIGHT**:
    PSDR0100: 7.4 oz. (210 g)
    PSDR0200: 8.8 oz. (250 g)
    PSDR0400: 14.1 oz. (400 g)

DIMENSIONS In inches (mm)



MODEL	C
PSDR0100	0.87 (22.5)
PSDR0200	1.77 (45)
PSDR0400	2.66 (67.5)

Connection and Operation Instructions

Caution: Danger! Never work on live equipment!
Caution: When the device is opened, a dangerous voltage may remain at the electrolytic capacitors for up to 2 minutes after shutdown!

The installation must be performed by a specialist in accordance with the requirements of EN 60950.

For vertical installations we recommend a minimum spacing of 5 cm (1.97 in.) between other modules and this power supply to ensure sufficient convection.

No minimum spacing is required for horizontal alignment.

The mains feed line must have an appropriate fixing or strain relief outside of the device.

The supply-side installation and the connection via screw terminal blocks must be done in a way that ensures protection against electric shock.

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PROTECTION

The device must be installed in accordance with the specifications of EN 60950.

It must be possible to switch off the device using a suitable disconnecting device outside the power supply. For example, primary side line protection could be used.

In case of DC applications it is necessary to connect in series an adequate fuse.

RAIL MOUNTING

The power supply unit can be snapped onto all mounting rails in accordance with EN 50022-35. Installation should be made horizontally (input terminal blocks below).

CABLE CONNECTION

The device is equipped with COMBICON plug connectors.

This easy-to assemble connection method allows devices to be exchanged easily and the electrical connection to be visibly isolated.

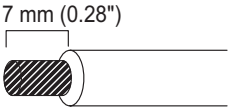
Connecting Cables:

Cable cross sections from 0.2 to 2.5 mm^2 rigid (solid)/flexible (stranded) (AWG 24-14) may be used.

To maintain UL, use copper cable rated for an operating temperature of 75°C/170°F.

For Reliable And Touch-proof Contacts:

Strip the connection ends (7 mm - See Figure).



ORDERING INFORMATION

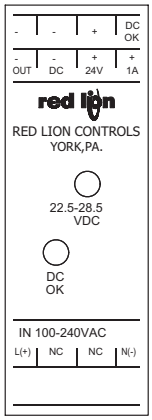
MODEL NO.	OUTPUT	PART NUMBER
PSDR1	24 VDC @ 1A	PSDR0100
PSDR2	24 VDC @ 2A	PSDR0200
PSDR4	24 VDC @ 4A	PSDR0400

INPUT

The input connection is made by the screw connections "L(+)" and "N(-)" (torque 0.5 Nm) on the COMBICON plug connection.

For device protection, there is an internal fuse. Additional device protection is not necessary.

Recommended backup fuses are power circuit-breakers 6 A or 10 A, charactistic B (or identical function). In DC applications, a suitable backup fuse must be wired in.



If the internal fuse is triggered, there is most probably a malfunction in the device. In this case, the device must be inspected in the factory!

OUTPUT

The 24 VDC connection is made by the screw connections "+" and "-" (torque 0.5 Nm) on the COMBICON plug connection. At the time of delivery, the output voltage is 24 VDC. The output voltage can be set from 22.5 to 28.5 VDC on the potentiometer.

The device is electronically protected against short circuits and idling. In the event of an error, the output voltage is limited to max 35 VDC.

Function Monitoring

For function monitoring, there is the active DC OK switching output and the DC OK LED.

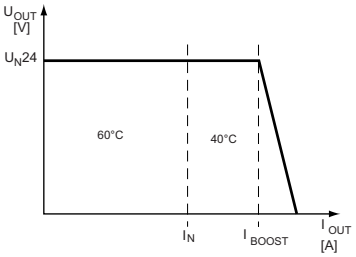
The 24 VDC signal is measured between the "DC OK" and "-" connection terminal blocks and can be loaded with 20 mA maximum. This signal output indicates that the output voltage has fallen below 21.5 VDC when "active high" changes to "low".

The DC OK signal is isolated from the power output.

	STATUS 1	STATUS 2
Green LED " DC OK"	on	off
Active DC OK switching output	U = +24 V (in reference to "-")	U = 0 V (in reference to "-")
Status	Normal operation of the power supply. U_{OUT} > 21.5 V	$U_{OUT} \leq 21.5$ V • Secondary consumer short-circuit or overload • No mains voltage or device faulty

Output Characteristic Curve

The device functions following the U-I characteristic curve. Under load, the operating point follows this curve. In the event of a short circuit or overload, the output current is limited to I_{BOOST}. The secondary voltage is reduced until the short circuit on the secondary side has been remedied.



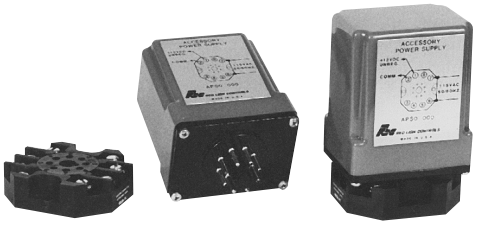
	I_N	I_{BOOST}
PSDR0100	1	1.3
PSDR0200	2	4
PSDR0400	4	6

Thermal Behavior

In the case of ambient temperatures above +60ºC, the output capacity has to be reduced by 2.5% per Kelvin increase in temperature.

From +70°C or a thermal overload, the device reduces the output power for its own protection, and returns to normal operation when it has cooled down.

MODEL APS - OCTAL PLUG-IN ACCESSORY POWER SUPPLY



PROVIDES . . .

- *+12 VDC "HELPER" SUPPLY FOR LOAD SHARING WITH UNREGULATED COUNTER SYSTEMS WITH UNUSUAL SENSOR AND ACCESSORY LOADS, OR . . .*
- *"STAND-ALONE" APPLICATIONS FOR POWERING SENSORS AND ACCESSORIES*

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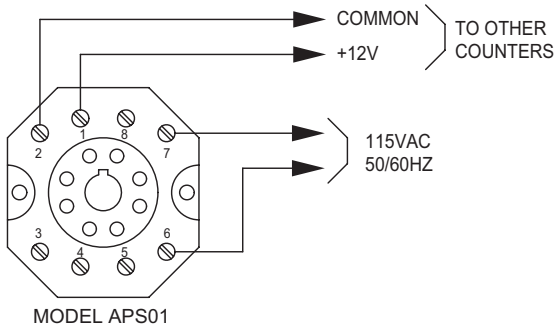
DESCRIPTION

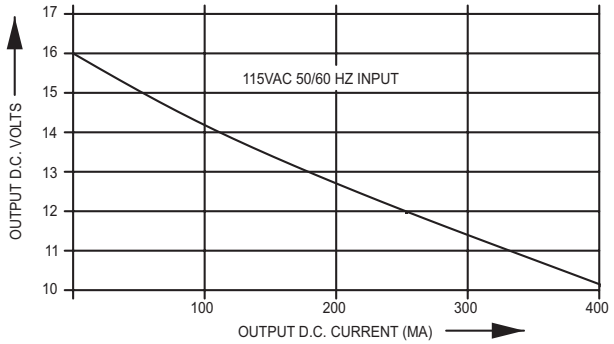
The Model APS is an unregulated +12 VDC supply designed to load share when connected in parallel with internal power supplies of many Red Lion Controls Counters and Rate Indicators. It can also be used as a general purpose "Stand-alone" power supply to power other control circuits, sensors and accessories. The APS is designed for 115 VAC ±10%, 50/60 Hz primary supply. Operating temperature range is -20° to +50°C. Output current is per regulation curve.

TYPICAL CONNECTION DIAGRAM

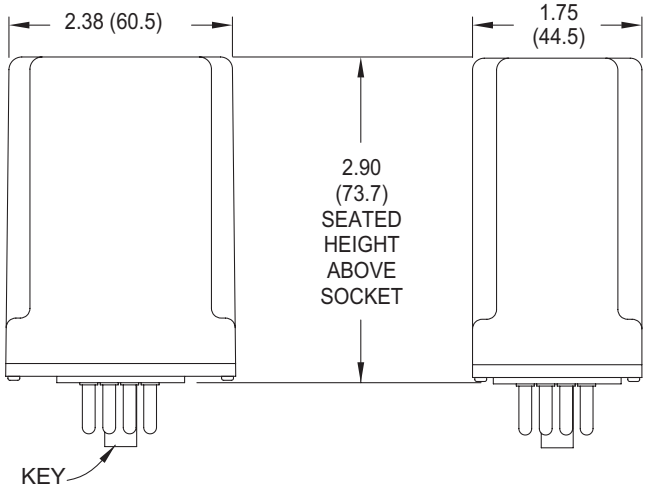


MODEL APS01

OUTPUT VOLTS/CURRENT REGULATION CURVE



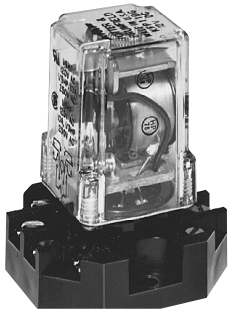
DIMENSIONS In inches (mm)



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
APS01	115 VAC Accessory Power Supply	APS01000
SKT1	Base Mount 8-pin Octal Socket	SKT10000
--	DIN Rail 8-pin Socket	SKTDIN00

ACCESSORY PLUG-IN RELAY



PLUG-IN RELAYS PROVIDED FOR EASY SERVICING & MAINTENANCE

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ORDERING INFORMATION

DESCRIPTION	COIL VOLTAGE	PART NUMBER
DPDT Plug-in Relay	12 VDC	RLY10000
	115 VAC	RLY30000
Base Mount 8-pin Octal Socket		SKT10000
DIN Rail 8-pin Socket		SKTDIN00

These industrial relays have a mechanical life expectancy in excess of 10 million cycles, and are both UL and CSA recognized.

RELAY SPECIFICATIONS

COIL: 12 VDC Coil - 120 Ω ±10%,
Rated +12 VDC @ 100 mA.
115 VAC Coil - 2250 Ω ±10%,
Rated 115 VAC @ 52 mA.

CONTACTS: 10 A @ 115 and 230 VAC
(1/6 HP @ 115 V, 1/3 HP @ 230 VAC)

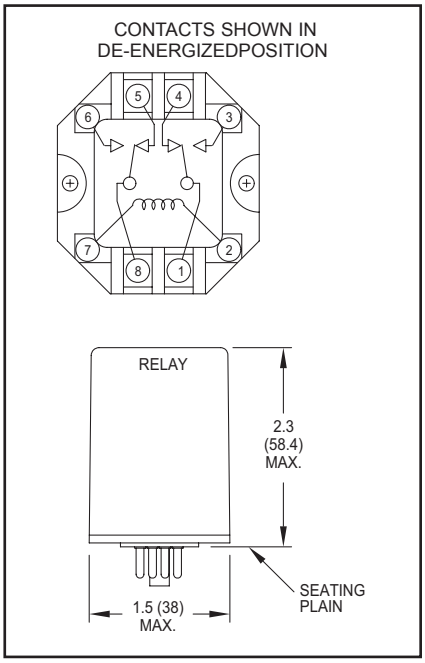
OPERATING TIMES:
Energize - 30 msec max.
De-energize - 30 msec max.
Operating times do not include bounce time *(approx. 3 msec)*.

OPERATING TEMPERATURE RANGE:
-45° to +60°C

ELECTRICAL LIFE: In excess of 100,000 operations @ rated load.

WEIGHT: 3 oz *(85.1 g)*

Mating sockets sold separately. See Ordering Information.



MODEL APSIS - Octal Plug-in Accessory Power Supply With 20 mA Current Sources

PROVIDES...

- *24 VDC UNREGULATED "HELPER" SUPPLY FOR LOAD SHARING WITH OTHER 24 VOLT SYSTEMS WITH UNUSUAL SENSOR AND ACCESSORY LOADS OR...*
- *"STAND-ALONE" APPLICATIONS FOR POWERING +24 VDC SENSORS AND ACCESSORIES OR...*
- *TWO 20 mA CURRENT SOURCES, EACH CAPABLE OF SUPPLYING 20 mA OF CURRENT FOR SERIAL COMMUNICATION LOOPS AND POWERING UP TO 16 UNITS PER LOOP.*

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DESCRIPTION

The Model APSIS is a convenient plug-in unregulated +24 VDC power supply designed to *"load share"* when connected in parallel with other +24 VDC unregulated systems with unusual power requirements due to sensor or accessory loading *(see Fig.1)*. It can also be used as a general purpose stand-alone supply to power +24 VDC control circuits, sensors and accessories *(see Fig.2)*. In addition, two 20 mA Current Source outputs are available, each capable of powering up to 16 Serial Communications units *(see Fig.3)*. The APSIS is available in 115 and 230 VAC ±10%, 50/60 Hz. primary supply *(see Ordering Information)*. Operating temperature range is -20°C to +50°C.

SPECIFICATIONS

1. **POWER SOURCE**: 2 versions, 115 VAC or 230 VAC ±10%, 50/60 Hz., 11 VA max. *(see Ordering Information)*.
2. **POWER OUTPUT**: +24 VDC unregulated @ 200 mA max. current*, Ripple = 1.5 V P-P max.
3. **OUTPUT**: Two 20 mA current sources, each capable of supplying 20 mA of current for serial communication loops and powering up to 16 units per loop.
4. **OPERATING TEMPERATURE**: -20°C to +50°C (-4°F to +122°F)

* *Maximum available output current derates to 175 mA with 1 source active and 150 mA max. with both sources active.*

TYPICAL LOAD SHARING CONNECTION DIAGRAM

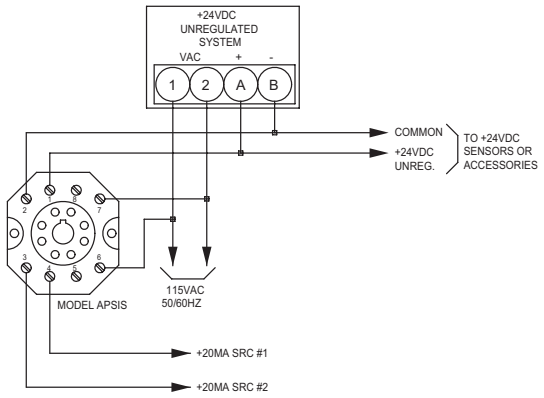
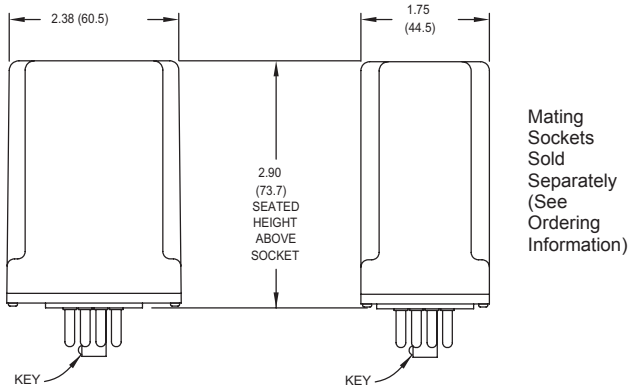


FIGURE 1

DIMENSIONS In inches (mm)



TEMPERATURE MONITORING SYSTEM

A temperature monitoring process requires both remote and control room indicators and datalogging capabilities. An RTD *(Resistance Temperature Detector)* to 4 to 20 mA Transmitter, provides a proportional 4 to 20 mA output from the RTD input. Two Red Lion Controls *"Loop Powered Process Indicators" (Model LPPI)* are installed in series in the *"Loop"* and scaled to provide Local and Remote temperature displays. A Datalogger is also placed in the *"Loop"* to provide a hard-copy of process temperatures. Each device in the *"Loop"* has an associated *"voltage drop"* as follows: RTD Transmitter = 9 VDC drop; LPPI = 3 VDC x 2 units = 6 VDC drop; Datalogger = 5 VDC drop. The total voltage drops in the *"Loop"* = 20 VDC. Therefore, RLC's Model APSIS, with its +24 VDC Supply, is used to power this process *"Loop"*.

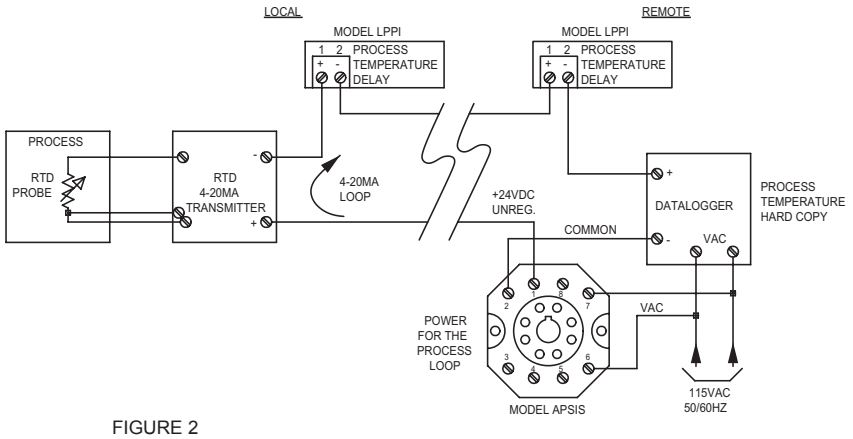


FIGURE 2

PROCESS MONITORING SYSTEM

8 Apollo Thermocouples *(APLTC)* and 8 GEMINIs, all with isolated 20 mA Current Loop Serial Communications, monitor and control processes within a plant. All units, which are located in different areas of the plant, are tied together in series in two *"Loops" (one Transmit Tx, the other Receive Rx)* and are connected to a Central Computer located in another area of the plant. Since there are more than 7, and no more than 16 units in the *"Loop"*, the APSIS +20 mA Current Source Outputs are used to power each *"Loop". (Both Apollo Thermocouple and Gemini units can power up to 7 units in a "Loop" when using their internal 20 mA sources. However, their sources may not be tied together to power more than 7 units.)* Each unit is assigned a different address number and the same Baud rate *(see appropriate APLTC or Gemini data sheet)*. An application program is written which allows the Central Computer to send and retreive data from any APLTC or Gemini.

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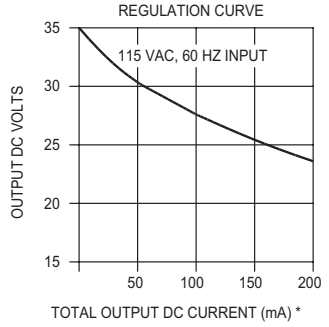
OUTPUT VOLTS/CURRENT



*Unregulated output +(2) 20 mA current sources (if used).

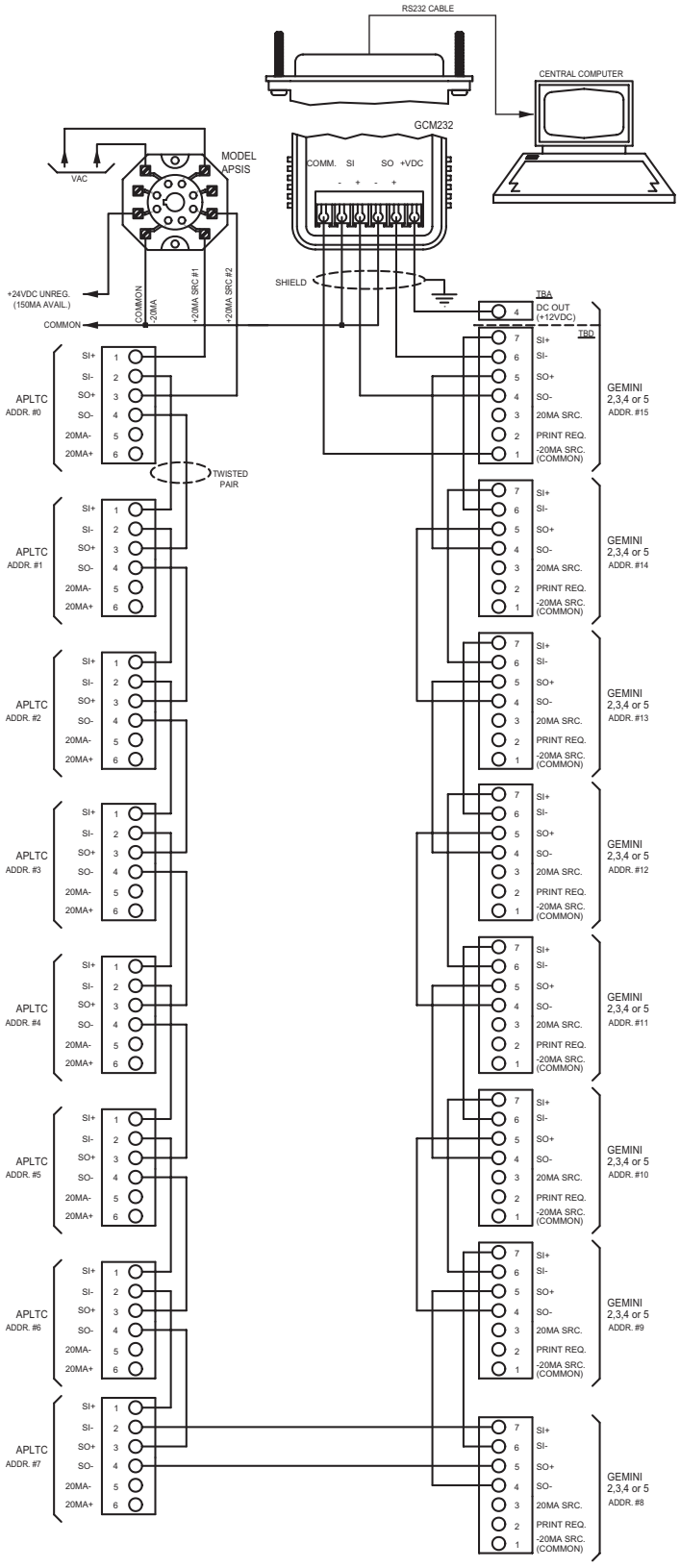


FIGURE 3

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES	
		230 VAC	115 VAC
APSIS	Accessory Power Supply- Current Source	APSIS010	APSIS000
—	Base Mount, 8-Pin Octal Socket	SKT10000	
—	Din Rail Mount, 8-Pin Octal Socket	SKTDIN00	

MODEL MLPS1 and MLPS2 - MICRO-LINE POWER SUPPLIES

- *PROVIDES POWER FOR THE MICRO-LINE SERIES*
- *MLPS1: 12 VDC OUTPUT @ 400 mA*
- *MLPS2: 24 VDC OUTPUT @ 200 mA*
- *EASILY ATTACHED TO BACK OF DT8, CUB4 AND CUB5*

UL Recognized Component, File # E179259

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DESCRIPTION

The Model MLPS power supplies are designed to attach to the rear of the Micro-Line Series. The MLPS1 provides a 12 VDC output, while the MLPS2 provides a 24 VDC output. Both supplies can be powered from an 85-250 VAC source.

Caution: The maximum output current of the MLPS1 is 400 mA and the MLPS2 is 200 mA. Check the specifications of the specific counter(s)/indicators(s) and sensors(s) being used to ensure that total current requirements do not exceed the respective values of the power supplies.

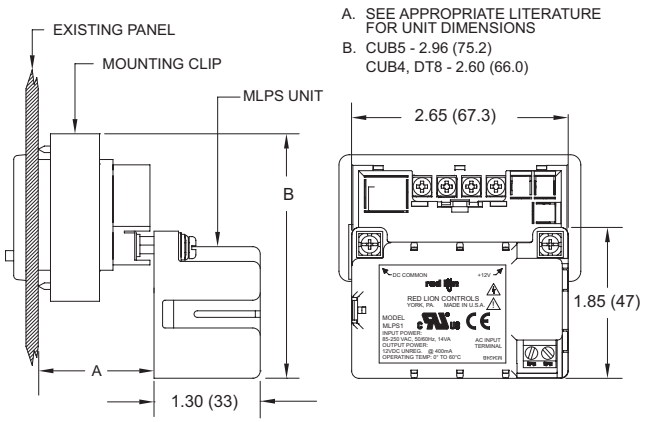
SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
MLPS1	+12 VDC Micro Line/Sensor Power Supply	MLPS1000
MLPS2	+24 VDC Micro Line/Sensor Power Supply	MLPS2000

SPECIFICATIONS

1. **POWER REQUIREMENTS:** 85-250 VAC, 50/60 Hz, 14 VA.
2. **POWER OUTPUT:**
   MLPS1: +16 VDC max @ 4 mA; 11.5 VDC min @ 400 mA
   MLPS2: +26 VDC max @ 0 mA; 22 VDC min @ 200 mA
3. **ENVIRONMENTAL CONDITIONS:**
   Operating Temperature: 0 to 60°C
   Storage Temperature: -30 to 75°C
   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
   Altitude: Up to 2000 meters
4. **CERTIFICATIONS AND COMPLIANCES:**
   SAFETY
   UL Recognized Component, File # E179259, UL61010-1, CAN/CSA-C22.2 No. 61010-1
   Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   Output meets Class 2 power requirements per UL 1310.
   IECEE CB Scheme Test Report # E179259-V2-S1
   Issued by Underwriters Laboratories, Inc.
   IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   ELECTROMAGNETIC COMPATIBILITY
   Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.
   Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV signal
Surge	EN 61000-4-5	Criterion B 1 kV L-L, 2 kV L&N-E power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle
Emissions:		
	EN 55011	Class B

   Notes:
   1. Criterion A: Normal operation within specified limits.
   2. Criterion B: Temporary loss of performance from which the unit self-recovers.
5. **CONSTRUCTION:** High impact black plastic. Mounting hardware included. Installation Category II, Pollution Degree 2.
6. **CONNECTION:** Two position terminal block which accepts one 14 AWG wire (torque terminal screws to 5 inch-lbs. [0.56 N-m]).
7. **WEIGHT:** 2 oz (47 g)

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

Installation Procedure

The MLPS is shipped with all the necessary hardware to mount to the rear of an installed Micro-Line unit. Refer to the instructions that correspond to your Micro-Line unit for proper installation.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

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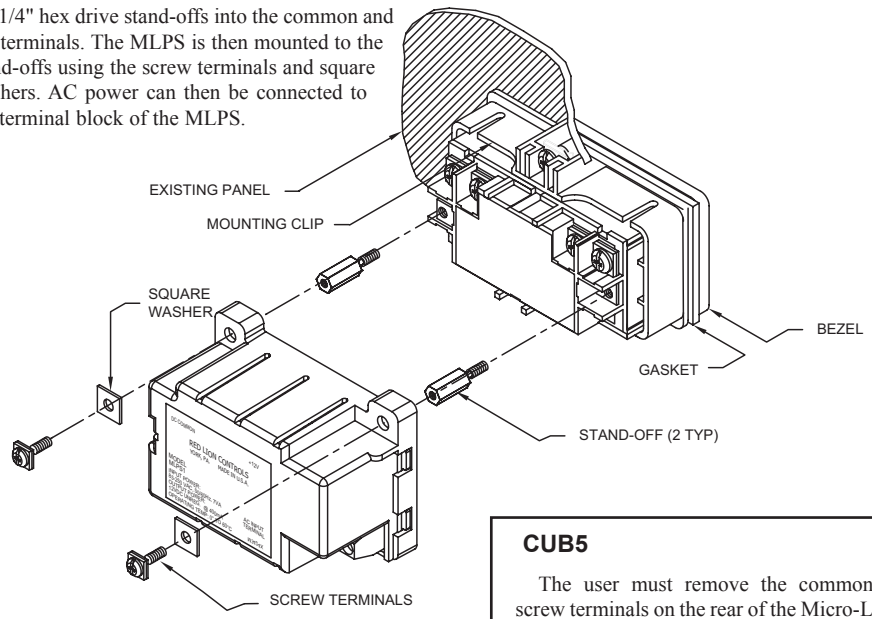
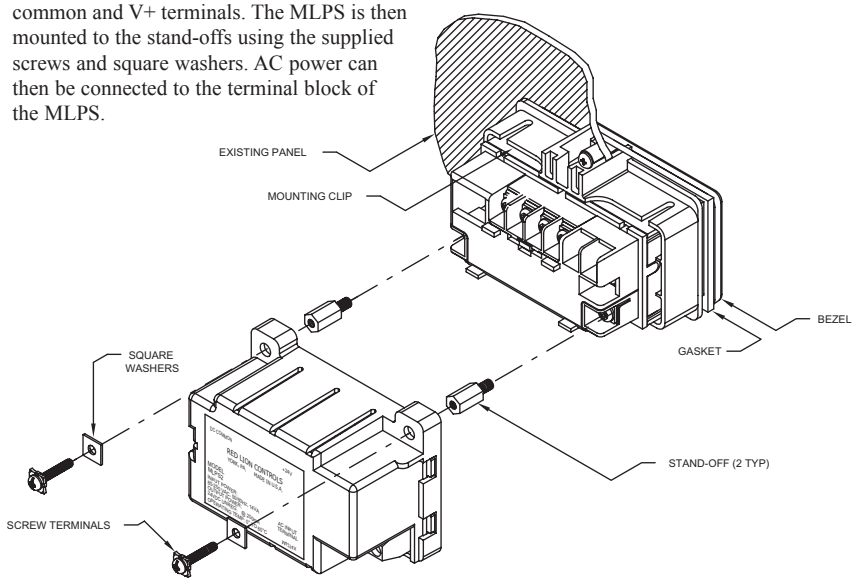
CUB4, DT8

The user must remove the common and V+ screw terminals on the rear of the Micro-Line unit. Install the 1/4" hex drive stand-offs into the common and V+ terminals. The MLPS is then mounted to the stand-offs using the screw terminals and square washers. AC power can then be connected to the terminal block of the MLPS.



