TOTALIZING COUNTERS

The Trusted Source for Innovative Control Solutions

QUICK Specs

Totalizers

COUNTERS

	CUB7	CUB4	PAXLC	CUB5
				
Description	1/32 DIN Miniature Counter	Counter	1/8 DIN Counter	Counter/Rate Meter With Output Option Card Capability
Dimensions (Height) x (Width)	28 mm (H) x 51mm (W)	39 mm (H) x 75mm (W)	50 mm (H) x 97mm (W)	39 mm (H) x 75mm (W)
Display	8 Digit, .35" (9mm) Reflective, Green and Red Backlight LCD	6 Digit, .46" (12mm), 8 Digit, .46" (12mm) Reflective, Green and Red Backlight LCD	6 Digit, .56" (14mm) 8 Digit, .4" (10mm) Red LED	8 Digit, .35" (9mm) Reflective, Green and Red Backlight LCD
Counting Capability	Uni-Directional	Uni-Directional	Uni-Directional Up/Down Inhibit Store	Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch
Max. Input Frequency	10,000 Counts/Sec.	5000 Counts/Sec.	25,000 Counts/Sec	20,000 Counts/Sec. Program Dependent.
Input Scaling & Decimal Points	No	No	Yes	Yes
Reset Capability	Front Panel, Remote	Front Panel, Remote	Front Panel, Remote	Front Panel, Remote
Sensor Power	No	No Yes, with Micro Line Power Supply	9 to 17.5 VDC @ 100 mA	No Yes, with Micro Line Power Supply
Setpoint Capability	No	No	No	Single Form C Relay Dual Sinking
Communications	No	No	No	RS485
Power Source	3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA	3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA	115/230 VAC 10 to 16 VDC	10 to 28 VDC
Page Number	Page 23	Page 29	Page 50	Page 35

QUICK Specs

Totalizing Counters

COUNTERS W/CONTROL

	PAXLCR	PAXC	PAXI	PAX2D
				
Description	1/8 DIN Counter/Rate Meter With Setpoint Capability	1/8 DIN Counter With Setpoint Card Capability	1/8 DIN Counter/Rate Meter With Output Option Card Capability	1/8 DIN Dual Line Counter/Dual Counter, Rate/Dual Rate Meter With Output Option Card Capability
Dimensions (Height) x (Width)	50 mm (H) x 97mm (W)	50 mm (H) x 97mm (W)	50 mm (H) x 97mm (W)	50 mm (H) x 97mm (W)
Display	6 Digit, .56" (14mm) Red LED	6 Digit, .56" (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity	6 Digit, .56" (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity	Top Line: 6 Digit, .71" (18mm) Tri-color Backlight Bottom Line: 9 Digit, .35" (9mm) Green Backlight
Counting Capability	Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch	Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch	Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch	Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch
Max. Input Frequency	20,000 Counts/Sec. Program Dependent	34,000 Counts/Sec. Program Dependent	34,000 Counts/Sec. Program Dependent	50,000 Counts/Sec. Program Dependent
Input Scaling & Decimal Points	Yes	Yes	Yes	Yes
Reset Capability	Front Panel, Remote	Front Panel, Remote	Front Panel, Remote	Front Panel, Remote
Sensor Power	24 VDC @ 100 mA, over 50 V 24 VDC @ 50 mA, under 50 V	12 VDC @ 100 mA	12 VDC @ 100 mA	18 VDC @ 60 mA
Setpoint Capability	Dual Form C Relays	Dual Form C Quad Form A Quad Sinking Quad Sourcing	Dual Form C Quad Form A Quad Sinking Quad Sourcing	Dual Form C Quad Form A Quad Sinking Quad Sourcing
Communications	No	No	RS232 or RS485 Modbus DeviceNet Profibus Ethernet w/ICM8	RS232 or RS485 Modbus DeviceNet Profibus
Power Source	50 to 250 VAC 21.6 to 250 VDC	85 to 250 VAC 11 to 36 VDC 24 VAC	85 to 250 VAC 11 to 36 VDC 24 VAC	50 to 250 VAC 21.6 to 250 VDC
Page Number	Page 57	Page 68	Page 97	Page 98

REPLACEMENT Guide

WHAT YOU'RE USING NOW		CURRENT PRODUCT	
MODEL NUMBER	**FEATURES**	**MODEL NUMBER**	**FEATURES**
 **CUB1**	■ Display: .2" (5 mm) Reflective LCD ■ Power Source: 2 "N" Alkaline Batteries ■ Count Speed: 5 KHz Max.	 **CUB7**	■ Display: .35" (9 mm) Reflective LCD ■ Power Source: Internal Battery ■ Count Speed: 10 KHz Max.
 **CUB2**	■ Display: .35" (9 mm) Reflective LCD ■ Power Source: Battery Powered ■ Count Speed: 5 KHz Max.	 **CUB4 / CUB4L8**	■ Display: .48" (12 mm) Reflective LCD ■ Power Source: Internal Battery ■ Count Speed: 10 KHz Max.
 **CUB3**	■ Display: .2" (5 mm) Reflective LCD ■ Power Source: 2 "N" Alkaline Batteries ■ Count Speed: 100 Hz Max.	 **CUB7**	■ Display: .35" (9 mm) Reflective LCD ■ Power Source: Internal Battery ■ Count Speed: 10 KHz Max. **Panel Cut-Out Dimension Differences**
 **APLT**	■ Display: 6 Digit, .56" (14 mm) Red LED, 8 Digit, .36" (9 mm) Red LED ■ Power Source: 115/230 VAC, 11 to 14 VDC ■ Count Speed: 10 KHz Max.	 **PAXLC**	■ Display: 6 Digit, .56" (14 mm) Red LED, 8 Digit, .4" (10 mm) Red LED ■ Power Source: 115/230 VAC, 10 to 16 VDC ■ Count Speed: 25 KHz Max.
 **SCT**	■ Display: 6 Digit, .43" (11 mm) Red LED ■ Power Source: 115/230 VAC, 12 VDC ■ Count Speed: 10 KHz Max.	 **PAXLC**	■ Display: 6 Digit, .56" (14 mm) Red LED ■ Power Source: 115/230 VAC, 10 to 16 VDC ■ Count Speed: 25 KHz Max.

Note: Refer to the current product literature, as some differences may exist.

MODEL CUB7 – MINIATURE ELECTRONIC 8 DIGIT COUNTER or TIMER

c UL US LISTED
3RSD
PROCESS CONTROL EQUIPMENT

- 0.35" (8.9 mm) *HIGH LCD DIGITS, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED BACKLIGHTING (6-26 VDC power supply required for version with LED backlighting)*
- *INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF TYPICAL UNINTERRUPTED OPERATION*
- *COUNT SPEEDS UP TO 10KHZ*
- *9 PROGRAMMABLE TIME RANGES*
- *CONTACT, LOGIC, OPEN COLLECTOR, OR HIGH VOLTAGE INPUTS*
- *STANDARD WIRE CONNECTIONS OR OPTIONAL PLUG-IN TERMINAL BLOCK*
- *NEMA 4X/IP65 SEALED FRONT BEZEL THAT FITS 1/32 DIN CUT-OUT*

DESCRIPTION

The CUB7 series is an 8-digit lithium battery powered miniature counter or timer with large 0.35" (8.9 mm) high digits. It has an LCD read-out available in Positive Imagine Reflective, Negative Image Transmissive with yellow/green or red backlighting. The backlight versions require an external 6-26 VDC power supply. The CUB7 series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with silicon rubber keypad meets NEMA 4X/IP65 specification for wash-down and/or dusty environments, when properly installed with supplied panel gasket and mounting clip.

Both counter and timer CUB7 models are available with a low voltage input (28 VDC max) or an isolated high voltage input (50-250 VDC/VAC). The low voltage input has DIP switch selections for SINKING or SOURCING along with a HIGH/LOW FREQUENCY selection (low frequency for contact inputs). Both units have front panel keypads that can be used to reset the display. The keypad can be enabled/disabled via a single DIP switch. The standard unit uses 22 gauge wires for external connections, an optional plug-in terminal block is available.

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.

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

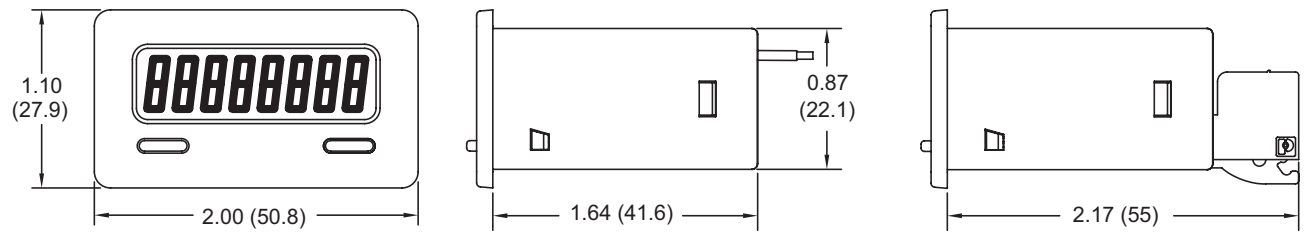
CAUTION: Risk of electric shock.

SPECIFICATIONS

1. **DISPLAY**: 8-digit LCD, 0.35" (8.90 mm) high digits
2. **POWER**: Non-replaceable internal 3.6 VDC lithium battery provides 7 years of typical continuous operation (high count speeds in SNK mode & extreme ambient temperatures will decrease battery life, use of SRC mode can extend battery life)
   OPTIONAL LED BACKLIGHT POWER: 6-26 VDC @ 25 mA max.
   Must use an NEC Class 2 or Limited Power Source (LPS) rated power supply.
   Note: External power shall incorporate disconnecting device (switch or circuit breaker) and provide Double/Reinforced isolation from MAINS supply.
3. **LOW VOLTAGE INPUT**:
   COUNTERS: CUB7CCS0, CUB7CCR0, CUB7CCG0
   SNK mode (DIP switch 1 off, internal pull-up to battery)
   V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
   I_{IN} Max = 8 µA; V_{IN} Max = 3.6 VDC
   Count Speed: (count on negative edge)
   High freq mode (DIP switch 2 off): max 5 kHz @ 50% duty cycle
   Low freq mode (DIP switch 2 on): max 30 Hz @ 50% duty cycle
   Note: The three models listed above may be used for count inputs with 10-50 VAC signals when using a VCM10000 converter module. DIP switches must be set for SNK and Low frequency.
   SRC mode (DIP switch 1 on, internal 20 kΩ pull-down to common)
   V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
   I_{IN} Max = 5 mA; V_{IN} Max = 28 VDC
   Count Speed: (count on negative edge)
   High freq mode (DIP switch 2 off): max 10 kHz @ 50% duty cycle
   Low freq mode (DIP switch 2 on): max 50 Hz @ 50% duty cycle
   TIMERS:
   Models: CUB7TCS0, CUB7TCR0, CUB7TCG0 **For these models, the unit will time when the CUB7 input is low.**
   SNK mode (DIP switch 1 off, internal pull-up to battery)
   V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
   I_{IN} Max = 8 µA; V_{IN} Max = 3.6 VDC
   Note: The three models listed above may be used with 10-50 VAC

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.5" (140) W.



With Wires **With Terminal Block**

signals when using a VCM10000 converter module.
SRC mode (DIP switch 1 on, internal 20 kΩ pull-down to common)
V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
I_{IN} Max = 5 mA; V_{IN} Max = 28 VDC
Models: CUB7TCS1, CUB7TCR1, CUB7TCG1 **For these models, the unit will time when the CUB7 input is high.**
SNK mode (DIP switch 1 off - **DO NOT USE**)
SRC mode (DIP switch 1 on, internal 20 kΩ pull-down to common)
V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
I_{IN} Max = 5 mA; V_{IN} Max = 28 VDC

4. **HIGH VOLTAGE INPUT**:
COUNTERS: CUB7CVS0, CUB7CVR0, and CUB7CVG0
The unit adds one count with voltage present
V_{IN} Range = 50-250 VDC/VAC 50/60 Hz, 5 mA max
Isolation: 2500 VAC 1 min
TIMERS: CUB7TVS0, CUB7TVR0, and CUB7TVG0
Unit will time with voltage present
V_{IN} Range = 50-250 VDC/VAC 50/60 Hz, 5 mA max
Isolation: 2500 VAC 1 min
5. **RESET INPUT**:
V_{IN} Low Max = 1.5 VDC (internal pull-up to battery)
I_{IN} Max = 20 µA
5 msec min (active low)
Note: Reset input is active low to clear display to zero
6. **TIMER ACCURACY**:
CUB7TV: 0.03% +100 msec per RUN terminal activation
CUB7TC low freq/snk setup: 0.03% +1 msec per RUN terminal activation
CUB7TC high freq/snk setup: 0.03% -1 msec per RUN terminal activation
7. **ENVIRONMENTAL CONDITIONS**:
Operating Temperature: 0 to 50 °C
Storage Temperature: -30 to 80 °C
Vibration according to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g.
Shock according to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
Operating and Storage Humidity: 85% max. (non-condensing)
8. **CONNECTIONS**: 22 gauge wire; wire length minimum 10"
OPTIONAL TERMINAL BLOCKS: Wire clamping terminals
Wire Strip Length: 0.275" (7 mm)
Wire Gage: 24-16 AWG copper wire
9. **CONSTRUCTION**: High impact plastic case with clear viewing window. The front panel meets NEMA 4X/IP65 requirements for outdoor use when properly installed. Installation Category II, Pollution Degree 2. Panel gasket and mounting clip are included.
10. **CERTIFICATIONS AND COMPLIANCES**:
SAFETY
UL Listed, File # E179259, UL508
Type 4X Outdoor Enclosure rating (Face only), UL50
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529
ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN 61326:2006: 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 (80 MHz to 1 GHz) 3 V/m (1.4 GHz to 2 GHz) 1 V/m (2 GHz to 2.7 GHz)
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV I/O signal
Surge	EN 61000-4-5	Criterion A power 1 kV L to L, 2 kV L to G
RF conducted interference	EN 61000-4-6	Criterion A 3 Vrms
Power freq magnetic fields	EN 61000-4-8	Criterion A 30 A/m
AC power	EN 61000-4-11	
Voltage dip		Criterion A 0% during 1 cycle 40% during 10/12 cycle 70% during 25/30 cycle
Short interruptions		Criterion B 0% during 250/300 cycles

Emissions:

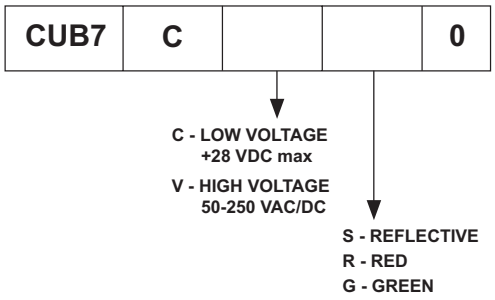
Emissions	EN 55011	Class B

Notes:
1. Criterion A: Normal operation within specified limits.
2. Criterion B: Temporary loss of performance from which the unit self-recovers.
Refer to the EMC Installation Guidelines section of the bulletin for additional information.

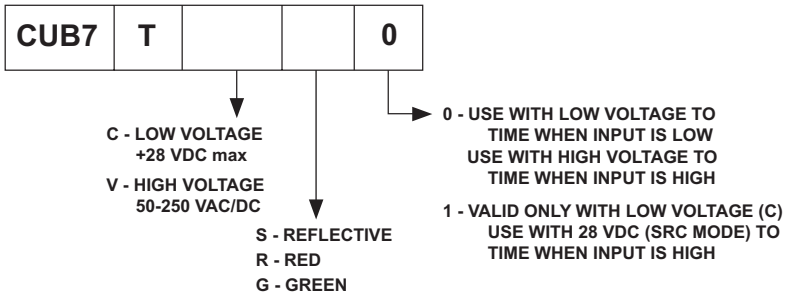
11. **WEIGHT**: 0.11 lbs. (0.05 Kg)

ORDERING INFORMATION

COUNTERS



TIMERS



Accessories Part Numbers

TYPE	DESCRIPTION	PART NUMBER	USED WITH
Plug-in Terminal Block	3 Position Terminal Block	TB100003	CUB7CCS0, CUB7TCS0, CUB7TCS1
	4 Position Terminal Block	TB100004	CUB7CCG0, CUB7TCG0, CUB7TCG1, CUB7CCR0, CUB7TCR0, CUB7TCR1, CUB7CVS0, CUB7TVS0
	5 Position Terminal Block	TB100005	CUB7CVG0, CUB7TVG0, CUB7CVR0, CUB7TVR0
Enclosure *	CUB7 Enclosure	ENC13000	
Base Mount *	CUB7 Base Mount	BMK80000	

See Wiring the Meter section to determine the terminal block needed.
** Enclosure and base mount will NOT function with plug-in terminal block option.*

1.0 Installing the Meter

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.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

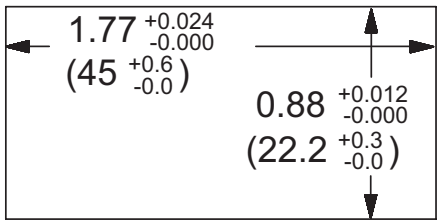
Installation

The CUB7 series of products meets NEMA 4X/IP65 requirements for outdoor use, when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for a washdown environment. A sponge rubber gasket and mounting clip are provided for installing the unit in the panel cut-out.

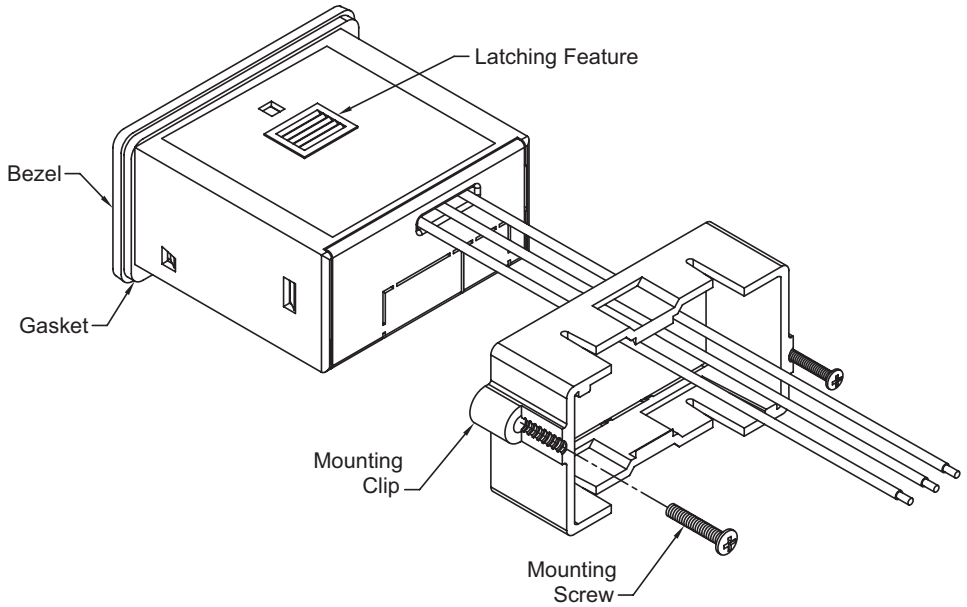
The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove and discard the center section of the gasket. Slide the panel gasket over the rear of the unit to the back of the bezel. Insert the mounting screws onto both sides of mounting clip. The tip of the screw should **NOT** project from the hole in the mounting clip.
3. Install the CUB7 unit through the panel cut-out until the front bezel flange contacts the panel.
4. Slide the mounting clip over the rear of the unit until the clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the CUB7 housing.

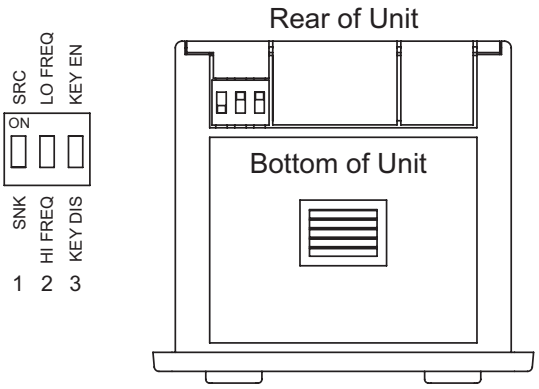
Note: It is necessary to hold the unit in place when sliding mounting clip into position.



5. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed to about 75 to 80% of its original thickness. If not, gradually turn mounting screws to further compress gasket.
6. If gasket is not adequately compressed and the mounting screws can no longer be turned, loosen mounting screws, and check that mounting clip is latched as close as possible to the panel.
7. Repeat from step #5 for tightening mounting screws.