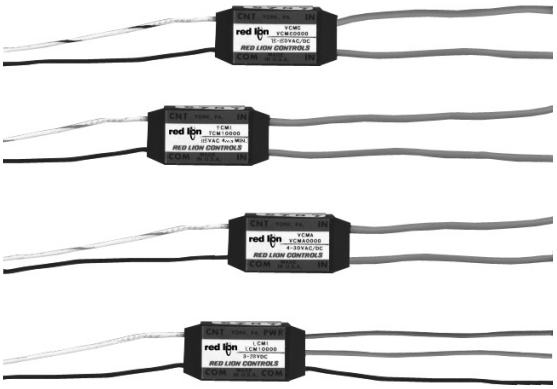
CUB5

The user must remove the common and V+ screw terminals on the rear of the Micro-Line unit. Install the 3/16" hex drive stand-offs into the common and V+ terminals. The MLPS is then mounted to the stand-offs using the supplied screws and square washers. AC power can then be connected to the terminal block of the MLPS.



CONVERTER MODULES

ADAPTS MANY RED LION CONTROLS' COUNTERS AND ACCESSORIES TO A WIDE RANGE OF SIGNAL SOURCES



VCM - VOLTAGE CONVERTER MODULES
Converts AC/DC voltages to an acceptable signal input for many RLC counters and accessories and provides input/output voltage isolation.

TCM - TRIAC CONVERTER MODULE
Accepts unloaded, high off-state leakage triac output from sensors and programmable controllers.

LCM - LOGIC CONVERTER MODULE
Interfaces with CMOS, TTL, and other logic circuits up to +28 VDC, at speeds to 50 KHz. Allows Cub Counters to share sensor outputs with other series counters.

These miniature sized modules are completely encapsulated in PVC, which provides protection against oil, water, dirt, and mechanical damage. They can be quickly and easily mounted to most surfaces by using the self-stick adhesive pad.

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VCM - VOLTAGE CONVERTER MODULES

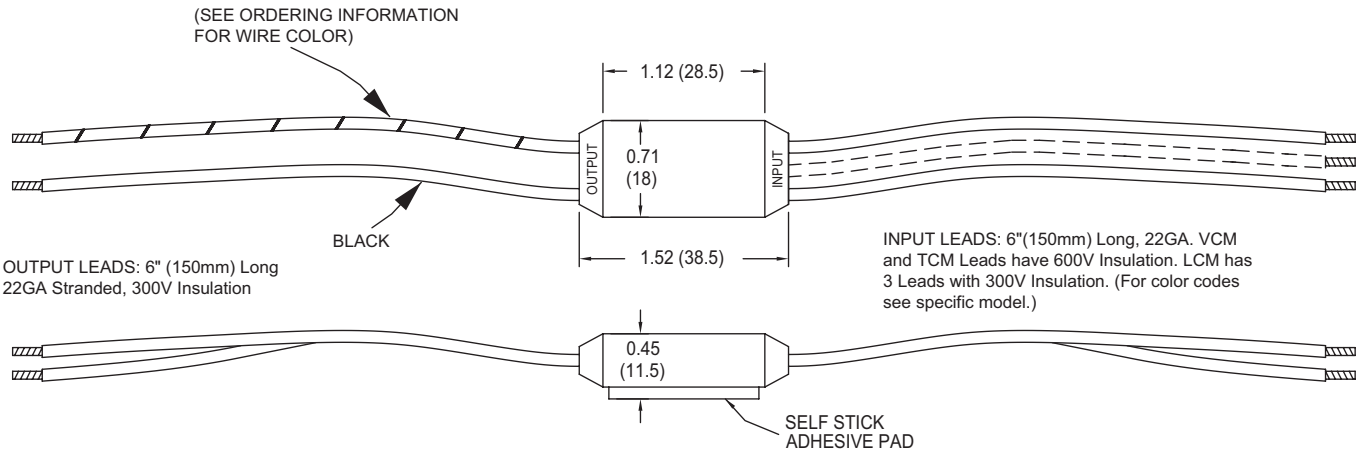
These modules provide a convenient way to adapt RLC Counters to most any machine control voltage signal. They also make it easy to upgrade electro-mechanical counter installations with RLC Counters.

VCM's are available in two input voltage ranges that cover the spectrum from 4-270 V. The non-polarized input of these modules will accept A.C. *(50/60 Hz)* or D.C. voltages at input cycles up to 30 Hz. The output uses MOSFET technology that is compatible with either the L.S. Count or Remote Reset inputs of RLC Counters. Electrical isolation between input and output is achieved by means of an internal opto-isolator rated at 2300 V_{RMS}.

SPECIFICATIONS

1. **INPUT:** VCM1 = 4 to 50 VAC/DC, 50/60 Hz
   VCM2 = 50 to 270 VAC/DC, 50/60 Hz
2. **OUTPUT:** Solid state DC contact closure
   Output rating: 30 VDC at 100 mA max
   Output Isolation: 2300 V_{RMS}
   Off State Leakage: 1 μA max
3. **FREQUENCY:** Max output frequency 20 Hz
4. **ENVIRONMENT:** 0-50 ºC

DIMENSIONS FOR VCM, TCM, & LCM In inches (mm)



TCM - TRIAC CONVERTER MODULE

The TCM is a specialized version of the VCM. It is specifically designed to operate with photo-electric sensors and programmable controllers that have 115 VAC Triac outputs. Due to protective suppression circuits connected in parallel with Triacs, these outputs have a high OFF-State Leakage current, which, if unloaded, is sufficient to keep a VCM in the ON condition continuously.

The TCM incorporates a current bias that offsets output leakage currents up to 4 mA and allows the application of RLC Counters to most unloaded Triac outputs. These modules are available for operation with 115 VAC ±10% 50/60 Hz only. They operate at count rates up to 10 cps, and also provide input/output electrical isolation. Connections for the TCM are the same as those for the VCM.

Note: VCM's can be used with Triac outputs that are also driving substantial loads, since the load will shunt the leakage current away from the VCM input.

SPECIFICATIONS

1. **INPUT:** 115 VAC ± 10% (50/60 Hz) 10 mA max current draw
2. **FREQUENCY:** 10 Hz max output
3. **OUTPUT:** Solid state DC contact closure
   Output rating: 30 VDC at 100 mA
   Output Isolation: 2300 V_{RMS}
   Off State Leakage: 1 µA max
4. **ENVIRONMENT:** 0-50 ºC

TYPICAL CONNECTION EXAMPLE FOR VCM & TCM (Shown with optional VCM for Control Voltage Remote Reset)

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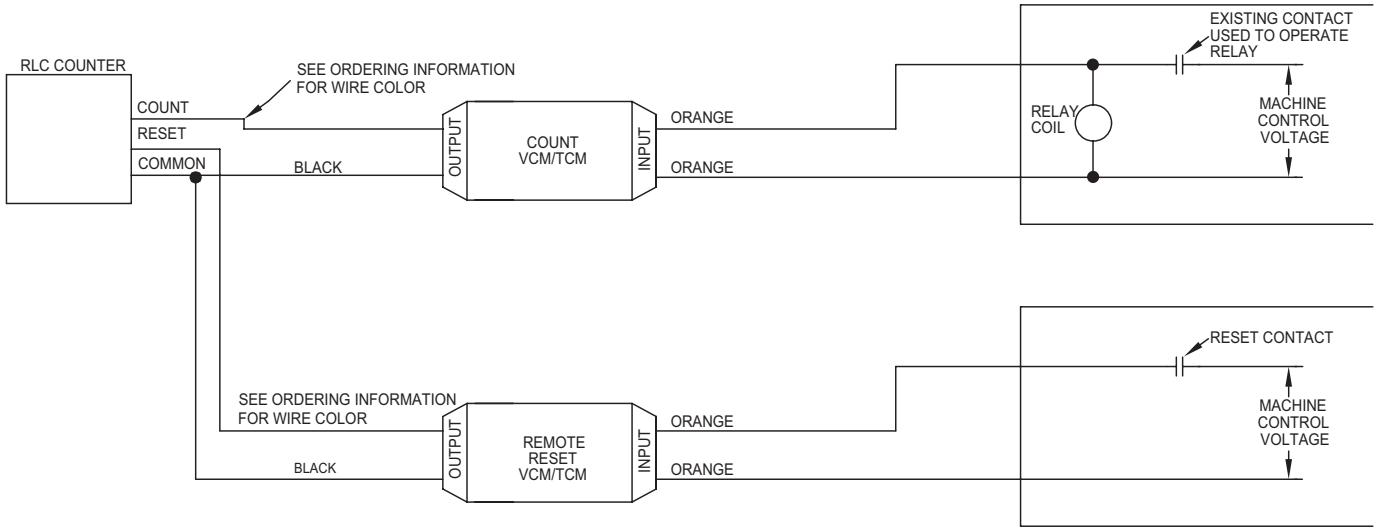
Consult Connections and Configurations set up information in counter instruction literature for wiring. Reference switch and contact input information.



LCM - CONVERTER MODULE

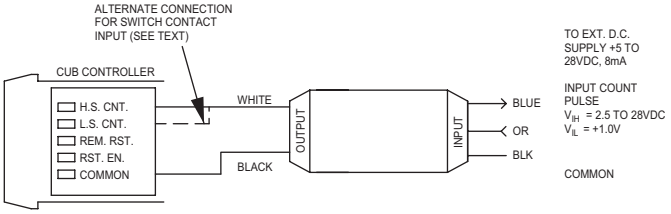
The LCM adapts CUB* Counters to practically any type of logic and sensor output, and to any count signal voltage from +3 to +28 VDC. The module accepts input count pulses from NPN Open-Collector Transistor outputs, Bi-Polar outputs, or sourcing outputs such as Emitter-Follower or PNP Open-Collector Transistors *(Sourcing outputs must be externally loaded with a load of 10 Kohms or less)*. The LCM output is a Bi-Polar drive that is compatible with either the Low-Speed or High-Speed Counter inputs as well as the Remote Reset input** of the CUB Counters. The output is inverted with respect to the input which causes the CUB Counter to increment on the leading *(positive going)* edge of a count pulse. Power for operation of the LCM can be normally obtained from the existing D.C. power supply used to operate the sensor or other logic circuitry. When count pulse signals are generated by switch contacts the LCM output can be applied to the L.S. input of the CUB to de-bounce these pulses. Minimum pulse width when driving the L.S. input is 10 msec and maximum count rate is 50 cps.

* *LCM intended for use with CUB1,2,3,and 7.*

** *When used to operate Remote Reset input, the LCM will reset counter when input to LCM goes high due to signal inversion.*

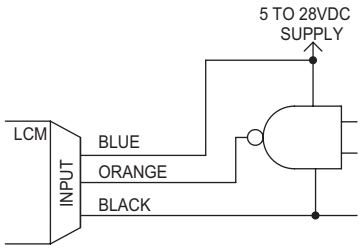
SPECIFICATIONS

1. **POWER:** 5 to 28 VDC, 8 mA max
2. **INPUT:** V_{IH} = +2.5 to 28 VDC, 500 µA max source
   V_{IL} = +1.0 VDC, 50 µA max sink
3. **OUTPUT:** Bipolar 3 VDC with 1 mA sink/source (output should not be connected to voltage levels above 3.5 VDC)
4. **FREQUENCY:** MAX input/output frequency = 50 KHz (see counter input for frequency limitations)
5. **ENVIRONMENT:** 0-50 ºC

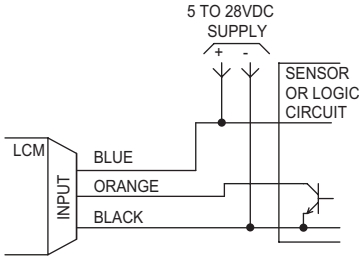


TYPICAL INPUTS TO LCM

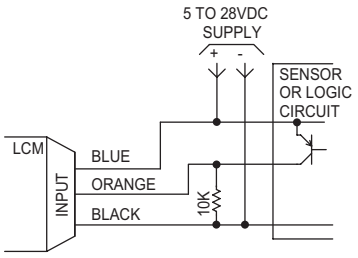
CMOS OR TTL



NPN OPEN COLLECTOR (SINK OUTPUT)



PNP OPEN COLLECTOR (SOURCE OUTPUT)



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ORDERING INFORMATION

MODEL NO.	DESCRIPTION	INPUT VOLTAGE	OUTPUT WIRE COLOR	PART NUMBER
VCM	Voltage Converter Module	4 - 50 V AC/DC	yellow	VCM10000
		50 - 270 V AC/DC	white	VCM20000
TCM	Triac Converter Module	115 VAC ±10%	white/green trace	TCM10000
LCM	Logic Converter Module	+3 to +28 VDC (signal) +5 to +28 VDC (supply)	white	LCM10000

MODEL RLY5 - SOLID STATE POWER UNIT

- *SWITCHES UP TO 45 AMPERES @ 240 VAC*
- *LOW LEVEL DC INPUT CONTROL SIGNAL (3-32 VDC)*
- *OPTICALLY-ISOLATED OUTPUT*
- *ZERO VOLTAGE TURN-ON, ZERO CURRENT TURN-OFF FOR REDUCED RFI*
- *INTERNAL SNUBBERS TO REDUCE FALSE TRIGGERING RELATED TO HIGH dv/dt APPLICATIONS*
- *SUPPLIED WITH HIGH EFFICIENCY HEATSINK FOR SUPERIOR THERMAL and SURGE CURRENT RATINGS*

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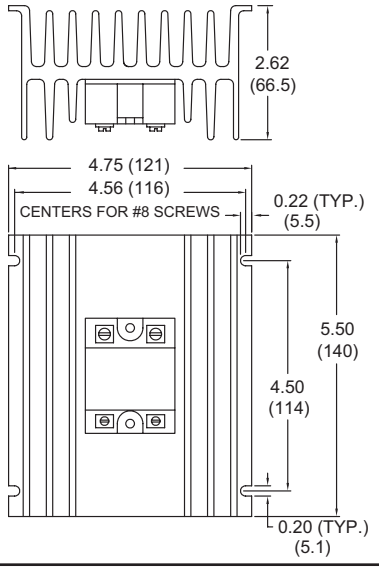
GENERAL DESCRIPTION

The SSR Power Unit is a solid state relay which can switch load currents up to 45 Amperes @ 240 VAC. The unit interfaces directly with a SSR Drive Module (OMD00003). The input and output terminals are isolated from each other to eliminate ground loops and noise problems. The unit features a zero voltage turn-on and a zero current turn-off detector to minimize radiated RFI when switching. An internal snubber minimizes inrush currents and guards against false triggering of the output; related to high dv/dt applications. A low DC control signal of +3 to +32 VDC is all that is needed for the switching operation. The solid state switch, highlighted by the inverse-parallel SCR output, provides a greatly increased operational life over a mechanical relay by avoiding the usual relay contact problems: arcing, bouncing, mechanical failure, etc. The solid state relay is shipped mounted to the high efficiency heatsink for immediate installation.

DIMENSIONS In inches (mm)



ORDERING INFORMATION

MODEL	DESCRIPTION	PART NUMBER
RLY5	SSR Power Unit	RLY50000

Do not dispose of unit in trash - Recycle

SPECIFICATIONS

OUTPUT SPECIFICATIONS

1. **Operating Voltage Range**: 50-280 VAC RMS
2. **Operating Frequency Range**: 47-63 Hz
3. **Maximum Continuous Load Current**: See Thermal Rating Code
4. **Maximum Surge Load Current**: See Peak Surge Current Curve
5. **Minimum Load Current**: 40 mA RMS
6. **Maximum Off-State Leakage Current**: 10 mA RMS
7. **Maximum Transient Voltage**: 600 V peak
8. **Maximum Output Voltage Drop**: 1.6 V peak
9. **Power Dissipation at Full Load**: 50 Watts
10. **Maximum I^2T**: 1600A^2sec
(For Fusing Purposes, t = 8.3 msec)
11. **Minimum Off-State dv/dt protection**: 500 V/usec

INPUT SPECIFICATIONS

(Use with RLC SSR Drive Module, OMD00003)

1. **Control Voltage Range**: 3 to 32 VDC
2. **Maximum Turn-on Voltage**: 3 VDC
3. **Minimum Turn-off Voltage**: 1 VDC
4. **Maximum Reverse Voltage**: -32 VDC
5. **Minimum Input Impedance**: 1500 Ω
6. **Maximum Turn-on/Turn-off time**: 8.3 msec

GENERAL SPECIFICATIONS

1. **Isolation (Input to Output to Base)**: 4000 V RMS
2. **Insulation Resistance**: 10 GΩ
3. **Operating Temperature Range**: -30° to +75°C
4. **Storage Temperature Range**: -40° to +120°C

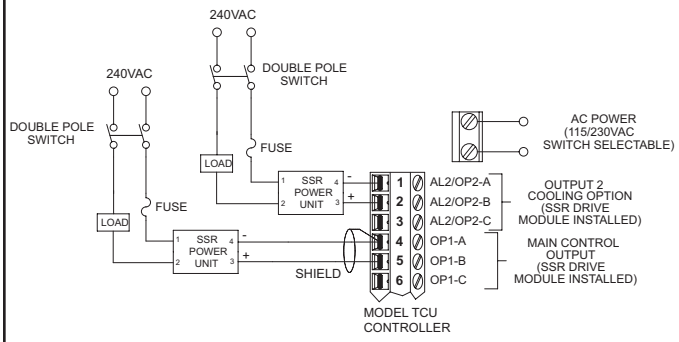
INSTALLATION

It is recommended to mount the unit outside of an enclosure in an area where there is unrestricted air flow. The unit should always be mounted with the fins in a vertical position to maximize heat dissipation. If mounting the unit inside an enclosure, the internal temperature of the enclosure will normally be higher than the surrounding area and must be accounted for. At full rated load, the unit will dissipate 50 watts and achieve a case temperature in excess of 90°C. In all installations, it is important to allow at least two inches around the power unit for proper ventilation.

CONNECTIONS

Separate power feed lines should be run to the load side of the relay. The controller unit and the load should NEVER share the same power feed. It is recommended to install the SSR Power Unit as close to the load as possible to keep the power cable runs short. This will help reduce noise from radiating into other equipment. The input control signal cable can be run over distances in excess of 200 ft. with shielded cable from the controller to the SSR power unit. Connect the shield to the minus "-" terminal of the control signal, on the SSR Power Unit and at only one end.

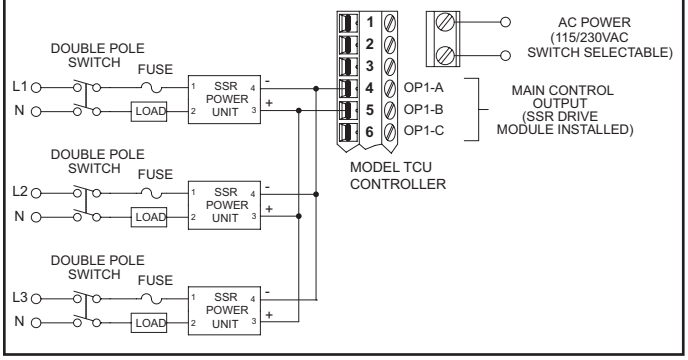
INDIVIDUAL RELAY CONNECTIONS



MULTIPLE UNITS

For increased power handling, up to four SSR Power Units may be parallel connected, and all controlled by a single output of an SSR Drive Module (OMD00003). The output of the SSR Power Units must NOT be parallel connected to the same load because of unequal current sharing among the devices. The outputs should be wired to individual heaters, but they may share the same supply. If five or more SSR Power Units are required, a Relay Output Module (OMD00000) may be used in conjunction with an external +12 VDC power source (RLC Model APS01000) to switch the SSR Power Units.

MULTIPLE RELAY CONNECTION



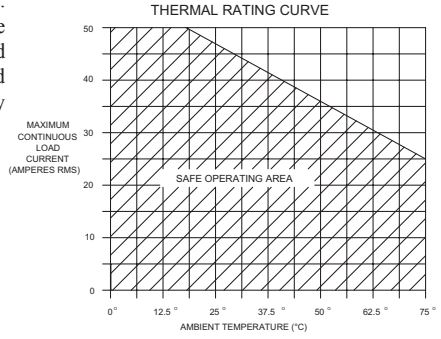
OPERATION

The following are important aspects of operation of the SSR power unit which must be considered. Adhering to these guidelines will ensure reliable and trouble free operation.

THERMAL RATING CURVES

The Thermal Rating Curve will determine the maximum allowable ambient operating temperature for the maximum continuous load current. The two parameters must intersect in the Safe Operating Area of the graph. Operation outside the safe operating area will shorten the life of or cause permanent damage to the SSR Power Unit. The ambient temperature of the power unit should be measured with all of the associated equipment operating to verify the Thermal Ratings.

THERMAL RATING CURVE

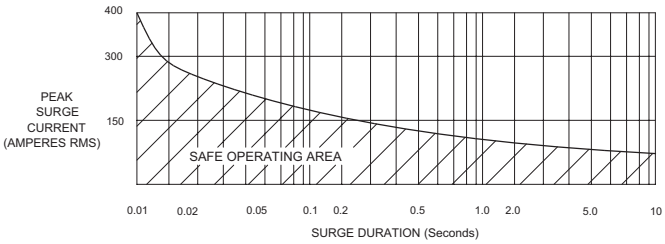


SURGE CURRENT

When the SSR Power Unit switches a load on, an in-rush (surge) current that is higher than the continuous load current will flow. The surge current can be estimated from the table below which outlines the ratio of surge to steady state current for various load devices. The surge current duration must be within the Safe Operating Area of the Peak Surge Current vs. Time Figure. Surge currents outside the safe operating area will shorten the life of or cause permanent damage to the power unit.

Load Device	Ratio Surge Current to Steady State Current
Incandescent Bulbs (cold)	5
Quartz Heaters (cold)	7
Motors (motionless)	10
Compressors	10

PEAK SURGE CURRENT vs. DURATION



FUSING

The output of the SSR Power Unit should be protected by a fast blow I^2t fuse (Bussman KAX-30 or equivalent). This guards against long duration surge currents, short circuits, etc., which may damage the SSR Power Unit.

MECHANICAL INTERRUPT SWITCH

The off-state output leakage current of the power unit is 10 mA maximum. The voltage level of the output will rise proportional to the resistance of the load due to this leakage current. Full line voltage can be measured when the output is connected to a high resistance load and the power unit is in the off-state.

A mechanical interrupt switch (double pole) should be placed between both sides of the line voltage and the load. The switch should be opened when servicing any part of the output wiring. When measuring the off-state output voltage of the unit for correct operation, load the output of the SSR Power Unit with a small resistance (approximately 100 ohms).

SNUBBING

The power unit has internal snubbers to guard against transients generated by most loads. Loads with low power factors (ie. motors) may require additional external snubbing network.

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MODEL RLY6/RLY6A - SINGLE PHASE DIN RAIL MOUNT SOLID STATE RELAY

- *INTEGRATED HEAT SINK*
- *OPTICALLY ISOLATED*
- *SOLID STATE SWITCHING*
- *SINGLE PHASE OUTPUT RATING: 25 A (RLY6) or 40 A (RLY6A)*
- *SWITCHING: 24 TO 660 VAC*
- *CONTROL SIGNAL: 4 TO 32 VDC*
- *ZERO VOLTAGE TURN-ON*
- *MOUNTS ON DIN RAIL OR DIRECTLY TO PANEL*
- *4000 VOLT ISOLATION*
- *BUILT-IN SNUBBER*
- *LED "ON" INDICATOR*
- *CAGE CLAMP TERMINATIONS*

UL Recognized Component, File #E191578

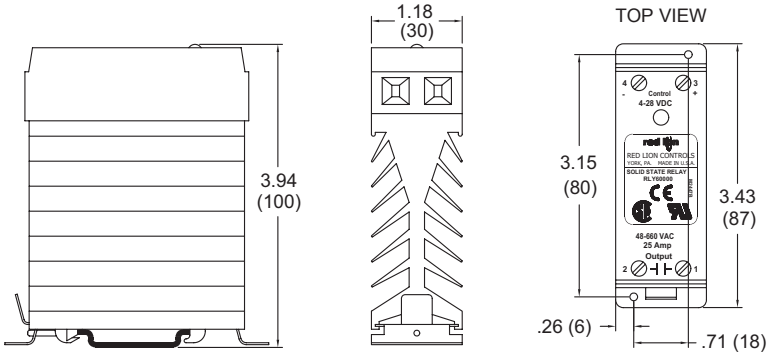
LR 702877

GENERAL DESCRIPTION

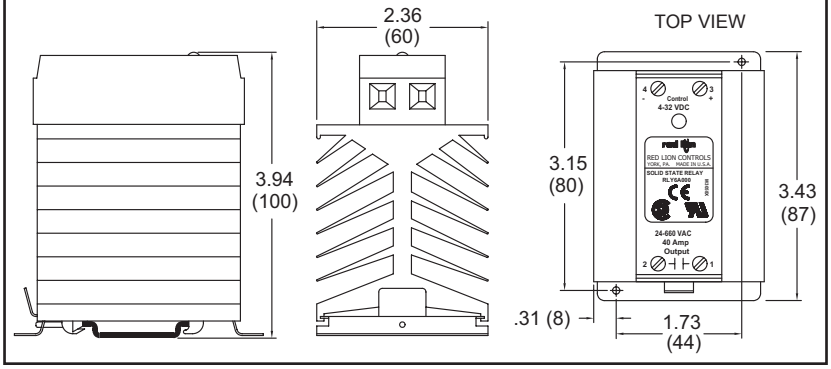
The RLY60000 is a solid state relay that switches load currents up to 25 A; the RLY6A000 switches load currents up to 40 A. These units feature a zero voltage turn-on detector to minimize radiated RFI when switching. An internal snubber guards against false triggering of the output related to high dv/dt applications. A low level DC control signal of 4 to 32 VDC is all that is needed for the switching operation. These units, highlighted by the inverse-parallel SCR output, provide a greatly increased operational life over mechanical relays by avoiding the usual relay contact problems such as: arcing, bouncing, and mechanical failure.

The RLY6/RLY6A can be directly controlled by logic/SSR drive output or sourcing output of Red Lion Controls products.