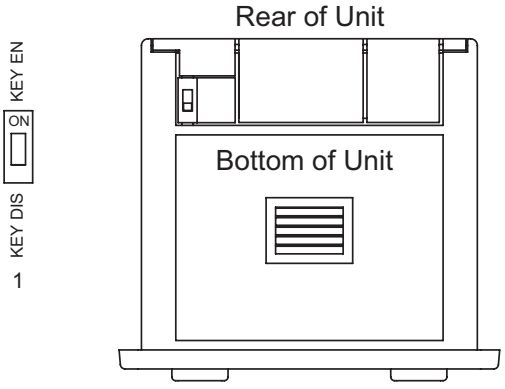


2.0 Setting the DIP Switches



Low Voltage Input Unit

Low voltage input units have 3 DIP switches that must be positioned appropriately prior to wiring.



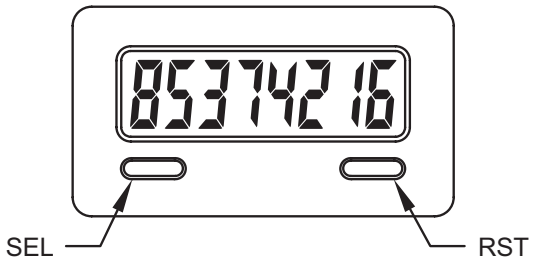
High Voltage Input Unit

High voltage input units have 1 DIP switch to enable or disable the front bezel keypad.

Note: Placing the KEY DISABLE/ENABLE DIP switch in the OFF position, disables all front panel keys.

3.0 Programming The Time Range

The CUB7 Timer has 9 time ranges. To change ranges, enable the front keypad with the DIP switch and press the SEL key. The currently programmed time range will be displayed (example 2222222.2 = time range 2). To change the range, press the RST key. The ranges will cycle from 0-8 and back to 0. To enter your time range, press the SEL key and the unit will retain the current time range and return back to normal.



DISPLAY DURING PROGRAMMING	TIMER RANGE
00000.000	0.001 SEC
111111.11	0.01 SEC
2222222.2	0.1 SEC
333333333	1 SEC
4444444.4	0.1 MIN
555555555	1 MIN
666666.66	0.01 HR
7777777.7	0.1 HR
88888888	1 HR

4.0 Resetting The Display

The display may be reset to zero via the front RST key, the remote reset input or both.

The front RST key must be enabled for front panel reset. DIP switch # 3 on the low voltage input units or the single DIP switch on the high voltage input units. (See 2.0 Setting the DIP Switches for switch location)

The remote reset is activated via an external momentary contact closure between the reset input (blue wire) and the common (black wire). When the optional terminal blocks are used, see 5.0 Wiring The Meter, for the appropriate reset input terminal and the common terminal.

5.0 Wiring The Meter

WIRING OVERVIEW

Electrical connections are made to the #22 AWG colored wires protruding from the rear of the unit. When using the optional terminal block, the #22 AWG colored wires are cut off and electrical connections are made via screwless type terminal block. All conductors should conform to the meter's voltage and current ratings. All cabling and wire terminations should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the backlight power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

USING THE COLOR CODED WIRES

The low voltage input units will contain three or four color coded wires depending on the backlight power requirements.

The high voltage input units will contain (2) orange wires and an additional two or three wires depending on the backlight power requirements.

The tables define the function of each colored wire.

LOW VOLTAGE INPUT
Wire Colors

WHITE	BLUE	BLACK	RED
Low Voltage Input	Reset	Common	+Backlight Power

HIGH VOLTAGE INPUT
Wire Colors

ORANGE	ORANGE	BLUE	BLACK	RED
High Voltage Input	High Voltage Input	Reset	Common	+Backlight Power

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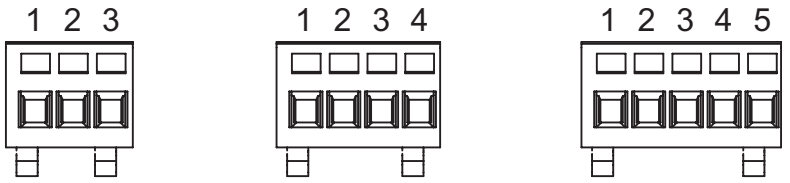
TERMINAL BLOCK OPTION

CONNECTIONS: Wire clamping terminals
Wire Strip Length: 0.275" (7 mm)
Wire Gage: 24-16 AWG copper wire



A

USING THE OPTIONAL TERMINAL BLOCK

1. Remove the rear cover. Refer to Figure 1. A small slotted screwdriver is required to release the side latches. Insert the screwdriver tip between the rear cover and the side of the unit. Leverage the screwdriver away from the case to unlatch the side latch and slightly lift the rear cover. Pinch the corners to hold the rear cover in place. Remove the screwdriver and repeat the same procedure on the other side of the rear cover. When both side latches are released, slide the rear cover from the unit and the wires.
2. For safety concerns, the wires should be cut off completely flush with the PC board to prevent a short.
3. Break out the break away tab(s) as required. Remove the left tab only for 3 position terminal block or both tabs for 4 and 5 position terminal blocks.
4. Reinstall the rear cover into CUB7 unit.
5. Mount the CUB7 into the panel (refer to 1.0 Installing The Meter)
6. Push the keyed terminal block onto the exposed PC board. The left most terminal, next to the DIP switch(s) is terminal #1.

Note: Wire sizes 16-24 AWG may be used with 0.25" length exposed. The screwless type terminal block requires a small slotted screwdriver engaged in the upper slot to open the wire clamp in the lower larger slot. Removing the screwdriver will lock the wire clamp unto the wire.

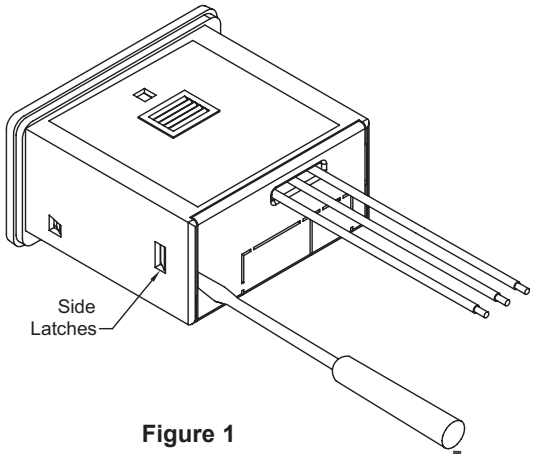
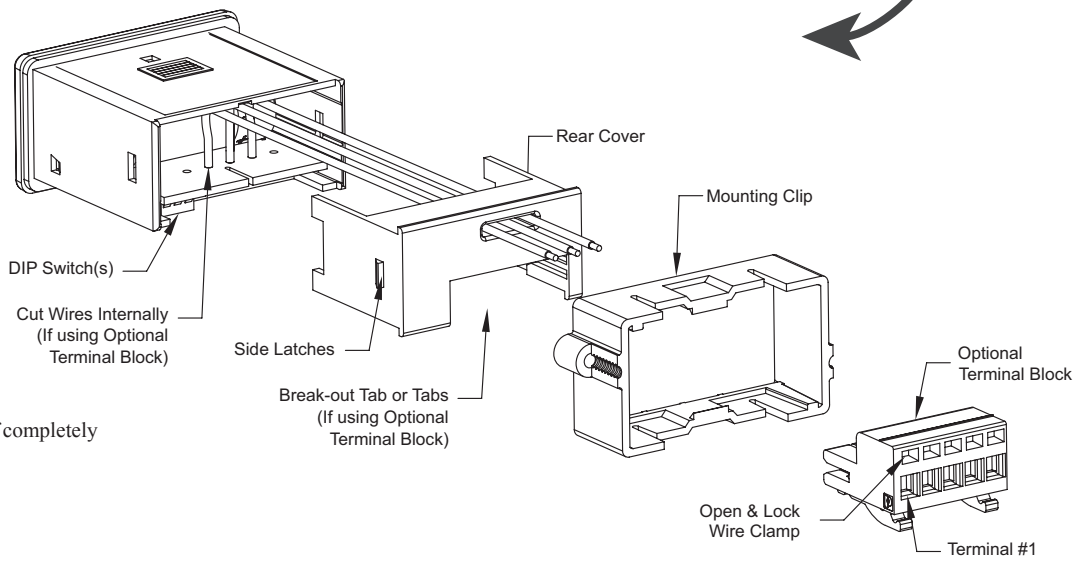
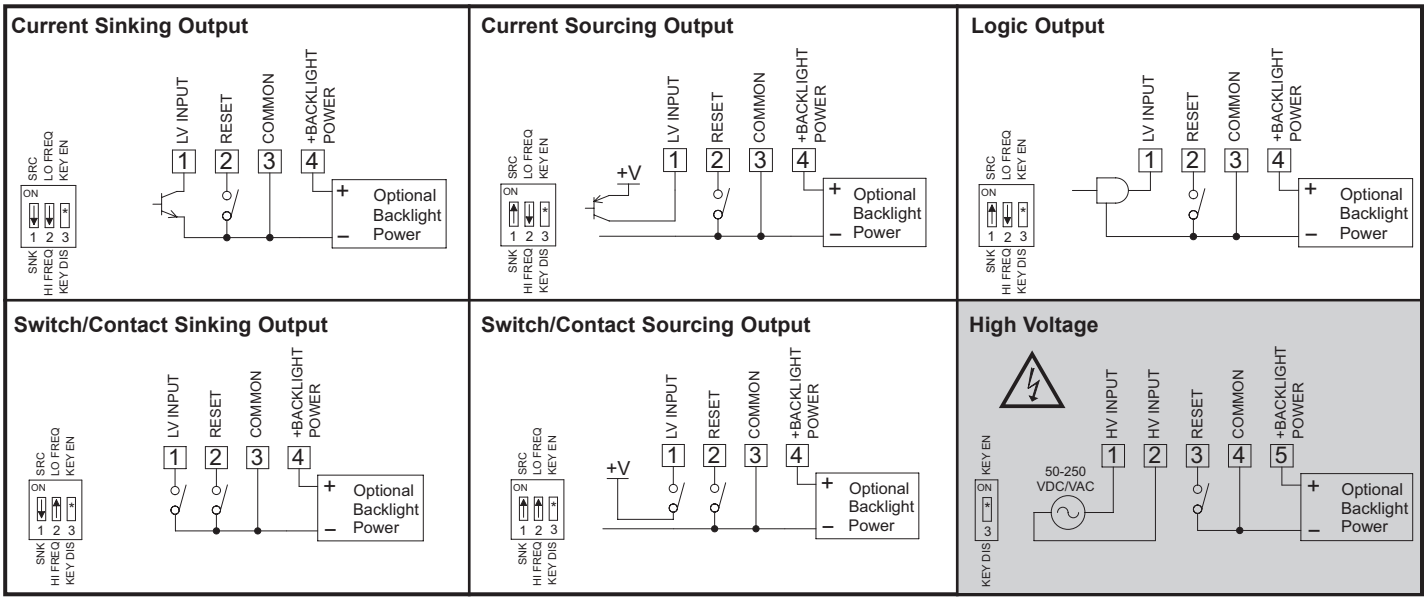


Figure 1



Wires must be cut off completely flush with PC board.



** Switch position is application dependent.*

Shaded area for high voltage applications.

MODEL CUB4L & CUB4L8 - MINIATURE ELECTRONIC COUNTERS

- *LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING*
- *INTERNAL LITHIUM BATTERY PROVIDES UP TO 6 YEARS OF UNINTERRUPTED OPERATION*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*
- *FRONT PANEL RESET, REMOTE RESET, OR BOTH*
- *COUNT SPEEDS UP TO 5 KHz*
- *WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS*

DESCRIPTION

The CUB4 offers a large display in a miniature package with a choice of three displays; reflective, red backlight or green backlight.

The backlight versions require power from an external 9–28 VDC supply. The optional power supply (MLPS) is designed to be attached directly to the rear of the CUB4 and is powered from an 85–250 VAC source.

The CUB4 series has a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber reset button meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
CUB4L (6-digit)	Counter Positive Image Reflective	CUB4L000
	Counter w/Yel-Grn Backlighting	CUB4L010
	Counter w/Red Backlighting	CUB4L020
CUB4L8 (8-digit)	Counter Positive Image Reflective	CUB4L800
	Counter w/Yel-Grn Backlighting	CUB4L810
	Counter w/Red Backlighting	CUB4L820
MLPS	+12 VDC Micro-Line Power Supply, 85 to 250 VAC source, 400 mA max out	MLPS1000
	+24 VDC Micro-Line Power Supply, 85 to 250 VAC source, 200 mA max out	MLPS2000

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.

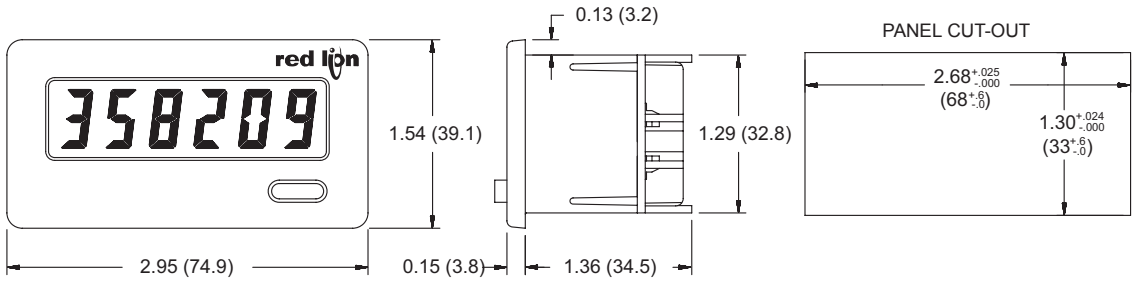
CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

SPECIFICATIONS

1. **DISPLAY**:
   CUB4L: 6-Digit, LCD, 0.48" *(12.2 mm)* high digits.
   CUB4L8: 8-Digit, LCD, 0.46" *(11.7 mm)* high digits.
2. **POWER SOURCE**: Internal 3.6 V lithium battery will provide up to 6 years of continuous operation (high speed counting and extreme temperatures will decrease battery life).
3. **BACKLIGHT POWER REQUIREMENTS**: 9 to 28 VDC, 30 mA typical, 50 mA max. Above 26 VDC, derate operating temperature to 50°C.
   Must use an RLC model MLPS or an NEC Class 2 or Limited Power Source (LPS) rated power supply.
4. **COUNT INPUT**:
   SNK mode (DIP switch 1 off, internal pull-up to battery)
   V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
   I_{IN} Max = 5 µA; V_{IN} Max = 3.6 VDC
   Count Speed: (count on negative edge)
   High freq mode (DIP switch 2 off): max 5 kHz @ 50% duty cycle
   Low freq mode (DIP switch 2 on): max 50 Hz @ 50% duty cycle
   SRC mode (DIP switch 1 on, internal 20 kΩ pull-down to common)
   V_{IN} High Min = 1.25 VDC; V_{IN} Low Max = 0.45 VDC
   I_{IN} Max = 5 mA; V_{IN} Max = 28 VDC
   Count Speed: (count on negative edge)
   High freq mode (DIP switch 2 off): max 5 kHz @ 50% duty cycle
   Low freq mode (DIP switch 2 on): max 50 Hz @ 50% duty cycle
5. **RESET INPUT**:
   V_{IN} Low Max = 1.5 VDC (internal pull-up to battery)
   I_{IN} Max = 20 µA
   5 msec min (active low for count reset to zero)
6. **ENVIRONMENTAL CONDITIONS**:
   Operating Temperature: 0 to 60°C (above 50°C, derate backlight operating voltage to 26 VDC max.).
   Storage Temperature: -30 to 85°C
   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
   Vibration to IEC 68-2-6: 5 to 500 Hz, 5 g.
   Shock to IEC 68-2-27: Operational 30 g.
   Altitude: Up to 2000 meters

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



7. **CERTIFICATIONS AND COMPLIANCES**:
   CE Approved
   EN 61326-1 Immunity to Industrial Locations
   Emission CISPR 11 Class B
   IEC/EN 61010-1
   RoHS Compliant
   UL Recognized Component: File #E179259
   Type 4X Indoor Enclosure rating (Face only)
   IP65 Enclosure rating (Face only)
   Refer to EMC Installation Guidelines section of the bulletin for additional information.
8. **CONSTRUCTION**:
   This unit is rated for NEMA 4X/IP65 indoor use. Installation Category I, Pollution Degree 2
9. **WEIGHT**: 3 oz. *(85 grams)*

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. Long cable runs are more susceptible to EMI pickup than short cable runs.
5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:
   Fair-Rite part number 0443167251 (RLC part number FCOR0000)
   Line Filters for input power cables:
   Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)
6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
   a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
   b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.
   RLC part numbers: Snubber: SNUB0000
   Varistor: ILS11500 or ILS23000
7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit RLC's web site at http://www.redlion.net/Support/InstallationConsiderations.html for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

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.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

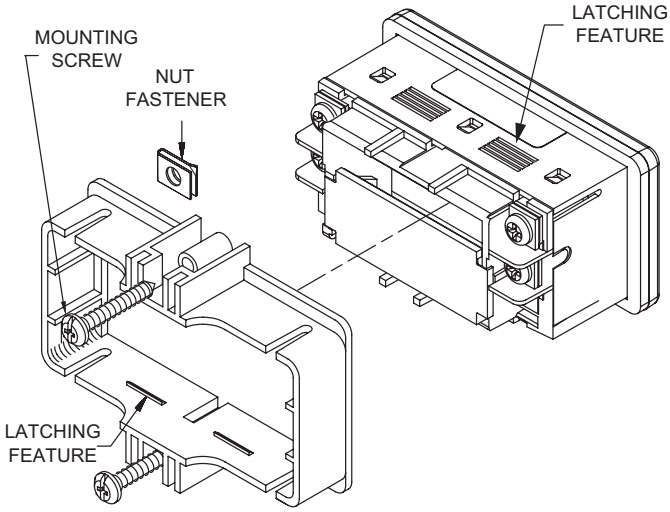
Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

Installation

The CUB4 series of products meet NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for a washdown environment. A sponge rubber gasket and mounting clip are provided for sealing the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove the center section of the panel gasket and discard. Slide gasket over rear of the unit to the back of the bezel.
3. Assemble nut fastener first and then mounting screw onto both sides of mounting clip. Tip of screw should not project from hole in mounting clip.
4. Install CUB4 unit through the panel cut-out until front bezel flange contacts the panel-mounted gasket.
5. Slide the mounting clip over the rear of the unit until the mounting clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the CUB4 housing.
   Note: It is necessary to hold the unit in place when sliding mounting clip into position.



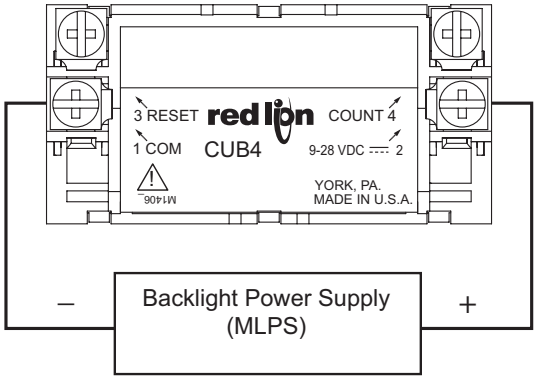
6. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed about 75 to 80% of its original thickness. (Recommended torque is 28 to 36 in-oz.) If not, gradually turn mounting screws to further compress gasket.
7. If gasket is not adequately compressed, and mounting screws can no longer be turned, loosen mounting screws and check that mounting clip is latched as close as possible to panel.
   Repeat procedure for tightening mounting screws.

WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. When wiring the unit, use the label to identify the wire position with the proper function. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Strip the wire, leaving approximately 1/4" bare wire exposed *(stranded wires should be tinned with solder)*. Insert the wire into the screw-clamp terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

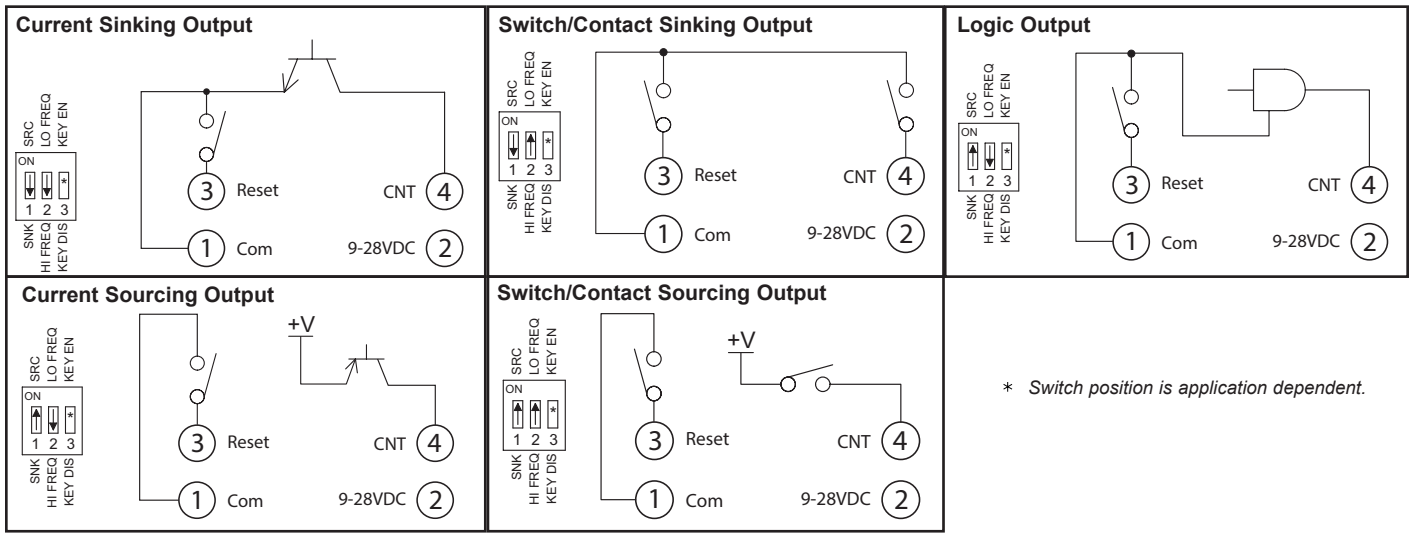
Backlight Wiring

Optional backlight versions of the CUB4 require an external 9-28 VDC power supply. The external supply is connected between the V+ and Common terminals.



Warning: *Lithium battery may explode if incinerated.*

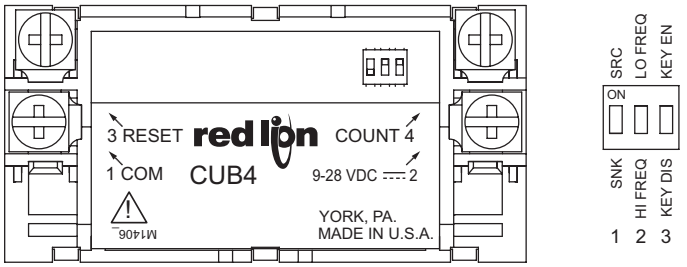
COUNT INPUT WIRING



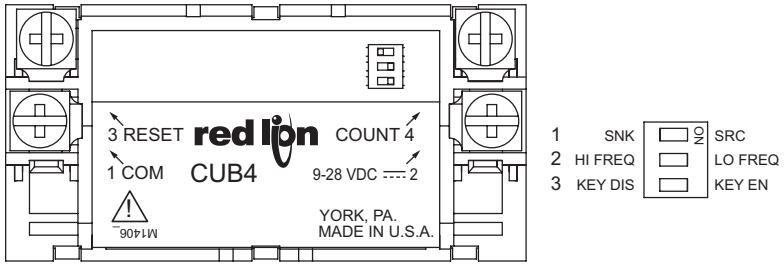
* *Switch position is application dependent.*

SETTING THE DIP SWITCHES

The switches must be positioned appropriately prior to wiring. Placing the key disable/enable DIP switch in the off position disables the front panel key.



CUB4L



CUB4L8

RESETTING THE DISPLAY

The display may be reset to zero via the front RST key, the remote reset input or both. The front RST key must be enabled for front panel reset by setting DIP switch # 3 ON. The remote reset is activated via an external momentary contact closure between the reset input and the common.

TROUBLESHOOTING

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

MODEL CUB4L8W - MINIATURE ELECTRONIC COUNTERS

- *LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING*
- *INTERNAL LITHIUM BATTERY PROVIDES UP TO 6 YEARS OF UNINTERRUPTED OPERATION*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*
- *FRONT PANEL RESET, REMOTE RESET, OR BOTH*
- *COUNT INPUT FROM 10 to 300 VAC/DC*
- *WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS*

DESCRIPTION

The CUB4L8W offers a large display in a miniature package. The CUB4L8W (8-digit counter with voltage input) has a choice of three displays; reflective, red backlight or green backlight.

The backlight versions require power from an external 9–28 VDC supply. The optional power supply (MLPS) is designed to be attached directly to the rear of the CUB4L8W and is powered from an 85–250 VAC source. The power supply provides 12 VDC @ 400 mA to power the backlight and sensor, if required.

The CUB4L8W has a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber reset button meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
CUB4L8W (8-digit w/VCM)	Counter Positive Image Reflective	CUB4L8W0
	Counter w/Yel-Grn Backlighting	CUB4L8W1
	Counter w/Red Backlighting	CUB4L8W2
	Counter Positive Image Reflective w/V+ Terminal	CUB4L8WM
MLPS	+12 VDC Micro-Line Power Supply, 85 to 250 VAC source, 400 mA max out	MLPS1000
	+24 VDC Micro-Line Power Supply, 85 to 250 VAC source, 200 mA max out	MLPS2000

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.

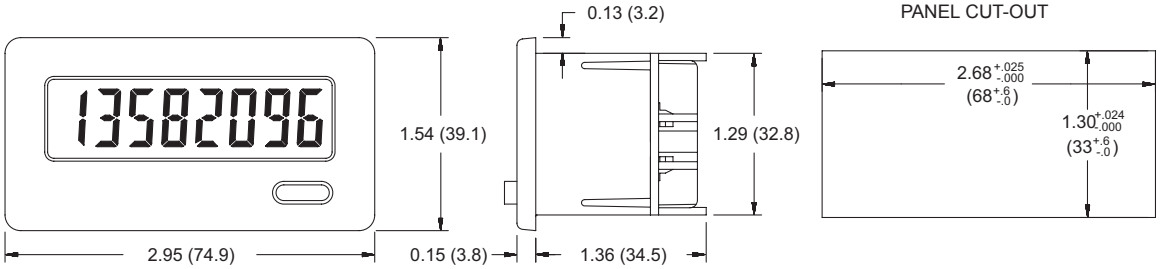
CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

SPECIFICATIONS

1. **DISPLAY**: 8-Digit, LCD, 0.46" *(11.7 mm)* high digits.
2. **POWER SOURCE**: Internal 3.0 V lithium battery to provide up to 6 years of continuous operation. Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time will reduce battery life.
3. **BACKLIGHT POWER REQUIREMENTS**: 9 to 28 VDC, 35 mA typical, 50 mA max. Above 26 VDC, derate operating temperature to 50°C.
   Must use the MLPS or a Class 2 or SELV rated power supply.
   Note: External power shall incorporate disconnecting device (switch or circuit breaker) and provide double/reinforced isolation from MAINS supply.
4. **INPUTS**:
   Low Speed Input: 10 to 300 VAC/DC, 50/60 Hz, 30 cps max. V_{IL} = 0.5 VDC max. Unit counts on positive going edge. Will not operate with Triac outputs.
   Remote Reset: 15 msec min. pulse width *(active low)* from 3.0 V bipolar output or an open collector transistor or a switch contact to common.
   Resetting Input: V_{IL} *(low)* = 0.5 V max.
5. **ENVIRONMENTAL CONDITIONS**:
   Operating Temperature: 0 to 60°C (above 50°C, derate backlight operating voltage to 26 VDC max.).
   Storage Temperature: -30 to 85°C
   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
   Vibration According to IEC 68-2-6: 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g.
   Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
   Altitude: Up to 2000 meters
6. **CERTIFICATIONS AND COMPLIANCES**:
   SAFETY
   Type 4X Enclosure rating (Face only)
   IP65 Enclosure rating (Face only), IEC 529
7. **CONSTRUCTION**:
   This unit is rated for NEMA 4X/IP65 indoor use. Installation Category I, Pollution Degree 2
8. **WEIGHT**: 3 oz. *(85 grams)*

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

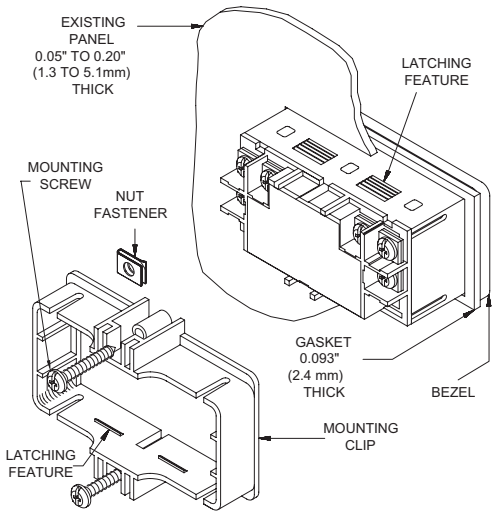
1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN2010-1/07 (RLC #LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom #1VR3
   Note: *Reference manufacturer's instructions when installing a line filter.*
5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

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.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.



Installation

The CUB4L8W meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for a washdown environment. A sponge rubber gasket and mounting clip are provided for sealing the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove the center section of the panel gasket and discard. Slide gasket over rear of the unit to the back of the bezel.
3. Assemble nut fastener first and then mounting screw onto both sides of mounting clip. Tip of screw should not project from hole in mounting clip.
4. Install the unit through the panel cut-out until front bezel flange contacts the panel-mounted gasket.
5. Slide the mounting clip over the rear of the unit until the mounting clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the unit housing.
   Note: It is necessary to hold the unit in place when sliding mounting clip into position.
6. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed about 75 to 80% of its original thickness. (Recommended torque is 28 to 36 in-oz.) If not, gradually turn mounting screws to further compress gasket.
7. If gasket is not adequately compressed, and mounting screws can no longer be turned, loosen mounting screws and check that mounting clip is latched as close as possible to panel.
   Repeat procedure for tightening mounting screws.

A

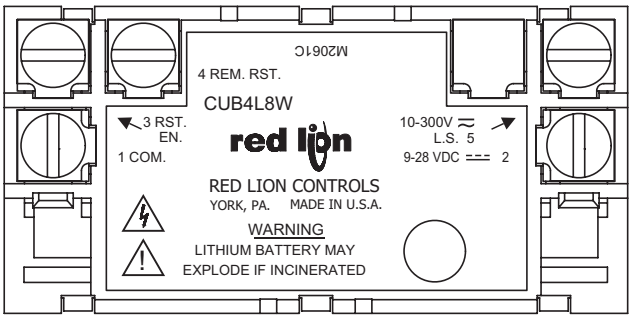
WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. When wiring the unit, use the label to identify the wire position with the proper function. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Strip the wire, leaving approximately 1/4" bare wire exposed *(stranded wires should be tinned with solder)*. Insert the wire into the screw-clamp terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

*Note: The Reflective CUB4 will **NOT** have a screw terminal installed at the V+ terminal, since it is **NOT** required for operation and is not internally connected. Refer to the Ordering Information for the part number of a reflective model that will accommodate the MLPS.*

Backlight Wiring

Optional backlight versions of the CUB4 require an external 9-28 VDC power supply. The external supply is connected between the V+ and Common terminals.

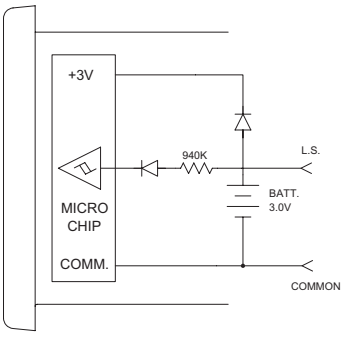


Warning: *Lithium battery may explode if incinerated.*
Caution*: All leads will be at the same line potential as the input leads.*

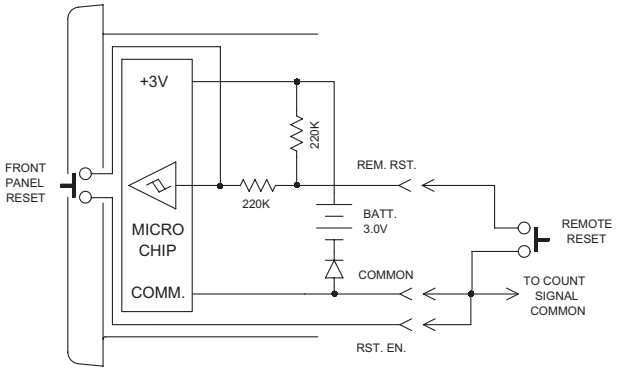
L.S. INPUT, 30 CPS MAX.

The CUB4L8W accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 300 V at count speeds up to 30 cps. The unit counts on the positive going edge of the input signal.

WARNING: Any lead may be at hazardous live input potential. External wiring and devices connected to the unit must be rated the same as applied signal input voltage and be properly isolated from Class 2 or SELV circuitry.



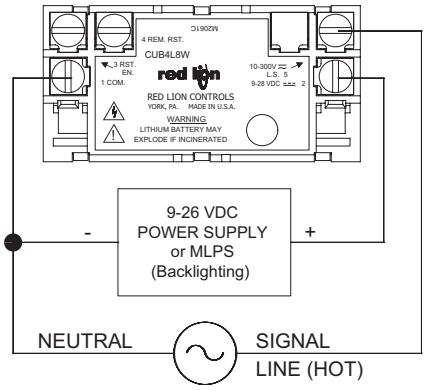
RESET OPTIONS



Connecting a wire from the *"RST. EN." (Reset Enable)* Input terminal to Common will enable the front panel Reset button. When Remote Reset is required, a wire is connected from the "*REM. RST."* input terminal to Common. Pulling this input low causes the counter to reset. The *"REM. RST."* can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load and leakage are the same as for "*L.S. CNT."* Input above.

Note: The RC protection circuit on the "REM. RST." Input causes a delay of approximately 15 msec in Reset response.

BACKLIGHT OPTION



Optional backlight versions of the CUB4 require an external 9-28 VDC power supply. The external supply is connected between the V+ and Common terminals as shown in the drawing.

Red Lion Controls optional power supply (MLPS1000) is designed to be attached directly to the rear of a CUB4 and is powered from a 85 to 250 VAC source. The MLPS provides power for unit backlighting and a sensor.

WARNING: When connecting the wiring for a backlit CUB4L8W measuring an AC input voltage, the neutral of the single phase AC signal is connected to Terminal 1 (COM), and line (hot) is connected to Terminal 5 (LS). The DC supply for the backlighting is connected as shown in the drawing. Three phase AC applications require an isolation transformer.

TROUBLESHOOTING

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

MODEL CUB5 - MINIATURE ELECTRONIC 8-DIGIT DUAL COUNTER AND RATE INDICATOR

c UL US LISTED
IND. CONT. EQ.
51EB

CE

- *LCD, REFLECTIVE OR GREEN/RED LED BACKLIGHTING*
- *0.46" (11.7 mm) HIGH DIGITS*
- *OPTIONAL SETPOINT OUTPUT CARD*
- *OPTIONAL SERIAL COMMUNICATIONS CARD (RS232 or RS485)*
- *OPTIONAL USB PROGRAMMING CARD*
- *OPERATES FROM 9 TO 28 VDC POWER SOURCE*
- *PROGRAMMABLE SCALING FOR COUNT AND RATE*
- *BI-DIRECTIONAL COUNTING, UP/DOWN CONTROL*
- *QUADRATURE SENSING (UP TO 4 TIMES RESOLUTION)*
- *BUILT-IN BATCH COUNTING CAPABILITY*
- *DISPLAY COLOR CHANGE CAPABILITY AT SETPOINT OUTPUT*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*

GENERAL DESCRIPTION

The CUB5 provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The meter can be programmed as a single or dual counter with rate indication capability. The display can be toggled either manually or automatically between the selected displays.

The CUB5 display has 0.46" (11.7 mm) high digits. The LCD is available in two versions, reflective (CUB5R000) and backlight (CUB5B000). The backlight version is user selectable for green or red backlighting with variable display intensity.

The counter is programmable for one of eight different count modes, including bi-directional and quadrature. When programmed as a dual counter, each counter has a separate scale factor and decimal points. In the counter/rate indicator mode, each have their own scaling and decimal point read-outs in different engineering units. The internal batch counter can be used to count setpoint output activations.

The meter has two separate inputs which provide different functions depending on which operating mode is selected. Input A accepts the signal for the Count and/or Rate displays, while Input B accepts the signal for the Count display or direction control. In the anti-coincidence mode, both inputs are monitored simultaneously so that no counts are lost. The resulting display can be chosen as the sum or difference of the two inputs. The Rate Indicator has programmable low (minimum) and high (maximum) update times to provide optimal display response at any input frequency. There is a programmable user input that can be programmed to perform a variety of functions.

The capability of the CUB5 can be easily expanded with the addition of option cards. Setpoint capability is field installable with the addition of the single setpoint relay output card or the dual setpoint solid state output card. Serial communications capability for RS232 or RS485 is added with a serial option card.

The CUB5 can be powered from an optional Red Lion Micro-Line/Sensor Power Supply (MLPS), which attaches directly to the back of a CUB5. The MLPS is powered from 85 to 250 VAC and provides up to 400 mA to drive the unit and sensors.

COUNTER

The CUB5 receives incoming pulses and multiplies them by the Count Scale Factor to obtain the desired reading for the count display. Input A accepts the signal for the count and Input B is used for quadrature, dual counter, anti-coincidence counting, or up/down control counting.

RATE

The rate indicator utilizes the signal at Input A to calculate the rate value using a time interval method (1/tau). The unit counts on the negative edge of the input pulses. After the programmed minimum update time elapses and the next negative edge occurs, the unit calculates the input rate based on the number of edges that occurred during the elapsed time. The input rate is then multiplied by the rate scaling value to calculate the rate display.

At slower rates, averaging can be accomplished by programming the rate minimum update time for the desired response. Extensive scaling capabilities allow practically any desired reading at very slow count rates.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this 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.

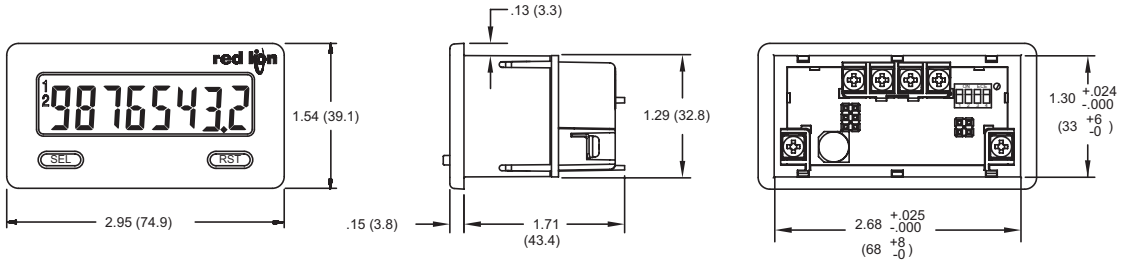
Do not use this meter to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the meter.

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

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



Ordering Information

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
CUB5	CUB5R	Dual Counter & Rate Indicator with Reflective Display	CUB5R000
	CUB5B	Dual Counter & Rate Indicator with Backlight Display	CUB5B000
Optional Plug-in Cards	CUB5RLY	Single Relay Option Card	CUB5RLY0
	CUB5SNK	Dual Sinking Open Collector Output card	CUB5SNK0
	CUB5COM	RS485 Serial Communications Card	CUB5COM1
		RS232 Serial Communications Card	CUB5COM2
	CUB5USB	USB Programming Card	CUB5USB0
Accessories	MLPS	+12 VDC Micro-Line Power Supply, 85 to 250 VAC source, 400 mA max out	MLPS1000
		+24 VDC Micro-Line Power Supply, 85 to 250 VAC source, 200 mA max out	MLPS2000
	CBLPRO	Programming Cable RS232 (RJ11-DB9)	CBLPROG0
	CBPRO	Programming Cable RS485 (RJ11-DB9)	CBPRO007
	SFCRD	Crimson PC Configuration Software for Windows 98, ME, 2000, XP [1]	SFCRD200
	CBLUSB	USB Programming Cable	CBLUSB00

[1] Crimson software is a free download from http://www.redlion.net

General Meter Specifications

1. **DISPLAY**: 8 digit LCD 0.46" (11.7 mm) high digits
   CUB5R000: Reflective LCD with full viewing angle
   CUB5B000: Transmissive LCD with selectable red or green LED backlight, viewing angle optimized. Display color change capability with output state when using an output module.
2. **POWER**: Input voltage range is +9 to +28 VDC with short circuit and input polarity protection. Must use an RLC model MLPS or an NEC Class 2 or Limited Power Source (LPS) rated power supply.