RLY6, 25 Amp DIMENSIONS In inches (mm)



RLY6A, 40 Amp DIMENSIONS In inches (mm)



SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

SPECIFICATIONS

OUTPUT SPECIFICATIONS

1. **OPERATING VOLTAGE RANGE**: 24 to 660 VAC
2. **OPERATING FREQUENCY RANGE**: 47 to 63 Hz
3. **MAXIMUM CONTINUOUS LOAD CURRENT**: (See Safe Operating Conditions)
   RLY6: 25 A_{RMS}
   RLY6A: 40 A_{RMS}
4. **SURGE CURRENT**:
   RLY6:
   Non-Repetitive 1 Cycle: 250 A_{PEAK}
   Non-Repetitive 1 Second: 100 A_{PEAK}
   RLY6A:
   Non-Repetitive 1 Cycle: 250 A_{PEAK}
   Non-Repetitive 1 Second: 150 A_{PEAK}
5. **MIN. LOAD CURRENT**: 100 mA
6. **LEAKAGE CURRENT @ V_{OUT} (Max.)**: 8 mA
7. **OVER VOLTAGE RATING**: 1400 PIV
8. **VOLTAGE DROP @ I_{OUT}**: 1.5 VAC
9. **POWER DISSIPATION AT FULL LOAD**:
   RLY6: 25.0 Watts
   RLY6A: 48.0 Watts

SPECIFICATIONS (Cont'd)

10. **I^2T FUSING**: 1035 A^2S
    (For Fusing Purposes, T = 8.3 msec.)
11. **Dv/Dt @ V_{OUT} (Max.)**: 500 V/µsec

INPUT SPECIFICATIONS

1. **CONTROL VOLTAGE RANGE**: 4 to 32 VDC
2. **TURN-ON VOLTAGE (MIN.)**: 4 VDC
3. **TURN-OFF VOLTAGE (MAX.)**: 1 VDC
4. **REVERSE VOLTAGE PROTECTION**: -75 VDC
5. **INPUT CURRENT (MAX.)**: 8 mA

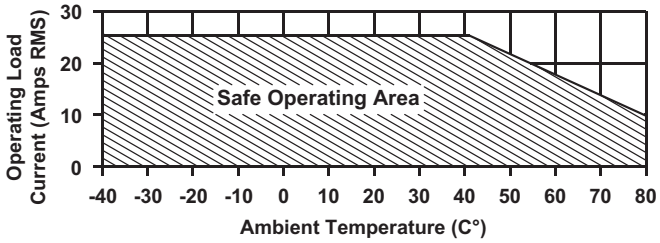
GENERAL SPECIFICATIONS

1. **ISOLATION (INPUT TO OUTPUT TO BASE)**: 4000 V_{RMS}
2. **CAPACITANCE INPUT TO OUTPUT**: 3 pf
3. **OPERATING TEMPERATURE RANGE**: -40°C to +80°C

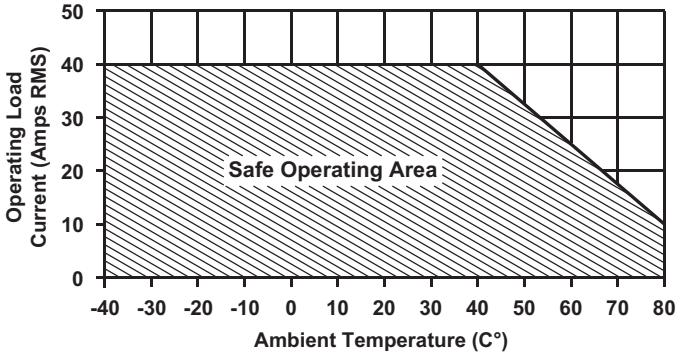
SAFE OPERATING CONDITIONS

The relay must always operate within the "Safe Operating Area" of the Derating Curve Figure. Operations outside the Safe Operating Area will shorten the life of, or cause permanent damage to, the relay. The ambient temperature should be measured 1" (25 mm) below the relay (when mounted to a vertical surface) and with all of the associated equipment operating.

RLY6 25 A Derating Curve



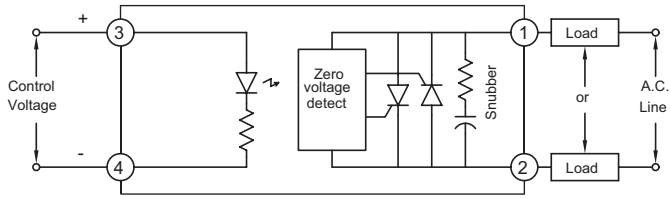
RLY6A 40 A Derating Curve



It is strongly recommended that a 0.18" (4.6 mm) clearance is maintained on all four sides of the relay. If the relays are mounted against each other, then the end relays must be derated by additional 10% (of the Derating Curve) and the middle relays by 20%.

In small enclosures, adequate ventilation must be provided to assure proper safe operating temperature. Accumulation of dust and dirt on the heat sink fins will also affect heat dissipation. In extreme dust and dirt conditions, the relay must be derated by additional 20%.

SCHEMATIC



FUSING

Devices such as electromechanical circuit breakers and slow blow fuses cannot react quickly enough to protect this relay in a shorted condition. Fast "semiconductor fuses" with appropriate I^2T ratings are strongly recommended.

MECHANICAL INTERRUPT SWITCH

The off-state leakage current of the power unit is 8 mA maximum. The voltage level of the output will rise proportional to the resistance of the load due to this leakage current. Full line voltage can be measured when the output is connected to a high resistance load and the power unit is in the off-state.

A mechanical interrupt switch is recommended between both sides of the line voltage and the load. The switch should be opened when servicing any part of the output wiring. When measuring the off-state output voltage of the unit for correct operation, load the output of the RLY6/RLY6A with a small resistance (approximately 100 ohms).

J

WIRING GUIDELINES

The controlling device and the relay load should NEVER share the same power feed. It is recommended that this relay be installed as close as possible to the load to keep the power cable runs short. The control voltage can run over distances in excess of 200 feet with shielded cable. If using shielded cable, connect the shield to the minus "-" terminal of the control signal at one end only.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
RLY6	25 A Single Phase Din Rail Mount Solid State Relay	RLY60000
RLY6A	40 A Single Phase Din Rail Mount Solid State Relay	RLY6A000

Do not dispose of unit in trash - Recycle

MODEL RLY7 - THREE PHASE DIN RAIL MOUNT SOLID STATE RELAY

- *INTEGRATED HEAT SINK*
- *OPTICALLY ISOLATED*
- *SOLID STATE SWITCHING*
- *25 A THREE PHASE OUTPUT RATING*
- *24 TO 660 VAC SWITCHING*
- *4 TO 32 VDC CONTROL SIGNAL*
- *ZERO VOLTAGE TURN-ON*
- *MOUNTS ON DIN RAIL OR DIRECTLY TO PANEL*
- *4000 VOLT ISOLATION*
- *BUILT-IN SNUBBER*
- *LED "ON" INDICATOR*
- *CAGE CLAMP TERMINATIONS*

UL Recognized Component, File #E191578

GENERAL DESCRIPTION

The RLY7 is a three phase solid state relay that switches load currents up to 25 A. The unit features a zero voltage turn-on detector to minimize radiated RFI when switching. An internal snubber guards against false triggering of the output related to high dv/dt applications. A low level DC control signal of 4 to 32 VDC is all that is needed for the switching operation. This unit, highlighted by the inverse-parallel SCR output, provides a greatly increased operational life over a mechanical relay by avoiding the usual relay contact problems such as: arcing, bouncing, and mechanical failure.

The RLY7 can be directly controlled by logic/SSR drive output or sourcing output of Red Lion Controls products.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

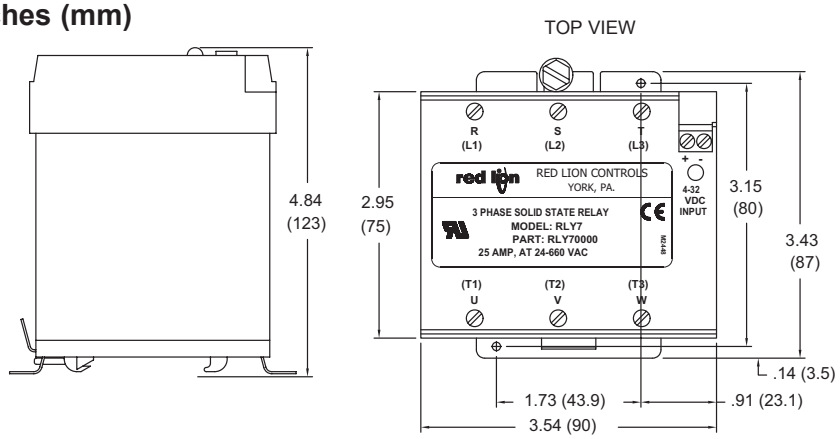
CAUTION: Risk of electric shock.

SPECIFICATIONS

OUTPUT SPECIFICATIONS

1. Operating Voltage Range: 24 to 660 VAC
2. Operating Frequency Range: 47 to 63 Hz
3. Maximum Continuous Load Current: 25 Amps (3 pole), 35 Amps (2 pole) (See Safe Operating Conditions)
5. Min. Load Current: 100 mA
6. Leakage Current @ V_{OUT} (Max.): 10 mA
7. Peak Blocking Voltage: 1400 VAC
8. Voltage Drop @ I_{OUT}: 3 VAC
9. I^2T Fusing: 1350 A^2sec (For Fusing Purposes, T = 8.3 msec.)
10. Dv/Dt @ V_{OUT} (Max.): 1000 V/µsec

DIMENSIONS In inches (mm)



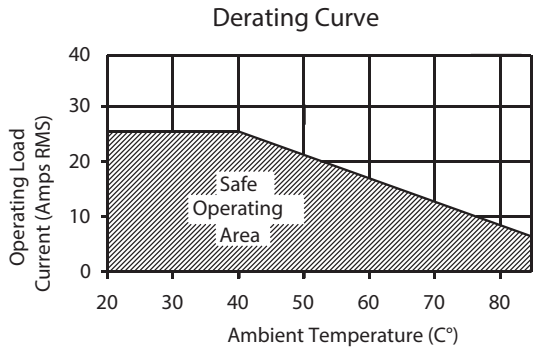
INPUT SPECIFICATIONS
1. Control Voltage Range: 4 to 32 VDC
2. Turn-on Voltage (Min.): 4 VDC
3. Turn-off Voltage (Max.): 1 VDC
4. Input Current (Max.): 15 mA

GENERAL SPECIFICATIONS
1. Isolation (Input to Output to Base): 4000 V_{RMS}
2. Operating Temperature Range: 0°C to 40°C

SAFE OPERATING CONDITIONS

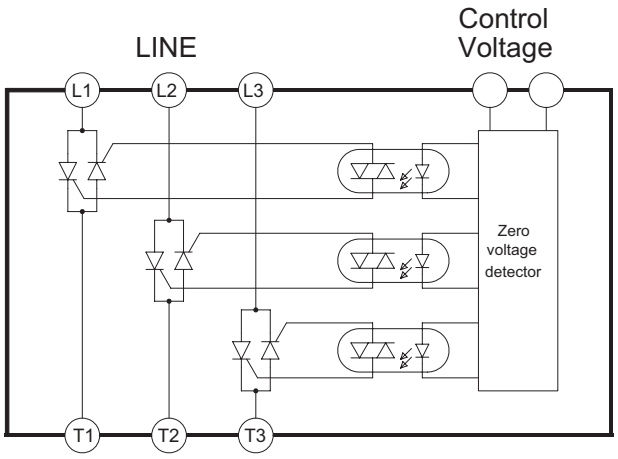
The relay must always operate within the "Safe Operating Area" of the Derating Curve Figure. Operations outside the Safe Operating Area will shorten the life of, or cause permanent damage to, the relay. The ambient temperature should be measured 1" (25 mm) below the relay (when mounted to a vertical surface) and with all of the associated equipment operating.

It is strongly recommended that a 1" (25 mm) clearance is maintained on all four sides of the relay. If the relays are mounted against each other, then the end relays must be derated by an additional 10% (of the Derating Curve) and the middle relays by 20%.



In small enclosures, adequate ventilation must be provided to assure proper safe operating temperature. Accumulation of dust and dirt on the heat sink fins will also affect heat dissipation. In extreme dust and dirt conditions, the relay must be derated by an additional 20%.

SCHEMATIC



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
RLY7	Three Phase Din Rail Mount Solid State Relay	RLY70000

Do not dispose of unit in trash - Recycle

FUSING

Devices such as electromechanical circuit breakers and slow blow fuses cannot react quickly enough to protect this relay in a shorted condition. Fast "semiconductor fuses" with appropriate I^2T ratings are strongly recommended.

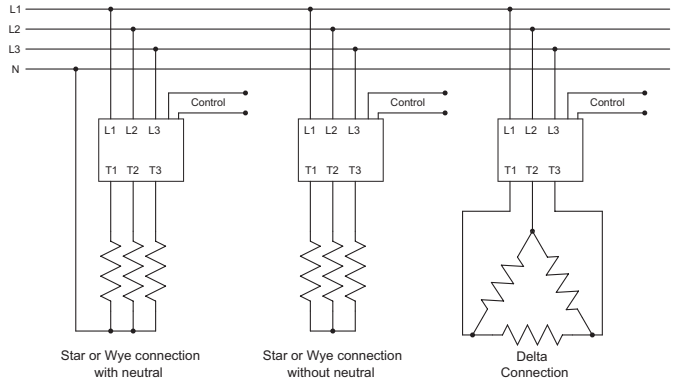
MECHANICAL INTERRUPT SWITCH

The off-state leakage current of the power unit is 10 mA maximum. The voltage level of the output will rise proportional to the resistance of the load due to this leakage current. Full line voltage can be measured when the output is connected to a high resistance load and the power unit is in the off-state.

A mechanical interrupt switch is recommended between the line voltage and the load. The switch should be opened when servicing any part of the output wiring. When measuring the off-state output voltage of the unit for correct operation, load the output of the RLY7 with a small resistance (approximately 100 ohms).

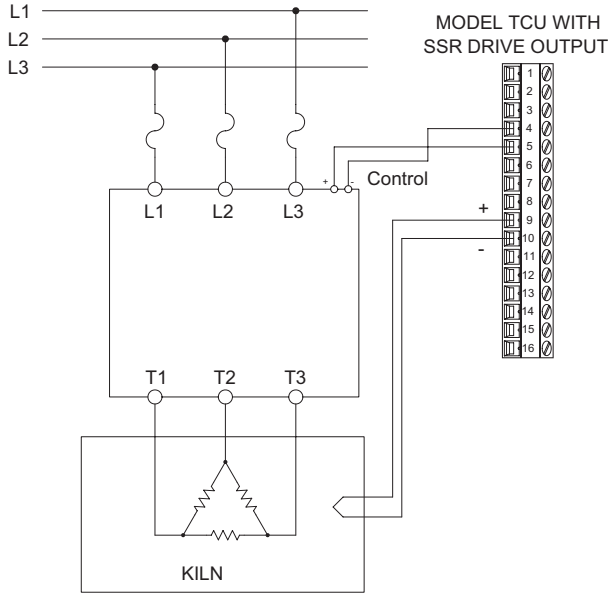
WIRING GUIDELINES

The controlling device and the relay load should NEVER share the same power feed. It is recommended that this relay be installed as close as possible to the load to keep the power cable runs short. The control voltage can run over distances in excess of 200 feet with shielded cable. If using shielded cable, connect the shield to the minus "-" terminal of the control signal at one end only.



THREE PHASE HEATING APPLICATION

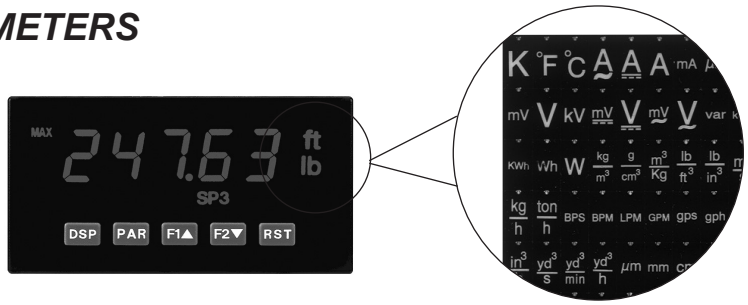
This application shows a Model TCU Temperature Controller regulating the temperature of a drying kiln. The TCU has an SSR Drive Output Module installed. This module controls the three phase relay directly.



MODEL PAXLBK - LABEL KITS FOR 5 DIGIT ANALOG PAX AND PAX LITE METERS

DESCRIPTION

These label kits provide a unique way to identify your display with one of 189 different engineering units. The label lights up from inside the PAX or PAX Lite Meters where it is protected from washdown and dirty environments. Simply select the appropriate label from the kit and apply it to the plastic frame. The frame then installs into holes in the PC board on the right side of the display. Activating the backlight is controlled in the meter program.



K	°F	°C	A~	A⎓	A	mA	µA	mA⎓	mA~	Hz	kHz	ØA	ØB	ØC	µV
mV	V	kV	mV⎓	V⎓	mV~	V	var	kvar	mΩ	Ω	kΩ	MΩ	VA	kVA	KW
KWh	Wh	W	kg/m³	g/cm³	m³/Kg	lb/ft³	lb/in³	m³/s	m³/min	m³/h	ℓ/s	ℓ/min	ℓ/h	kg/s	kg/min
kg/h	ton/h	BPS	BPM	LPM	GPM	gps	gph	gpm	ppb	ppm	ft³/s	ft³/min	ft³/h	in³/s	in³/min
in³/h	yd³/s	yd³/min	yd³/h	µm	mm	cm	m	km	in	ft	yd	MPa	mPa	kPa	Pa
Torr	mm Hg	bar	in Hg	psi	mm H_2O	kgf/cm²	kgf/mm²	atm	N/m	mm/s	cm/s	cm/min	m/s	m/min	m/h
kph	CPS	FPS	YPS	MPS	IPS	CPH	FPH	YPH	FPM	MPM	YPM	RPS	IPH	IPM	CPM
MPH	rps	rpm	rph	fps	fpm	mph	ms	SEC	s	min	h	%	O_2	mb	%RH
ORP	pH	dB	%obs	cts	x10	x100	x1000	Ø-mm	M~	ℓx	t	SCCM	G	m/s³	ft/s³
PS	hp	deg	cP	cSt	pcs	rad	mg	g	kg	ton	slug	lbm	gal	kGL	ℓ
Kℓ	m³	cm³	mm³	in³	ft³	yd³	mℓ	qt	oz	lb	kip	dyne	N	kgf/cm	gf/cm
kcal	cal	J	kJ	BTU	BTU/h	kcal/h	J/s	ft lb	in lb	lb in	lb ft	N m	kN/m		

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
PAXLBK	Units Label Kit for 5 Digit PAX Meters	PAXLBK10
	Units Label Kit for 5 Digit PAX Lite Meters	PAXLBK30

LPAX ENCLOSURE, MOUNTING AND LABEL ACCESSORIES

- *ENGINEERING UNIT LABELS*
- *BRACKETS FOR BASE, CEILING, OR WALL MOUNTING*
- *NEMA 4/IP65 ENCLOSURE FOR WASHDOWN ENVIRONMENTS*
- *FRONT PANEL SHROUD FOR ENHANCED VIEWING*

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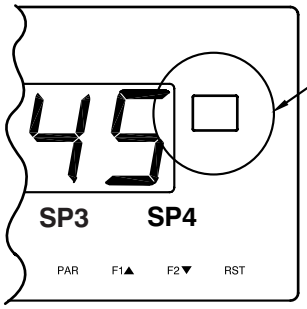
LX LABEL ACCESSORY

The LX label accessories allow the 5 digit LPAX display to be customized with an engineering unit. The label is affixed to the embossed area on the bezel of the LPAX. The LPAX module is then programmed to turn on its backlighting, which illuminates the label from behind.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
LX	Custom Units Label for 5 Digit LPAX	Listed Below



INSTALLATION

Before applying the label, ensure that the embossed area is clean, dry, and free of dirt. Remove the backing and center the label in the embossed area and attach. Take extra care to seat the edges of the label.

LXBLANK0 *		LXK00000	LXA00000	LXMA0000	LXUA0000	LXHZ0000	LXKHZ000	LXKV0000	LXVA0000	LXKVA000	LXVAC000	LXMV0000	LXV00000
LXMOHM10	LXOHM000	LXKOHM00	LXMOHM20	LXW00000	LXKW0000	LXKWH000	LXKG0000	LXTON000	LXGAL000	LXL00000	LXML0000	LXKL0000	LXM30000
LXCM3000	LXMM3000	LXIN3000	LXFT3000	LXYD3000	LXL/H000	LXKG/S00	LXKG/MIN	LXM3/S00	LXM3/MIN	LXM3/H00	LXL/S000	LXL/MIN0	LXKG/H00
LXTON/H0	LXFT3/S0	LXFT3/MN	LXFT3/H0	LXBPS000	LXBPM000	LXLPM000	LXGPS000	LXGPM100	LXGPM200	LXGPH000	LXFPS100	LXFPM100	LXFPH000
LXFPS200	LXFPM200	LXYPS000	LXYPM000	LXYPH000	LXIPS000	LXIPM000	LXIPH000	LXCPS000	LXCPM000	LXCPH000	LXMPS000	LXMPM000	LXMPH000
LXKPH000	LXRPS100	LXRPS200	LXRPM000	LXRPH000	LXPPB000	LXPPM000	LXMM/S00	LXCM/S00	LXCM/MIN	LXM/S000	LXM/MIN0	LXM/H000	LXT/MIN0
LXU/MIN0	LXLB/MIN	LXLB/H00	LXT10000	LXT20000	LX%RH000	LXPH0000	LXDEG000	LXG00000	LXOZ0000	LXLB0000	LX10X000	LX100X00	LX1000X0
LXPHA000	LXPHB000	LXPHC000	LXBAR000	LXINHG00	LXPSI000	LXKPA000	LX%00000	LXIN0000	LXFT0000	LXYD0000	LXMM0000	LXCM0000	LXM00000
LXKM0000	LXN00000	LXHP0000	LXINLB00	LXFTLB00	LXMIN000	LXH00000	LXS00000	LXSEC000	LXVDC000	LXDF0000 **	LXDC0000 **		

* Blank label included with each LPAX

** These labels included with MPAXT units

MODEL CUB5USB - USB PROGRAMMING OPTION CARD

DESCRIPTION

This bulletin serves as a guide for the installation, configuration and operation of the CUB5 USB Programming plug-in card for the CUB5. The plug-in card is a separately purchased option card that plugs into the main circuit board of the meter. The CUB5USB card in conjunction with the Crimson® programming software enables the user to configure CUB5 on a PC. The CUB5USB requires installation of drivers which are included with the Crimson Programming software. Following installation of the drivers, the card appears as a Virtual communications port.

Crimson is a Windows® based program that allows configuration of the CUB® 5 meters from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the CUB5 meters. The CUB5 program can then be saved in a PC file for future use. A CUB5 serial plug-in card is required to program the meter using the software.

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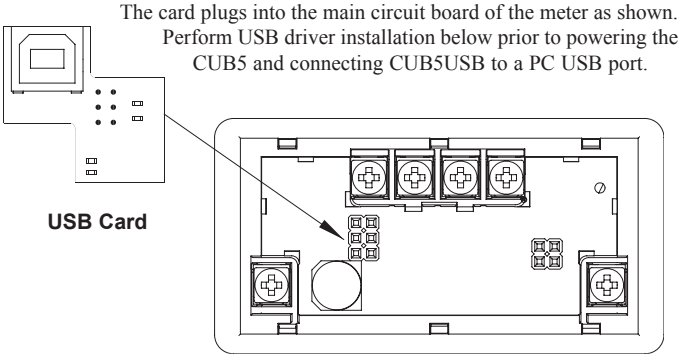
INSTALLING PLUG-IN CARDS

The card plugs into the main circuit board of the meter as shown. Perform USB driver installation below prior to powering the CUB5 and connecting CUB5USB to a PC USB port.



WARNING: Disconnect all power to the unit before installing Plug-in card.

CAUTION: The Plug-in cards and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

USB DRIVER INSTALLATION

1. Download and install the latest Crimson 2 build on your Windows® compatible PC. Earlier builds may not have the RLC Virtual Comm port drivers. Crimson software is available as a free download at http://www.redlion.net.
2. Install CUB5USB card into CUB5 meter and apply power to the CUB5.
3. Connect Type A USB cable to computer and CUB5USB option card. Windows will prompt you for the location of the drivers for the device. The default location for these drivers is "C:\Program Files\Red Lion controls\ Crimson 2.0\Device." When the hardware setup appears, choose "Install from a list or Specific location," click Next, and then check "Include this location..." and click the Browse button. Point the Wizard at the location specified above or whatever other location you specified during installation of the software. It is important that you perform this step correctly, or you may have to manually remove the drivers using the Device Manager, and repeat the installation once more.
   Note: Crimson's USB drivers have not been digitally signed by Microsoft®, and you will therefore see a dialog offering you the chance to stop the installation. You should be sure to select the Continue option to indicate that you do indeed wish to install the drivers.
4. Windows will automatically assign a comms port to the CUB5USB. To determine the port assigned, open "System Properties" from within Windows® Control Panel. Select the Hardware tab, and click the "Device Manager" button. Expand the "Ports" line. Take note of which Comms port is assigned to "RLC Virtual Comm port". It must be Com4 or lower to operate with Crimson 2. If higher, right-click on the entry and select "Properties," "Port Settings" tab, and then "Advanced" button. Select a Coms port that is COM4 or lower and is not physically being used.

SPECIFICATIONS

CUB5USB PROGRAMMING CARD
Type: USB Virtual Comms Port
Baud Rate: 300 to 38.4k
Unit Address: 0 to 99

CRIMSON 2 SYSTEM REQUIREMENTS

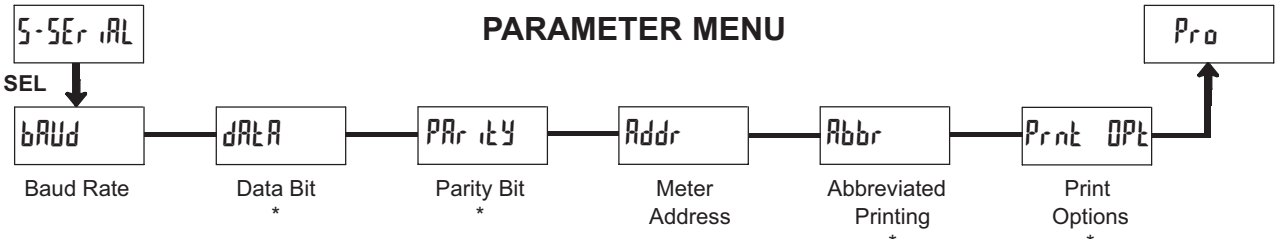
- Windows 2000, XP, or Vista
- RAM and free disk space as required by the chosen operating system.
- An additional 50 MB of disk space for software installation.
- A display of at least 800 by 600 pixels
- A USB port for downloading to the CUB5

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
CUB5USB	CUB5 USB Programming Card	CUB5USB0
CBLUSB	Type A to B USB Cable	CBLUSB00
SFCRUSB*	USB Programming Kit containing USB Card, USB Cable and Crimson software	SFCRUSB0
SFCRD*	Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP	SFCRD200

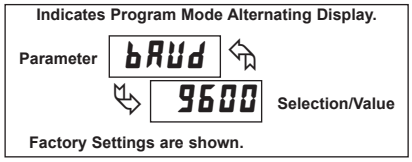
* Crimson software is available for download from http://www.redlion.net/

MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-SEr)



* - Disregard these parameters when configuring unit to upload or download wth Crimson.

Module 5 is the programming module for the Serial Communications Parameters. The only paramters of concern when utilizing the CUB5USB programming option card to communicate with Crimson 2 programming software is the Baud Rate and Meter Address. The Parameters are only accessible when an optional CUB5USB, RS232 or RS485 serial communications card is installed in the meter.

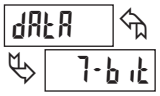


BAUD RATE

300 600 1200 2400 4800 9600 19200 38400

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

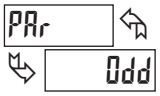
DATA BIT *



7-bit 8-bit

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

PARITY BIT*



nO Odd EVEn

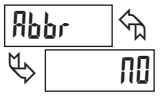
This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to nO, an additional stop bit is used to force the frame size to 10 bits.

METER ADDRESS

0 to 99

Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

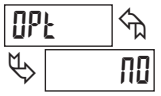
ABBREVIATED PRINTING *



nO YES

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select nO for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

PRINT OPTIONS *



nO YES

This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as nO will not be sent.

The "Print All" (P-ALL) option selects all meter values for transmitting (YES), without having to individually select each parameter in the sublist.

Note: Inactive parameters will not be sent regardless of the print option setting. For example, the Setpoint value(s) will not be sent unless an optional setpoint card is installed in the meter.

* - Disregard these parameters when configuring unit to upload or download wth Crimson software.

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MODEL CUB5COM -SERIAL COMMUNICATIONS PLUG-IN OPTION CARDS

DESCRIPTION

This bulletin serves as a guide for the installation, configuration and operation of the RS232 and RS485 serial communications plug-in cards for the CUB5. The plug-in cards are separately purchased option cards that plug into the main circuit board of the meter. Only one communication card can be used at a time.

Crimson is a Windows® based program that allows configuration of the CUB5 meters from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the CUB5 meters. The CUB5 program can then be saved in a PC file for future use. A CUB5 serial plug-in card is required to program the meter using the software.

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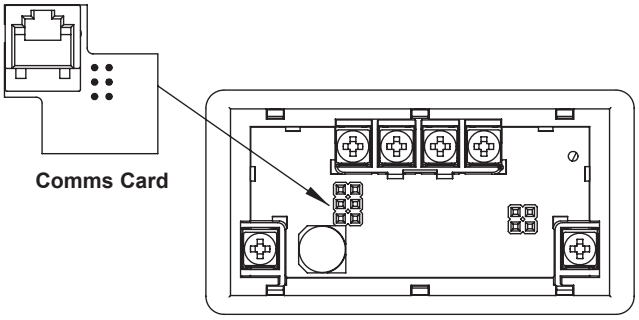
INSTALLING PLUG-IN CARDS

The cards plug into the main circuit board of the meter as shown.