MODEL NO.	DISPLAY COLOR	INPUT CURRENT @ 9 VDC WITHOUT CUB5RLY0	INPUT CURRENT @ 9 VDC WITH CUB5RLY0
CUB5R000	---	10 mA	30 mA
CUB5B000	Red (max intensity)	85 mA	115 mA
CUB5B000	Green (max intensity)	95 mA	125 mA

3. **COUNTER DISPLAYS**:
   Counter A: 8-digits, enabled in all count modes
   Display Range: -9999999 to 99999999
   Overflow Indication: Display flashes "CnE OVEr"
   Counter B: 7-digits, enabled in Dual Counter Mode or batch counting
   Display Designator: "b" to the left side of the display
   Display Range: 0 to 9999999 (positive count only)
   Overflow Indication: Display flashes "bCnEOVEr"
   Maximum Count Rates: 50% duty cycle
   Without setpoint option card: 20 KHz (all count modes)
   With setpoint option card: 20 KHz for any count mode except Dual Counter (16 KHz), Quadrature x2 (14 KHz) and Quadrature x4 (13 KHz).
4. **RATE DISPLAY**: 6-digits, may be enabled or disabled in any count mode
   Display Designator: "R" to the left side of the display
   Display Range: 0 to 999999
   Over Range Display: "R OLOLOL"
   Maximum Frequency: 20 KHz
   Minimum Frequency: 0.01 Hz
   Accuracy: ±0.01%
5. **COUNT/RATE SIGNAL INPUTS (INP A and INP B):**
   Input A: DIP switch selectable to accept pulses from a variety of sources. See Section 2.0 Setting the DIP Switches for Input A specifications.
   Input B: Logic signals only
   Trigger levels: V_{IL} = 0.7 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
   Current sinking: Internal 10KΩ pull-up resistor to +9 to 28 VDC
   Filter (LO Freq.): Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec min.
6. **USER INPUT (USR):** Programmable input. Connect to input common (INP COMM) to activate function. Internal 10KΩ pull-up resistor to +9 to 28 VDC.
   Threshold Levels: V_{IL} = 0.7 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
   Response Time: 5 msec typ.; 50 msec debounce (activation and release)
7. **MEMORY**: Nonvolatile E^2PROM memory retains all programming parameters and count values when power is removed.
8. **CONNECTIONS**: Wire clamping screw terminals
   Wire Strip Length: 0.3" (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 5 inch-lbs (0.565 N-m) max.
9. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 requirements for outdoor use. Installation Category I, Pollution Degree 2. High impact plastic case with clear viewing window. Panel gasket and mounting clip included.
10. **ENVIRONMENTAL CONDITIONS**:
    Operating Temperature Range for CUB5R000: -35 to 75 °C
    Operating Temperature Range for CUB5B000 depends on display color and intensity level as per below:

	INTENSITY LEVEL	TEMPERATURE
Red Display	1 & 2	-35 to 75°C
	3	-35 to 70°C
	4	-35 to 60°C
	5	-35 to 50°C
Green Display	1 & 2	-35 to 75°C
	3	-35 to 65°C
	4	-35 to 50°C
	5	-35 to 35°C

    Storage Temperature: -35 to 85 °C
    Operating and Storage Humidity: 0 to 85% max. relative humidity (non-condensing)
    Vibration to IEC 68-2-6: Operational 5-500 Hz, 5 g
    Shock to IEC 68-2-27: Operational 40 g
    Altitude: Up to 2000 meters
11. **CERTIFICATIONS AND COMPLIANCES**:
    CE Approved
    EN 61326-1 Immunity to Industrial Locations
    Emission CISPR 11 Class A
    IEC/EN 61010-1
    RoHS Compliant
    UL Recognized Component: File #E179259
    UL Listed: File #E137808
    Type 4X Outdoor Enclosure rating (Face only)
    IP65 Enclosure rating (Face only)
    IP20 Enclosure rating (Rear of unit)
    Refer to EMC Installation Guidelines for additional information.
12. **WEIGHT**: 3.2 oz (100 g)

Optional Plug-in Cards

ADDING OPTION CARDS

The CUB5 meters can be fitted with optional output cards and/or serial communications cards. The details for the plug-in cards can be reviewed in the specification section below. The plug-in cards, that are sold separately, can be installed initially or at a later date.

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

SINGLE RELAY OUTPUT CARD (One setpoint only)

Type: Single FORM-C relay
Isolation To Sensor & User Input Commons: 1400 Vrms for 1 min.
Working Voltage: 150 Vrms
Contact Rating: 1 amp @ 30 VDC resistive; 0.3 amp @ 125 VAC resistive
Life Expectancy: 100,000 minimum operations
Response Time:
Turn On Time: 4 msec. max.
Turn Off Time: 4 msec. max.

DUAL SINKING OUTPUT CARD (One or two setpoints)

Type: Non-isolated switched DC, N Channel open drain MOSFET
Current Rating: 100 mA max.
$V_{DS\ ON}$: 0.7 V @ 100 mA
$V_{DS\ MAX}$: 30 VDC
Offstate Leakage Current: 0.5 mA max.

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

USB PROGRAMMING CARD

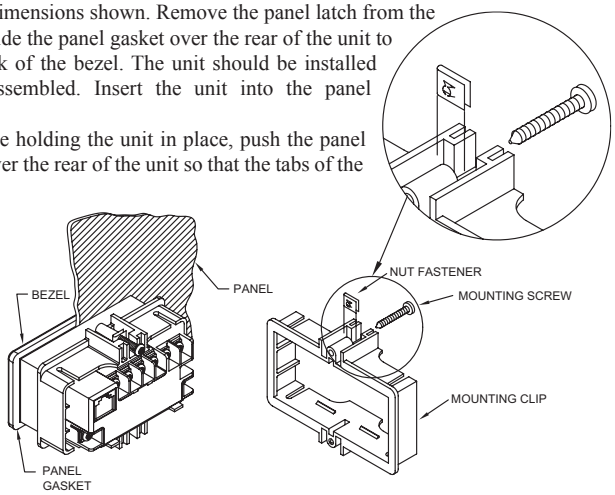
Type: USB virtual comms port
Connection: Type B
Baud Rate: 300 to 38.4k
Unit Address: 0 to 99

1.0 Installing the Meter

INSTALLATION

The meter meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.

While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approx. 28 to 36 in-oz [0.202 to 0.26 N-m]). Do not over-tighten the screws.

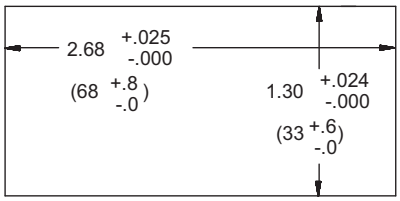


INSTALLATION ENVIRONMENT

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

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.



2.0 Setting the DIP Switches

To access the switches, remove the rear cover of the meter as described below. A bank of 4 switches is located in the upper right hand corner. After setting the switches, install any optional plug-in cards before replacing the rear cover (see next section).

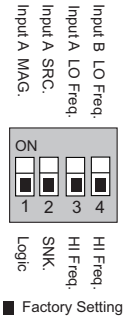
Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

REMOVING THE REAR COVER

To remove the rear cover, locate the cover locking tab below the 2nd and 3rd input terminals. To release the tab, insert a small, flat blade screwdriver between the tab and the plastic wall below the terminals. Inserting the screwdriver will provide enough pressure to release the tab locks. To replace the cover, align the cover with the input terminals and press down until the cover snaps into place.

SETTING THE INPUT DIP SWITCHES

The meter has four DIP switches for Input A and Input B that must be set before applying power.



SWITCH 1

LOGIC: Input A trigger levels V_{IL} = 1.25 V max.; V_{IH} = 2.75 V min.; V_{MAX} = 28 VDC

MAG: 200 mV peak input sensitivity; 100 mV hysteresis; maximum input voltage: ±40 V peak (28 Vrms); Must also have SRC switch ON. (Not recommended with counting applications.)

SWITCH 2

SNK.: Adds internal 7.8 KΩ pull-up resistor to +9 to 28 VDC, I_{MAX} = 3.8 mA.

SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

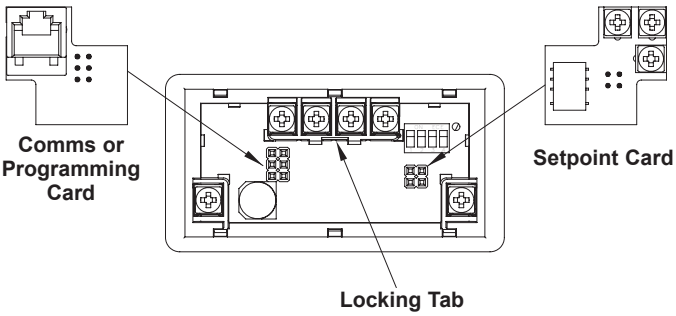
SWITCHES 3 and 4

HI Frequency: Removes damping capacitor and allows max. frequency.

LO Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.

3.0 Installing Plug-In Cards

The Plug-in cards are separately purchased option cards that perform specific functions. The cards plug into the main circuit board of the meter. After installing the cards, replace the rear cover before wiring the meter.



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.

REPLACING THE REAR COVER

To replace the rear cover, align the cover with the input terminals and press down until the cover snaps into place.

4.0 Wiring the Meter

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

EMC INSTALLATION GUIDELINES

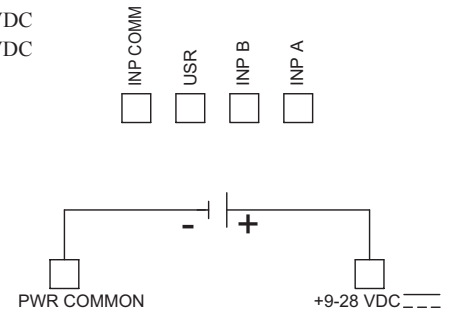
Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

4.1 POWER WIRING

DC Power

+9 to +28 VDC: +VDC
Power Common: -VDC

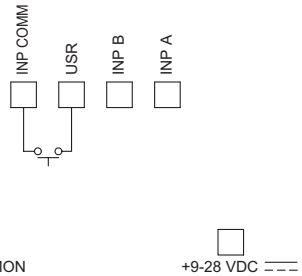


4.2 USER INPUT WIRING

Sinking Logic

INP COMM } Connect external switching device between the
USR } User Input terminal and Input Common.

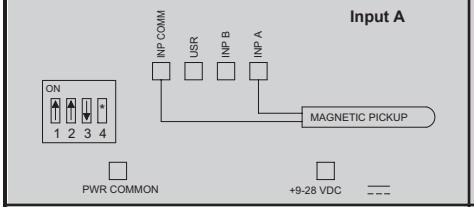
The user input of the meter is internally pulled up to +9 to +28 V with 10 K resistance. The input is active when it is pulled low (<1 .0 V).



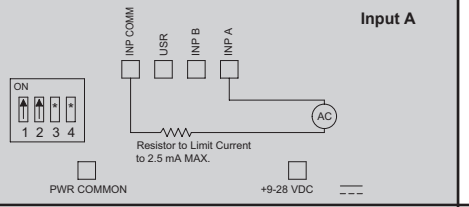
4.3 INPUT WIRING

CAUTION: Power common (PWR COMMON) is NOT isolated from input common (INP COMM). In order to preserve the safety of the meter application, the power common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the Signal or User Inputs and input common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground; and the common of the plug-in cards with respect to input common.

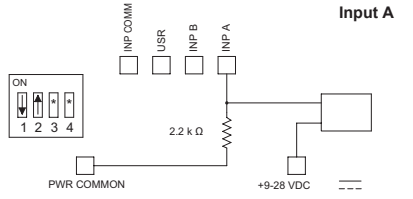
Magnetic Pickup



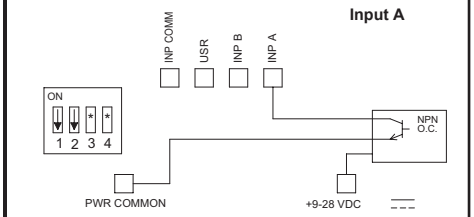
AC Inputs From Tach Generators, Etc.



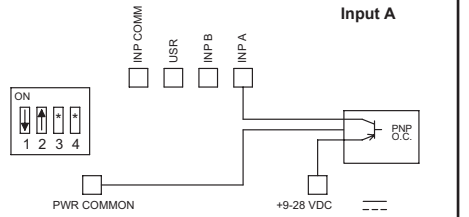
Two Wire Proximity, Current Source



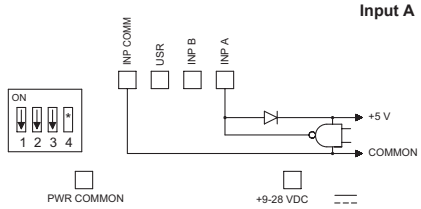
Current Sinking Output



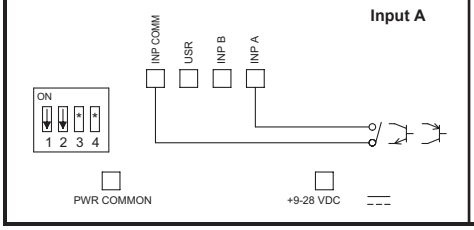
Current Sourcing Output



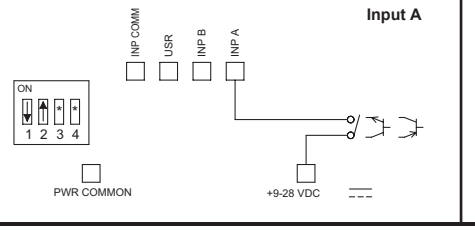
Interfacing With TTL



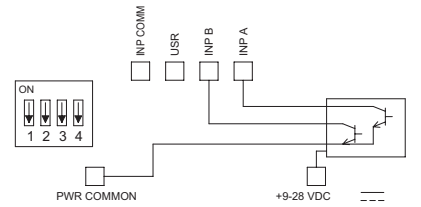
Switch or Isolated Transistor; Current Sink



Switch or Isolated Transistor; Current Source



Current Sink Output; Quad/Direction

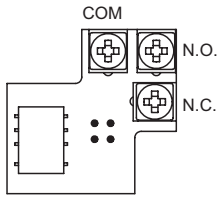


* *Switch position is application dependent.*

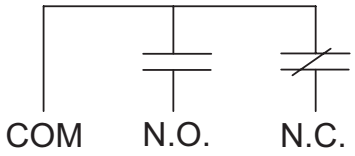
Shaded areas not recommended for counting applications.

4.4 SETPOINT (OUTPUT) WIRING

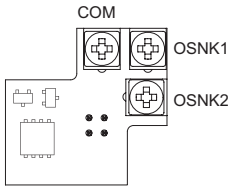
SINGLE SETPOINT RELAY PLUG-IN CARD



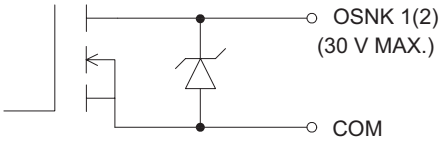
ELECTRICAL CONNECTIONS



DUAL SETPOINT N-FET OPEN DRAIN PLUG-IN CARD



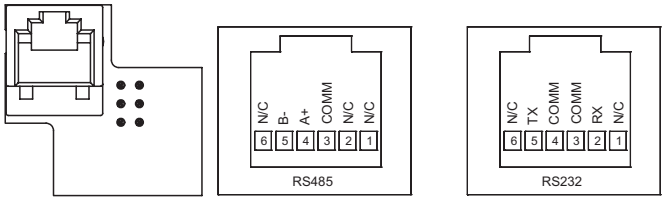
ELECTRICAL CONNECTIONS



Note: Output Common is not isolated from DC Power Common. Load must be wired between OSNK terminal and V+ of the load supply.

4.5 SERIAL COMMUNICATION WIRING

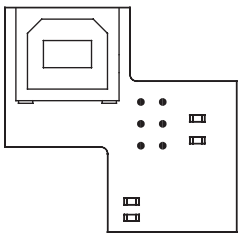
SERIAL COMMUNICATIONS PLUG-IN CARD



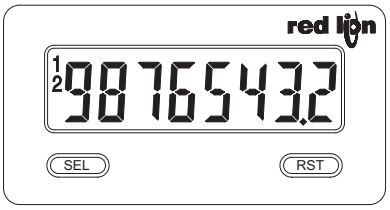
RJ11 CONNECTOR PIN OUTS

4.6 USB PROGRAMMING

USB PROGRAMING PLUG-IN CARD



5.0 Reviewing the Front Buttons and Display



KEY	DISPLAY MODE OPERATION	ENTERING PROGRAM MODE	PROGRAMMING MODE OPERATION
SEL	Index display through enabled values	Press and hold for 2 seconds to activate	Store selected parameter and index to next parameter
RST	Resets count display(s) and/or outputs		Advances through the program menu/ Increments selected parameter value or selection

OPERATING MODE DISPLAY DESIGNATORS

"R" - To the left of the display is the rate value.
- Counter A has no designator.

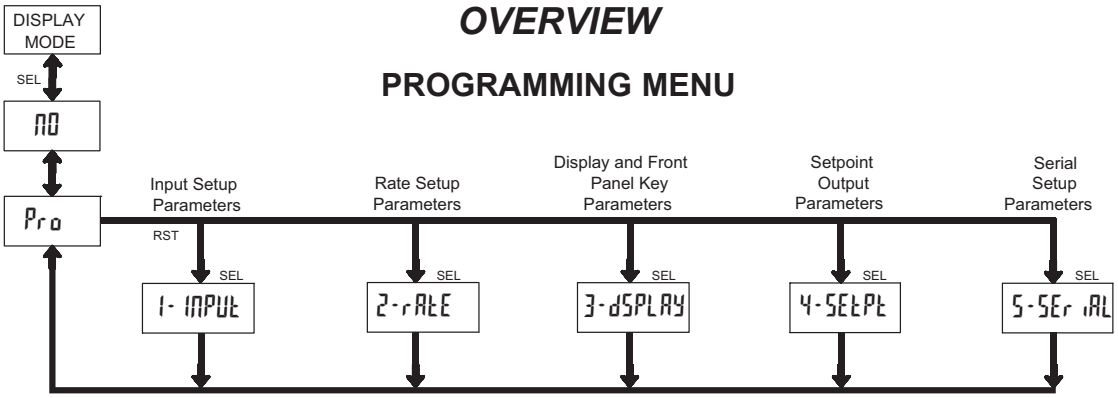
"b" - To the left of the display is the Counter B value (dual count or batch).
"1" and "2" - Indicates setpoint 1 and 2 output status.

Pressing the **SEL** button toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically every four seconds between the rate and count values.

6.0 Programming the Meter

OVERVIEW

PROGRAMMING MENU



PROGRAMMING MODE ENTRY (SEL KEY)

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing and holding the **SEL** key. If it is not accessible then it is locked by either a security code, or a hardware lock.

MODULE ENTRY (SEL & RST KEYS)

The Programming Menu is organized into separate modules. These modules group together parameters that are related in function. The display will alternate between Pro and the present module. The **RST** key is used to select the desired module. The displayed module is entered by pressing the **SEL** key.

MODULE MENU (SEL KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The **SEL** key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro no. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The **RST** key is used to move through the selections/values for that parameter. Pressing the **SEL** key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, press the **RST** key to access the value. The right hand most digit will begin to flash. Pressing the **RST** key again increments the digit by one or the user can hold the **RST** key and the digit will automatically scroll. The **SEL** key will advance to the next digit. Pressing and holding the **SEL** key will enter the value and move to the next parameter.

PROGRAMMING MODE EXIT (SEL KEY)

The Programming Mode is exited by pressing the **SEL** key with Pro no displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

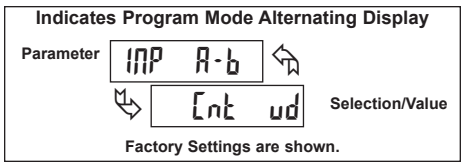
It is recommended to start with Module 1 for counting or Module 2 for rate. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

FACTORY SETTINGS

Factory settings may be completely restored in Module 3. This is useful when encountering programming problems.

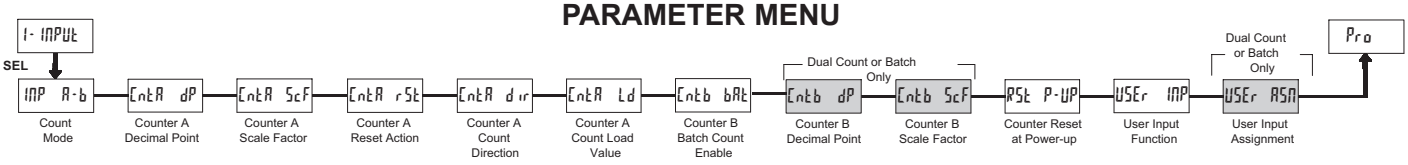
ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's factory setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.



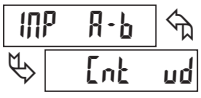
6.1 MODULE 1 - INPUT SETUP PARAMETERS (1- INPUT)

PARAMETER MENU



Shaded area selections only apply when Counter B is enabled (Dual Counter mode or batch counter).

COUNT MODE



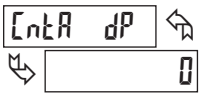
Cnt ud QUAd 1 Add Add
RAtE Cnt QUAd 2 Add Sub
dUAL Cnt QUAd 4

Select the count mode that corresponds with your application. The input actions are shown in the boxes below. For simple counting applications, it is recommended to use Count with Direction for the count mode. Simply leave the direction input unconnected.

DISPLAY	MODE	INPUT A ACTION	INPUT B ACTION
Cnt ud	Count with Direction	Counter A	Counter A Direction
RAtE Cnt	Rate/Counter	Rate only	Counter A Add
dUAL Cnt	Dual Counter	Counter A Add	Counter B Add
QUAd 1	Quadrature x1	Count A	Quad A
QUAd 2	Quadrature x2	Count A	Quad A
QUAd 4	Quadrature x4	Count A	Quad A
Add Add	2 Input Add/Add	Counter A Add	Counter A Add
Add Sub	2 Input Add/Subtract	Counter A Add	Counter A Subtract

Note: The Rate indicator signal is derived from Input A in all count modes.

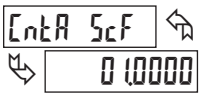
COUNTER A DECIMAL POSITION



0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for Counter A. The selection will also affect Counter A scale factor calculations.

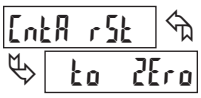
COUNTER A SCALE FACTOR



0.0001 to 9999

The number of input counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)*

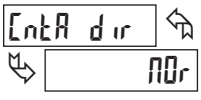
COUNTER A RESET ACTION



to 2Ero to CtLd

When Counter A is reset, it returns to Zero or Counter A Count Load value. This reset action applies to all Counter A resets, except a setpoint generated Counter Auto Reset programmed in Module 4.

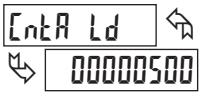
COUNTER A COUNT DIRECTION



nor rEU

Reverse (rEU) switches the normal Counter A count direction shown in the Count Mode parameter chart.

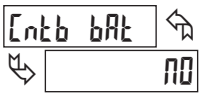
COUNTER A COUNT LOAD VALUE



-9999999 to 99999999

Counter A resets to this value if Reset to Count Load action is selected.

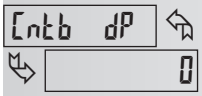
COUNTER B BATCH COUNT ENABLE



no SP2
SP1 SP1-2

The Counter B batch count function internally counts the number of output activations of the selected setpoint(s). The count source for the batch counter can be SP1, SP2 or both. Batch counting is available in all count modes except Dual Counter, which uses an external input signal for Counter B. This parameter only appears if a Setpoint Output option card is installed.

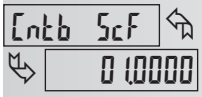
COUNTER B DECIMAL POSITION



0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for Counter B. The selection will also affect Counter B scale factor calculations.

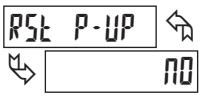
COUNTER B SCALE FACTOR



0.0001 to 9999

The number of input or batch counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input or batch counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER RESET AT POWER-UP



no no Count b
yES Count A both A-b

The selected counter(s) will reset at each meter power-up.

* For value entry instructions, refer to selection/value entry in the Programming The Meter section.

A

SCALING FOR COUNT INDICATION

The CUB5's scale factor is factory set to 1, to provide one count on the display for each pulse that is input to the unit. In many applications, there will not be a one-to-one correspondence between input pulses and display units. Therefore, it is necessary for the CUB5 to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.)

The Count Scale Factor Value can range from 00.0001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. The following formula is used to calculate the scale factor.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

WHERE:

Desired Display Units: Count display units acquired after pulses that occurred.

Number of Pulses: Number of pulses required to achieve the desired display units.

Decimal Point Position:

0	=	1
0.0	=	10
0.00	=	100
0.000	=	1000
0.0000	=	10000
0.00000	=	100000

EXAMPLE: The counter display is used to indicate the total number of feet used in a process. It is necessary to know the number of pulses for the desired units to be displayed. The decimal point is selected to show the resolution in hundredths.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

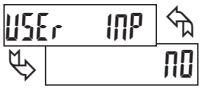
Given that 128 pulses are equal to 1 foot, display total feet with a one-hundredth resolution.

$$\text{Scale Factor} = \frac{1.00}{128} \times 100$$

$$\text{Scale Factor} = 0.007812 \times 100$$

$$\text{Scale Factor} = 0.7812$$

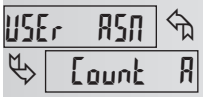
USER INPUT FUNCTION



DISPLAY	MODE	DESCRIPTION
no	No Function	User Input disabled.
Pro Loc	Program Mode Lock-out	See Programming Mode Access chart. (Module 3)
Inhibit	Inhibit	Inhibit counting for the selected counter(s).
rESEt	Maintained Reset	Level active reset of the selected counter(s).
StorE	Store	Freeze display of selected counter(s) while allowing counts to accumulate internally.
Stor-rSt	Store and Reset	Edge triggered reset of the selected counter(s) after storing the count.
d-SELECt	Display Select *	Advance once for each activation
d-LEVEL	Display Intensity Level *	Increase intensity one level for each activation. (backlight version only)
d-COLOr	Backlight Color *	Change backlight color with each activation (backlight version only)
Print	Print Request	Serial transmit of the active parameters selected in the Print Options (Module 5)
Prnt-rSt	Print and Reset *	Same as Print Request followed by a momentary reset of the selected counter(s).
rESEt-1	Setpoint 1 Reset *	Reset Setpoint 1 output
rESEt-2	Setpoint 2 Reset *	Reset Setpoint 2 output
rESEt-12	Setpoint 1 and 2 Reset *	Reset Setpoint 1 and 2 outputs

*Note: * indicates Edge Triggered function. Other functions are Level Active (maintained)*

USER INPUT ASSIGNMENT



Count A Count b both A-b

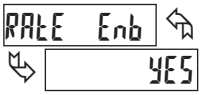
The User Input Assignment is only active when Counter B is enabled and the User Input performs a Reset, Inhibit or Store function on one or both counters.

6.2 MODULE 2 - RATE SETUP PARAMETERS (2-rAtE)

PARAMETER MENU

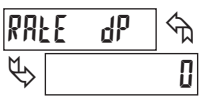
Module 2 is the programming for the rate parameters. For maximum input frequency, Rate Enable should be set to no when not in use. When set to no, the remaining rate parameters are not accessible. The rate value is shown with an annunciator of "R" in the Display Mode.

RATE ENABLE



no YES

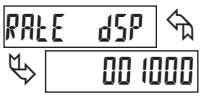
RATE DECIMAL POINT



0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for the rate display and any setpoint value assigned to rate. This parameter does not affect rate scaling calculations.

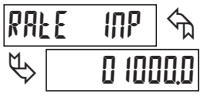
RATE SCALING DISPLAY VALUE



0 to 999999

Enter the desired Rate Display Value for the Scaling Point.*

RATE SCALING INPUT VALUE



0.1 to 999999

Enter the corresponding Rate Input Value for the Scaling Point.*

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.

SCALING FOR RATE INDICATION

To scale the rate, enter a Scaling Display value with a corresponding Scaling Input value. These values are internally plotted to a display value of 0 and input value of 0.0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The meter is capable of showing a rate display value for any linear process.

SCALING CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (RATE dSP) and Scaling Input (RATE INP). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY (RATE dSP)	INPUT (RATE INP)
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

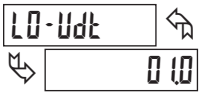
NOTES:

1. If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

EXAMPLE:

1. With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

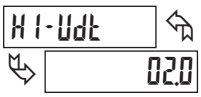
RATE LOW UPDATE TIME



0.1 to 99.9 seconds

The Low Update Time is the minimum amount of time between display updates for the rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady.

RATE HIGH UPDATE TIME



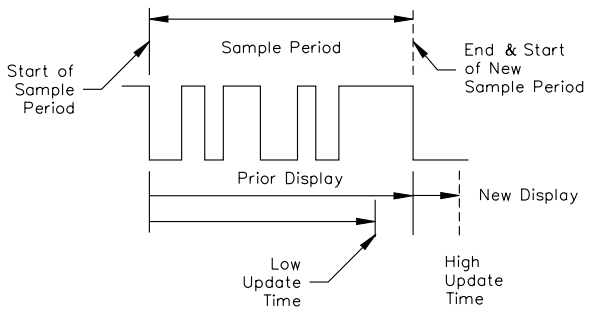
0.2 to 99.9 seconds

The High Update Time is the maximum amount of time before the rate display is forced to zero. (For more explanation, refer to Rate Value Calculation.) The High Update Time **must** be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

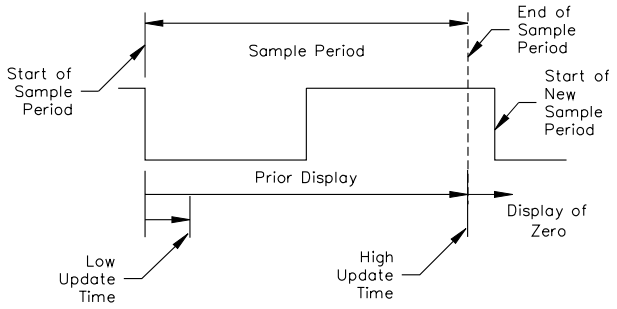
INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by the scaling calculation.

RATE VALUE CALCULATED



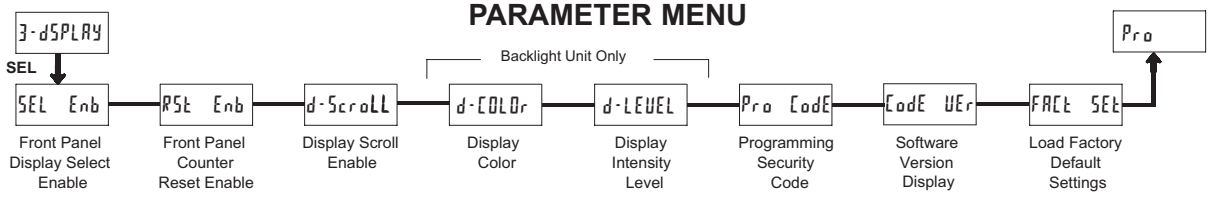
ZERO RATE CALCULATED



A

6.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY PARAMETERS (3-dSPLAY)

PARAMETER MENU



FRONT PANEL DISPLAY SELECT ENABLE (SEL)

SEL Enb / YES — YES NO

The YES selection allows the **SEL** button to toggle through the enabled displays.

FRONT PANEL COUNTER RESET ENABLE (RST)

RSt Enb / YES — YES NO; NO Count A Count b; both A-b dSPLAY

The YES selection allows the **RST** button to reset the selected counter(s). The shaded selections are only active when Counter B is enabled (Dual Count mode or batch counter).

DISPLAY SCROLL ENABLE

d-ScroLL / NO — YES NO

The YES selection allows the display to automatically scroll through the enabled displays. Each display is shown for 4 seconds.

DISPLAY COLOR (BACKLIGHT UNIT ONLY)

d-COLOr / rEd — rEd Grn

Enter the desired display color, red or green. This parameter is active for backlight units only.

DISPLAY INTENSITY LEVEL (BACKLIGHT UNIT ONLY)

d-LEVEL / 5 — 1 to 5

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed. This parameter is active for backlight units only.

PROGRAMMING SECURITY CODE

Pro CodE / 000 — 0 to 999

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used indepentently or along with the Program Mode Lock-out (Pro Loc) selection in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all unit parameters to be viewed and modified. Quick Programming mode permits only user selected values to be modified, but allows direct access to these values without having to enter Full Programming mode.

Entering a Security Code from 1-99 enables Quick Programming mode, and displays a sublist to select what values appear in the Quick Programming menu. All applicable values set to YES in the sublist will be accessible in Quick Programming. The sublist includes Setpoint values (SP1 VAL, SP2 VAL), Output Time-out values (SP1 tOUt, SP2 tOUt), Counter A Count Load value (CntA Ld) and the Display Intensity Level (d-LEVEL) for backlight units.

Programming any Security Code other than 0, requires this code to be entered at the Pro CodE prompt in order to access Full Programming mode. Quick Programming mode, if enabled, is accessed before the Pro CodE prompt.

USER INPUT FUNCTION	USER INPUT STATE	SECURITY CODE	MODE WHEN "SEL" KEY IS PRESSED	FULL PROGRAMMING MODE ACCESS
not Pro Loc	_____	0	Full Programming	Immediate Access
		1-99	Quick Programming	After Quick Programming with correct code entry at Pro CodE prompt *
		100-999	Pro CodE prompt	With correct code entry at Pro CodE prompt *
Pro Loc	Active	0	Programming Lock	No Access
		1-99	Quick Programming	No Access
		100-999	Pro CodE prompt	With correct code entry at Pro CodE prompt *
	Not Active	0-999	Full Programming	Immediate Access

** Entering Code 222 allows access regardless of security code.*

SOFTWARE VERSION DISPLAY

CodE UEr / NO — NO YES

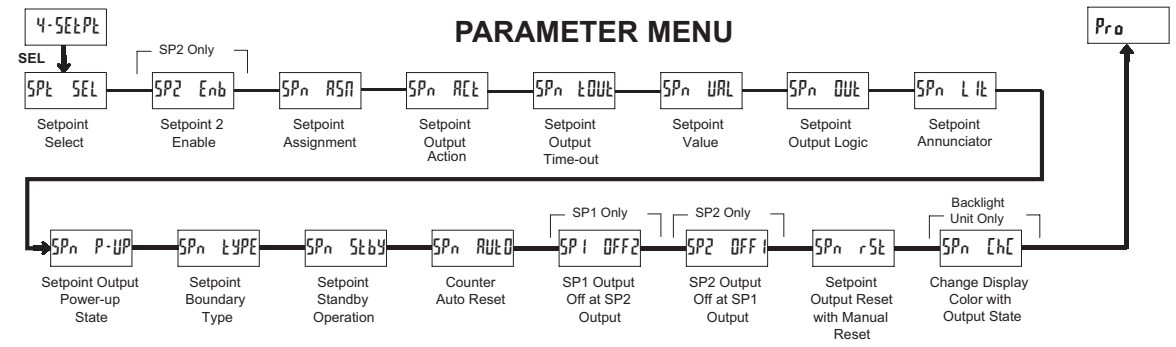
Select YES to momentarily display the meter software version before advancing to the next parameter. The software version is also displayed at power-up.

LOAD FACTORY DEFAULT SETTINGS

FACt SEt / NO — NO YES

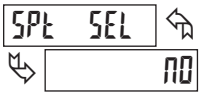
The YES selection will return the meter to the factory default settings. The meter will display rESEt and then return to Pro, at which time all settings have been changed.

6.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SETPT)



The Setpoint Output Parameters are only active when an optional Setpoint Output Module is installed in the meter. Some parameters in the menu will not appear depending on the Setpoint Assignment and Setpoint Output Action. The Setpoint Parameter Availability chart below illustrates this.

SETPOINT SELECT

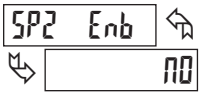


no SP1 SP2

Select the Setpoint Output to be programmed, starting with Setpoint 1. The "n" in the following parameters reflects the chosen Setpoint number. After Setpoint 1 is completely programmed, the display returns to SPt SEL. Repeat steps for Setpoint 2 if both Setpoints are used in the application.

Select no to exit the Setpoint programming module. The number of Setpoints available is dependent on the Setpoint option module installed.

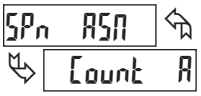
SETPOINT 2 ENABLE (SP2 Only)



no yES

Select yES to enable Setpoint 2 and access the setup parameters. If no is selected, the unit returns to SPt SEL and Setpoint 2 is disabled.

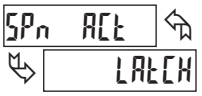
SETPOINT ASSIGNMENT



Count A Count b rAtE

Select the display to which the Setpoint is assigned.

SETPOINT OUTPUT ACTION



LAtCH t-OUt bOUnd

The parameter selects the action of the Setpoint Output as described in the chart. Boundary output action is not applicable for Counter B assignment.

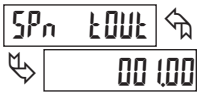
SPT ACTION	DESCRIPTION	OUTPUT ACTIVATES	OUTPUT DEACTIVATES
LAtCH	Latched Output Mode	When Count = Setpoint	At Manual Reset (if SPn rSt=yES)
t-OUt	Timed Output Mode	When Count = Setpoint	After Setpoint Output Time-Out
bOUnd	Boundary Mode (High Acting Type)	When Count ≥ Setpoint	When Count < Setpoint
	Boundary Mode (Low Acting Type)	When Count ≤ Setpoint	When Count > Setpoint

SETPOINT PARAMETER AVAILABILITY

PARAMETER	DESCRIPTION	COUNTER ASSIGNMENT (A or B) *			RATE ASSIGNMENT		
		TIMED OUT t-OUt	BOUNDARY bOUnd	LATCH LAtCH	TIMED OUT t-OUt	BOUNDARY bOUnd	LATCH LAtCH
SPn tOUt	Setpoint Output Time-out Value	Yes	No	No	Yes	No	No
SPn VAL	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
SPn OUt	Setpoint Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
SPn LIt	Setpoint Annunciator	Yes	Yes	Yes	Yes	Yes	Yes
SPn P-UP	Setpoint Output Power-up State	No	No	Yes	No	No	Yes
SPn tYPE	Setpoint Boundary Type	No	Yes	No	Yes	Yes	Yes
SPn StbY	Standby Operation (Low acting only)	No	Yes	No	Yes	Yes	Yes
SPn AUtO	Counter Auto Reset	Yes	No	Yes	No	No	No
SP1 OFF2	SP1 Output Off at SP2 (SP1 only)	Yes	No	Yes	No	No	No
SP2 OFF1	SP2 Output Off at SP1 (SP2 only)	Yes	No	Yes	No	No	No
SPn rSt	Output Reset with Manual Reset	Yes	No	Yes	Yes	No	Yes
SPn ChC	Change Display Color w/ Output State	Yes	Yes	Yes	Yes	Yes	Yes

** BOUNDARY Setpoint Action not applicable for Counter B Assignment*

SETPOINT OUTPUT TIME-OUT



0.01 to 59999 seconds

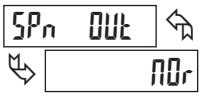
This parameter is only active if the Setpoint Action is set to time out (t-OUt). Enter the value in seconds that the Setpoint output will be active, once the Setpoint Value is reached.

SETPOINT VALUE

Count A: -9999999 to 99999999
Count B: 0 to 9999999
Rate: 0 to 999999

Enter the desired Setpoint value. To enter a negative setpoint value, increment digit 8 to display a "-" sign (Counter A only).

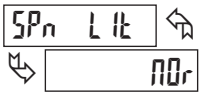
SETPOINT OUTPUT LOGIC



nOr rEV

Normal (nOr) turns the output "on" when activated and "off" when deactivated. Reverse (rEV) turns the output "off" when activated and "on" when deactivated.

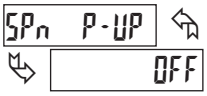
SETPOINT ANNUNCIATOR



nOr rEV

Normal (nOr) displays the setpoint annunciator when the corresponding output is "on". Reverse (rEV) displays the setpoint annunciator when the output is "off".

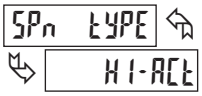
SETPOINT OUTPUT POWER-UP STATE



OFF ON SAVE

SAVE will restore the output to the same state it was at before the meter was powered down. ON will activate the output at power up. OFF will deactivate the output at power up.

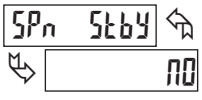
SETPOINT BOUNDARY TYPE



HI-ACt LO-ACt

High Acting Boundary Type activates the output when the assigned display value (SPn ASn) equals or exceeds the Setpoint value. Low Acting activates the output when the assigned display value is less than or equal to the Setpoint.

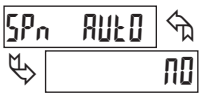
SETPOINT STANDBY OPERATION



nO YES

This parameter only applies to Low Acting Boundary Type setpoints. Select YES to disable a Low Acting Setpoint at power-up, until the assigned display value crosses into the output "off" area. Once in the output "off" area, the Setpoint will then function per the description for Low Acting Boundary Type.

COUNTER AUTO RESET

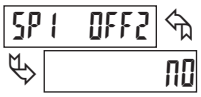


nO 2Ero-Str CtLd-Str
2Ero-End CtLd-End

This parameter automatically resets the counter to which the setpoint is assigned (SPn ASn) each time the setpoint value is reached. The automatic reset can occur at output start, or at output end if the Setpoint Output Action is programmed for timed output mode. The Reset-to-Count Load selections ("CtLd-") only apply to Counter A assignment. This reset may be different from the Counter A Reset Action selected in Module 1.

SELECTION	ACTION
nO	No Auto Reset.
2Ero-Str	Reset to Zero at the start of output activation.
CtLd-Str	Reset to Count Load value at the start of output activation.
2Ero-End	Reset to Zero at the end of output activation (timed out only).
CtLd-End	Reset to Count Load value at the end of output activation (timed out only).

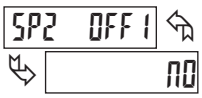
SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)



nO Out2-Str Out2-End

This parameter will deactivate Setpoint 1 output at the Start or End of Setpoint 2 output (O1 off at O2). The "-End" setting only applies if Setpoint 2 Output Action is programmed for timed output.

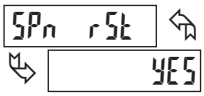
SETPOINT 2 OUTPUT OFF AT SETPOINT 1 (SP2 Only)



nO Out1-Str Out1-End

This parameter will deactivate Setpoint 2 output at the Start or End of Setpoint 1 output (O2 off at O1). The "-End" setting only applies if Setpoint 1 Output Action is programmed for timed output.

SETPOINT OUTPUT RESET WITH MANUAL RESET

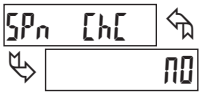


YES nO

Selecting YES causes the Setpoint output to deactivate (reset) when the Setpoint Assigned Counter is reset. The counter reset can occur by the **RST** button, User Input, Counter Reset at Power-up or a serial Reset Counter command.