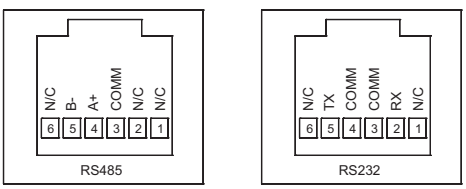
WARNING: Disconnect all power to the unit before installing Plug-in card.

CAUTION: The Plug-in cards and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

WIRING CONNECTIONS

Connections to the serial communications cards are made through an RJ11 modular connector. Connector pin-outs for the RS485 and RS232 cards are shown below.

RJ11 CONNECTOR PIN OUTS



SPECIFICATIONS

RS485 SERIAL COMMUNICATIONS CARD

Type: RS485 multi-point balanced interface (non-isolated)
Baud Rate: 300 to 38.4k
Data Format: 7/8 bits; odd, even, or no parity
Bus Address: 0 to 99; max 32 meters per line
Transmit Delay: Selectable, 2 msec min. or 50 msec min.

RS232 SERIAL COMMUNICATIONS CARD

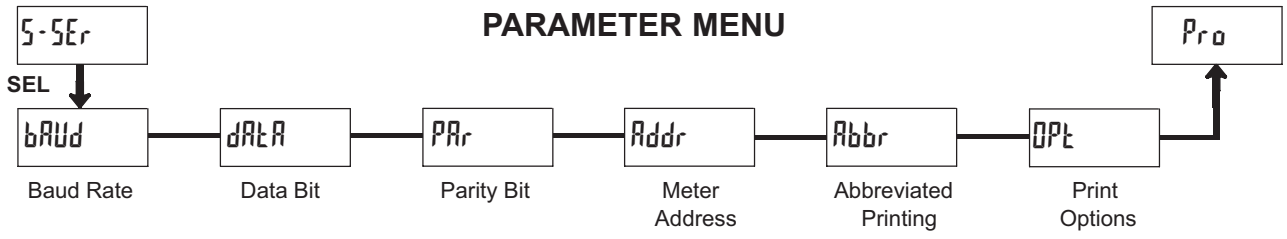
Type: RS232 half duplex (non-isolated)
Baud Rate: 300 to 38.4k
Data Format: 7/8 bits; odd, even, or no parity

ORDERING INFORMATION

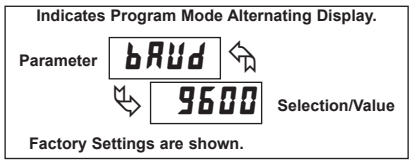
MODEL NO.	DESCRIPTION	PART NUMBER
CUB5COM	RS485 Serial Communications Card	CUB5COM1
	RS232 Serial Communications Card	CUB5COM2
CBL	RS232 Programming Cable (DB9-RJ11)	CBLPROG0
	RS485 Programming Cable (DB9-RJ11)	CBPRO007
SFCRD*	Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP	SFCRD200

* Crimson software is available for download from http://www.redlion.net/

MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-SEr)



Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the CUB5 with those of the host computer or other serial device. The Serial Setup Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.

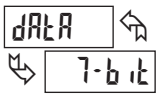


BAUD RATE

300 600 1200 2400 4800 9600 19200 38400

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

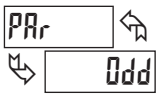
DATA BIT



7-bit 8-bit

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

PARITY BIT



nO Odd EVEn

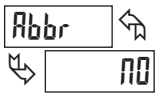
This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to nO, an additional stop bit is used to force the frame size to 10 bits.

METER ADDRESS

0 to 99

Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

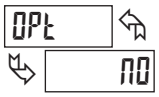
ABBREVIATED PRINTING



nO YES

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select nO for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

PRINT OPTIONS



nO YES

This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as nO will not be sent.

The "Print All" (P-ALL) option selects all meter values for transmitting (YES), without having to individually select each parameter in the sublist.

Note: Inactive parameters will not be sent regardless of the print option setting. For example, the Setpoint value(s) will not be sent unless an optional setpoint card is installed in the meter.

ANALOG MODELS - CUB5V, CUB5I, CUB5P, CUB5TC, CUB5RT

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
INP	Input	YES	INP
HI	Maximum	nO	MAX
LO	Minimum	nO	MIN
SPt-1	Setpoint 1	nO	SP1
SPt-2	Setpoint 2	nO	SP2

Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

Command	Description	Notes
N	Node (meter) Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by a register ID character.
V	Value Change (write)	Write to register of the meter. Must be followed by a register ID character and numeric data.
R	Reset	Reset a register value or setpoint output. Must be followed by a register ID character
P	Block Print Request (read)	Initiates a block print output. Registers in the print block are selected in Print Options.

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See Command Response Time section for differences in meter response time when using the * and $ terminator.

Register Identification Chart

Analog Models - CUB5V, CUB5I, CUB5P, CUB5TC, CUB5RT

ID	Value Description	MNEMONIC	Applicable Commands	Transmit Details (T and V)
A	Input	INP	T	5 digit
B	Maximum	MAX	T, R	5 digit
C	Minimum	MIN	T, R	5 digit
D	Setpoint 1 (Reset output 1)	SP1	T, R, V	5 digit positive/4 digit negative
E	Setpoint 2 (Reset output 2)	SP2	T, R, V,	5 digit positive/4 digit negative

Command String Examples:

1. Node address = 17, Write 350 to the setpoint 1 value
   String: N17VD350*
2. Node address = 5, Read input, response time of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint 1 output
   String: RD*
4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31P$

Transmitting Data to the Meter

Numeric data sent to the meter must be limited to transmit details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: The meter's scaled decimal point position is set for 0.0 and 25 is written to a register. The value of the register is now 2.5. In this case, write a value of 250 to equal 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

Byte	Description
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-15	9 byte data field; 7 bytes for number, one byte for sign, one byte for decimal point
16	<CR> (carriage return)
17	<LF> (line feed)
18	<SP>* (Space)
19	<CR>* (carriage return)
20	<LF>* (line feed)

** These characters only appear in the last line of a block print.*

The first two characters transmitted are the meter address. If the address assigned is 0, two spaces are substituted. A space follows the meter address field. The next three characters are the register mnemonic, as shown in the Register Identification Chart.

The numeric data is transmitted next. The numeric field (bytes 7 to 15) is 9 characters long. When a requested display value exceeds the meter's display limits, decimal points are sent in place of numerical data to indicate a display overrange.

The remaining 7 positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and five positions for the requested value. The data within bytes 9 to 15 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with a <CR> and <LF>. After the last line of a block print, an extra <SP>, <CR> and <LF> are added to provide separation between the print blocks.

Abbreviated Transmission

Byte	Description
1-9	9 byte data field, 7 bytes for number, one byte for sign, one byte for decimal point
10	<CR> (carriage return)
11	<LF> (line feed)
12	<SP>* (Space)
13	<CR>* (carriage return)
14	<LF>* (line feed)

** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and the register mnemonic, leaving only the numeric part of the response.

Meter Response Examples (Analog models):

1. Node address = 17, full field response, Input = 875
   17 INP 875 <CR><LF>
2. Node address = 0, full field response, Setpoint 1 = -250.5
   SP1 -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint 2 = 250, last line of block print 250<CR><LF><SP><CR><LF>

Command Response Time

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval t_1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t_1, the command characters are under transmission and at the end of this period, the command terminating character (* or $) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel.

t_1 = (10 times the # of characters) / baud rate

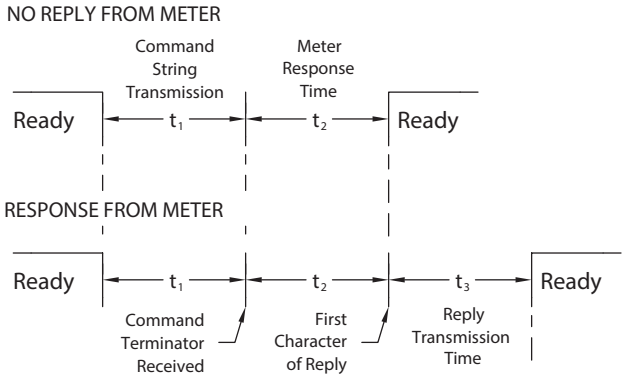
At the start of time interval t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t_2 is controlled by the use of the command terminating character. The '*' terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '$' results in a response time (t_2) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel. At the end of t_3, the meter is ready to receive the next command.

t_3 = (10 times the # of characters) / baud rate

The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.



Timing Diagram Figure

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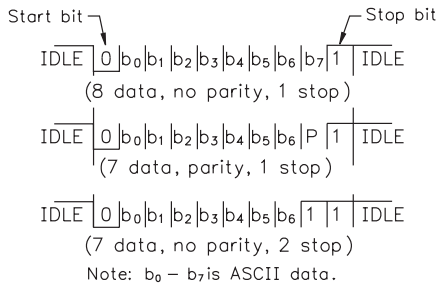
Communication Format

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character. The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD,RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD,RXD; +3 to +15 V	a-b > +200 mV
* Voltage levels at the Receiver			

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.



Character Frame Figure

Start Bit and Data Bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.

Parity Bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The CUB5 meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop Bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.

MODEL PAXUSB - USB PROGRAMMING OPTION CARD

DESCRIPTION

This bulletin serves as a guide for the installation of the PAX USB Programming plug-in card. The plug-in card is a separately purchased option card that plugs into the main circuit board of the unit. The PAX USB card in conjunction with the Crimson® programming software enables the user to configure a PAX from a PC. The PAXUSB requires the installation of drivers that are included with the Crimson Programming software.

Following installation of the drivers, the card appears as a Virtual communications port.

Crimson is a Windows® based program that allows configuration of the PAX® units from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the PAX units. The PAX program can then be saved in a PC file for future use.

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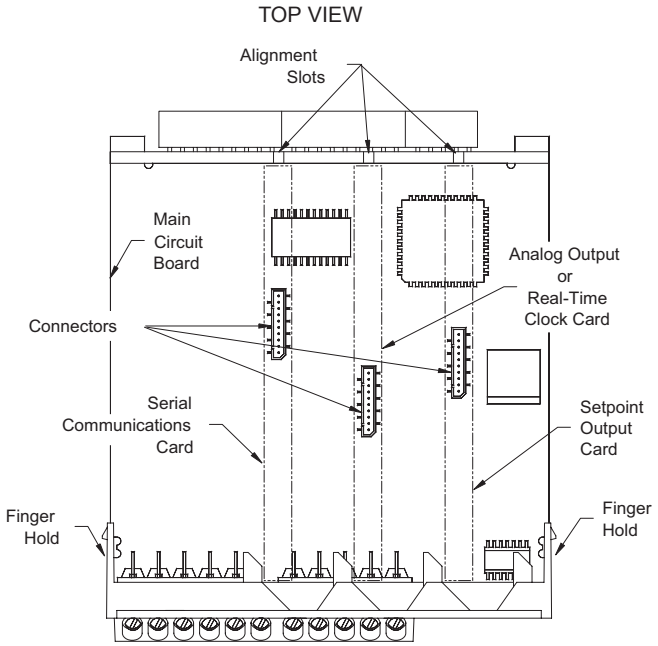
INSTALLING AN OPTION CARD

***CAUTION**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, handle the cards by the edges only. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***WARNING**: Exposed line voltage may be present on the circuit boards when power is applied. Remove all power to the unit AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot bay in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Perform USB driver installation below prior to powering the PAX and connecting PAXUSB to PC USB port.



COMMUNICATIONS

It is necessary to match the PAX unit's serial communications parameters to the host's parameters before communications can be established. This is accomplished by using the PAX front panel keys to enter the Serial Communications Parameters Module.

CRIMSON 2 SYSTEM REQUIREMENTS

- Windows 2000, XP, or Vista
- RAM and free disk space as required by the chosen operating system.
- An additional 50 MB of disk space for software installation.
- A display of at least 800 by 600 pixels
- A USB port for downloading to the PAX

SPECIFICATIONS

PAXUSB PROGRAMMING CARD

Type: USB Virtual Comms Port

Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.

PAXH Isolation:

Isolation To Sensor Common: 1400 Vrms for 1 min.
Working Voltage: 125 V

Isolation To User Input Common: 500 Vrms for 1 min.
Working Voltage: 50 V

Baud Rate: 300 to 19.2k

Unit Address: 0 to 99; only 1 unit can be configured at a time

USB DRIVER INSTALLATION

1. Download and install the latest Crimson 2 build on your Windows® compatible PC. Earlier builds may not have the RLC Virtual Comm port drivers. Crimson software is available as a free download at http://www.redlion.net.
2. Install PAXUSB card into the unit and apply power to the PAX.
3. Connect Type A to mini B USB cable to computer and PAX option card. Windows will prompt you for the location of the drivers for the device. The default location for these drivers is "C:\Program Files\Red Lion controls\ Crimson 2.0\Device." When the hardware setup appears, choose "Install from a list or Specific location," click Next, and then check "Include this location..." and click the Browse button. Point the Wizard at the location specified above or whatever other location you specified during installation of the software. It is important that you perform this step correctly, or you may have to manually remove the drivers using the Device Manager, and repeat the installation once more.
   Note: Crimson's USB drivers have not been digitally signed by Microsoft®, and you will therefore see a dialog offering you the chance to stop the installation. You should be sure to select the Continue option to indicate that you do indeed wish to install the drivers.
4. Windows will automatically assign a comms port to the PAXUSB. To determine the port assigned, open "System Properties" from within Windows® Control Panel. Select the Hardware tab, and click the "Device Manager" button. Expand the "Ports" line. Take note of which Comms port is assigned to "RLC Virtual Comm port". It must be Com4 or lower to operate with Crimson 2. If higher, right-click on the entry and select "Properties," "Port Settings" tab, and then "Advanced" button. Select a Coms port that is COM4 or lower and is not physically being used.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXUSB	PAX USB Programming Card	PAXUSB00
CBLUSB	Type A to mini B USB Cable	CBLUSB01
SFCRUSB*	USB Programming Kit containing USB Card, USB Cable, and Crimson Software	SFCRUSB1

* Crimson software is available for download from http://www.redlion.net/

MODEL PAXCDC -SERIAL COMMUNICATIONS PLUG-IN OPTION CARDS

DESCRIPTION

This bulletin serves as a guide for the installation, configuration and operation of the RS232 and RS485 cards for the PAX family of meters. Only one communication card can be used at a time.

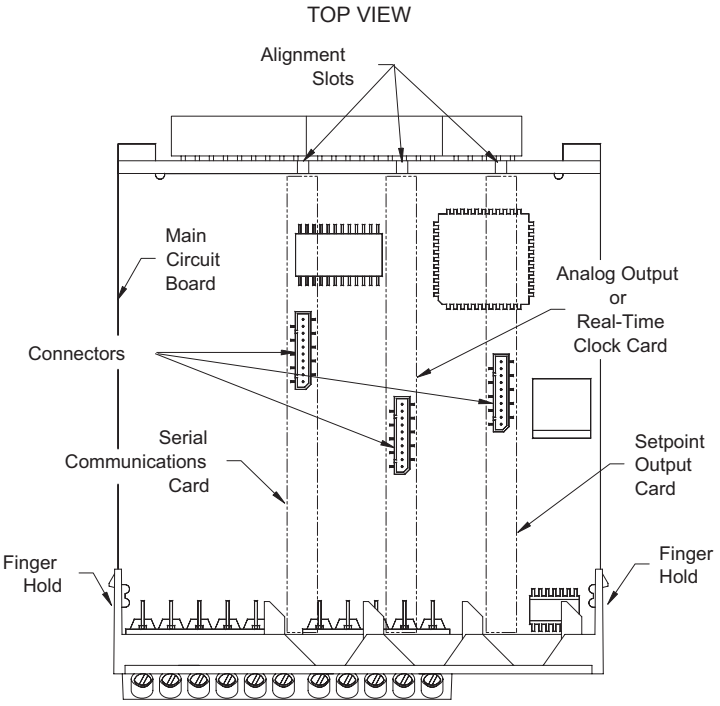
The PAX meter can be fitted with up to three different option cards. The slot bays of the option cards are dedicated to a particular card function. The option card functions are: serial communications, analog output and setpoint output. Only one card from each function category can be installed into the meter.

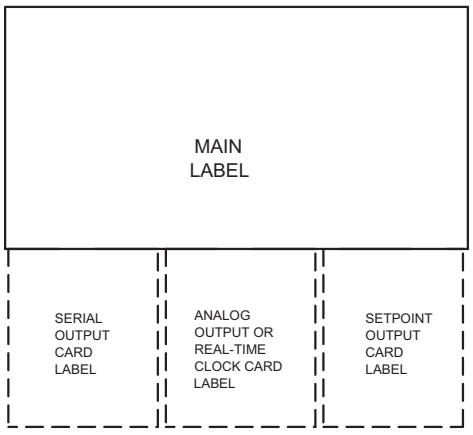
INSTALLING AN OPTION CARD

***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, handle the cards by the edges only. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot bay in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Apply the option card label to the bottom side of the meter. **Do not cover the vents on the top surface of the meter.** The surface of the case must be clean for the label to adhere properly. Apply the label to the area designated by the large case label.





ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXCDC	RS485 Serial Communications Output Card with Terminal Block	PAXCDC10
	Extended RS485 Serial Communications Output Card with Dual RJ11 Connector	PAXCDC1C
	RS232 Serial Communications Output Card with Terminal Block	PAXCDC20
	Extended RS232 Serial Communications Output Card with 9 Pin D Connector	PAXCDC2C

SPECIFICATIONS

PAXH Isolation For Both Cards:
- **Isolation To Sensor Common**: 1400 Vrms for 1 min.
  Working Voltage: 125 V
- **Isolation To User Input Common**: 500 Vrms for 1 min.
  Working Voltage: 50 V

RS485 Communication Card
- **Type**: RS485 multi-point balanced interface
- **Isolation To Sensor & User Input Commons**: 500 Vrms for 1 min.
  Working Voltage: 50 V. Not Isolated from all other commons.
- **Baud Rate**: 300 to 19.2k
- **Data Format**: 7/8 bits; odd, even, or no parity
- **Bus Address**: 0 to 99, max 32 meters per line
- **Transmit Delay**: Selectable; 2 - 50 msec or 50 - 100 msec

RS232 Communication Card
- **Type**: RS232 half duplex
- **Isolation To Sensor & User Input Commons**: 500 Vrms for 1 min.
  Working Voltage: 50 V. Not Isolated from all other commons.
- **Baud Rate**: 300 to 19.2k
- **Data Format**: 7/8 bits; odd, even or no parity

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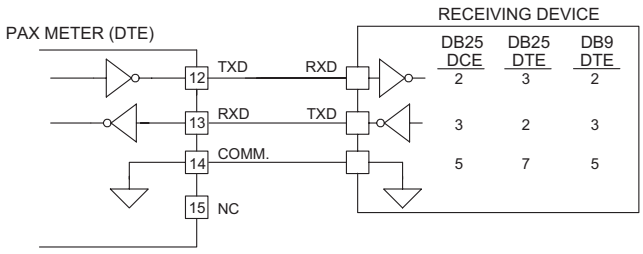
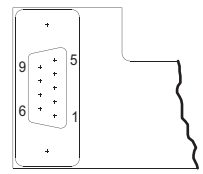
WIRING CONNECTIONS

RS232 Communications



Terminal Block Connection Figure



PIN 2 TXD
PIN 3 RXD
PIN 5 COMMON

FEMALE

Extended Comms Connection Figure

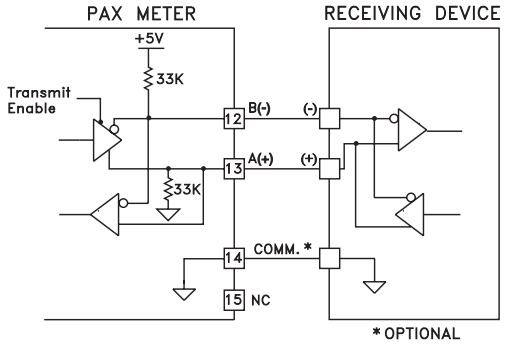
RS232 is intended to allow only two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The PAX emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device.

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function.

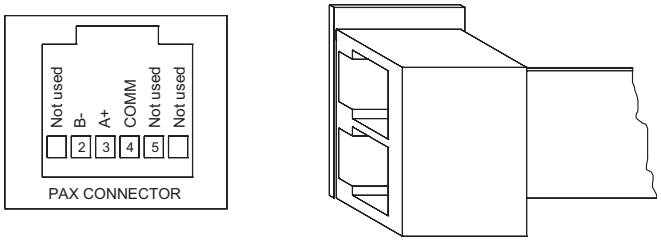
As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is "busy". The receiving device asserts that it is busy by setting the RXD line into a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the PAX is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. An RS485 bus is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

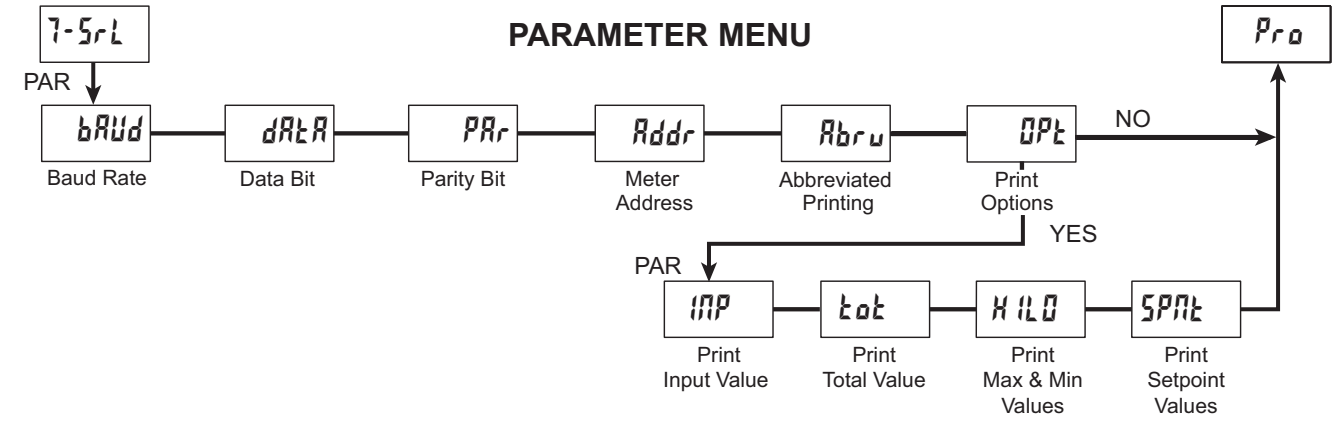


Terminal Block Connection Figure

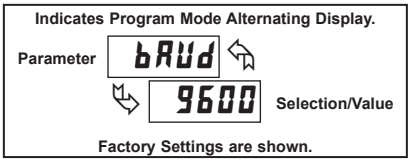


Extended Comms Connection Figure

MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS (7-SrL)



It is necessary to match the PAX meter's serial communications parameters to the host's parameters before communications can be established. This is accomplished by using the PAX front panel keys to enter 7-SrL.



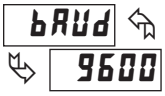
J

METER ADDRESS

0 to 99

Enter the serial node address. With a single unit on a bus, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

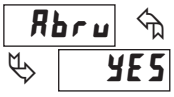
BAUD RATE



300 600 1200 2400 4800 9600 19200

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting.

ABBREVIATED PRINTING



YES NO

Select abbreviated transmissions (numeric only) or full field transmission. When the data from the meter is sent directly to a terminal for display, the extra characters that are sent identify the nature of the meter parameter displayed. In this case, select NO. When the data from the meter goes to a computer, it may be desirable to suppress the node address and mnemonic when transmitting. In this case, set this parameter to YES.

DATA BIT

7 8

Select either 7 or 8 bit data word lengths. Set the word length to match that of other serial communication equipment. Since the meter receives and transmits 7-bit ASCII encoded data, 7 bit word length is sufficient to request and receive data from the meter.

PRINT OPTIONS

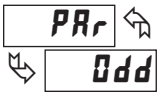
YES NO

YES - Enters the sub-menu to select those meter parameters to appear in the block print. For each parameter in the sub-menu select YES for the parameter to appear with the block print, and NO to disable the parameter.

*Setpoints 1-4 are setpoint plug-in card dependent.

Input Value	inP	YES	NO
Max and Min Values	h iLO	YES	NO
Total Value	tot	YES	NO
Setpoint values*	SPnt	YES	NO

PARITY BIT



Odd EVEN NO

Set the parity bit to match that of the other serial communications equipment used. The meter ignores the parity when receiving data, and sets the parity bit for outgoing data. If no parity is selected with 7-bit word length the meter transmits and receives data with 2 stop bits. (For example: 10 bit frame with mark parity)

Sending Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character * or $.

Command Chart

Command	Description	Notes
N	Node Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by register ID character.
V	Value change (write)	Write to register of the meter. Must be followed by register ID character and numeric data.
R	Reset	Reset a register or output. Must be followed by register ID character
P	Block Print Request (read)	Initiates a block print output. Registers are defined in programming.

J

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences of * and $ terminating characters.

Register Identification Chart

ID	Value Description	Register ID	Applicable Commands/Comments	
A	Input	INP	T, P, R	(Reset command [Ver2.5+] zeros the input [“REL” or Tare])
B	Total	TOT	T, P, R	(Reset command resets total to zero)
C	Max Input	MAX	T, P, R	(Reset command resets total to zero)
D	Min Input	MIN	T, P, R	(Reset command resets MIN to current reading)
E	Setpoint 1	SP1	T, P, V, R	(Reset command resets the setpoint output)
F	Setpoint 2	SP2	T, P, V, R	(Reset command resets the setpoint output)
G	Setpoint 3	SP3	T, P, V, R	(Reset command resets the setpoint output)
H	Setpoint 4	SP4	T, P, V, R	(Reset command resets the setpoint output)
I	Analog Output Register	AOR	T, V	(Applies to manual mode)
J	Control Status Register	CSR	T, V	
L	Absolute (gross) input display value	ABS GRS †	T, P	
Q	Offset/Tare (PAXS)	OFS TAR †	T, P, V	(Ver 2.5+)

† -Register ID for the PAXS.

Command String Examples:

1. Node address = 17, Write 350 to Setpoint 1, response delay of 2 msec min
   String: N17VE350$
2. Node address = 5, Read Input value, response delay of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint 4 output, response delay of 50 msec min
   String: RH*

Sending Numeric Data

Numeric data sent to the meter must be limited to 5 digits (-19,999 to 99,999). If more than 5 digits are sent, the meter accepts the last 5. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: the meter’s scaled decimal point position = 0.0 and 25 is written to a register. The value of the register is now 2.5 In this case, write a value = 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data

Data is transmitted by the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. In this case, the response contains only the numeric field. The meter response mode is established in programming.

Full Field Transmission

Byte	Description
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point (The T command may be a different byte length)
19	<CR> carriage return
20	<LF> line feed
21	<SP>* (Space)
22	<CR>* carriage return
23	<LF>* line feed

** These characters only appear in the last line of a block print.*

The first two characters transmitted are the node address, unless the node address assigned =0, in which case spaces are substituted. A space follows the node address field. The next three characters are the register ID (Serial Mnemonic).

The numeric data is transmitted next. The numeric field is 12 characters long (to accommodate the 10 digit totalizer), with the decimal point position floating within the data field. Negative value have a leading minus sign. The data field is right justified with leading spaces.

The end of the response string is terminated with a carriage return <CR> and <LF>. When block print is finished, an extra <SP><CR> <LF> is used to provide separation between the blocks.

Abbreviated Transmission

Byte	Description
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> carriage return
14	<LF> line feed
15	<SP>* (Space)
16	<CR>* carriage return
17	<LF>* line feed

** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Input = 875
   17 INP 875 <CR><LF>
2. Node address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

(CSR) Control Status Register

The Control Status Register is used to both directly control the meter's outputs (setpoints and analog output), and interrogate the state of the setpoint outputs. The register is bit mapped with each bit position within the register assigned to a particular control function. The control function are invoked by

bit 0: Setpoint 1 Output Status
- 0 = output off
- 1 = output on

bit 1: Setpoint 2 Output Status
- 0 = output off
- 1 = output on

bit 2: Setpoint 3 Output Status
- 0 = output off
- 1 = output on

bit 3: Setpoint 4 Output Status
- 0 = output off
- 1 = output on

bit 4: Manual Mode
- 0 = automatic mode
- 1 = manual mode

bit 5: Always stays 0, even if 1 is sent.

bit 6: Sensor Status (PAXT only)
- 0 = sensor normal
- 1 = sensor fail

bit 7: Always stays 0, even if 1 is sent.

writing to each bit position. The bit position definitions are:

Although the register is bit mapped starting with bit 7, HEX < > characters are sent in the command string. Bits 7 and 5 always stay a zero, even if a "1" is sent. This allows ASCII characters to be used with terminals that may not have extended character capabilities.