This output reset will not occur when the Assigned Counter is reset by a Setpoint generated Counter Auto Reset.

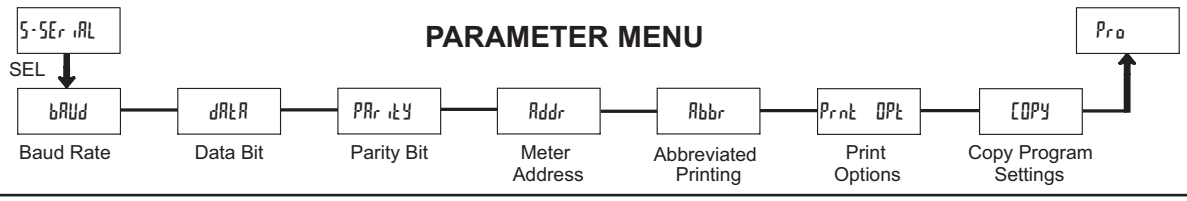
CHANGE DISPLAY COLOR WITH OUTPUT STATE



nO YES

This parameter enables the backlight CUB5 to switch the backlight color when the output state changes. This parameter is only active for the backlight version.

6.5 MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-SEr iAL)



The Serial Setup Parameters are only active when one of the optional serial communication/programming cards is installed in the meter.

Refer to the CUB5USB bulletin for details on the CUB5 USB programming and programming requirements. This section replaces the bulletin shipped with the RS232 and RS485 serial communications plug-in cards. Discard the separate bulletin when using those serial plug-in cards with the CUB5B and CUB5R.

BAUD RATE

bAUd / 9600

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

dAtA / 7-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

PAr itY / Odd

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

Addr / 00

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

Abbr / nO

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

Prnt OPt / nO

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" (Prnt 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, Counter B or Scale Factor B will only be sent if Counter B is enabled (Dual Counter mode or batch count). Likewise, the Setpoint value(s) will not be sent unless an optional setpoint card is installed in the meter.

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
Count A	Counter A	YES	CTA
Count b	Counter B	nO	CTB
RAtE	Rate Value	nO	RTE
CntA ScF	Scale Factor A	nO	SFA
Cntb ScF	Scale Factor B	nO	SFB
SP1	Setpoint 1	nO	SP1
SP2	Setpoint 2	nO	SP2
CntA Ld	Counter A Count Load	nO	CLD

COPY PROGRAM SETTINGS

COPY / nO

nO YES

This parameter is used to copy all the program settings from one CUB5 meter directly to another CUB5 meter, through the serial communications cards (RS232 or RS485). The USB programming card cannot be used for the copy procedure. No PC connection or additional software is required. Copying program settings eliminates the need for repetitive programming when multiple meters use identical settings.

Copy Requirements:

To copy program settings from one meter to another requires the following:

1. Both meters must have the same software version (Version 3.1 or later). The version is displayed during the meter power-up sequence, or in Module 3 at the Software Version Display parameter. (See Module 3 for details)
2. The meter receiving the program settings (receiver) must have the Baud Rate set to 9600 baud. Since this is the factory default setting, a new meter will arrive ready for copying. The meter sending the program settings (master) should be set to the desired Baud Rate for the application (if different than 9600). This Baud Rate setting will then be copied to the receiver.

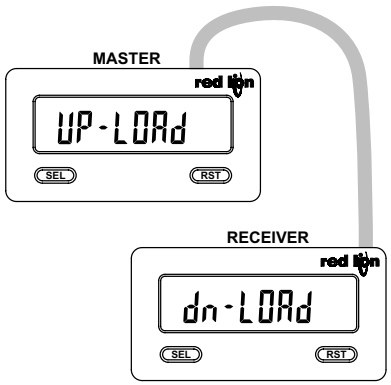
Copy Connections:

To connect the meters for copying, install a serial communications card of the same type into each meter (RS232 or RS485). Connect the meters using the proper cable listed in the chart.

TYPE	DESCRIPTION	PART NUMBER
RS232	Copy Cable RS232 10' (RJ12-RJ12)	CBLRLC02
RS485	Copy Cable RS485 10' (RJ12-RJ12)	CBLRLCS2

Copy Procedure:

1. Connect the master and receiver using the appropriate copy cable.
2. Apply power to the meters. The receiving meter must be operating in the normal display mode (not programming mode).
3. On the master meter, enter programming mode and proceed to the Copy Program Settings parameter in Module 5. Select YES to begin copying.
4. During the copy process (~ 2 sec.), the master meter displays an upload message (UP-LOAd) while the receiver displays a download message (dn-LOAd). This indicates successful communication between the master and receiver. If the receiver message is not displayed, be sure the proper cable is connected.
5. When copying is complete, the receiver displays the power-up sequence and returns to normal operating mode, programmed with all the same settings as the master meter. The master remains at the COPY prompt, ready to connect another receiver for copying.



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, and 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 count 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.

Register Identification Chart

ID	Value Description	MNEMONIC	Applicable Commands	Transmit Details (T and V)
A	Counter A	CTA	T, V, R	8 digit positive/7 digit negative (with minus sign)
B	Counter B	CTB	T, V, R	7 digit, positive only
C	Rate	RTE	T	6 digit, positive only
D	Scale Factor A	SFA	T, V	6 digit, positive only
E	Scale Factor B	SFB	T, V,	6 digit, positive only
F	Setpoint 1 (Reset Output 1)	SP1	T, V, R	per setpoint Assignment, same as Counter or Rate
G	Setpoint 2 (Reset Output 2)	SP2	T, V, R	per setpoint Assignment, same as Counter or Rate
H	Counter A Count Load Value	CLD	T, V	8 digit positive/7 digit negative (with minus sign)

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 $ terminating characters.

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint 1 value
   String: N17VF350*
2. Node address = 5, Read Counter A, response time of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint 1 output
   String: RF*
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
7-18	12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point
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 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 18) is 12 characters long. When a requested counter or rate value exceeds the meter's display limits, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 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
1-12	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, Counter A = 875
   17 CTA 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 1 = 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

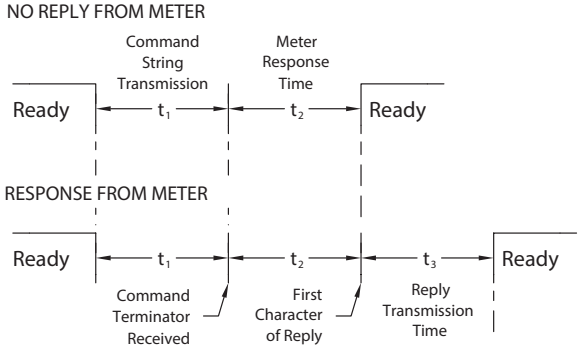
At the start of time interval t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies. If no response from the meter is expected, the meter is ready to accept another command.

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.



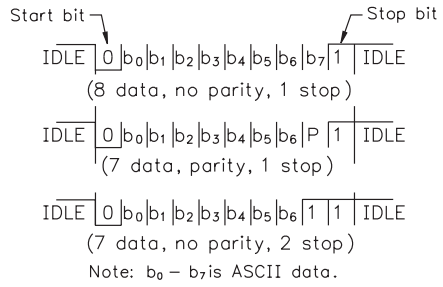
Timing Diagram Figure

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 PAXLC - PAX® LITE COUNTER

- *AVAILABLE IN 6 OR 8-DIGIT VERSIONS*
- *6-DIGIT, 0.56" (14.2 mm) / 8-DIGIT, 0.4" (10.1 mm) HIGH RED LED DISPLAYS*
- *ACCEPTS INPUT COUNT RATES UP TO 25 KHZ*
- *BI-DIRECTIONAL COUNTING*
- *REMOTE RESET CAPABILTY*
- *DISPLAY STORE*
- *COUNT INHIBIT*
- *PROGRAMMABLE SCALE FACTOR*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*

c UL US LISTED
IND. CONT. EQ.
51EB

GENERAL DESCRIPTION

The PAX® Lite Counter, Model PAXLC, is a versatile totalizing counter that can be adapted to a wide variety of counting, measuring, and positioning readout applications.

The unit features a programmable scale factor, front panel and remote reset, store, inhibit, and a count rate of 25 KHz, while offering an economical solution to any totalizing need.

The PAXLC accepts digital inputs from a variety of sources including switch contacts, NPN-OC and TTL outputs, as well as most standard Red Lion sensors. The input can be scaled to display any desired unit of measure by simply using the programmable scale factor. The meter can accept bi-directional and uni-directional signals.

The meter is programmed through the front panel buttons and the use of DIP switches. The Down Arrow Key will also function as a front panel display reset. Once the front panel programming is complete, the buttons can be disabled by a DIP switch setting.

The meter has been specifically designed for harsh industrial environments. With a NEMA 4X/IP65 sealed bezel and extensive testing to meet CE requirements, the meter provides a tough yet reliable application solution.

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.

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

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.

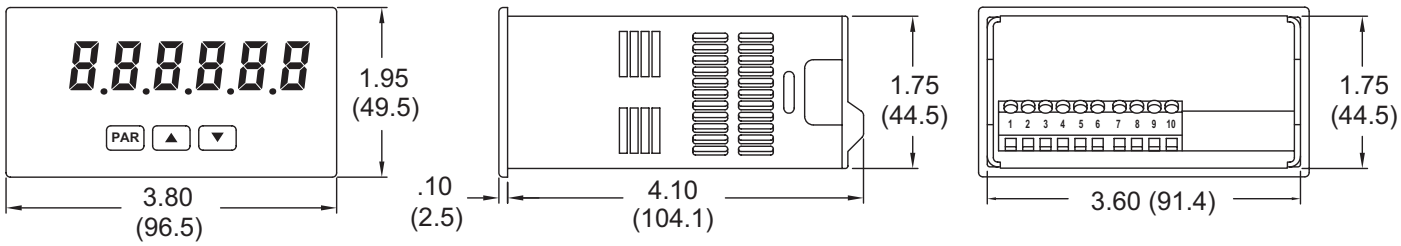
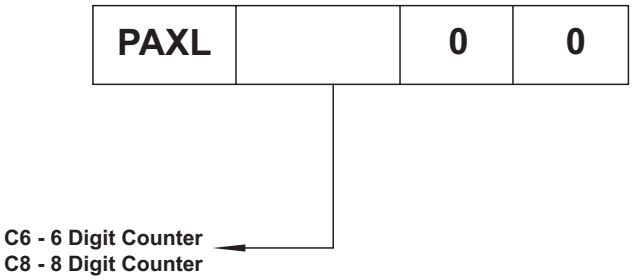


Table of Contents

A

Ordering Information

Meter Part Numbers



General Meter Specifications

1. **DISPLAY**: 6-digit, 0.56" (14.2 mm) or 8-digit, 0.4" (10.1 mm) 7-segment red LED
   Display Range: 6-digit, -99999 to 999999 or 8-digit, -9999999 to 99999999
   Display Overflow indicated by flashing dot to the right of digit 1
   Decimal points are programmed by front panel keys
2. **POWER**:
   AC Power: 115/230 VAC, switch selectable. Allowable power line variation ±10%, 50/60 Hz, 6 VA.
   Isolation: 2300 Vrms for 1 min. to input and DC Out/In.
   DC Power: 10 to 16 VDC @ 0.1 A max.
3. **SENSOR POWER**: 9 to 17.5 VDC @ 100 mA max.
4. **KEYPAD**: 3 programming keys, the ▼ (Down Arrow) key can also function as the front panel reset button
5. **COUNT INPUT**: (DIP switch selectable)
   Accepts pulses from a variety of sources including switch contacts, NPN-OC and TTL Outputs, as well as most standard Red Lion® sensors
   Logic State: Active Low
   Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
   Current Sinking: Internal 7.8 KΩ pull-up to +12 VDC, I max = 1.9 mA
   Current Sourcing: Internal 3.9 KΩ pull-down, 8 mA max. @ 30 VDC max.
   Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.
6. **MAXIMUM COUNT RATE**: 25 KHz max.
7. **CONTROL INPUTS**:
   Count Up/Down Control, Remote Reset, Inhibit, and Store
   Max. Continuous Input: 30 VDC
   Isolation To Sensor Input Commons: Not isolated
   Logic State: Active Low, 22 KΩ pull-up to +12 V
   Active: V_{IN} < 0.9 VDC
   Inactive: V_{IN} > 3.6 VDC
   Response Time:
   Up/Down and Inhibit: 25 µsec max.
   Reset and Store: 10 msec. max.
8. **MEMORY**: Nonvolatile E^2PROM retains all programmable parameters and count values.
9. **ENVIRONMENTAL CONDITIONS**:
   Operating Temperature Range: 0 to 60°C
   Storage Temperature Range: -40 to 60°C
   Operating and Storage Humidity: 0 to 85% max. relative humidity non-condensing
   Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g's.
   Shock According to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions.
   Altitude: Up to 2000 meters
10. **CERTIFICATIONS AND COMPLIANCES**:
    SAFETY
    UL Recognized Component, File # E179259, UL61010A-1, CSA C22.2 No. 61010-1
    Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    Type 4X Enclosure rating (Face only), UL50
    IECEE CB Scheme Test Report # 04ME11209-20041018
    Issued by Underwriters Laboratories, Inc.
    IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    IP65 Enclosure rating (Face only), IEC 529
    IP20 Enclosure rating (Rear of unit), IEC 529
    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] 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A [2] 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
Power frequency magnetic fields	EN 61000-4-8	Criterion A 30 A/m
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle
Emissions:		
Emissions	EN 55011	Class B

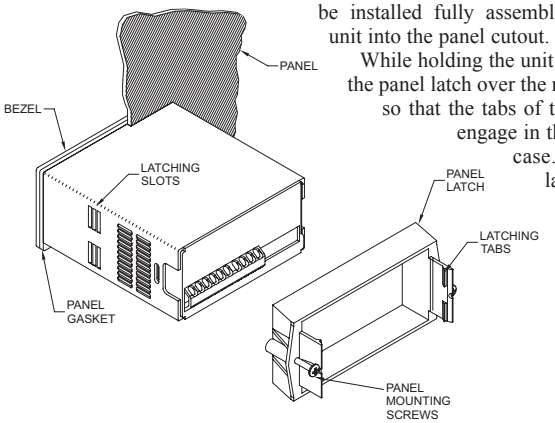
Notes:
1. Criterion A: Normal operation within specified limits.
2. EMI filter placed on the DC power supply, when DC powered: Corcom #1VB3 or Schaffner #FN610-1/07 (RLC #LFIL0000).

11. **CONNECTIONS**: High compression cage-clamp terminal block
    Wire Strip Length: 0.3" (7.5 mm)
    Wire Gage: 30-14 AWG copper wire
    Torque: 4.5 inch-lbs (0.51 N-m) max.
12. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.
13. **WEIGHT**: 12 oz. (340 g)

1.0 Installing the Meter

Installation

The PAX Lite meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

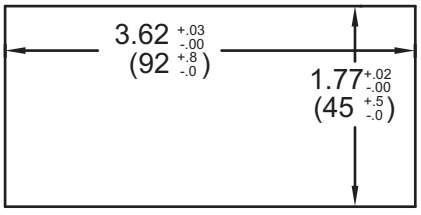
Installation Environment

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.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



2.0 Setting the Switches

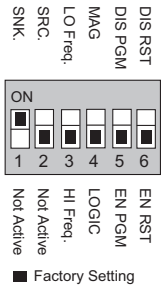
The meter has switches that must be checked and/or changed prior to applying power. To access the power switch, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Power Selection Switch

Caution: Insure the AC power selection switch is set for the proper voltage before powering-up the meter. The meter is shipped from the factory in the 230 VAC position.

Setup DIP Switches

A DIP switch is at the rear of the meter. It is used to set up the input, enable/disable programming and front panel reset functions. For the correct input setup, refer to 3.3 Wiring the Meter.



Switch 1

SNK.: Adds internal 7.8 KΩ pull-up resistor to +12 VDC, I_{MAX} = 1.9 mA

Switch 2

SRC: Adds internal 3.9 KΩ pull-down resistor, 8 mA max. @ 30 VDC max.

Switch 3

HI Frequency: Removes damping capacitor and allows max. frequency.

LO Frequency: Limits input frequency to 50 Hz and input pulse widths to 10 msec.

Switch 4

LOGIC: Input trigger levels V_{IL} = 1.5 V max; V_{IH} = 3.75 V max.

MAG: Not used for count applications.

Switch 5

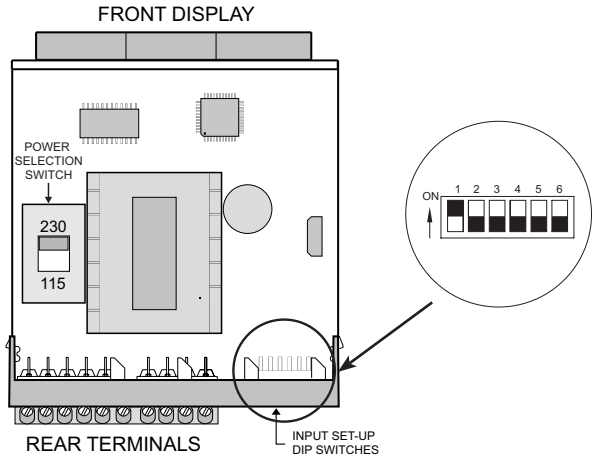
Enable Programming: Enables programming through the front panel buttons.

Disables Programming: Disables the front panel buttons from any programming changes.

Switch 6

Enable Reset: Enables the front panel reset (down arrow key).

Disable Reset: Disables the front panel reset key. *Note: The remote reset terminal is not disabled by this switch.*



3.0 Wiring the Meter

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

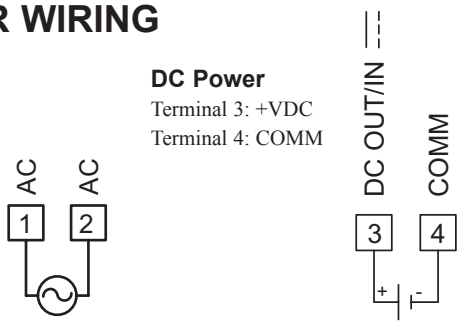
Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

3.1 POWER WIRING

AC Power
Terminal 1: VAC
Terminal 2: VAC

DC Power
Terminal 3: +VDC
Terminal 4: COMM



3.2 CONTROL INPUT WIRING

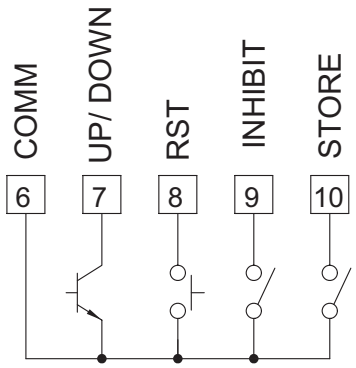
The PAXLC provides a number of control inputs, including Store, Reset, Inhibit and Up/Down control. These inputs are active low (connected to common), so the external switching device should be connected between the control input and common terminals.

Up/Down - This input determines the direction of the count. Unconnected, the meter will count up. When input is pulled low, the meter will count down.

Reset - When this input is pulled low, the meter will reset to zero. If the input remains low or connected to common, the meter will be held in the reset mode, and not able to count.

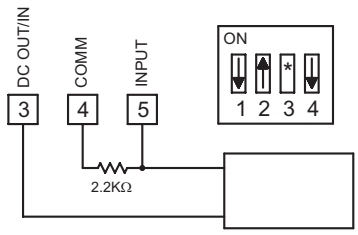
Inhibit - When low, this input will prevent the meter from counting. If the input remains low or connected to the common, the meter will not be able to count.

Store - A low will stop the display from updating. It will freeze the display as long as the input is held low. Once released the display will update to the current count display.

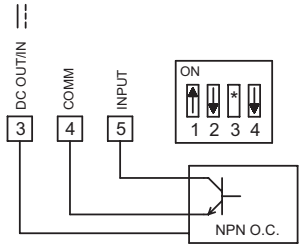


3.3 INPUT WIRING

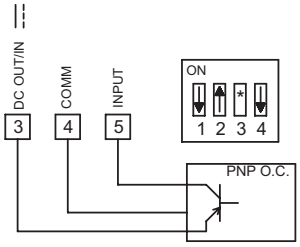
Two Wire Proximity, Current Source



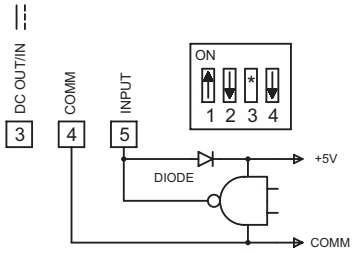
Current Sinking Output



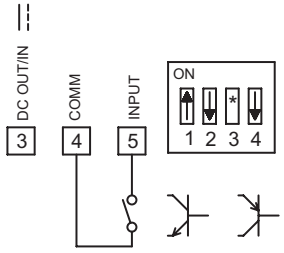
Current Sourcing Output



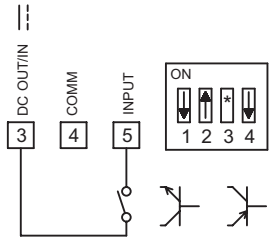
Interfacing With TTL



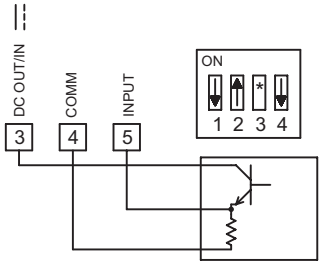
Switch or Isolated Transistor; Current Sink



Switch or Isolated Transistor; Current Source



Emitter Follower; Current Source



*Switch position is application dependent.

4.0 Reviewing the Front Buttons and Display

KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
PAR	Access Programming Mode	Store selected parameter and index to next parameter
▲	No Function	Increment selected digit of parameter value
▼	Front Panel Reset	Select digit position in parameter value

5.0 Scaling the Meter

In many industrial applications, a meter is required to totalize the output of an operation or event. The pulses from a sensor are received by the PAXLC, and then totalized on the display. In many cases the incoming pulses do not represent the desired display readout. For those applications, a scale factor can be entered into the meter, scaling the pulses to obtain the desired readout. The following formula will help provide the scaling values to achieve the desired readout.

$$SF = \frac{DR}{EPU}$$

WHERE:

SF = Scale Factor
DR = Desired Readout* (Single unit of measure, i.e. foot, gallon, etc.)
EPU = Existing Pulses per Unit (Number of pulses per single unit of measure, i.e. foot, gallons, etc.)

**For applications requiring a decimal point, select and program the appropriate decimal point. When calculating the Scale Factor, use the whole value of the number to be displayed, for example, 1.0 feet, the Desired Readout in this case is 10. Do not use decimal points in the Scaling Formula.*

For calculated SF values less than 9.99999

If the Scale Factor is a value less than 9.99999, it can be entered directly into the meter as the Scale Factor and the Scale Multiplier can be left at 1.

For calculated SF values greater than 9.99999

If the Scale Factor is a value over 9.99999 (maximum value), the Scale Multiplier must be used to reduce the calculated SF value until it is less then 9.99999. The Scale Multiplier multiplies the calculated Scale Factor value by 1, 0.1, and 0.01, thus reducing the calculated value accordingly. Select the appropriate Scale Multiplier value that allows the Scale Factor to be a value under 9.99999. Both the Scale Factor and Scale Multiplier can then be entered into the meter.

Example 1:

This application involves counting cases from a production line. The sensor provides a pulse for every can produced. The desired readout is in cases, therefore the incoming pulses need to be converted to obtain the proper readout. The following is used to calculate scale factor.

$$SF = \frac{DR}{EPU}$$

DR = 1 case
EPU = 12 cans/case

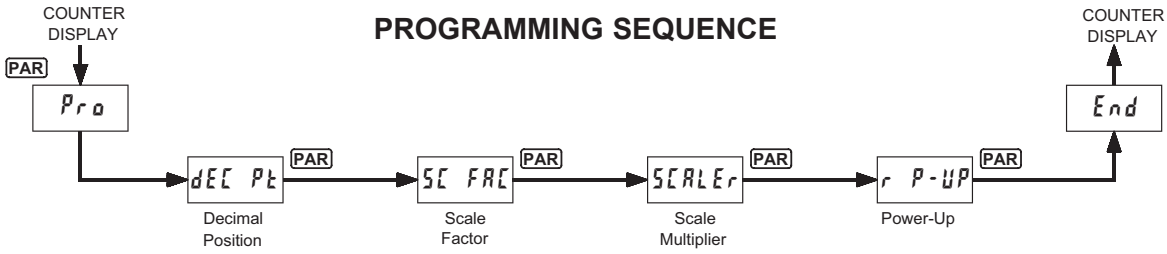
$$SF = \frac{1}{12}$$

SF = 0.083333

Since the Calculated Scale Factor Value is less than 9.99999, it can be entered directly into the meter. The Scale Multiplier can be left at 1.

6.0 PROGRAMMING THE METER

PROGRAMMING SEQUENCE



The Totalizer has four programmable parameters which are entered in the sequence shown above, using the front panel push buttons.

Before programming, refer to the section on Scaling the Meter to determine the Decimal Position, Scale Factor and Scale Multiplier to use for the specific application.

Note: Programming mode can be locked out with the Program Disable DIP switch. With the switch in the Disabled (up) position the meter will not enter programming mode. Refer to the section on DIP switch setup.

PROGRAMMING MODE ENTRY

Press the **PAR** key to enter Programming Mode. The meter briefly displays Pro followed by the first programming parameter described below.

PROGRAMMING PARAMETERS

In programming mode, the display alternates between the parameter and the current selection or value for that parameter. The dual display with arrows is used below to illustrate the alternating display. The selection choices or value range for each parameter is shown to the right of the alternating display.

DECIMAL POSITION

0 0.00 0.0000
0.0 0.000 0.00000

This parameter selects the decimal point position on the display.

Press the arrow keys (▲ or ▼) to sequence through the selection list until the desired selection is shown. Press the **PAR** key to save the displayed selection and advance to the next parameter.

SCALE FACTOR

0.00001 to 9.99999

The number of input counts is multiplied by the Scale Factor and the Scale Multiplier to obtain the desired process value. A Scale Factor of 1.00000 and a Scale Multiplier of 1 will result in the display of the actual number of input counts. (See details on scaling calculations.)

The Scale Factor is displayed as a six-digit value with one selected digit flashing (initially digit 6). Press the ▲ (up arrow) key to increment the value of the selected (flashing) digit. Holding the ▲ key automatically scrolls the value of the selected digit.

Press the ▼ (down arrow) key to select the next digit position to the right. Use the ▲ key to increment the value of this digit to the desired number. Press the ▼ key again to select the next digit to be changed. Holding the ▼ key automatically scrolls through each digit position. Repeat the "select and set" sequence until all digits are displaying the desired Scale Factor value. Press the **PAR** key to save the displayed value and advance to the next parameter.

SCALE MULTIPLIER

1 0.1 0.01

The number of input counts is multiplied by the Scale Multiplier and the Scale Factor to obtain the desired process value. A Scale Multiplier of 1 will result in only the Scale Factor affecting the display. (See details on scaling calculations.)

Press the arrow keys (▲ or ▼) to sequence through the selection list until the desired selection is displayed. Press the **PAR** key to save the selection and exit programming mode.

COUNTER RESET AT POWER-UP

YES no

The totalizer may be programmed to reset at each meter power-up.

PROGRAMMING MODE EXIT

The meter exits Programming Mode when the **PAR** key is pressed to save the Scale Multiplier selection. The meter briefly displays End upon exiting Programming Mode. All programmed selections are now transferred to the non-volatile memory and the meter returns to the Counter display.

(If power loss occurs during programming mode, verify parameter changes and reprogram, if necessary, when power is restored.)

PROGRAMMING MODE TIME OUT

The Programming Mode has an automatic time out feature. If no keypad activity is detected for approximately 60 seconds, the meter automatically exits Programming Mode. The meter briefly displays End and returns to the Counter display. When automatic timeout occurs, any changes that were made to the parameter currently being programmed, will not be saved.

FACTORY SETTINGS

The factory settings for the programming parameters are shown above in the alternating display illustrations. The factory settings can be easily restored by removing power from the meter, and then pressing and holding the **PAR** key while power is reapplied. The meter displays rESEt until the **PAR** key is released. The normal power-up sequence then resumes, with the factory settings loaded and saved in non-volatile memory. The Count is reset to 0.

Note: The Program Disable DIP switch must be in the Enabled (down) position to allow loading factory settings. See section on DIP switch setup.

MODEL PAXLCR - PAX LITE DUAL COUNTER AND RATE METER

- *6 DIGIT, 0.56" HIGH RED LED DISPLAY*
- *PROGRAMMABLE SCALING FOR COUNT AND RATE*
- *BI-DIRECTIONAL COUNTING, UP/DOWN CONTROL*
- *QUADRATURE SENSING (UP TO 4 TIMES RESOLUTION)*
- *BUILT-IN BATCH COUNTING CAPABILITY*
- *PROGRAMMABLE USER INPUT*
- *DUAL 5 AMP FORM C RELAYS*
- *UNIVERSALLY POWERED*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*

c UL US LISTED IND. CONT. EQ. 51EB

For Model No. PAXLCRU0 Only

GENERAL DESCRIPTION

The PAXLCR is a versatile meter that provides a single or dual counter with rate indication, scaling and dual relay outputs. The 6-digit display has 0.56" high digits with adjustable display intensity. The display can be toggled manually or automatically between the selected counter and rate values.

The meter has two signal inputs and a choice of eight different count modes. These include bi-directional, quadrature and anti-coincidence counting, as well as a dual counter mode. When programmed as a Dual Counter, each counter has separate scaling and decimal point selection.

Rate indication is available in all count modes. The Rate Indicator has separate scaling and decimal point selection, along with programmable display update times. In addition to the signal inputs, the User Input can be programmed to perform a variety of meter control functions.

Two setpoint outputs are provided, each with a Form C relay. The outputs can activate based on either counter or rate setpoint values. An internal batch counter can be used to count setpoint output activations.

The PAXLCR can be powered from a wide range of AC or DC voltages. The meter has been specifically designed for harsh industrial environments. With a NEMA 4X/IP65 sealed bezel and extensive testing to meet CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding 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 meter 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 meter

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

CAUTION: Risk of electric shock.

SPECIFICATIONS

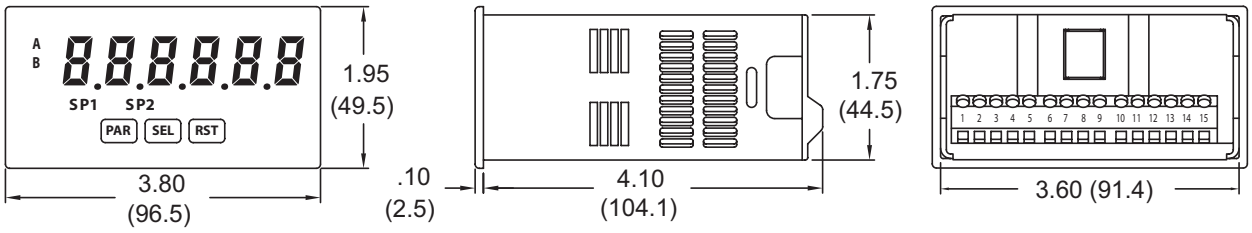
1. **DISPLAY**: 6 digit, 0.56" (14.2 mm) intensity adjustable Red LED
2. **POWER REQUIREMENTS**:
   AC POWER: 50 to 250 VAC 50/60 Hz, 12 VA
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs
   DC POWER: 21.6 to 250 VDC, 6 W
   DC Out: +24 VDC @ 100 mA if input voltage is greater than 50 VAC/VDC
   +24 VDC @ 50 mA if input voltage is less than 50 VDC
3. **COUNTER DISPLAYS**:
   Counter A: 6-digits, enabled in all count modes
   Display Designator: "A" to the left side of the display
   Display Range: -99999 to 999999
   Counter B: 6-digits, enabled in Dual Count mode or Batch Counter
   Display Designator: "B" to the left side of the display
   Display Range: 0 to 999999 (positive count only)
   Overflow Indication: Display "OLOL" alternates with overflowed count value
   Maximum Count Rates: 50% duty cycle, count mode dependent.
   With setpoints disabled: 25 KHz, all modes except Quadrature x4 (23 KHz).
   With setpoint(s) enabled: 20 KHz, all modes except Dual Counter (14 KHz), Quadrature x2 (13 KHz) and Quadrature x4 (12 KHz).

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
PAXLCR	Dual Counter & Rate Meter with Dual Relay Output	PAXLCR00
PAXLCRU	UL Listed Dual Counter & Rate Meter with Dual Relay Output	PAXLCRU0

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.0" (127) W.



4. **RATE DISPLAY**: 6-digits, may be enabled or disabled in any count mode
   Display Range: 0 to 999999
   Over Range Display: "OLOL"
   Maximum Frequency: 25 KHz
   Minimum Frequency: 0.01 Hz
   Accuracy: ±0.01%
5. **COUNT/RATE SIGNAL INPUTS (INPUT A and INPUT B)**:
   See Section 2.0 Setting the DIP Switches for complete Input specifications. DIP switch selectable inputs accept pulses from a variety of sources. Both inputs allow selectable active low or active high logic, and selectable input filtering for low frequency signals or switch contact debounce.
   Input A: Logic level or magnetic pickup signals.
   Trigger levels: V_{IL} = 1.25 V max; V_{IH} = 2.75 V min; V_{MAX} = 28 VDC
   Mag. pickup sensitivity: 200 mV peak, 100 mV hysteresis, 40 V peak max.
   Input B: Logic level signals only
   Trigger levels: V_{IL} = 1.0 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
6. **USER INPUT**: Programmable
   Software selectable for active logic state: active low, pull-up (24.7 KΩ to +5 VDC) or active high, pull-down resistor (20 KΩ).
   Trigger levels: V_{IL} = 1.0 V max; V_{IH} = 2.4 V min; V_{MAX} = 28 VDC
   Response Time: 10 msec typ.; 50 msec debounce (activation and release)
7. **MEMORY**: Nonvolatile E^2PROM retains all programming parameters and count values when power is removed.
8. **OUTPUTS**:
   Type: Dual Form C contacts
   Isolation to Input & User/Exc Commons: 1400 Vrms for 1 min. Working Voltage: 150 Vrms
   Contact Rating: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load)
   Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads.
   Response Time: Turn On or Off: 4 msec max.
9. **ENVIRONMENTAL CONDITIONS**:
   Operating temperature: 0 to 50 °C
   Storage temperature: -40 to 70 °C
   Operating and storage humidity: 0 to 85% max. RH (non-condensing)
   Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2g's.
   Shock According to IEC 68-2-27: Operational 30 g (10g relay), 11 msec in 3 directions.
   Altitude: Up to 2,000 meters
10. **CONNECTIONS**: High compression cage-clamp terminal block
    Wire Strip Length: 0.3" (7.5 mm)
    Wire Gage: 30-14 AWG copper wire
    Torque: 4.5 inch-lbs (0.51 N-m) max.
11. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.
12. **CERTIFICATIONS AND COMPLIANCES**:
    SAFETY
    Type 4X Enclosure rating (Face only), UL50
    IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    IP65 Enclosure rating (Face only), IEC 529
    IP20 Enclosure rating (Rear of unit), IEC 529
    For Model No. PAXLCRU0 Only: UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    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 C 1 kV L-L, 2 kV L&N-E power
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:

Emissions	EN 55011	Class A

Notes:
1. Criterion A: Normal operation within specified limits.
2. Criterion C: Temporary loss of function which requires operator intervention.

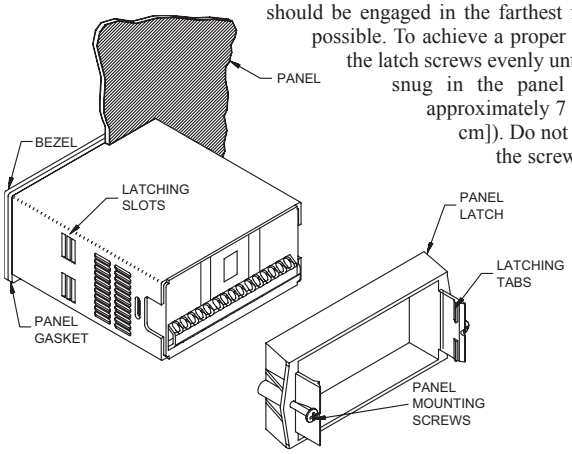
13. **WEIGHT**: 10.4 oz. (295 g)

1.0 Installing the Meter

Installation

The PAX Lite meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.

While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.



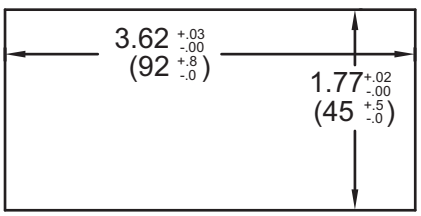
Installation Environment

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.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



2.0 Setting the DIP Switches

To access the switches, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start on the other side latch.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

SWITCH 1 (Input A)

LOGIC: Input A trigger levels V_{IL} = 1.25 V max.; V_{IH} = 2.75 V min.; V_{MAX} = 28 VDC

MAG: 200 mV peak input sensitivity; 100 mV hysteresis; maximum voltage: 40 V peak (28 Vrms); Must also have Input A SRC switch ON. (Not recommended with counting applications.)

SWITCH 2 (Input A) {See Note 1}

SNK.: Adds internal 7.8 KΩ pull-up resistor to +5 VDC, I_{MAX} = 0.7 mA.

SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

SWITCH 3 (Input A)

HI Frequency: Removes damping capacitor and allows max. frequency.

LO Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.

SWITCH 4 (Input B) {See Note 1}

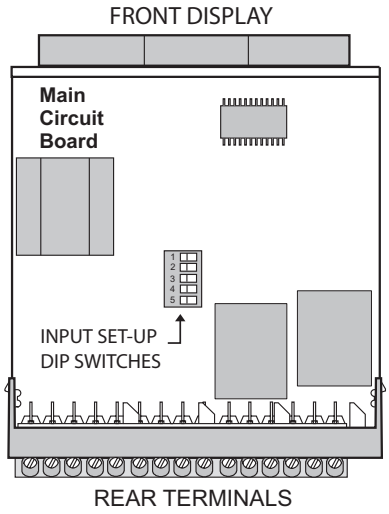
SNK.: Adds internal 7.8 KΩ pull-up resistor to +5 VDC, I_{MAX} = 0.7 mA.

SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

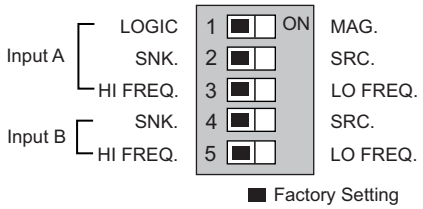
SWITCH 5 (Input B)

HI Frequency: Removes damping capacitor and allows max. frequency.

LO Frequency: Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.



Note 1: When the DIP switch is in the SNK position (OFF), the signal input is configured as active low. When the switch is in the SRC position (ON), the signal input is configured as active high.



3.0 Wiring the Meter

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

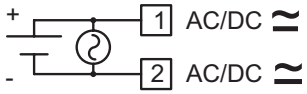
EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

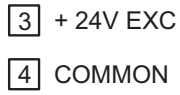
1. The meter should be properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

3.1 POWER WIRING

Power
Terminal 1: VAC/DC +
Terminal 2: VAC/DC -



DC Out Power
Terminal 3: + 24 VDC OUT
Terminal 4: Common

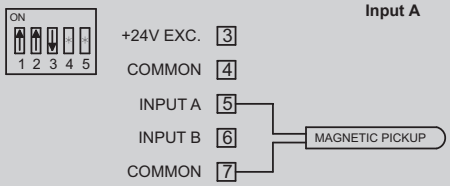


3.2 INPUT SIGNAL WIRING

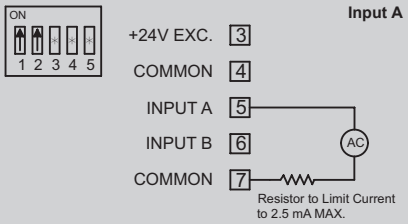
The meter provides a choice of eight different count modes using two signal inputs, A and B. The Count Mode selected determines the action of Inputs A and B. Section 5.1, Input Setup Parameters, provides details on count mode selection and input action.

CAUTION: DC common (Terminal 4) is NOT isolated from Input common (Terminal 7) or User common (Terminal 9). In order to preserve the safety of the meter application, DC common must be suitably isolated from hazardous live earth referenced voltage; or Input common and User common must be at protective earth ground potential. If not, hazardous voltage may be present at the Signal or User Inputs, and Input or User common terminals. Appropriate considerations must then be given to the potential of the Input or User common with respect to earth ground.

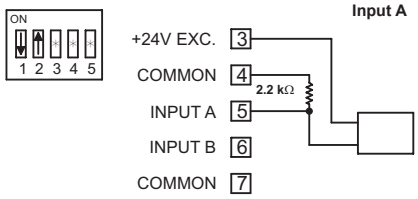
Magnetic Pickup



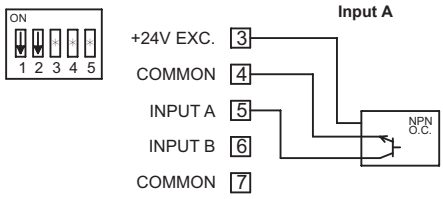
AC Inputs From Tach Generators, Etc.