Writing a "1" to bit 4 of CSR selects manual mode. In this mode, the setpoint outputs are defined by the values written to the bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden.

In automatic mode, the setpoint outputs can only be reset off. Writing to the setpoint output bits of the CSR has the same effect as a Reset command (R). The contents of the CSR may be read to interrogate the state of the setpoint outputs and to check the status of the temperature sensor (PAXT only).

Examples:

1. Set manual mode, turn all setpoints off:

		7	6	5	4	3	2	1	0:bit location
VJ<30>* or VJ0*	ASCII 0 =	0	0	1	1	0	0	0	0 or <30>

V is command write, J is CSR and * is terminator.

2. Turn SP1, SP3 outputs on and SP2, SP4 outputs off:

		7	6	5	4	3	2	1	0:bit location
VJ<35>* or VJ5*	ASCII 5 =	0	0	1	1	0	1	0	1 or <35>

3. Select Automatic mode:

		7	6	5	4	3	2	1	0:bit location
VJ<40>* or VJ@*	ASCII @ =	0	1	0	0	0	0	0	0 or <40>

Note: Avoid writing values <0A> (LF), <0D> (CR), <24> ($) and <2E> (*) to the CSR. These values are interpreted by the meter as end of command control codes and will prematurely end the write operation.

(AOR) Analog Output Register

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the Control Status Register. The range of values of this register is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. The table lists correspondence of the output signal with the register value.

Register Value	Output Signal*	
	I (mA)	V (V)
0	0.000	0.000
1	0.005	0.0025
2047	10.000	5.000
4094	19.995	9.9975
4095	20.000	10.000

**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V).*

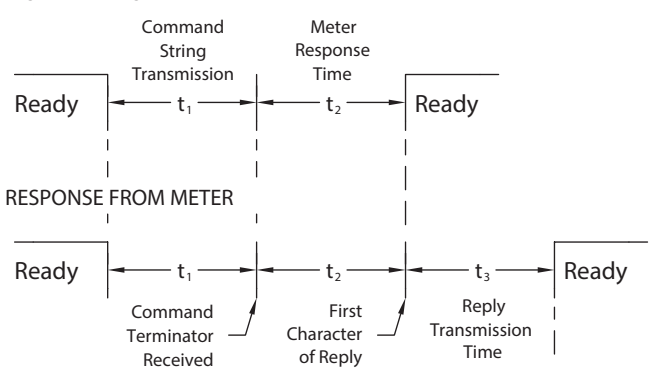
Writing to this register while the meter is in the manual mode causes the output signal to update immediately. While in the automatic mode, this register may be written to, but the output will not update until the meter is placed in manual mode.

Examples:

1. Set output to full scale:
   VI4095*
2. Set output to zero scale:
   VI0*

Command Response Time

The meter can only receive data or transmit data at any one time (half-duplex operation). The meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.



Timing Diagram Figure

At the start of the time interval t_1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t_1, the command characters are under transmission and at the end of this period, the command terminating character (*) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel.

t_1 = (10 * # of characters) / baud rate

At the start of time interval t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies from 2 msec to 50 msec. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t_2 is controlled by the use of the command terminating character. The standard command line terminating character is '*'. This terminating character results in a response time window of 50 msec minimum and 100 msec maximum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '$' results in a response time window (t_2) of 2 msec minimum and 50 msec maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel. t_3 = (10 * # of characters) / baud rate. At the end of t_3, the meter is ready to receive the next command.

The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.

Communication Format

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character.

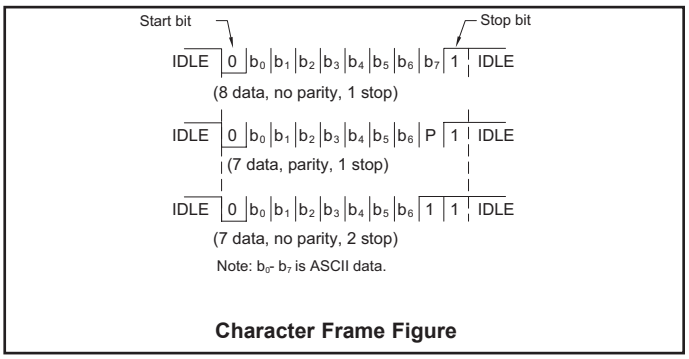
The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD,RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD,RXD; +3 to +15 V	a-b > +200 mV
* Voltage levels at the Receiver			

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional error detection parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

Start bit and Data bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted. Since the sending and receiving devices operate at the same transmission speed (baud rate), the data is read without timing errors.



Character Frame Figure

Parity bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The PAX meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit.

MODEL PAXCDC -DEVICENET™ OUTPUT OPTION CARD

DESCRIPTION

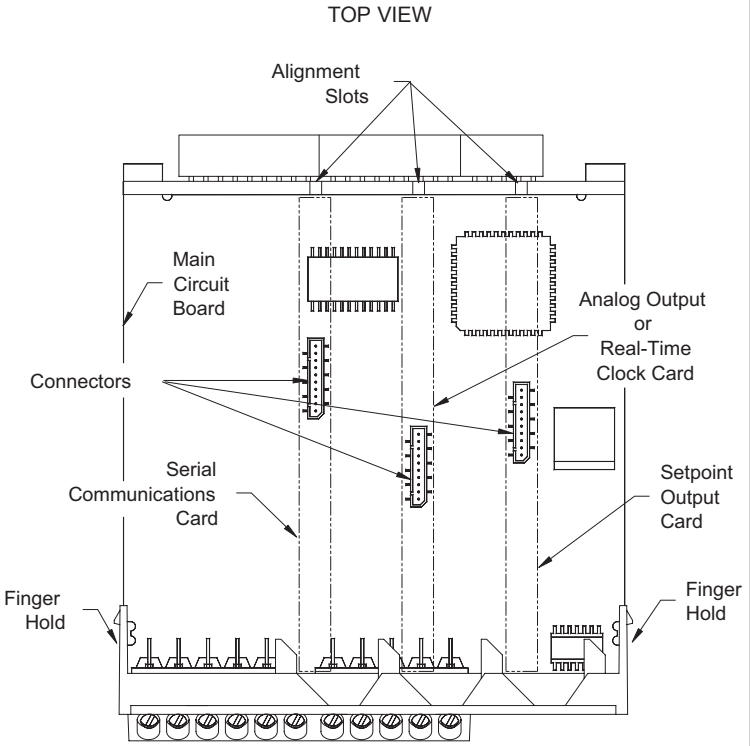
The DeviceNet Option Card (PAXCDC30) is designed for the PAX series of meters. It fits into the Comms slot of any PAX meter and allows the meter to communicate with a DeviceNet bus. The card supports Polling, Bit Strobe, and Explicit Message Commands. The MAC ID and the Baud Rate are switch adjustable via a DIP switch. A bicolor LED is used to indicate the meter's status in relationship to the bus.

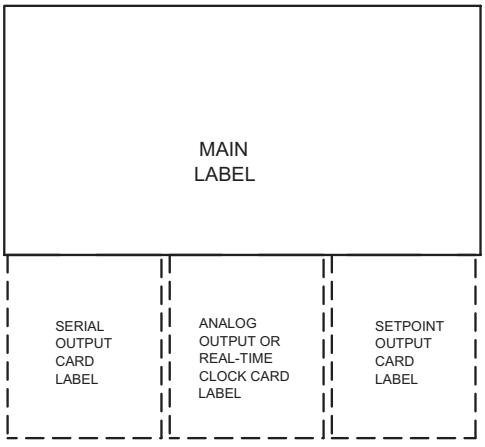
INSTALLING AN OPTION CARD

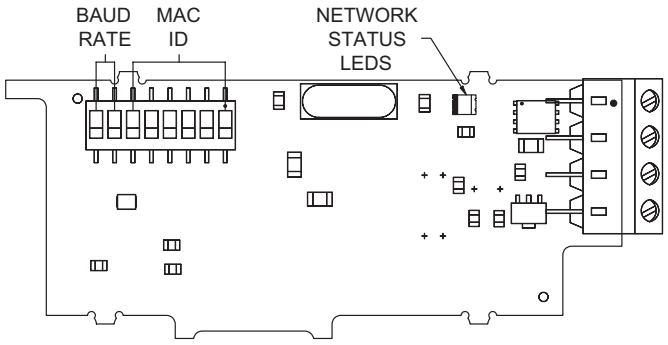
***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Apply the option card label to the bottom side of the meter. Do not cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly. Apply the label to the area designated by the large case label.
6. See manual for wiring connections and programming procedures.







ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXCDC	PAX DeviceNet™ Output Card	PAXCDC30

DIP SWITCHES

Both MAC ID and baud rate are set via DIP switches on the DeviceNet™ option card. See the DIP switch setting table for more details on these DIP switches. Configuration of MAC ID and baud rate is not supported over DeviceNet™.

NETWORK STATUS LEDs

The network status LEDs provide visual indication to the operator of the DeviceNet™ card's current status.

DeviceNet™ SPECIFICATIONS

POWER SUPPLY

Source: Supplied by DeviceNet™ bus.
The bus does not power the host.
Voltage: 11 to 25 VDC.
Current:
Nominal: 40 mA at 25 VDC.
Inrush: 550 mA for 5 msec at 25 VDC.
*Power must be applied to the PAX meter before bus power is applied to the card.

NETWORK SPECIFICS

Compatibility: Group 2 Server Only, not UCMM capable.
Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud.
Bus Interface: Phillips 82C250 or equivalent with mis-wiring protection per DeviceNet™ Volume 1 Section 10.2.2.
Node Isolation: Bus powered, isolated node.
Host Isolation: 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.
Bus Connection:
12 V+
13 CAN_H
14 CAN_L
15 V-
Shield: No Connection

INSTALLATION INFORMATION

Factory Settings:
Baud rate: 125 KBs.
MAC ID: 63
Strobe Register: 07h
Polling flags: All on.
Swap data flag: Off.
Store Flags: All on.

DIP SWITCH SETTING TABLE

SWITCH #	SETTING
1 - 6	MAC ID (all off = 0, all on = 63) Switch 1 is LSB (1), switch 6 is MSB (32).
7 off, 8 off	125 K baud
7 on, 8 off	250 K baud
7 off, 8 on	500 K baud
7 on, 8 on	N/A

CONNECTION SIZES

Device Profile: This product conforms to the DeviceNet™ specification Volumes I and II of version 2.0.
Device Configuration: No DeviceNet™ configuration is supported.

MESSAGE	PRODUCED	CONSUMED
Explicit	4 Bytes	4 Bytes
Polled	4 Bytes	6 Bytes
Bit Strobe	4 Bytes	8 Bytes

However, some meter configuration is supported.

NETWORK STATUS LEDs

Flashing Red LED:
This device is the only device on the network (waiting for an acknowledgment to its duplicate MAC ID check), or an I/O connection has timed out, or a recoverable error has occurred.
Flashing Green LED:
The device is functioning correctly and is waiting to be commissioned by a bus master.
Solid Red LED:
The device has encountered a non-recoverable fault, such as a duplicate MAC ID response, and has removed itself from the bus, or the device is in a power up reset state and is attempting to come on line.
Solid Green LED:
The device is on line, functioning correctly and has been commissioned by a bus master.

SUPPORTED CONNECTIONS

Polled Command: The Polled Command consumes 6 bytes of data, and is used to get, set, or reset attributes. The meter attribute is determined by the value in byte 0 of the data field. Refer to the Attribute Identification Chart for the appropriate value. Byte 1 determines the action: 0 = get, 1 = set, 2 = reset. The next 4 bytes are the new attribute value for the set command. For get or reset commands, enter 4 zeros. The data response from the Polled Command is in the format of a 4 byte hexadecimal number. For the get command (0), the response is the attribute value. For the set command (1), the response is an echo of the data input. For the reset command (2), all 0s are returned.

Bit Strobe Command: The Bit Strobe Command consumes eight bytes of data, or less. This is a read only predetermined meter attribute. The data response from the Bit Strobe Command is in the format of a 4 byte hexadecimal number. The register that will be read using the Bit Strobe command is determined by setting Attribute 2, Instance 1, Class 100* (decimal) with a value that represents the desired attribute. Refer to the Attribute Identification Chart for the appropriate value.

**Class 100 (decimal) is a vendor specific class.*

EXPLICIT MESSAGE COMMAND

Get Attribute: The attribute that will be read using the Get Attribute command is determined by setting Service Code 14, Instance 1, Class 100* (decimal), and the attribute with a value that represents the desired meter attribute. Refer to the Attribute Identification Chart for the appropriate value. The data response from the Get Attribute Command is in the format of a 4 byte hexadecimal number.

Set Attribute: The attribute that will be set using the Set Attribute command is determined by setting Service Code 16, Instance 1, Class 100* (decimal), and the attribute with a value that represents the desired meter attribute. Refer to the Attribute Identification Chart for the appropriate value. The data field for the Set Attribute Command is entered as a 4 byte hexadecimal number.

Reset Attribute: The attribute that will be reset using the Reset Attribute command is determined by setting Service Code 5, Instance 1, Class 100* (decimal), and the attribute with a value that represents the desired meter attribute. Refer to the Attribute Identification Chart for the appropriate value.

**Class 100 (decimal) is a vendor specific class.*

Note: Not all meter attributes respond to a Set or Reset Attribute command. Refer to the Attribute Identification Chart for details.

Vendor Specific Error Responses

CODE ERROR #	ERROR CODE MEANING
1F (General Code)	Vendor Specific Error
1 (Additional Code)	Meter Response Time-out
2 (Additional Code)	Vendor Service Not Supported
3 (Additional Code)	Command String Syntax Error

Attribute Identification Chart

VALUE	DESCRIPTION						SERVICE CODES SUPPORTED						POLLING	STORE
	PAX	PAXI	PAXCK	PAXDP	PAX2A	PAXDR	PAX	PAXI	PAXCK	PAXDP	PAX2A	PAXDR		
1	Data Swapping Flag ①						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
2	Bit Strobe Attribute						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
3	Polling Flags 1 ②						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
4	Polling Flags 2 ②						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
5	Polling Flags 3 ②						N/A	G, S	G, S	G, S	G, S	G, S	N/A	N/A
6	DIP Switch ③						G	G	G	G	G, S	G, S	N/A	N/A
7	Input	Count A	Timer	Input A (rel)	Input (rel)	Rate A	G	G, S, R	G, S, R	G, R	G, R	G	Attr 3, bit 0	Attr 26, bit 0
8	Total	Count B	Count	Input B (rel)	Total	Rate B	G, R	G, S, R	G, S, R	G, R	G, R	G	Attr 3, bit 1	Attr 26, bit 1
9	Max	Count C	RTC Time	Calc	Max. Input	Rate C	G, R	G, S, R	G, S	G	G, R	G	Attr 3, bit 2	Attr 26, bit 2
10	Min	Rate	RTC Date	Total	Min. Input	Total A	G, R	G, S	G, S	G, R	G, R	G, S, R	Attr 3, bit 3	Attr 26, bit 3
11	SP 1	Min	SP 1	Min Input	Setpoint 1	Total B	G, S, R	G, S, R	G, S, R	G, R	G, S, R	G, S, R	Attr 3, bit 4	Attr 26, bit 4
12	SP 2	Max	SP 2	Max Input	Setpoint 2	Total C	G, S, R	G, S, R	G, S, R	G, R	G, S, R	G, R	Attr 3, bit 5	Attr 26, bit 5
13	SP 3	Scale A	SP 3	Input A (abs)	Setpoint 3	Scale A	G, S, R	G, S	G, S, R	G	G, S, R	G, S	Attr 3, bit 6	Attr 26, bit 6
14	SP 4	Scale B	SP 4	Input B (abs)	Setpoint 4	Scale B	G, S, R	G, S	G, S, R	G	G, S, R	G, S	Attr 3, bit 7	Attr 26, bit 7
15	AOR ④	Scale C	SP 1 Off	Input A (offset)	Band/Dev 1	Scale C	G, S	G, S	G, S	G, S	G, S	G, S	Attr 4, bit 0	Attr 27, bit 0
16	CSR ④	Load A	SP 2 Off	Input B (offset)	Band/Dev 2	Load A	G, S	G, S	G, S	G, S	G, S	G, S	Attr 4, bit 1	Attr 27, bit 1
17	-----	Load B	SP 3 Off	-----	Band/Dev 3	Load B	-----	G, S	G, S	-----	G, S	G, S	Attr 4, bit 2	Attr 27, bit 2
18	-----	Load C	SP 4 Off	-----	Band/Dev 4	-----	-----	G, S	G, S	-----	G, S	----	Attr 4, bit 3	Attr 27, bit 3
19	-----	SP 1	Timer Start	SP 1	Input (abs)	Setpoint 1	-----	G, S, R	G, S	G, S, R	G	G, S, R	Attr 4, bit 4	Attr 27, bit 4
20	-----	SP 2	Count Start	SP 2	Input Offset	Setpoint 2	-----	G, S, R	G, S	G, S, R	G, S	G, S, R	Attr 4, bit 5	Attr 27, bit 5
21	-----	SP 3	Timer Stop	SP 3	-----	Setpoint 3	-----	G, S, R	G, S	G, S, R	----	G, S, R	Attr 4, bit 6	Attr 27, bit 6
22	-----	SP 4	Count Stop	SP 4	-----	Setpoint 4	-----	G, S, R	G, S	G, S, R	----	G, S, R	Attr 4, bit 7	Attr 27, bit 7
23	-----	MMR ④	MMR ④	MMR ④	MMR ④	MMR ④	-----	G, S	G, S	G, S	G, S	G, S	Attr 5, bit 0	Attr 28, bit 0
24	-----	AOR ④	RTC Day	AOR ④	AOR ④	AOR ④	-----	G, S	G, S	G, S	G, S	G, S	Attr 5, bit 1	Attr 28, bit 1
25	-----	SOR ④	SOR ④	SOR ④	SOR ④	SOR ④	-----	G, S	G, S	G, S	G, S	G, S	Attr 5, bit 2	Attr 28, bit 2
26	Store Flags 1 ⑤						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
27	Store Flags 2 ⑤						G, S	G, S	G, S	G, S	G, S	G, S	N/A	N/A
28	Store Flags 3 ⑤						N/A	G, S	G, S	G, S	G, S	G, S	N/A	N/A

① Data Swap: (1 byte), Attribute 1, Instance 1, Class 100 (decimal). Data is normally sent and entered as follows: Pax display value = 500000 (7A120h). 4 byte value sent would be 20 A1 07 00. Setting the data swap value to 1 would result in the data being sent as 00 07 A1 20. This attribute can only be set to 0 or 1, all other values are ignored. The factory setting value is 0. Data Byte is saved in EEPROM memory.

② Polling Flags: (3 bytes) Attribute 3 - 5, Instance 1, Class 100 (decimal). The DeviceNet card is continually requesting values from the PAX unit. The polling flags determine what values are requested during each loop. Setting the flags to "1" enables the card to poll that particular value. A "0" value disables it. Turning polling flags off allows the card to request fewer values and therefore decreases the internal loop time, which allows the values that are polled to be updated more often.

TYPICAL UPDATE TIMES

PAX	PAXI/PAXCK/PAXDP
All values (10) – 1.00 sec	All values (19) – 750 msec
5 values – 500 msec	10 values – 430 msec
1 value – 100 msec	5 values – 230 msec
	1 value – 52 msec

If a Set Attribute is executed for any value, that value is automatically updated to the latest value, regardless of whether the polling flag is on or off. On power up, all values are updated regardless of Polling flag settings. Polling flag values are saved in EEPROM memory. Factory settings is "on" for all Polling flags.
See Meter Attribute Identification Chart for polling flags.

③ DIP Switch Values: (1 byte), Attribute 6, Instance 1, Class 100 (decimal). Returns the dip switch setting. Switch 1 = LSB, 1 = on.

④ Indicates PAX Manual Mode Registers. See next section for descriptions of these registers.

⑤ Store Flags: (3 bytes) Attribute 26 - 28, Instance 1, Class 100 (decimal). This set of flags determines whether the attribute is stored to EEPROM when a Set or Reset service code is executed. If the flag is 0, the value is not saved to EEPROM memory in the PAX. If the flag is 1, the value is saved immediately to EEPROM memory in the PAX. Factory setting is "on" for all Store Flags. The attributes are grouped in blocks. Storing one attribute may cause others to be stored. If an attribute is SET frequently, its store flag should be set to 0 to increase EEPROM life.

MANUAL MODE DESCRIPTION

(CSR) Control Status Register [16] (PAX)

The Control Status Register is used to directly control the meter's outputs (setpoints and analog output), or view the state of the setpoint outputs and the status of the temperature sensor (PAXT only). The attribute is bit mapped with each bit position within the attribute assigned to a particular control function. The control functions are invoked by writing to each bit position. The bit position definitions are:

bit 0: SP1 Output
bit 1: SP2 Output
bit 2: SP3 Output
bit 3: SP4 Output
0 = output off
1 = output on

bit 4: Manual Mode
0 = automatic mode
1 = manual mode

bit 5: Always stays 0, even if 1 is sent.

bit 6: Sensor Status (PAXT only)
0 = sensor normal
1 = sensor fail

bit 7: Always stays 0, even if 1 is sent.

In Manual Mode, the setpoint outputs are defined by the values written to bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden. In automatic mode, the setpoint outputs can only be reset off.

Example:
1. Select manual mode for all outputs:
   Value to write to attribute 16: 0010h

MANUAL MODE DESCRIPTION (CONTINUED)

(MMR) Auto/Manual Mode Register [23] (PAXI/PAXCK/PAXDP/PAX2A/PAXDR)

This attribute sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint output. In Manual Mode (1) the outputs are defined by the attribute SOR. When transferring from auto mode to manual mode, the meter holds the last output value (until the attribute is changed by a write). Each output may be independently changed to auto or manual. Select values to place in manual mode by writing appropriate value to attribute 23. The bit position definitions are:

PAXI/PAXDP/PAX2A/PAXDR

bit 0: Analog Output
bit 1: SP4
bit 2: SP3
bit 3: SP2
bit 4: SP1
} 0 = Auto Mode, 1 = Manual Mode

PAXCK

bit 0: SP4
bit 1: SP3
bit 2: SP2
bit 3: SP1
} 0 = Auto Mode, 1 = Manual Mode

Example:

1. Select manual mode for all outputs and AOR (PAXI/PAXDP/PAX2A/PAXDR):
   Value to write to attribute 23: 001Fh

(SOR) Setpoint Output Register [25] (PAXI/PAXCK/PAXDP/PAX2A/PAXDR)

This attribute is used to view or change the states of the setpoint outputs. Reading from this attribute will show the present state of all the setpoint outputs. A "0" in the setpoint location means the output is inactive and a "1" means the output is active.

In Automatic Mode (See MMR Description), the meter controls the setpoint output state. In Manual Mode, writing to this attribute will change the output state. The bit position definitions are:

bit 0: SP1
bit 1: SP2
bit 2: SP3
bit 3: SP4
} 0 = Output off, 1 = Output on

Examples:

1. Turn all outputs on:
   Value to write to attribute 25 - 000Fh.
2. Turn outputs 1, 3 on:
   Value to write to attribute 25 - 0005h.
3. Turn all outputs off:
   Value to write to attribute 25 - 0000h.

(AOR) Analog Output Register (Not PAXCK)

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the CSR (PAX) or bit 0 of the MMR (PAXI). The range of values of this attribute is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. If a value larger than 4095 is written to the AOR Attribute, 4095 will be loaded. The table lists correspondence of the output signal with the attribute value.

**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V).*

Attribute Value	Output Signal*	
	I (mA)	V (V)
0	0.000	0.000
1	0.005	0.0025
2047	10.000	5.000
4094	19.995	9.9975
4095	20.000	10.000

Writing to this attribute while the meter is in the manual mode causes the output signal to update immediately. While in the automatic mode, this attribute may be written to, but the output will not update until the meter is placed in manual mode.

Examples:

1. Set output to full scale:
   Value to write to attribute 15 (PAX) or attribute 24 (PAXI) - 0FFFh (4095).
2. Set output to zero scale:
   Value to write to attribute 15 (PAX) or attribute 24 (PAXI) - 0000h (0).

MODEL PAXCDC -MODBUS OUTPUT OPTION CARD

DESCRIPTION

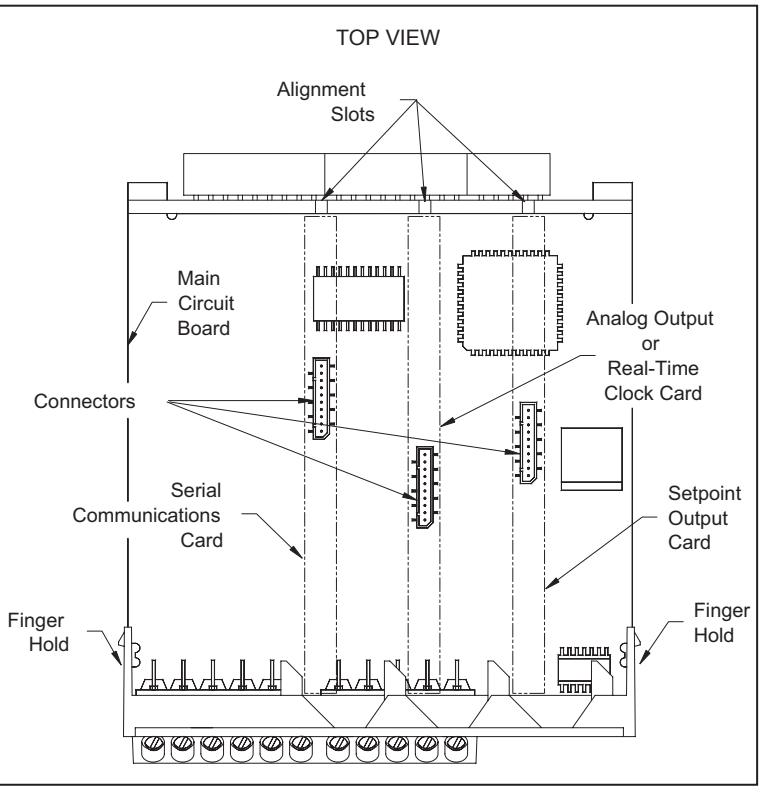
This product bulletin covers the MODBUS Communication Card for the PAX Meters. The card will allow the PAX Meter to transmit Display Values, Setpoints and Reset Values via MODBUS RS485 communication, in the RTU and ASCII modes.

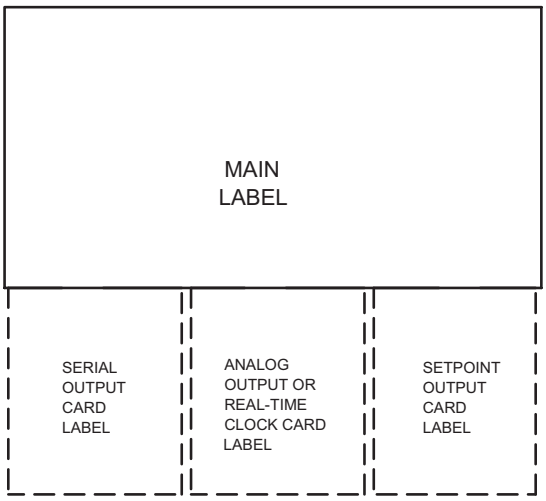
INSTALLING AN OPTION CARD

***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small scewdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Apply the option card label to the bottom side of the meter. Do not cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly. Apply the label to the area designated by the large case label.
6. See manual for wiring connections and programming procedures.





MODBUS SPECIFICATIONS

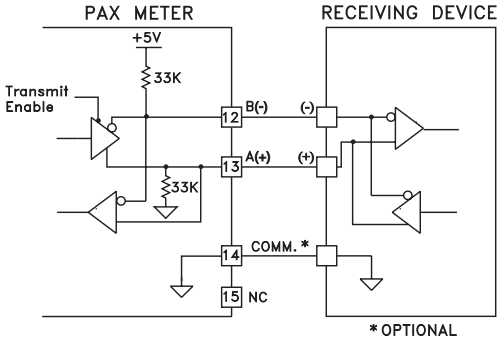
1. **Type**: RS485; RTU and ASCII MODBUS modes
2. **Isolation To Sensor & User Input Commons**: 500 Vrms for 1 minute. Working Voltage: 50 V. Not isolated from all other commons.
3. **Baud Rates**: 300 to 38400.
4. **Data**: 7/8 bits
5. **Parity**: No, Odd, or Even
6. **Addresses**: 1 to 247.
7. **Transmit Delay**: Programmable; See Transmit Delay explanation.

ORDERING INFORMATION

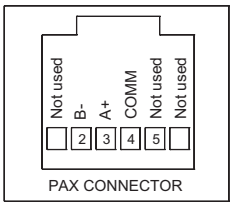
MODEL	DESCRIPTION	PART NUMBER
PAXCDC	PAX MODBUS Output Card	PAXCDC40
	PAX MODBUS Output Card with RJ11 Connector	PAXCDC4C

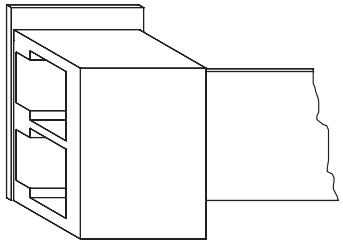
RS485 COMMUNICATIONS

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the PAX is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.



Terminal Block Connection Figure





Extended Comms Connection Figure

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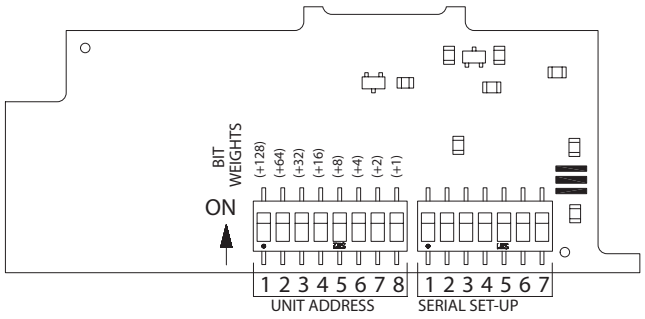
SERIAL SET-UP DIP SWITCH OPERATION

Serial port configuration is accomplished through two banks of DIP switches on the MODBUS card. The bank of 8 switches sets the Unit Address, the bank of 7 switches sets the Serial port parameters (ASCII/RTU, 7/8 bits, Parity, and Baud rate). Changes to the switch settings are only detected on power-up of the unit. After changing a switch setting, power to the unit must be cycled for the new switch setting to take effect.



Both unit address and serial set-up are set via DIP switches on the MODBUS option card. See the DIP switch setting table for more details on these DIP switches.

For the Unit Address bank, the high order bit is switch 1, and the ON position is a '1', the OFF position is a '0'. Legal unit addresses are 1 to 247. When a Unit Address of 0 is selected, the card responds to Unit Address 1. When a Unit Address of 248 through 255 is selected, the card responds to Unit Address 247.

For the serial bank, the following settings apply:

SWITCH	SETTINGS AVAILABLE		FACTORY SETTINGS
1	OFF: ASCII	ON: RTU	RTU
2	OFF: 7 Bits	ON: 8 Bits	8 Bits
3	OFF: None	ON: Parity	No Parity
4	OFF: Even	ON: Odd	OFF
5	Baud Rate	(See Baud Rate Switch Selections)	9600
6	Baud Rate		
7	Baud Rate		

BAUD RATE SWITCH SELECTIONS

	5	6	7
38400:	ON	ON	ON
19200:	ON	ON	OFF
9600:	ON	OFF	ON
4800:	ON	OFF	OFF
2400:	OFF	ON	ON
1200:	OFF	ON	OFF
600:	OFF	OFF	ON
300:	OFF	OFF	OFF

MODBUS SUPPORTED FUNCTION CODES

COIL FUNCTIONS

FC01: Read Coils

FC05: Force Single Coil, FC15: Force Multiple Coils.

1. Valid coil addresses are 1-49.
2. Block starting point can not exceed coil 49.

HOLD REGISTER FUNCTIONS

FC03: Read Holding Registers.

FC06: Preset Single Register, FC16: Preset Multiple Registers.

1. Valid register address are 40001 – 40039, 40041, 40042, 41001 – 41010.
2. Up to 16 registers can be requested at one time.
3. Block starting point can not exceed the register boundaries.
4. Holding registers are a mirror of Input registers (FC04).
5. Unused registers will return a value of HEX <8000>.
6. If a register is implemented, but does not exist for a particular unit configuration (such as SP3, SP4) a value of HEX <0000> will be returned.
7. Registers 41001 – 41010 contain the slave ID. See FC17.
8. Broadcast write is supported for FC06 & FC16. Register writes using address "0" will be recognized by the MODBUS card, regardless of address DIP switch setting.

OTHER SUPPORTED FUNCTIONS

FC04:

Returns the same values as FC03, except the register number starts with "3" (Ex: Pax Input Hi is 30001)

FC08 – Fetch Comm. Event Counter.

The MODBUS response breaks down as follows:

":010804"<TOT HI><TOT LO><GOOD HI><GOOD LO>XX<CR><LF>

The "TOT HI" and "TOT LO" values are the total number of messages that were received, that started with the card's address. The "GOOD HI" and "GOOD LO" are "good" messages (correct address, parity, and checksum). The values are reset on power up and every time the FC08 function is requested.

FC17 - Report Slave ID.

The following is sent upon FC17 request:

Unit Address, 17 (FC code), RLC-PAX(I or ?) 00?0, 0100 (for code version 1.00), 16 (number of read supported registers), 16 (number of write supported registers), 00 (number of registers available for GUID/Scratch pad memory), checksum of the string.

The following is the HEX of a PAXI (with unit address of 247):

:<F7><11><14><52><4C><43><2D><50><41><58><49><30><30><3F><30><01><00><00><10><00><10><00><00><XX><CR><LF>

XX is the LRC Checksum

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PAX MANUAL MODE DESCRIPTION

(CSR) Control Status Register [40021]

The Control Status Register is used to directly control the meter's outputs (setpoints and analog output), or view the state of the setpoint outputs and the status of the temperature sensor (PAXT only). The register is bit mapped with each bit position within the register assigned to a particular control function. The control functions are invoked by writing to each bit position. The bit position definitions are:

bit 0: SP1 Output
bit 1: SP2 Output
bit 2: SP3 Output
bit 3: SP4 Output
} 0 = output off, 1 = output on

bit 4: Manual Mode
0 = automatic mode
1 = manual mode

bit 5: Always stays 0, even if 1 is sent.

bit 6: Sensor Status (PAXT only)
0 = sensor normal
1 = sensor fail

bit 7: Always stays 0, even if 1 is sent.

In Manual Mode, the setpoint outputs are defined by the values written to bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden. In automatic mode, the setpoint outputs can only be reset off.

(MMR) Auto/Manual Mode Register [40036] (PAXI/DR/CK/TM)

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint output. In Manual Mode (1) the outputs are defined by the registers SOR. When transferring from auto mode to manual mode, the meter holds the last output value (until the register is changed by a write). Each output may be independently changed to auto or manual. Select values to place in manual mode by writing appropriate value to holding register 40036. The bit position definitions are:

PAXI/PAXDR

bit 0: Analog Output
bit 1: SP4
bit 2: SP3
bit 3: SP2
bit 4: SP1
} 0 = Auto Mode, 1 = Manual Mode

PAXCK/PAXTM

bit 0: SP4
bit 1: SP3
bit 2: SP2
bit 3: SP1
} 0 = Auto Mode, 1 = Manual Mode

Examples:

1. Select manual mode for all outputs (PAX):
   Value to write to holding register 40021: 0010h
2. Select manual mode for all outputs and AOR (PAXI, PAXDR):
   Value to write to holding register 40036: 001Fh

(SOR) Setpoint Output Register [40038] (PAXI/DR/CK/TM)

This register is used to view or change the states of the setpoint outputs. Reading from this register will show the present state of all the setpoint outputs. A "0" in the setpoint location means the output is inactive and a "1" means the output is active.

In Automatic Mode (See MMR Description), the meter controls the setpoint output state. In Manual Mode, writing to this register will change the output state. The bit position definitions are:

bit 0: SP1
bit 1: SP2
bit 2: SP3
bit 3: SP4
} 0 = Output off, 1 = Output on

Examples:

1. Turn all outputs on:
   Value to write to holding register 40038: 000Fh.
2. Turn outputs 1, 3 on:
   Value to write to holding register 40038: 0005h.
3. Turn all outputs off:
   Value to write to holding register 40038: 0000h.

(AOR) Analog Output Register (Not Applicable to PAXCK/TM)

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the CSR (PAX) or bit 0 of the MMR (PAXI/DR). The range of values of this register is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. If a value larger than 4095 is written to the AOR register, 4095 will be loaded. The table lists correspondence of the output signal with the register value.

Register Value	Output Signal*	
	I (mA)	V (V)
0	0.000	0.000
1	0.005	0.0025
2047	10.000	5.000
4094	19.995	9.9975
4095	20.000	10.000

**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V).*

Writing to this register while the meter is in the manual mode causes the output signal to update immediately. While in the automatic mode, this register may be written to, but the output will not update until the meter is placed in manual mode.

Examples:

1. Set output to full scale:
   Value to write to holding register 40020 (PAX) or 40037 (PAXI/DR): 0FFFh (4095).
2. Set output to zero scale:
   Value to write to holding register 40020 (PAX) or 40037 (PAXI/DR): 0000h (0).

HOLDING REGISTERS

Values less than 65,535 will be in (LO word). Values greater than 65,535 will continue into (HI word). Negative values are represented by two's complement of the combined (HI word) and (LO word).

HOLDING REGISTER	PAX [4]		PAXI [5]	PAXCK/PAXTM [5]		PAXDR [5]	
		ACCESS			ACCESS		ACCESS
40001:	Input (HI)	Read Only	CTA (HI)	Timer (HI)	Read/Write	Rate A (HI)	Read Only
40002:	Input (LO)	Read Only	CTA (LO)	Timer (LO)	Read/Write	Rate A (LO)	Read Only
40003:	Total (HI)	Read Only	CTB (HI)	Counter (HI)	Read/Write	Rate B (HI)	Read Only
40004:	Total (LO)	Read Only	CTB (LO)	Counter (LO)	Read/Write	Rate B (LO)	Read Only
40005:	Min (HI)	Read Only	CTC (HI)	RTC Time (HI)	Read/Write	Rate C (HI)	Read Only
40006:	Min (LO)	Read Only	CTC (LO)	RTC Time (LO)	Read/Write	Rate C (LO)	Read Only
40007:	Max (HI)	Read Only	RTE (HI)	RTC Date (HI)	Read/Write	Total A (HI)	Read/Write
40008:	Max (LO)	Read Only	RTE (LO)	RTC Date (LO)	Read/Write	Total A (LO)	Read/Write
40009:	SP1 (HI)	Read/Write	Min (HI)	SP1 (HI)	Read/Write	Total B (HI)	Read/Write
40010:	SP1 (LO)	Read/Write	Min (LO)	SP1 (LO)	Read/Write	Total B (LO)	Read/Write
40011:	SP2 (HI)	Read/Write	Max (HI)	SP2 (HI)	Read/Write	Total C (HI)	Read/Reset
40012:	SP2 (LO)	Read/Write	Max (LO)	SP2 (LO)	Read/Write	Total C (LO)	Read/Reset
40013:	SP3 (HI)	Read/Write	SFA (HI)	SP3 (HI)	Read/Write	SFA (HI)	Read/Write
40014:	SP3 (LO)	Read/Write	SFA (LO)	SP3 (LO)	Read/Write	SFA (LO)	Read/Write
40015:	SP4 (HI)	Read/Write	SFB (HI)	SP4 (HI)	Read/Write	SFB (HI)	Read/Write
40016:	SP4 (LO)	Read/Write	SFB (LO)	SP4 (LO)	Read/Write	SFB (LO)	Read/Write
40017:	Polling1 *	Read/Write	SFC (HI)	SP1 Off (HI)	Read/Write	SFC (HI)	Read/Write
40018:	Reset *	Read/Write	SFC (LO)	SP1 Off (LO)	Read/Write	SFC (LO)	Read/Write
40019:	TRX Delay [3]	Read/Write	LDA (HI)	SP2 Off (HI)	Read/Write	LDA (HI)	Read/Write
40020:	AOR [2]	Read/Write	LDA (LO)	SP2 Off (LO)	Read/Write	LDA (LO)	Read/Write
40021:	CSR	Read/Write	LDB (HI)	SP3 Off (HI)	Read/Write	LDB (HI)	Read/Write
40022:	Terminate1	Read/Write	LDB (LO)	SP3 Off (LO)	Read/Write	LDB (LO)	Read/Write
40023:			LDC (HI)	SP4 Off (HI)	Read/Write		
40024:			LDC (LO)	SP4 Off (LO)	Read/Write		
40025:			SP1 (HI)	Timer Start (HI)	Read/Write	SP1 (HI)	Read/Write
40026:			SP1 (LO)	Timer Start (LO)	Read/Write	SP1 (LO)	Read/Write
40027:			SP2 (HI)	Counter Start (HI)	Read/Write	SP2 (HI)	Read/Write
40028:			SP2 (LO)	Counter Start (LO)	Read/Write	SP2 (LO)	Read/Write
40029:			SP3 (HI)	Timer Stop (HI)	Read/Write	SP3 (HI)	Read/Write
40030:			SP3 (LO)	Timer Stop (LO)	Read/Write	SP3 (LO)	Read/Write
40031:			SP4 (HI)	Counter Stop (HI)	Read/Write	SP4 (HI)	Read/Write
40032:			SP4 (LO)	Counter Stop (LO)	Read/Write	SP4 (LO)	Read/Write
40033:			Polling1 *	Polling1 *	Read/Write	Polling1 *	Read/Write
40034:			Polling2 *	Polling2 *	Read/Write	Polling2 *	Read/Write
40035:			TRX Delay [3]	TRX Delay [3]	Read/Write	TRX Delay [3]	Read/Write
40036:			MMR	MMR	Read/Write	MMR	Read/Write
40037:			AOR [2]	RTC Day	Read/Write	AOR [2]	Read/Write
40038:			SOR	SOR	Read/Write	SOR	Read/Write
40039:			Reset *	Reset *	Read/Write	Reset *	Read/Write
40040:							
40041:			Terminate1	Terminate1	Read/Write	Terminate1	Read/Write
40042:			Terminate2	Terminate2	Read/Write	Terminate2	Read/Write

* See Coil Table for register mapping and Coil Descriptions for functionality.

Notes:

1. Any registers marked with "——" are unused and will return a value of HEX <8000>.
2. If a value larger than 4095 is written to the AOR register, 4095 will be loaded.
3. TRX delay is the minimum time from the reception of the last character in the MODBUS Query until the response is started. The minimum delay value is equal to 2 character times (2 msec min.). The user can increase the delay time by writing to the TRX Delay register. Any value written to the TRX Delay register that is less than the value calculated at power up will be ignored. The TRX Delay value is stored in E^2PROM memory. On power-up, the calculated value is compared to the value read back from the E^2PROM. The greater of the 2 values will be used as the TRX Delay value and will be written to the TRX Delay register.
4. Numeric data is limited to value -19999 to 99999.
5. Numeric data is limited to the value listed for that parameter according to the meter's literature.

COIL TABLE

COIL ADDRESS	COIL NUMBER	PAX		PAXI		PAXCK		PAXDR	
		COIL NAME	MIRROR REGISTER	COIL NAME	MIRROR REGISTER	COIL NAME	MIRROR REGISTER	COIL NAME	MIRROR REGISTER
01	0	SP1 Output	40021 (bit 0)	SP1 Output	40038 (bit 0)	SP1 Output	40038 (bit 0)	SP1 Output	40038 (bit 0)
02	1	SP2 Output	40021 (bit 1)	SP2 Output	40038 (bit 1)	SP2 Output	40038 (bit 1)	SP2 Output	40038 (bit 1)
03	2	SP3 Output	40021 (bit 2)	SP3 Output	40038 (bit 2)	SP3 Output	40038 (bit 2)	SP3 Output	40038 (bit 2)
04	3	SP4 Output	40021 (bit 3)	SP4 Output	40038 (bit 3)	SP4 Output	40038 (bit 3)	SP4 Output	40038 (bit 3)
05	4	Reset Max	40018 (bit 2)	Reset Max	40039 (bit 2)	———	———	Reset Total C	40039 (bit 2)
06	5	Reset Min	40018 (bit 3)	Reset Min	40039 (bit 3)	———	———	Reset Total B	40039 (bit 3)
07	6	———	———	Reset CNT A	40039 (bit 7)	Reset Timer	40039 (bit 7)	———	———
08	7	———	———	Reset CNT B	40039 (bit 6)	Reset Counter	40039 (bit 6)	———	———
09	8	———	———	Reset CNT C	40039 (bit 5)	———	———	———	———
10	9	Reset Total	40018 (bit 4)	———	———	———	———	———	———
11	10	Poll Input	40017 (bit 0)	Poll CNT A	40033 (bit 0)	Poll Timer	40033 (bit 0)	Poll Rate A	40033 (bit 0)
12	11	Poll Total	40017 (bit 1)	Poll CNT B	40033 (bit 1)	Poll Counter	40033 (bit 1)	Poll Rate B	40033 (bit 1)
13	12	Poll Max	40017 (bit 2)	Poll MAX	40033 (bit 2)	Poll SP2	40033 (bit 2)	Poll Total C	40033 (bit 2)
14	13	Poll Min	40017 (bit 3)	Poll MIN	40033 (bit 3)	Poll SP1	40033 (bit 3)	Poll Total B	40033 (bit 3)
15	14	Poll SP1	40017 (bit 4)	Poll SP1	40033 (bit 4)	Poll Timer Start	40033 (bit 4)	Poll SP1	40033 (bit 4)
16	15	Poll SP2	40017 (bit 5)	Poll SP2	40033 (bit 5)	Poll Counter Start	40033 (bit 5)	Poll SP2	40033 (bit 5)
17	16	Poll SP3	40017 (bit 6)	Poll SP3	40033 (bit 6)	Poll Timer Stop	40033 (bit 6)	Poll SP3	40033 (bit 6)
18	17	Poll SP4	40017 (bit 7)	Poll SP4	40033 (bit 7)	Poll Counter Stop	40033 (bit 7)	Poll SP4	40033 (bit 7)
19	18	Poll AOR	40017 (bit 8)	Poll AOR	40033 (bit 8)	Poll Day	40033 (bit 8)	Poll AOR	40033 (bit 8)
20	19	Poll CSR	40017 (bit 9)	Poll SOR	40033 (bit 9)	Poll SOR	40033 (bit 9)	Poll SOR	40033 (bit 9)
21	20	Term Total	40022 (bit 0)	Poll CNT C	40033 (bit 10)	Poll RTC Time	40033 (bit 10)	Poll Rate C	40033 (bit 10)
22	21	Term Max	40022 (bit 1)	Poll RATE	40033 (bit 11)	Poll RTC Date	40033 (bit 11)	Poll Total A	40033 (bit 11)
23	22	Term Min	40022 (bit 2)	Poll SFA	40033 (bit 12)	Poll SP3	40033 (bit 12)	Poll SFA	40033 (bit 12)
24	23	Term SP1	40022 (bit 3)	Poll SFB	40033 (bit 13)	Poll SP4	40033 (bit 13)	Poll SFB	40033 (bit 13)
25	24	Term SP2	40022 (bit 4)	Poll SFC	40033 (bit 14)	Poll SP1 Off	40033 (bit 14)	Poll SFC	40033 (bit 14)
26	25	Term SP3	40022 (bit 5)	Poll LDA	40033 (bit 15)	Poll SP2 Off	40033 (bit 15)	Poll LDA	40033 (bit 15)
27	26	Term SP4	40022 (bit 6)	Poll LDB	40034 (bit 0)	Poll SP3 Off	40034 (bit 0)	Poll LDB	40034 (bit 0)
28	27	Term AOR	40022 (bit 7)	Poll LDC	40034 (bit 1)	Poll SP4 Off	40034 (bit 1)	———	———
29	28	Term CSR	40022 (bit 8)	Poll MMR	40034 (bit 2)	Poll MMR	40034 (bit 2)	Poll MMR	40034 (bit 2)
30	29	Response Delay	40017 (bit 10)	Response Delay	40034 (bit 3)	Response Delay	40034 (bit 3)	Response Delay	40034 (bit 3)
31	30	———	———	Term CNT A	40041 (bit 0)	Term Timer	40041 (bit 0)	Term CNT A	40041 (bit 0)
32	31	———	———	Term CNT B	40041 (bit 1)	Term Count	40041 (bit 1)	Term CNT B	40041 (bit 1)
33	32	———	———	Term CNT C	40041 (bit 2)	Term RTC Time	40041 (bit 2)	Term CNT C	40041 (bit 2)
34	33	———	———	Term Rate	40041 (bit 3)	Term RTC Date	40041 (bit 3)	Term Total A	40041 (bit 3)
35	34	———	———	Term Min	40041 (bit 4)	Term SP1	40041 (bit 4)	Term Total B	40041 (bit 4)
36	35	———	———	Term Max	40041 (bit 5)	Term SP2	40041 (bit 5)	Term Total C	40041 (bit 5)
37	36	———	———	Term SFA	40041 (bit 6)	Term SP3	40041 (bit 6)	Term SFA	40041 (bit 6)
38	37	———	———	Term SFB	40041 (bit 7)	Term SP4	40041 (bit 7)	Term SFB	40041 (bit 7)
39	38	———	———	Term SFC	40041 (bit 8)	Term SP1 Off	40041 (bit 8)	Term SFC	40041 (bit 8)
40	39	———	———	Term LDA	40041 (bit 9)	Term SP2 Off	40041 (bit 9)	Term LDA	40041 (bit 9)
41	40	———	———	Term LDB	40041 (bit 10)	Term SP3 Off	40041 (bit 10)	Term LDB	40041 (bit 10)
42	41	———	———	Term LDC	40041 (bit 11)	Term SP4 Off	40041 (bit 11)	———	———
43	42	———	———	Term SP1	40041 (bit 12)	Term Time Start	40041 (bit 12)	Term SP1	40041 (bit 12)
44	43	———	———	Term SP2	40041 (bit 13)	Term Count Start	40041 (bit 13)	Term SP2	40041 (bit 13)
45	44	———	———	Term SP3	40041 (bit 14)	Term Time Stop	40041 (bit 14)	Term SP3	40041 (bit 14)
46	45	———	———	Term SP4	40041 (bit 15)	Term Count Stop	40041 (bit 15)	Term SP4	40041 (bit 15)
47	46	———	———	Term AOR	40042 (bit 0)	Term MMR	40042 (bit 0)	Term AOR	40042 (bit 0)
48	47	———	———	Term MMR	40042 (bit 1)	Term Day	40042 (bit 1)	Term MMR	40042 (bit 1)
49	48	———	———	Term SOR	40042 (bit 2)	Term SOR	40042 (bit 2)	Term SOR	40042 (bit 2)

COIL DESCRIPTIONS

Coils 1-4: Output Coils

These coils are used to read or change the states of the Setpoint Outputs. To change the state of the output(s), the output(s) must be in manual mode. Refer to the CSR or MMR/SOR registers in the Manual Mode Description section.

Coils 5-10: Reset Coils

These coils are used to perform the Reset command for the values listed. Forcing the coil "on" causes the appropriate value in the unit to be reset. The coil is cleared after the command is executed, therefore, the coil value read will always be 0 (zero).

Coils 11-29: Polling Coils

The MODBUS card is continually requesting values from the PAX unit. The polling bit coils determine what values are requested during each loop. Setting the coils to "1" enables the card to poll that particular value. A "0" value disables it. Turning polling coils off allows the user to request fewer values and therefore decreases the internal loop time, which allows the values that are polled to be updated more often.

If a MODBUS read is issued for any value, that value is automatically updated to the latest value, regardless of whether the polling bit is on or off. On power up, all values are updated regardless of Polling bit settings. Polling coil values are saved in E^2PROM memory. Factory settings is "on" for all Polling coils.

TYPICAL UPDATE TIMES**	
PAX	**PAXI/DR/CK/TM**
All values (10) - 1.15 sec	All values (19) - 900 msec
5 values - 500 msec	10 values - 480 msec
1 value - 100 msec	5 values - 230 msec
	1 value - 52 msec

***Update time is the typical time to update the internal memory provided no MODBUS requests are incoming.*

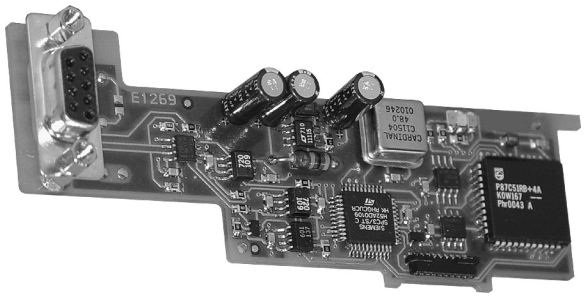
Coils 21-29 (PAX), Coils 31-49 (PAXI/DR/CK/TM): Terminating Coils

This set of coils determines what terminating character is sent to the PAX meter when a write command is executed. If the flag is 0, a $ is used as the terminating character and the value is not saved to E^2PROM memory in the PAX. If the flag is 1, an * is used as the terminating character and the value is saved to E^2PROM memory in the PAX.

Coil 30: Response Delay

When a write command is issued, the new value is written to the PAX. If the coil is off, the MODBUS write response is not issued until the value is read back from the PAX. For MODBUS reads, if a polling coil is off, the response is not issued until the latest value is read back from the PAX. If the coil is set "on" the MODBUS response is issued as soon the received command is complete. The write coil is saved in E^2PROM memory. Factory setting is on.

MODEL PAXCDC - PROFIBUS-DP COMMUNICATIONS OPTION CARD



- *CONNECTS PAX METER TO PROFIBUS-DP NETWORK*
- *STANDARD 9-PIN D-SUB CONNECTOR INTERFACE*
- *CYCLIC I/O DATA TRANSMISSION, UP TO 84 BYTES IN/OUT*
- *OPERATING RANGE FROM 9.6 KBAUD TO 12 MBAUD WITH AUTOMATIC BAUD RATE DETECTION*
- *STATION ADDRESS SET THROUGH ROTARY SWITCHES*
- *CONFIGURATION VIA SELECTION OF PRE-CONFIGURED MODULES FOR THE SPECIFIC PAX METER TYPE*
- *FREEZE MODE AND SYNC MODE SUPPORTED*
- *DIAGNOSTIC LEDs INDICATE CARD STATUS*
- *PNO CERTIFIED, CONFORMANCE TESTED SLAVE DEVICE*

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DESCRIPTION

The PAX PROFIBUS-DP Communications Option Card provides a direct connection for a PAX panel meter to a PROFIBUS-DP Network. This allows a PROFIBUS Master device, such as a PLC, to control and monitor the operation of the PAX meter. The meter functions as an intelligent PROFIBUS-DP Slave device on the Network.

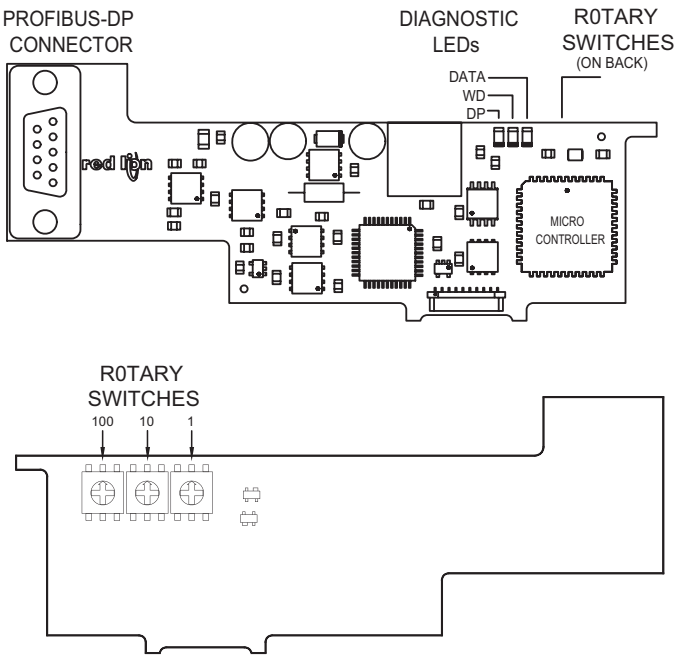
The PROFIBUS-DP Network connects through a 9-pin D-subminiature female connector on the rear of the card. The card is installed in the PAX meter using a slotted rear cover, allowing the PROFIBUS-DP Connector to extend beyond the rear of the PAX case. Power for the card is provided internally from the power supply of the PAX meter. The PROFIBUS-DP Network is isolated from the control electronics on the card using high-speed optocouplers.

This fully featured communications card supports Automatic Baud Rate Detection, with an operating range of 9.6 Kbaud up to 12 Mbaud. The Station Address is set via rotary switches. The card's address is read at power up.

Data Exchange with the Master device occurs through cyclic I/O data transmission. The size of the I/O data block is determined by the selection of pre-configured Modules for the specific PAX meter type. All data values are in 32-bit integer format, Motorola byte ordering. The PROFIBUS-DP protocol per EN 50170 is implemented using the Siemens SPC3 ASIC. Three on-board Diagnostic LEDs indicate the status of Data Exchange (DATA), the SPC3 Watchdog (WD) and DP State Machine (DP).

PNO Conformance and GSD File

The PAX PROFIBUS-DP Card is PNO certified, having passed the conformance test for PROFIBUS-DP Slave devices, Certificate No. Z01170. The PNO Identifier for this PROFIBUS device is 0x09D0. The functional characteristics are described in GSD file REDL09D0.GSD. The GSD file and PAX bitmap can be downloaded from the Red Lion Controls website.



SPECIFICATIONS

1. **FIELDBUS TYPE**: PROFIBUS-DP per standard EN 50170, implemented with Siemens SPC3 ASIC
2. **BUS INTERFACE**: Isolated RS485 through 9-Pin D-Sub connector
3. **NETWORK ISOLATION**: 500 Vrms for 1 minute (50 V working) between PROFIBUS-DP network and PAX Sensor & User Input commons. Not isolated from other PAX option card commons.
4. **POWER**: Card powered internally by the PAX meter
5. **OUTPUT POWER**: +5 VDC @ 90 mA max. available on the D-Sub connector pins 5 (GND) and 6 (+5 V)
6. **BAUD RATES**: 9.6 Kbaud to 12 Mbaud, Auto Baud Rate Detection
7. **STATION ADDRESS**: 0 to 125, set by rotary switches
8. **SUPPORTED FUNCTIONS**:
   FREEZE Mode: Supported
   SYNC Mode: Supported
   FAIL SAFE Mode: Not Supported
   EXTERNAL DIAGNOSTIC DATA: Not Supported
9. **INSTALLATION REQUIREMENTS**:
   Installed Depth: 4.88" (124 mm) from the rear of the PAX bezel
   Additional Height: 0.35" (9 mm) above the PAX case surface

ORDERING INFORMATION

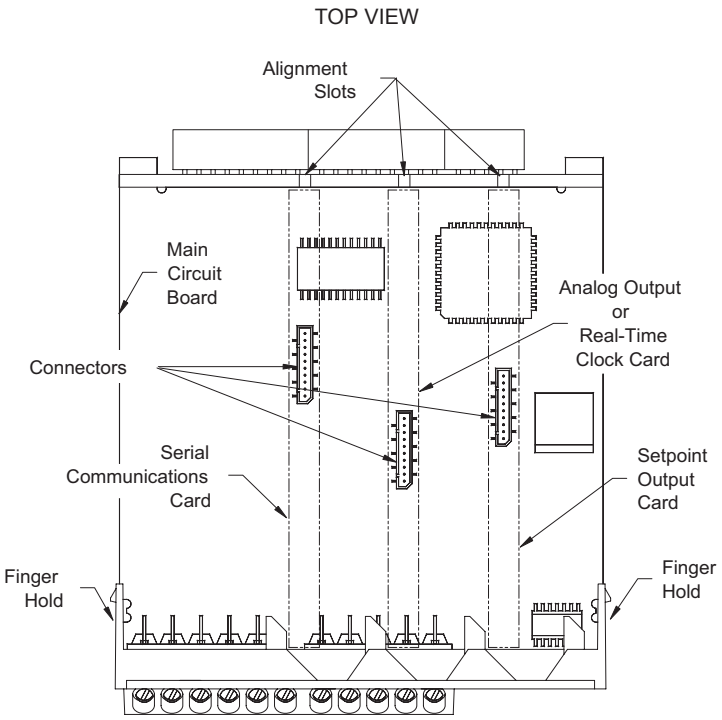
MODEL NO.	DESCRIPTION	PART NUMBER
PAXCDC	PAX PROFIBUS-DP Communications Card	PAXCDC50

INSTALLING AN OPTION CARD

***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the serial communication card. Hold the unit by the rear cover, not the display board, when installing an option card.
3. Install the option card by aligning the option card with the slot in the rear cover. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.



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PRINCIPLE OF OPERATION

The PAX PROFIBUS-DP Card provides the PROFIBUS Network with access to an Input Data Block (data written to the PROFIBUS Network from the PAX) and an Output Data Block (data read from the PROFIBUS Network by the PAX). Using an internal high speed protocol, the card scans each PAX register in turn, continuously reading Input Data and only writing Output Data on demand. The PAX registers are mapped into each Input and Output Data Block, allowing the PROFIBUS Network read/write access to all the registers in the PAX. The structure of these Data Blocks is described in more detail in section **Data Block Structure**.

The Input Data and Output Data Blocks are updated at the end of each scan of the host PAX Meter. In order to increase the rate that new data is made available to the PROFIBUS Network, a scheme is employed that reduces the number of registers polled by the card in each scan to only those that are required in the application. This Polled Read Mask maps each bit to a PAX register index which, when set, will force that register to be read from the PAX Meter. This Polled Read Mask is defined as User Parameter Data and is described in more detail in section **Parameterization**.

Due to the cyclic nature of data exchange in the PROFIBUS network changing Output Data in a slave device, a scheme is employed that indicates which registers need to be written to the PAX Meter. This Demand Write Mask maps each bit to a register index which when set, will perform a "once only" write from the Output Data Block to the PAX Meter. Clearing and re-setting the bit in the Demand Write Mask will cause the value to be written again. The Demand Write Mask is part of the Data Block structure and is described in detail in section **Demand Write and Store Request Masks**.

STATION ADDRESS

The station address is set using three rotary switches allowing the ID to be set in standard decimal notation (e.g. address = 123 - SWC = 1, SWB = 2, SWA = 3). Valid addresses range from 0 to 125. If an address greater than 125 is set, the card will default to a station address of 125.

Note: The card will not default to 125 if set for 999, this number is a special test mode.

DIAGNOSTIC LEDs

Three LEDs indicate the status of the SPC3 DP Control State Machine (DP), the Watchdog State Machine (WD) and the PROFIBUS-DP Data Exchange State (DATA) as shown in Table 1. The LEDs are viewable through the vents on the top of the PAX case.

Table 1 - LED Indication of PROFIBUS-DP Card Status

LED STATE			CARD STATUS
DP (Red)	WD (Green)	DATA (Red)	
FLASHING	FLASHING	OFF	Bus Not Connected
OFF	FLASHING	OFF	Baud Rate Search
OFF	ON	OFF	Baud Control
FLASHING	ON	OFF	Waiting for Parameterization
ON	ON	OFF	Waiting for Configuration
OFF	OFF	ON	Data Exchange

PARAMETERIZATION

The Polled Read Mask defines which PAX registers will be polled by the card and therefore updated in the Input Data Block. The Polled Read Mask is a 32-bit integer with each bit mapped to a PAX register index. The Polled Read Mask is configured in the card by the Master sending a Parameterization telegram with 4 bytes of User Parameter Data representing the Polled Read Mask, in Motorola byte ordering.

Table 2 shows the User Parameter bytes representing the Polled Read Mask and gives the default value and a typical example. The default Polled Read Mask indicates PAX register index 0 will be updated in the Input Block. The example Polled Read Mask indicates that PAX registers 0 and 8 will be updated in the Input Block.

Table 2 - User Parameter Data

BYTE	0	1	2	3	4
DESCRIPTION	-	Polled Read Mask			
DEFAULT	0x00	0x00	0x00	0x00	0x01
EXAMPLE	0x00	0x00	0x00	0x01	0x01

CONFIGURATION

Configuration of the Data Block is by the selection of pre-configured modules, identified in the GSD file as “PAX Digital (6-digit)” and “PAX Analog (5-digit)”. They differ in the number of registers available and therefore the size of the Data Block required to map all the registers completely. Each PAX register is represented as a 32-bit Integer requiring 2, 16-bit words or 4 bytes.

DATA EXCHANGE

Demand Write and Store Request Masks

The Demand Write Mask defines how data is written to the PAX. The Demand Write Mask is a 32-bit integer with each bit mapped to a PAX register index. Setting a bit in the Demand Write Mask of the Output Data Block will force the corresponding register to be written “once only” to the PAX. Clearing and re-setting the bit will cause the value to be written again. The Demand Write Mask is part of the Data Block structure.

The Write Service Status register in the Input Data Block reports when the register has been written to the PAX by setting the corresponding bit. By monitoring this register a PLC program can detect when the Output Data has been serviced. The bit will be cleared in the Service Status register when the corresponding bit is cleared in the Demand Write Mask.

The Store Mask defines how the written value is to be stored in the PAX. The PAX meters have some values stored in EEPROM so they may power up in the last saved state. For values that change often it is possible to exceed the life of an EEPROM with repeated writes to the same address location - this method inhibits writes to EEPROM. The Store Mask is a 32-bit integer with each bit mapped to a PAX register index. Setting a bit will inhibit the corresponding register from being saved to EEPROM.

Data Block Structure

Table 3 shows the Data Block Structure, consisting of the Write and Store Masks and the individual PAX Data Registers. Each Data Register value is a 32-bit Integer, with Motorola byte ordering. For the Analog PAX meters, the Data Block size is 48 bytes Input, 48 bytes Output. For the PAXDP and PAX2A Analog meters, and the Digital PAX meters, the Data Block size is 84 bytes Input, 84 bytes Output.

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Table 3 - Data Block Structure

REGISTER INDEX (Mask Bit)	DATA BLOCK BYTES	PAX ANALOG INPUT METER (5-Digit)	PAXDP ANALOG INPUT METER (5-Digit) ****	PAX2A ANALOG INPUT METER (6-Digit) ****	PAXI DIGITAL COUNT / RATE (6-Digit)	PAXDR DIGITAL DUAL RATE (6-Digit)	PAXCK DIGITAL CLOCK / TIMER (6-Digit)
-	1 - 4	Demand Write Mask (Output) / Service Status (Input)					
-	5 - 8	Store Mask (Output) / Unused (Input)					
0	9 - 12	Input *	Input A (relative) *	Input (relative) *	Count A	Rate A *	Timer
1	13 - 16	Total *	Input B (relative) *	Total *	Count B	Rate B *	Counter
2	17 - 20	Max. Input *	Calculation *	Max. Input *	Count C	Rate C *	RTC Time
3	21 - 24	Min. Input *	Total *	Min. Input *	Rate	Total A	RTC Date
4	25 - 28	Setpoint 1	Min Input *	Setpoint 1	Min. Rate	Total B	Setpoint 1
5	29 - 32	Setpoint 2	Max Input *	Setpoint 2	Max. Rate	Total C *	Setpoint 2
6	33 - 36	Setpoint 3	Input A (absolute) *	Setpoint 3	Scale Factor A	Scale Factor A	Setpoint 3
7	37 - 40	Setpoint 4	Input B (absolute) *	Setpoint 4	Scale Factor B	Scale Factor B	Setpoint 4
8	41 - 44	AOR **	Input A (offset)	Band/Deviation 1	Scale Factor C	Scale Factor C	Setpoint Off 1
9	45 - 48	CSR **	Input B (offset)	Band/Deviation 2	Count Load A	Count Load A	Setpoint Off 2
10	49 - 52	----	***	Band/Deviation 3	Count Load B	Count Load B	Setpoint Off 3
11	53 - 56	----	***	Band/Deviation 4	Count Load C	***	Setpoint Off 4
12	57 - 60	----	Setpoint 1	Input (absolute) *	Setpoint 1	Setpoint 1	Timer Start
13	61 - 64	----	Setpoint 2	Input Offset	Setpoint 2	Setpoint 2	Counter Start
14	65 - 68	----	Setpoint 3	***	Setpoint 3	Setpoint 3	Timer Stop
15	69 - 72	----	Setpoint 4	***	Setpoint 4	Setpoint 4	Counter Stop
16	73 - 76	----	MMR **	MMR **	MMR **	MMR **	MMR **
17	77 - 80	----	AOR **	AOR **	AOR **	AOR **	RTC Day
18	81 - 84	----	SOR **	SOR **	SOR **	SOR **	SOR **

* Indicates Read-Only parameters. All other parameters are Read/Write.
** Indicates PAX Manual Mode Registers. See next section for description.
*** Indicates bit value must not be set in the Parameterization polled read mask.
**** Select “PAX Digital (6-digit)” module for full mapping of the available registers.

PAX MANUAL MODE REGISTERS

CSR - Control Status Register (PAX Analog Only)

The Control Status Register is used to directly control the meter's outputs (setpoints and analog output), or view the state of the setpoint outputs and the status of the temperature sensor (PAXT only). The CSR register is bit mapped, with the bit positions of the least-significant byte assigned to specific control functions. The control functions are invoked by writing to the appropriate bit position. The bit position definitions are:

bit 0: Setpoint 1 Output
bit 1: Setpoint 2 Output
bit 2: Setpoint 3 Output
bit 3: Setpoint 4 Output
(0 = output off, 1 = output on)

bit 4: Auto/Manual Mode
0 = automatic mode
1 = manual mode

bit 5: Unused (always stays 0)

bit 6: Sensor Status (PAXT only)
0 = sensor normal
1 = sensor fail

bit 7: Unused (always stays 0)

Setting bit 4 of the CSR selects Manual Mode. In this mode, the setpoint outputs are defined by the values written to bits b0, b1, b2, b3; and the analog output is defined by the value written to the Analog Output Register (AOR). Internal control of these outputs is then overridden.

In Automatic Mode, the setpoint outputs can only be Reset off. The contents of the CSR may be read to interrogate the state of the setpoint outputs and to check the status of the temperature sensor (PAXT only).

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MMR - Auto/Manual Mode Register (PAXDP/PAX2A/PAXI/PAXDR/PAXCK)

This register sets the controlling mode for each output in the PAX meters. Each output may be independently changed to Auto or Manual mode. The MMR register is bit mapped, with the bit positions of the least-significant byte assigned to specific outputs. Auto or Manual mode is selected by writing to the appropriate bit position. The bit position definitions are:

PAXDP/PAX2A/PAXI/PAXDR	PAXCK
bit 0: Analog Output	bit 0: Setpoint 4 Output
bit 1: Setpoint 4 Output	bit 1: Setpoint 3 Output
bit 2: Setpoint 3 Output	bit 2: Setpoint 2 Output
bit 3: Setpoint 2 Output	bit 3: Setpoint 1 Output
bit 4: Setpoint 1 Output	

0 = Auto Mode, 1 = Manual Mode

In Auto Mode (0) the meter controls the setpoint output state and the Analog Output (PAXDP/PAX2A/PAXI/PAXDR only). In Manual Mode (1) the setpoint outputs are defined by the value in the Setpoint Output Register (SOR); and the Analog Output is defined by the value written to the Analog Output Register (AOR). When transferring from Auto Mode to Manual Mode, the meter holds the last output value (until the register is changed by a write).

SOR - Setpoint Output Register (PAXDP/PAX2A/PAXI/PAXDR/PAXCK)

The Setpoint Output Register is used to view or change the states of the setpoint outputs in the PAX meters. Reading this register will show the present state of all the setpoint outputs. A "0" means the output is inactive and a "1" means the output is active.

In Auto Mode (see MMR description), the meter controls the setpoint output state. In Manual Mode, the four least-significant bits of the SOR are assigned to specific outputs. Writing to the appropriate bit position defines the state of the setpoint output. The bit position definitions are:

bit 0: Setpoint 4 Output Status
bit 1: Setpoint 3 Output Status
bit 2: Setpoint 2 Output Status
bit 3: Setpoint 1 Output Status
(0 = Output Off, 1 = Output On)

(AOR) Analog Output Register (Not applicable to PAXCK)

The Analog Output Register value defines the signal level of the meter's analog output. The range of values for this register is 0 to 4095 (0FFFh), which corresponds to the analog output signal ranges shown in Table 4.

Table 4 - Analog Output Signal Ranges

Register Value	Output Signal*		
	0-20 mA	4-20 mA	0-10 V
0	0.000	4.000	0.000
1	0.005	4.004	0.0025
2047	10.000	12.000	5.000
4094	19.995	19.996	9.9975
4095	20.000	20.000	10.000

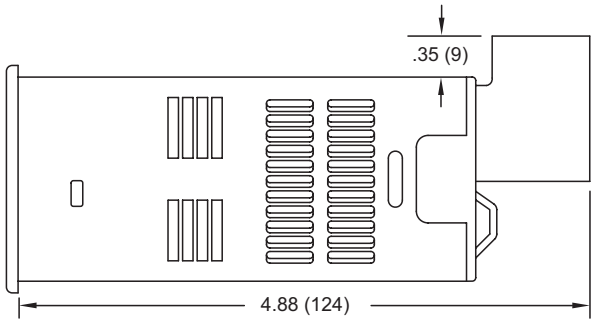
**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (0-20 mA or 0-10 V).*

In Automatic mode, the meter controls the analog output signal level. Reading the AOR will show the present value of the analog output signal. While in Automatic mode, this register may be written to, but it has no effect until the analog output is placed in the Manual mode.

In Manual mode, writing to the AOR causes the analog output signal level to update per the value written. Manual mode is engaged by setting bit 4 of the CSR (PAX Analog meter) or bit 0 of the MMR (PAXDP/PAX2A/PAXI/PAXDR). If a value larger than 4095 is written to the AOR, 4095 will be loaded.

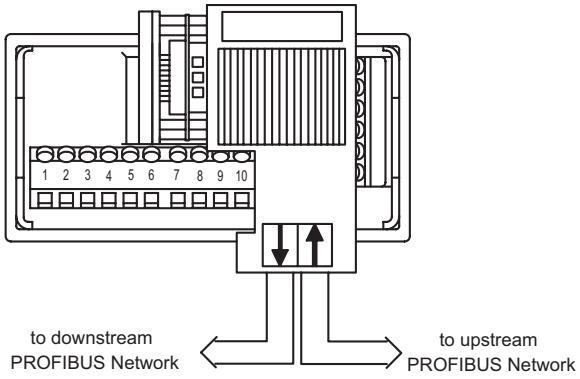
INSTALLATION AND CONNECTION

Installation Clearance Required - In Inches (mm)



PROFIBUS-DP Network Connection

PROFIBUS plug connectors such as Siemens 6ES7 972-0BA10-0XA0 are recommended. When wiring the connector, be sure to observe the proper direction for data flows, indicated by the arrows on the connector. When the PAX meter is the last device on the network, set the terminating resistor switch on the connector to the "ON" position.



MODEL PAXCDS -SETPOINT OUTPUT PLUG-IN OPTION CARDS

DESCRIPTION

This bulletin serves as a guide for the installation of PAX Setpoint cards. The setpoint cards are available as dual relay, quad relay, quad sinking transistor, quad sourcing transistor/SSR drive, or dual triac/dual SSR drive outputs.

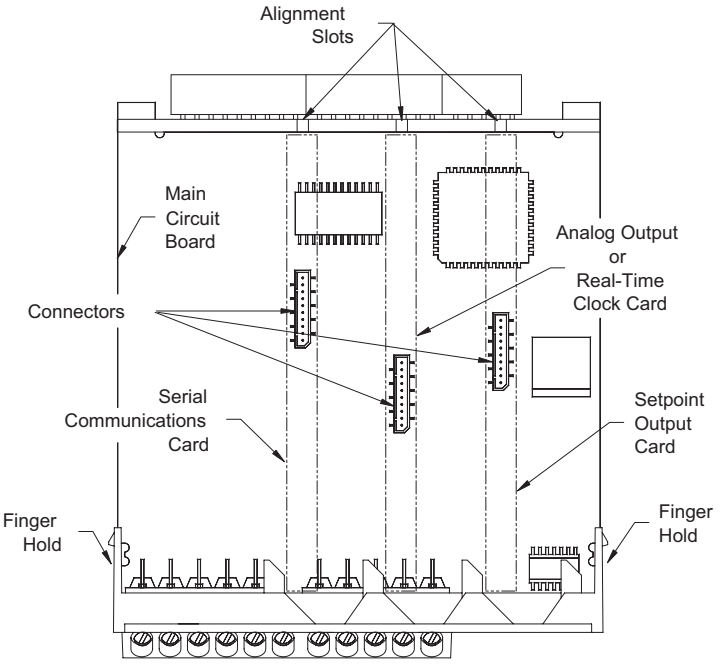
INSTALLING AN OPTION CARD

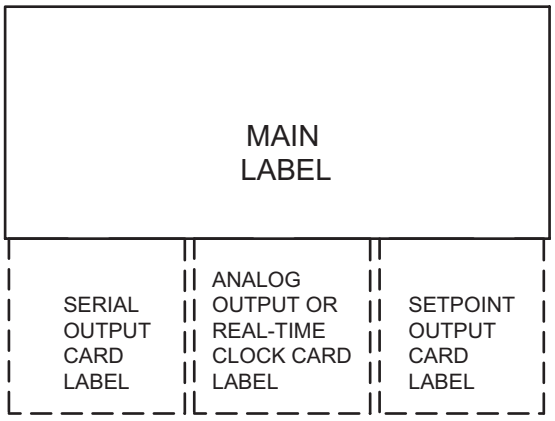
***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage may be present on the circuit boards when power is applied. Remove all power to the unit AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Apply the option card label to the bottom side of the unit. **Do not cover the vents on the top surface of the unit.** The surface of the case must be clean for the label to adhere properly. Apply the label to the area designated by the large case label.

TOP VIEW





PAX REAR TERMINAL CONNECTIONS

DUAL RELAY PAXCDS10

20	RLY1
21	
22	
23	RLY2
24	
25	

QUAD RELAY PAXCDS20

20	RLY1
21	COMM
22	RLY2
23	RLY3
24	COMM
25	RLY4

QUAD SINKING PAXCDS30

20	- COMMON
21	- 01 SNK.
22	- 02 SNK.
23	- 03 SNK.
24	- 04 SNK.
25	- COMMON

QUAD SOURCING/SSR DRIVE PAXCDS40

20	- EXTERNAL SUPPLY
21	- 01 SRC.
22	- 02 SRC.
23	- 03 SRC.
24	- 04 SRC.
25	- COMMON

DUAL TRIAC/DUAL SSR DRIVE PAXCDS50

20	TRIAC 1
21	COMM 1/2
22	TRIAC 2
23	- 03 SSR
24	- 04 SSR
25	- COMM 3/4

SPECIFICATIONS

Setpoint Output Cards: Five types of field installable cards

Response Time: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)700 msec. max. (digital filter disabled, internal zero correction enabled)

PAXH only: 1 sec. max. to within 99% of final readout value (digital filter disabled)

PAXT only: 200 msec. typ.; 700 msec max. (digital filter disabled)

PAXH Isolation For All Four Cards:

Isolation To Sensor Common: 1400 Vrms for 1 min.
Working Voltage: 125 V

Isolation To User Input Common: 500 Vrms for 1 min.
Working Voltage: 50 V

Dual Relay Card: PAXCDS10

Type: Two FORM-C relays
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min.
Working Voltage: 250 V
Contact Rating:
One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @120 VAC, inductive load
Total Current With Both Relays Energized not to exceed 5 amps
Life expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

Quad Relay Card: PAXCDS20

Type: Four FORM-A relays
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min.
Working Voltage: 250 V
Contact Rating:
One Relay Energized: 3 amps @ 250 VAC or 30 VDC (resistive load), 1/10 HP @120 VAC, inductive load
Total Current With All Four Relays Energized not to exceed 4 amps
Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

Quad Sinking Open Collector Card: PAXCDS30

Type: Four isolated sinking NPN transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating: 100 mA max @ V_{SAT} = 0.7 V max. V_{MAX} = 30 V

Quad Sourcing Open Collector/SSR Drive Card: PAXCDS40

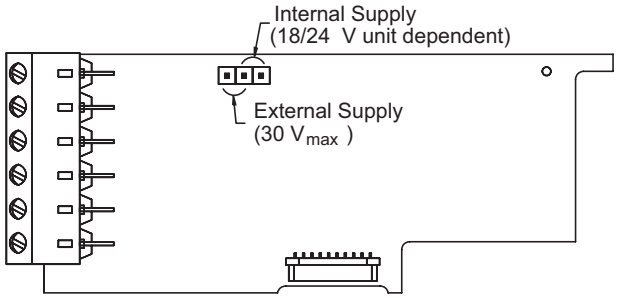
Type: Four isolated sourcing PNP transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating:
Internal supply: 18/24 VDC (unit dependent) ± 10%, 30 mA max. total all four outputs
External supply: 30 VDC max., 100 mA max each output

Dual Triac/Dual SSR Drive Card: PAXCDS50

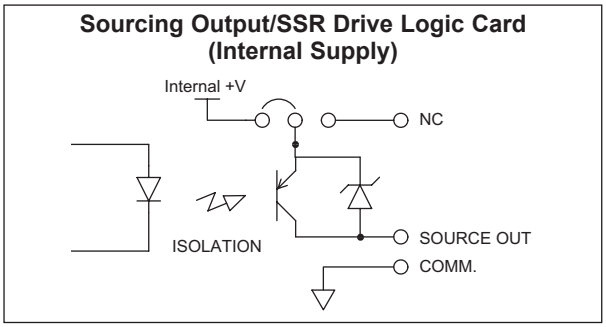
Triac:
Type: Isolated, zero crossing detection
Voltage: 260 VAC max., 20 VAC min.
Max Load Current: 1 Amp @ 25°C
0.75 Amp @ 50°C
Total load current with both triacs ON not to exceed 1.5 Amps
Min Load Current: 5 mA
Off State Leakage Current: 1 mA max @ 60 Hz
Operating Frequency: 20-400 Hz

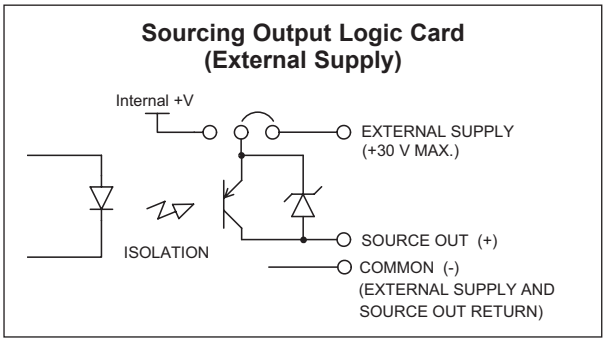
SSR Drive:
Type: Two isolated sourcing PNP Transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating:
Output Voltage: 18/24 VDC (unit dependent) ± 10%, 30 mA max. total both outputs

Quad Sourcing Open Collector Output Card Supply Select



For Quad Sourcing/SSR Drive Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before applying power.





ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXCDS	Dual Relay Output Card	PAXCDS10
	Quad Relay Output Card	PAXCDS20
	Quad Sinking Open Collector Output Card	PAXCDS30
	Quad Sourcing Open Collector/SSR Drive Output Card	PAXCDS40
	Dual Triac/Dual SSR Drive Output Card	PAXCDS50

MODEL PAXCDL -ANALOG OUTPUT PLUG-IN OPTION CARD

DESCRIPTION

This bulletin serves as a guide for the installation, configuration and operation of the PAX® Analog Output card. The analog output can be configured for 0 to 20 mA, 4 to 20 mA or 0-10 VDC. Only one range can be used at a time.

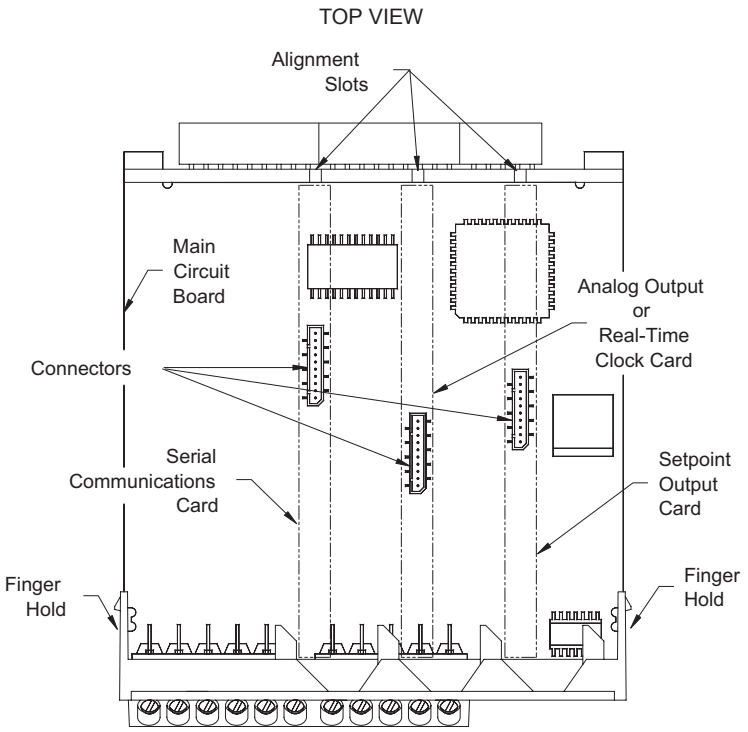
The PAX® meter can be fitted with up to three optional plug-in cards. The slot bays of the plug-in cards are dedicated to a particular card function. The plug-in card functions are: serial communications, analog output and setpoint output. Only one card from each function category can be installed.

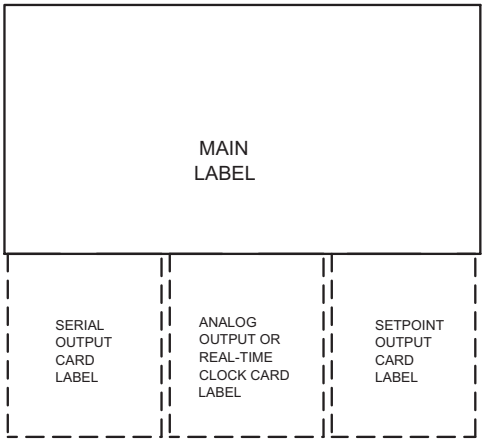
INSTALLING AN OPTION CARD

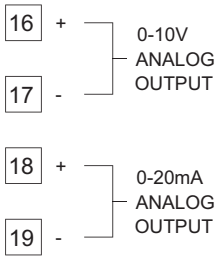
***Caution**: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.*

***Warning**: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.*

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the type of option card to be installed. Hold the unit by the rear connector, not the display board, when installing an option card.
3. Install the option card by aligning the option card connector with the slot bay in the rear cover. The cards are keyed by position with different main board connector locations. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.
5. Apply the option card label to the bottom side of the meter. **Do not cover the vents on the top surface of the meter.** The surface of the case must be clean for the label to adhere properly. Apply the label to the area designated by the large case label.







SPECIFICATIONS

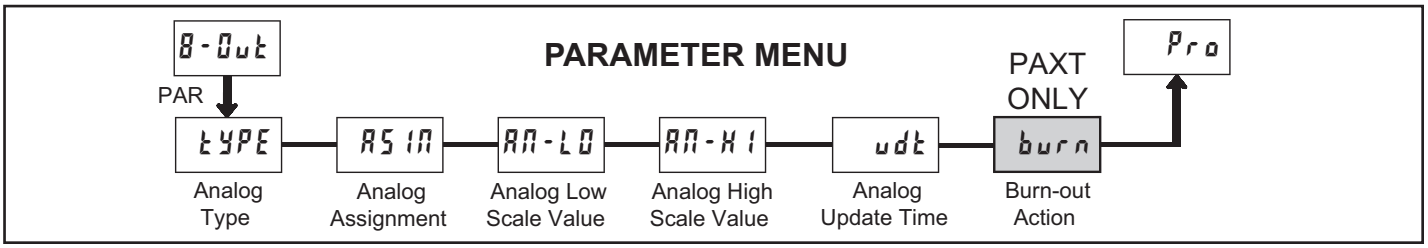
Analog Output Card

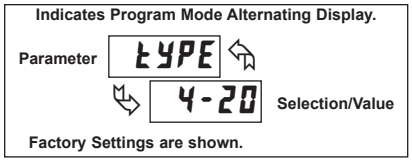
Types: 0 to 20 mA, 4 to 20 mA and 0 to 10 VDC
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not isolated from all other commons.
PAXH Only:
Isolation To Sensor Common: 1400 Vrms for 1 min.
Working Voltage: 125 V
Isolation To User Input Common: 500 Vrms for 1 min.
Working Voltage: 50 V
Accuracy: 0.17% of FS (18 to 28°C); 0.4% of FS (0 to 50°C)
Resolution: 1/3500
Compliance:
10 VDC: 10 KΩ load min.
20 mA: 500 Ω load max. (self-powered)
Update Time: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)
700 msec. max. (digital filter disabled, internal zero correction enabled)
PAXH only: 1 sec. max. to within 99% of final readout value (digital filter disabled)

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXCDL	Analog Output Card	PAXCDL10

MODULE 8 - Analog Output Parameters (8-Out)





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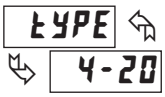
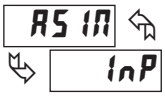
ANALOG TYPE



SELECTION	RANGE
0-20	0 to 20 mA
4-20	4 to 20 mA
0-10	0 to 10 V

Enter the analog output type. For 0-20 mA or 4-20 mA use terminals 18 and 19. For 0-10 V use terminals 16 and 17. Only one range can be used at a time.

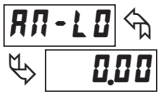
ANALOG ASSIGNMENT



inP H1 LO tot

Enter the source for the analog output to retransmit:
inP = Display Input Value
H1 = Maximum Display Input Value
LO = Minimum Display Input Value
tot = Totalize Display Value

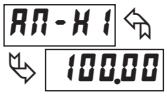
ANALOG LOW SCALE VALUE



-19999 to 99999

Enter the Display Value that corresponds to 0 mA (0-20 mA) , 4 mA (4-20 mA) or 0 VDC (0-10 VDC).

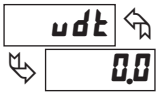
ANALOG HIGH SCALE VALUE



-19999 to 99999

Enter the Display Value that corresponds to 20 mA (0-20 mA) , 20 mA (4-20 mA) or 10 VDC (0-10 VDC).

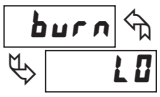
ANALOG UPDATE TIME



0.0 to 10.0

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at a rate of 20/sec.

PROBE BURN-OUT ACTION (PAXT ONLY)



LO H1

Enter the probe burn-out action. In the event of a temperature probe failure, the analog output can be programmed for low or high scale.

INSTALLATION CONSIDERATIONS OF ELECTRONIC INSTRUMENTS & CONTROLS, IN INDUSTRIAL ENVIRONMENTS

Most electronic equipment designed for use in industrial environments has a high degree of noise immunity and protection against damage. But even the best can experience difficulties in operation if certain minimal considerations are not adhered to when installing the equipment. When relay contacts are used to switch inductive loads, such as auxiliary relays or solenoids, extremely large voltage spikes can be generated when the relay contact opens, these voltage spikes can cause pitting of the relay's contacts, thereby reducing its usable life.

The internal functioning components of an electronic instrument operate on a low DC voltage, generally 5 V, and respond to signals as low as 1 V or less. In contrast, stray voltage spikes in excess of 100 V and sometimes thousands of volts can be detected in the industrial environment. These voltage spikes can be coupled from power lines that are powering equipment that contains S.C.R. circuitry, or in other ways causes rapid load changes on the AC line. These spikes can also be coupled from lines that are actuating AC or DC solenoids or actuators. In other words, any wiring in an industrial application should be considered a potential noise source.

How can these noise spikes get into the instrument? There are three major ways that noise spikes can enter the instrument.

1. Noise can enter directly, via the AC power input. It is recommended that electronic instruments be connected to a relatively clean source of power. If this cannot be accomplished, there are means of suppressing noise or isolating the instrument from the noise. These consist of everything from simple inductive load suppressors (M.O.V.'s) to constant voltage isolation transformers, depending on the severity of power line disturbance.
2. Noise can enter via the input leads. Here, there are two modes (See Fig. 1) by which the noise can enter. Normal mode, which means the noise enters on the input lead, with respect to the instrument common; and common mode, which means the noise enters on both the input and the instrument common with respect to earth ground (power line neutral). It is recommended that sensor input and control input wiring not be run in the same conduit or raceways with power lines or current carrying control lines. It is also recommended that these lines be kept away from inductive loads such as motors, solenoids, relays and contactors. For best results, it is recommended that two-conductor shielded cable be used to connect these inputs. The shield should be connected to the input common at the instrument only. In addition, the input common should only be connected to machine ground (earth) at one point, preferably a direct connection to the input common terminal.
3. The third way noise can enter the instrument is via the output lines. This is one of the most overlooked sources of trouble. When an output is driving an inductive load, such as solenoids, contactors, or relays; a large noise spike, several times the supply voltage, is generated every time the output is turned off. This noise spike, in addition to physically degrading the relay contact, can radiate off the output lines and into more sensitive areas of the instrument. The surest way to alleviate this situation is to suppress the noise spike. It is best to do it at the noise source (See Fig. 2), to prevent noise currents from flowing in the output lines. There are several ways to do this. If it is a DC device, then either a diode or a M.O.V. (Metal Oxide Varistor) can be placed across the device to suppress it. The greater the current load of the device, the higher wattage diode required. If it is an AC load, then a M.O.V. or capacitor and resistor in series can be used. It can be seen that the output lines can be noise sources and as such should be kept away from the instrument's own input lines, as well as the input lines of other instruments.

In addition to the foregoing considerations, care should be taken when connecting input and output returns to the instrument's common. When separate input and output commons are provided, they should not be mixed. When an output device return is connected to an input common (See Fig. 4), the output current will flow in the input common line. This will cause a noise voltage to be present, which can affect the operation of the instrument.

In summary, it is much easier to eliminate problems when building up a system than after it is installed.

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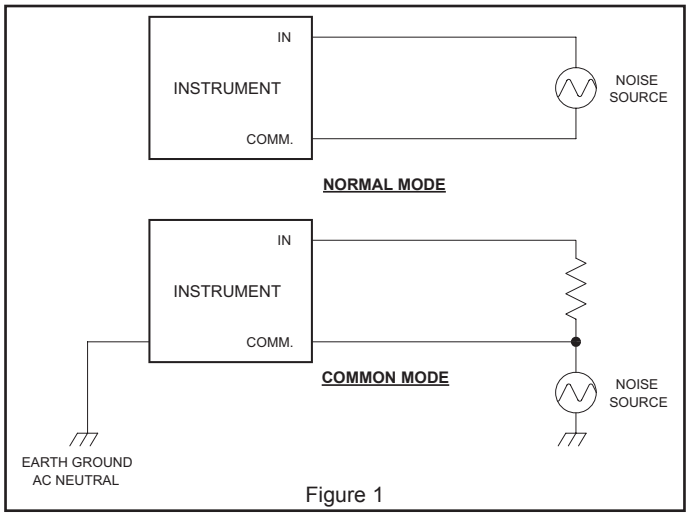


Figure 1

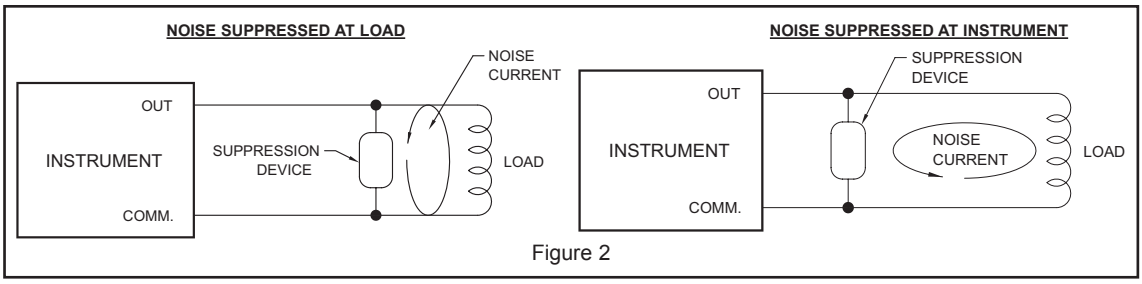


Figure 2

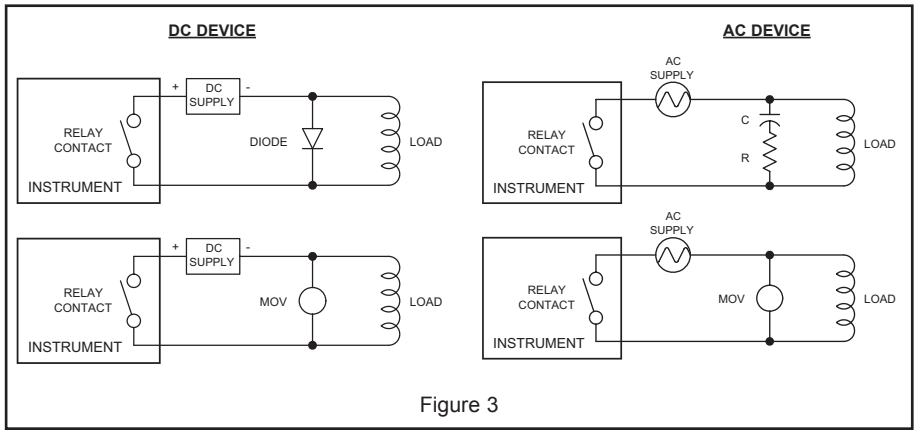


Figure 3

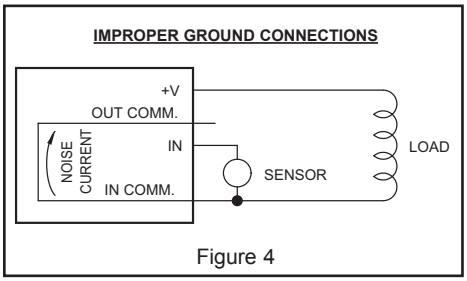


Figure 4

MODEL FCOR - FERRITE SUPPRESSION CORE

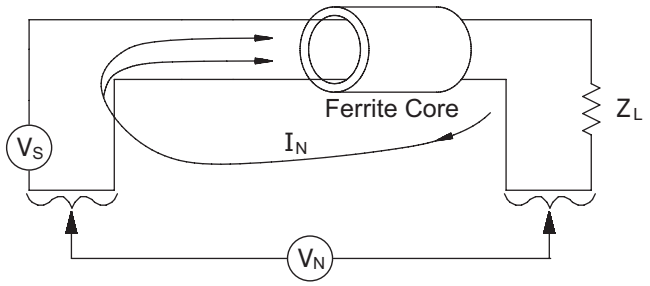
DESCRIPTION

This Ferrite suppression core is packaged in a nylon case ready to clamp on a single cable or several cables connecting to electronic equipment. The purpose of the core is to attenuate conducted Electro-Magnetic Interference (EMI) in the 25 MHz to 200 MHz range. Increasing the number of cable turns through the core increases the impedance of the core. A higher impedance results in greater EMI attenuation.

Placing more than one core on a cable increases the impedance at a slower rate than adding turns to one core. The impedance for multiple cores is equal to the sum of each core's impedance. For a given application, start with a single core using 2 turns. Add additional turns or additional cores as necessary.

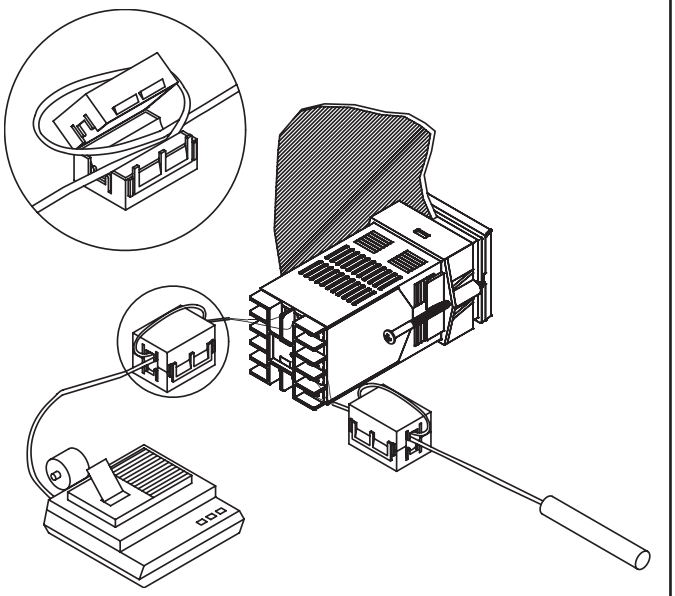
Note: Increasing the number of turns beyond two will tend to degrade performance at higher frequencies (see Specifications).

Place the cores on the cables as close to the equipment as possible unless the equipment is mounted in a shielded enclosure and the source of the EMI is from outside the enclosure. In this case, place the cores on the cable just inside or outside the entry point of the enclosure.



Ferrite core used for suppressing common--mode noise.
I_N = Common-mode Noise Current
Z_L = Load Impedance
V_S = Signal Voltage
V_N = Common-mode Noise Voltage

APPLICATION



SPECIFICATIONS

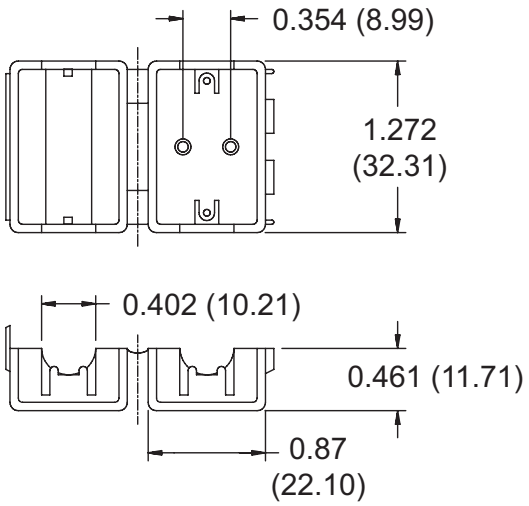
1. **MAX. CABLE DIAMETER:** 0.390" (9.9 mm)
2. **IMPEDANCE (OHMS):**

# OF TURNS	25 MHz MIN.	100 MHz ±20%
1	110	225
2	440	900
4	1760	1000

 # OF TURNS = The number of times the cable passes through the core.

3. **WEIGHT:** 0.63 oz. (18 g)

DIMENSIONS In inches (mm)



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
FCOR	Ferrite Suppression Core	FCOR0000

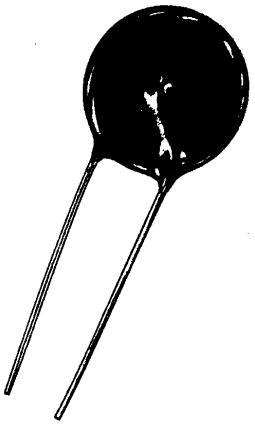
Do not dispose of unit in trash - Recycle

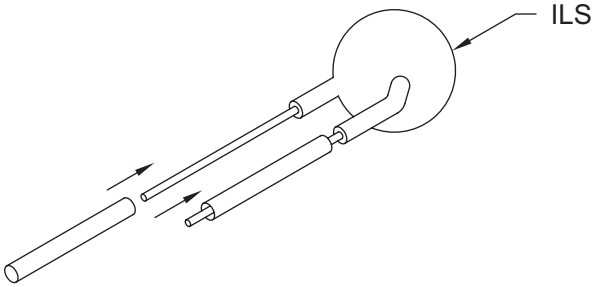
INDUCTIVE LOAD SUPPRESSOR

DESCRIPTION

These devices, when installed across an inductive load, such as a contactor, solenoid or relay, will suppress transient surges during a switching. This will enhance relay life and provide increased reliability of operation.

There are two devices available, one for use in 115 volt circuits and one for use in 230 volt circuits.





Fully slide PVC insulating tubing over Model ILS leads, as shown.
Caution: Ensure VAC is "OFF" before installing Model ILS.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ILS1	115 VAC Inductive Load Suppressor	ILS11500
ILS2	230 VAC Inductive Load Suppressor	ILS23000

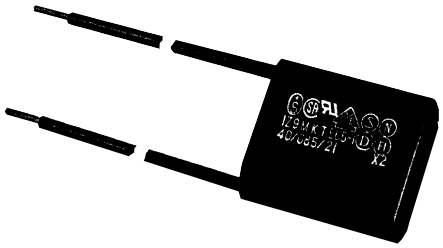
ILS SPECIFICATIONS *

DEVICE MODEL NUMBER	RATED VOLTAGE		RATED PEAK SINGLE PULSE TRANSIENT CURRENT (AMPS)	SINGLE PULSE TRANSIENT ENERGY JOULES	POWER DISSIPATION WATTS	CLAMPING VOLTAGE VOLTS
	AC VOLTS	DC VOLTS				
ILS1	130	175	6500	80	1.0	340 V @ 100 A
ILS2	275	370	6500	150	1.0	710 V @ 100 A

*NOTE: These devices will suppress most transient surges. However, if the device heats up or stops functioning after a short period of time a higher joules rated device may be required.

Do not dispose of unit in trash - Recycle

R-C SNUBBER NOISE AND ARC SUPPRESSOR



J

SPECIFICATIONS

1. **R-C Value:** 0.1 µf, 47 Ω 1/2 Watt (±30%)
2. **Max. Line Voltage:** 250 V rms or 250 VDC
3. **Frequency:** DC to 62 Hz
4. **Peak Pulse Voltage:** 1200 V max.

UL recognized component
(Okaya Electric America, Inc. PN# XEB0471, UL-1414, File # E47474)

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
SNUB	R-C Snubber Inductive Load Suppressor	SNUB0000

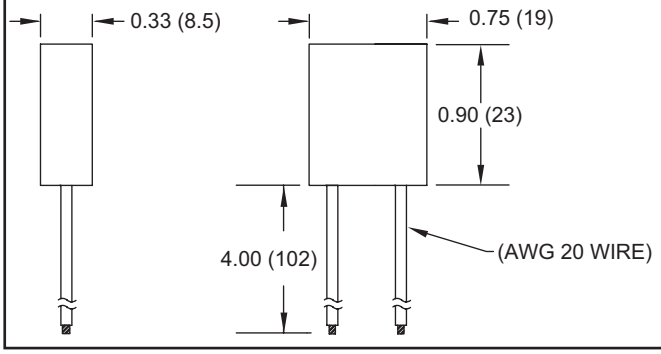
Do not dispose of unit in trash - Recycle

GENERAL DESCRIPTION

The R-C Snubber is intended to suppress the "inductive kick" from motors, solenoids or relay coils. High energy noise spikes are generated whenever current is interrupted through an inductive load. These noise spikes may interfere with associated equipment causing erratic operation and may also accelerate relay contact wear. Applied across an inductive load, the R-C snubber suppresses the noise spikes and extends contact life.

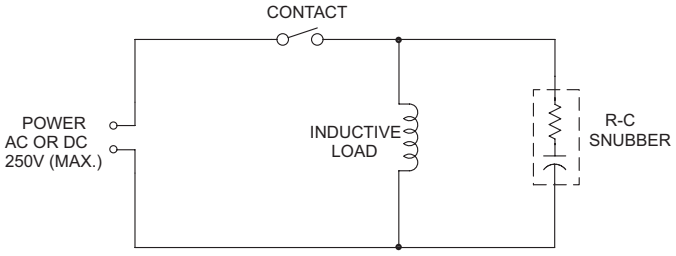
DIMENSIONS In inches (mm)

[All Dimensions are nominal]

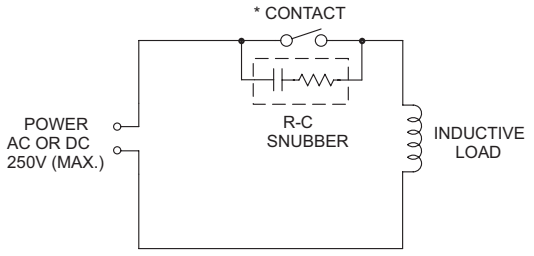


APPLICATION

The R-C snubber inductive load suppressor should be applied as shown below. Placing the suppressor across the contact in many cases can work as well, but for maximum effect, it is best to place the suppressor directly across the load. All inductive loads in a system should be suppressed in this manner to avoid mutual interference. The suppressors are effective in both AC and DC circuits.



Preferred Application



Alternate Application

** Use a snubber across all contacts in the load circuit.*

MODEL LFIL - GENERAL PURPOSE LINE FILTER

DESCRIPTION

This line filter can be used in AC or DC power supply lines to attenuate conducted Electro-Magnetic Interference (EMI). EMI is the most common cause of erratic operation in electronic equipment. Line filters should be installed close to electronic equipment and mounted directly to a metal enclosure that is connected to earth ground (protective earth).

Note: Always connect the earth lead of the filter to the power line ground (protective earth).

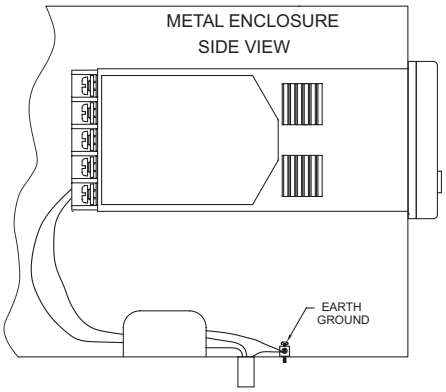


Figure 1

The ideal location for the line filter is directly inside the metal enclosure in which the unit is mounted when the source of EMI is external to the enclosure (See Figure 1). Mount the filter where the power enters the enclosure. If the enclosure contains many different types of equipment or EMI generating devices, such as motors or contactors, then the EMI source may be inside the enclosure. In this case, mount the line filter as close to the unit as possible (See Figure 2).

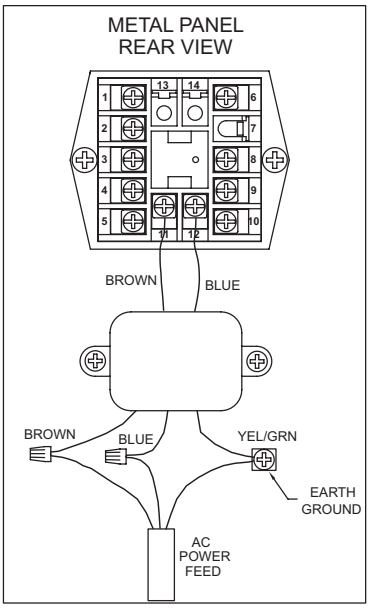
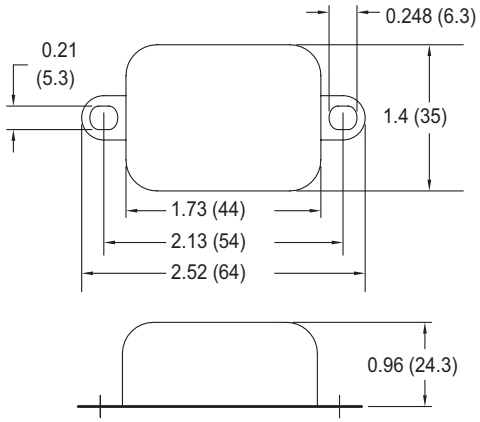


Figure 2

If the panel and enclosure are non-conductive, then the power feed ground is the only earth ground connection. Connecting only the earth lead of the filter to the earth ground without mounting the filter directly to a metal enclosure will not be as effective.

DIMENSIONS In inches (mm)

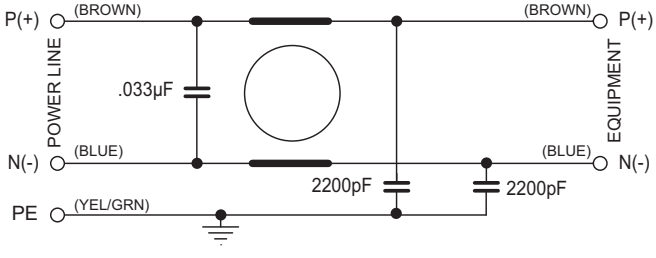


SPECIFICATIONS

1. **CURRENT RATING:** 1.15 A @ 25°C ; 1 A @ 40°C
2. **LEAKAGE CURRENT:** 0.74 mA/Lead @ 230 V, 50 Hz
3. **INDUCTANCE:** 12 mH
4. **CONNECTIONS:** Flexible wires 20 AWG
5. **HIPOT TEST VOLTAGE:** P→E: 2 KV for 2 sec
   P→N: 760 VAC for 2 sec
6. **MAX OPERATING VOLTAGE:** 250 VAC, 50/60 Hz
7. **OPERATING FREQUENCY:** DC to 400 Hz
8. **TEMPERATURE RANGE:** -25°C to +100°C
9. **WEIGHT:** 2.29 oz. (65 g)

UL recognized component
(Schaffner, PN# FN2010-1/07, File # E64388)

BLOCK DIAGRAM



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
LFIL	General Purpose Line Filter	LFIL0000

Do not dispose of unit in trash - Recycle

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