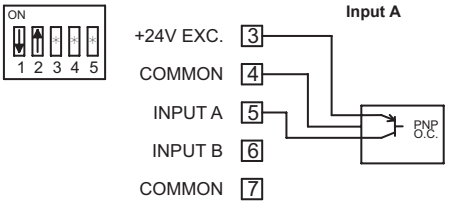
Two Wire Proximity, Current Source



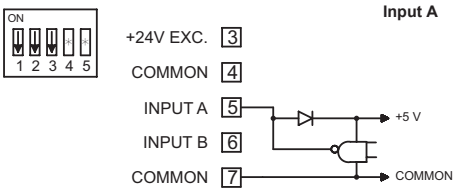
Current Sinking Output



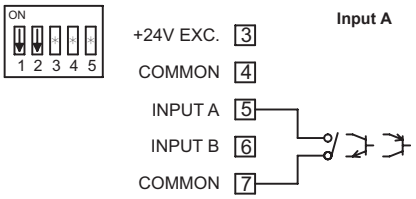
Current Sourcing Output



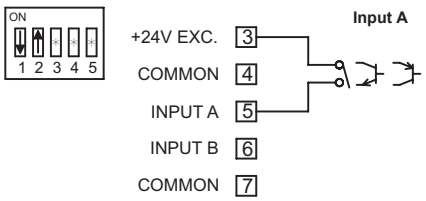
Interfacing With TTL



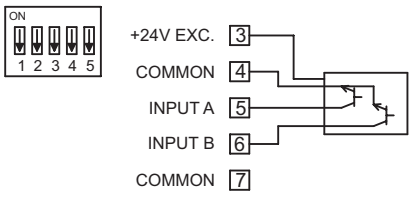
Switch or Isolated Transistor; Current Sink



Switch or Isolated Transistor; Current Source



Current Sink Output; Quad/Direction



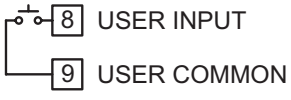
** Switch position is application dependent.*

Shaded areas not recommended for counting applications.

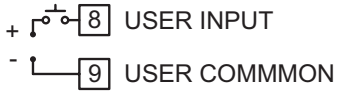
3.3 USER INPUT WIRING

Terminal 8: User Input
Terminal 9: User Common

Current Sinking (Active Low Logic)

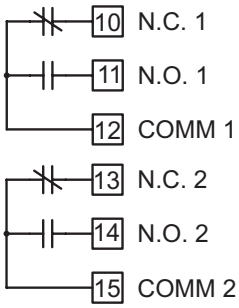


Current Sourcing (Active High Logic)



3.4 SETPOINT (OUTPUT) WIRING

Terminal 10: NC 1
Terminal 11: NO 1
Terminal 12: Relay 1 Common
Terminal 13: NC 2
Terminal 14: NO 2
Terminal 15: Relay 2 Common



4.0 Reviewing the Front Buttons and Display

BUTTON	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
PAR	Access Programming Mode	Store selected parameter and index to next parameter
SEL	Index display through enabled values	Advance through selection list/select digit position in parameter value
RST	Resets count display(s) and/or outputs	Increment selected digit of parameter value

OPERATING MODE DISPLAY DESIGNATORS

"A" - Counter A value
"B" - Counter B value (dual count or batch)
- Rate value is displayed with no designator

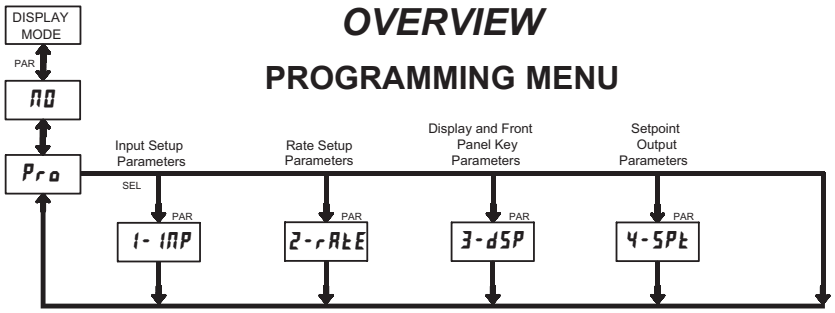
"SP1" - Indicates setpoint 1 output status.
"SP2" - Indicates setpoint 2 output status.

Pressing the **SEL** button toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically every four seconds between the enabled display values.

5.0 Programming the Meter

OVERVIEW

PROGRAMMING MENU



PROGRAMMING MODE ENTRY (PAR BUTTON)

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the **PAR** button. If it is not accessible, then it is locked by either a security code or a hardware lock.

MODULE ENTRY (SEL & PAR BUTTONS)

The Programming Menu is organized into four modules. These modules group together parameters that are related in function. The display will alternate between **Pro** and the present module. The **SEL** button is used to select the desired module. The displayed module is entered by pressing the **PAR** button.

MODULE MENU (PAR BUTTON)

Each module has a separate module menu (which is shown at the start of each module discussion). The **PAR** button is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to **Pro no**. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The **SEL** and **RST** buttons are used to move through the selections/values for that parameter. Pressing the **PAR** button, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the value is displayed with one digit flashing (initially the right most digit). Pressing the **RST** button increments the digit by one or the user can hold the **RST** button and the digit will automatically scroll. The **SEL** button will select the next digit to the left. Pressing the **PAR** button will enter the value and move to the next parameter.

PROGRAMMING MODE EXIT (PAR BUTTON)

The Programming Mode is exited by pressing the **PAR** button with **Pro no** displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

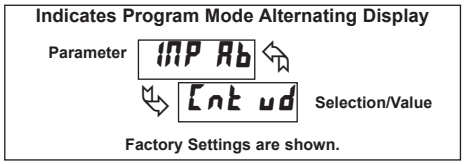
It is recommended to start with Module 1 and proceed through each module in sequence. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

FACTORY SETTINGS

Factory Settings may be completely restored in Module 3. This is useful when encountering programming problems.

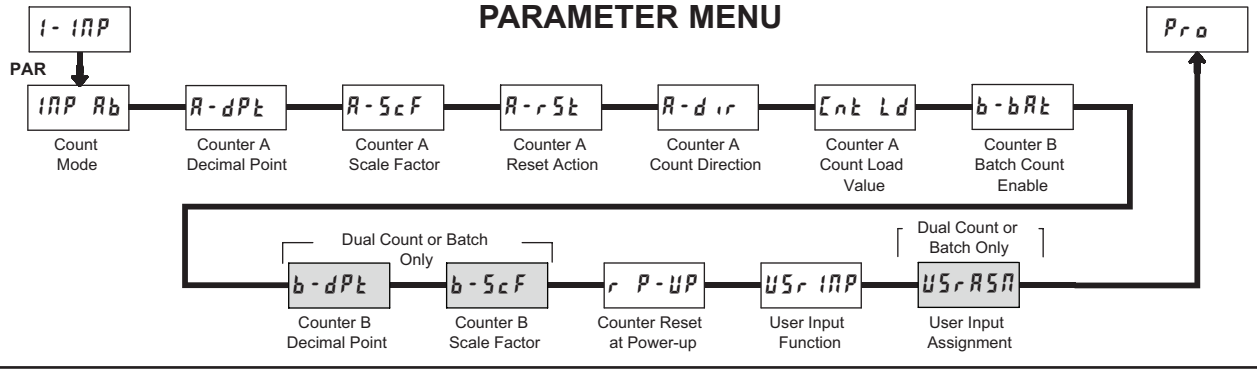
ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.



5.1 MODULE 1 - INPUT SETUP PARAMETERS (1- INP)

PARAMETER MENU



Shaded area selections only apply when Counter B is enabled (Dual Count mode or batch counter).

COUNT MODE

INP Rb → Cnt ud

Cnt ud QUAd 1 AddAdd
rt-Cnt QUAd 2 AddSub
dUAL QUAd 4

Select the count mode that corresponds with your application. The input actions are shown in the boxes below. For simple counting applications, it is recommended to use Count with Direction for the count mode. Simply leave the direction input unconnected.

DISPLAY	MODE	INPUT A ACTION	INPUT B ACTION
Cnt ud	Count with Direction	Counter A	Counter A Direction
rt-Cnt	Rate/Counter	Rate only	Counter A Add
dUAL	Dual Counter	Counter A Add	Counter B Add
QUAd 1	Quadrature x1	Count A	Quad A
QUAd 2	Quadrature x2	Count A	Quad A
QUAd 4	Quadrature x4	Count A	Quad A
AddAdd	2 Input Add/Add	Counter A Add	Counter A Add
AddSub	2 Input Add/Subtract	Counter A Add	Counter A Subtract

Note: The Rate indicator signal is derived from Input A in all count modes.

COUNTER A DECIMAL POSITION

A-dPt → 0

0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for Counter A. The selection will also affect Counter A scale factor calculations.

COUNTER A SCALE FACTOR

A-ScF → 0 1.0000

00.0001 to 99.9999

The number of input counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER A RESET ACTION

A-rSt → 2Ero

2Ero Cnt Ld

When Counter A is reset, it returns to Zero or Counter A Count Load value. This reset action applies to all Counter A resets, except a Setpoint generated Counter Auto Reset programmed in Module 4.

COUNTER A COUNT DIRECTION

A-dir → nor

nor rEU

Reverse (rEU) switches the normal Counter A count direction shown in the Count Mode parameter chart.

COUNTER A COUNT LOAD VALUE

Cnt Ld → 000500

-99999 to 999999

Counter A resets to this value if Reset to Count Load action is selected. To enter a negative Count Load value, increment digit 6 to display a "-" sign.*

COUNTER B BATCH COUNT ENABLE

b-bAt → no

no SP-2
SP-1 SP1-2

The Counter B Batch Count function internally counts the number of output activations of the selected setpoint(s). The count source for the batch counter can be SP1, SP2 or both. Batch counting is available in all count modes except Dual Counter, which uses an external input signal for Counter B.

COUNTER B DECIMAL POSITION

b-dPt → 0

0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for Counter B. The selection will also affect Counter B scale factor calculations.

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.

COUNTER B SCALE FACTOR

The number of input or batch counts is multiplied by the scale factor to obtain the desired process value. A scale factor of 1.0000 will result in the display of the actual number of input or batch counts. (Details on scaling calculations are explained at the end of this section.)*

COUNTER RESET AT POWER-UP

no	no	Cnt b
YES	Cnt A	both

The selected counter(s) will reset at each meter power-up.

SCALING FOR COUNT INDICATION

The counter's scale factor is factory set to 1, to provide one count on the display for each pulse that is input to the unit. In many applications, there will not be a one-to-one correspondence between input pulses and display units. Therefore, it is necessary for the meter to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.)

The Count Scale Factor Value can range from 00.0001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. The following formula is used to calculate the scale factor.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

WHERE:

Desired Display Units: Count display units acquired after pulses that occurred.

Number of Pulses: Number of pulses required to achieve the desired display units.

Decimal Point Position:

0	=	1
0.0	=	10
0.00	=	100
0.000	=	1000
0.0000	=	10000
0.00000	=	100000

EXAMPLE 1: The counter display is used to indicate the total number of feet used in a process. It is necessary to know the number of pulses for the desired units to be displayed. The decimal point is selected to show the resolution in hundredths.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

Given that 128 pulses are equal to 1 foot, display total feet with a one-hundredth resolution.

$$\text{Scale Factor} = \frac{1.00}{128} \times 100$$

$$\text{Scale Factor} = 0.007812 \times 100$$

$$\text{Scale Factor} = 0.7812$$

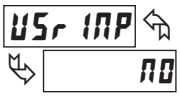
EXAMPLE 2: A manufacturer wants to count the total number of bricks molded in a process yielding 12 bricks per mold. The counter receives 1 pulse per mold and should increase by 12 for each pulse received. Since single brick accuracy is not required, a Scale Factor greater than 1 can be used in this case.

$$\text{Scale Factor} = \frac{\text{Desired Display Units}}{\text{Number of Pulses}} \times \text{Decimal Point Position}$$

$$\text{Scale Factor} = \frac{12}{1} \times 1$$

$$\text{Scale Factor} = 12.0000$$

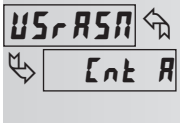
USER INPUT FUNCTION



DISPLAY	MODE	DESCRIPTION
no	No Function	User Input disabled.
ProLoc	Program Mode Lock-out	See Programming Mode Access chart (Module 3).
Inhibt	Inhibit	Inhibit counting for the selected counter(s).
rESEt	Maintained Reset	Level active reset of the selected counter(s).
StorE	Store	Freeze display for the selected counter(s) while allowing counts to accumulate internally.
St-rSt	Store and Reset	Edge triggered reset of the selected counter(s) after storing the count.
d-SEL	Display Select *	Advance once for each activation.
d-LEU	Display Intensity Level *	Increase intensity one level for each activation.
rSt-1	Setpoint 1 Reset *	Reset setpoint 1 output.
rSt-2	Setpoint 2 Reset *	Reset setpoint 2 output.
rSt-12	Setpoint 1 and 2 Reset *	Reset both setpoint 1 and 2 outputs.

** Indicates Edge Triggered function. All others are Level Active functions.*

USER INPUT ASSIGNMENT



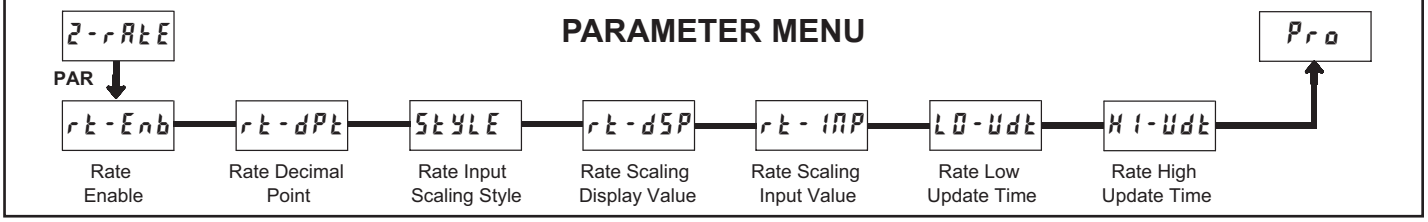
The User Input Assignment is only active when Counter B is enabled and the user input selection performs a Reset, Inhibit or Store function on one or both of the counters.

USER INPUT ACTIVE LEVEL

Select whether the user input is configured as active low or active high.

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.

5.2 MODULE 2 - RATE SETUP PARAMETERS (2-rAtE)



RATE ENABLE

rt-Enb / YES — nO YES

This parameter enables the Rate display. For maximum input frequency, Rate Enable should be set to nO when not in use. When set to nO, the remaining rate parameters are not accessible.

RATE DECIMAL POINT

rt-dPt / 0 — 0 0.00 0.0000 / 0.0 0.000 0.00000

This selects the decimal point position for the rate display. This parameter does not affect rate scaling calculations.

RATE INPUT SCALING STYLE

StyLE / KEY — KEY APLY

If a Rate Input value (in Hz) and the corresponding Rate Display value are known, the Key-in (KEY) Scaling Style can be used. This allows rate scaling without the presence of a rate input signal.

If the Rate Input value has to be derived from the actual rate input signal, the Apply (APLY) Scaling Style should be used.

RATE SCALING DISPLAY VALUE

rt-dSP / 001000 — 0 to 999999

Enter the desired Rate Display value. This value is entered using the front panel buttons for either Scaling Style.*

RATE SCALING INPUT VALUE

rt-InP / 01000.0 — 0.1 to 99999.9

Enter the corresponding Rate Input value using the Scaling Style selected.

Key-in Style:

Enter the Rate Input value using the front panel buttons. This value is always in pulses per second (Hz).*

Apply Style:

The meter initially shows the stored Rate Input value. To retain this value, press **PAR** to advance to the next parameter. To enter a new value, apply the rate input signal to Input A. Press **RST** and the applied input frequency (in Hz) will appear on the display. To insure the correct reading, wait several rate sample periods (see Rate Low Update Time) or until a consistent reading is displayed. Press **PAR** to store the displayed value as the new Rate Input value.

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.

RATE LOW UPDATE TIME (DISPLAY UPDATE)

LO-Udt / 01.0 — 0.1 to 99.9 seconds

The Low Update Time is the minimum amount of time between display updates for the Rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady.

RATE HIGH UPDATE TIME (DISPLAY ZERO)

HI-Udt / 02.0 — 0.2 to 99.9 seconds

The High Update Time is the maximum amount of time before the Rate display is forced to zero. (For more explanation, refer to Input Frequency Calculation.) The High Update Time **must** be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

SCALING FOR RATE INDICATION

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. These values are internally plotted to a Display value of 0 and Input value of 0.0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The meter is capable of showing a rate display value for any positive slope linear process.

SCALING CALCULATION FOR KEY-IN STYLE

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (rt-dSP) and Scaling Input (rt-InP). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY (rt-dSP)	INPUT (rt-InP)
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

NOTES:

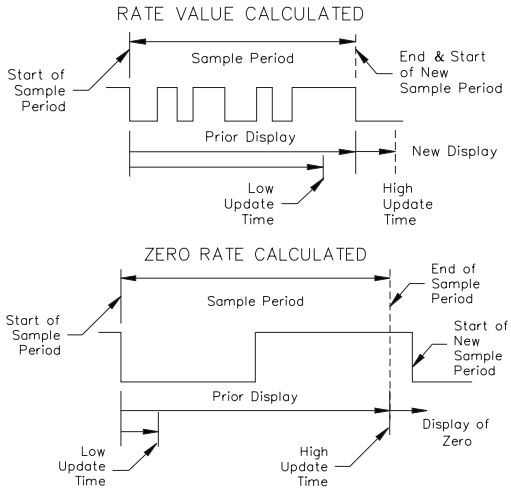
1. If # of pulses per unit is less than 1, multiply both Input and Display values by 10 or 100 as needed to obtain greater accuracy.
2. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
3. Both values must be greater than 0.

EXAMPLE:

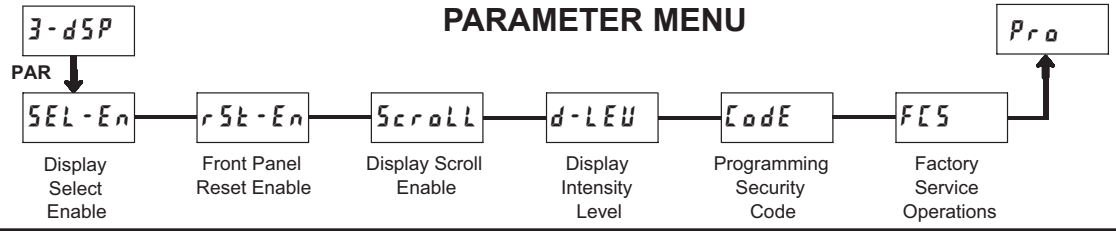
1. With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by the scaling calculation.



5.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY PARAMETERS (3-dSP)



FRONT PANEL DISPLAY SELECT ENABLE (SEL)

SEL-En / YES — nO YES

The **YES** selection allows the **SEL** key to toggle through the enabled displays.

FRONT PANEL COUNTER RESET ENABLE (RST)

rSt-En / YES — nO YES

nO	nO	both
YES	Cnt A	dSPLAY
	Cnt b	

The **YES** selection allows the **RST** key to reset the selected counter(s). The shaded selections are only active when Counter B is enabled (Dual Count Mode or batch counter).

DISPLAY SCROLL ENABLE

ScroLL / nO — nO YES

The **YES** selection allows the display to automatically scroll through the enabled displays. Each display is shown for 4 seconds.

DISPLAY INTENSITY LEVEL

d-LEU / 3 — 1 to 5

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed.

PROGRAMMING SECURITY CODE

CodE / 000 — 0 to 999

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (ProLoc) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all unit parameters to be viewed and modified. Quick Programming mode permits only user selected values to be modified, but allows direct access to these values without having to enter Full Programming mode.

Entering a Security Code from 1-99 enables Quick Programming mode, and displays a sublist to select which values appear in the Quick Programming menu. All of the values set to **YES** in the sublist are accessible in Quick Programming. The values include Setpoints (SP-1, SP-2), Output Time-outs (tOUt-1, tOUt-2), Count Load value (Cnt Ld) and Display Intensity (d-LEU).

Programming any Security Code other than 0, requires this code to be entered at the CodE prompt in order to access Full Programming mode. Quick Programming mode, if enabled, is accessed before the CodE prompt appears.

USER INPUT FUNCTION	USER INPUT STATE	SECURITY CODE	MODE WHEN "PAR" KEY IS PRESSED	FULL PROGRAMMING MODE ACCESS
not ProLoc	———	0	Full Programming	Immediate Access
		1-99	Quick Programming	After Quick Programming with correct code entry at CodE prompt *
		100-999	CodE prompt	With correct code entry at CodE prompt *
ProLoc	Active	0	Programming Lock	No Access
		1-99	Quick Programming	No Access
		100-999	CodE prompt	With correct code entry at CodE prompt *
	Not Active	0-999	Full Programming	Immediate Access

** Entering Code 222 allows access regardless of security code.*

FACTORY SERVICE OPERATIONS

FCS / no — no yes

Select YES to perform either of the Factory Service Operations shown below.

VIEW MODEL AND VERSION DISPLAY

CodE / 50

Entering Code 50 will display the model and version (x.x) of the meter. The display then returns to CodE 00. Press the **PAR** button to exit the module.

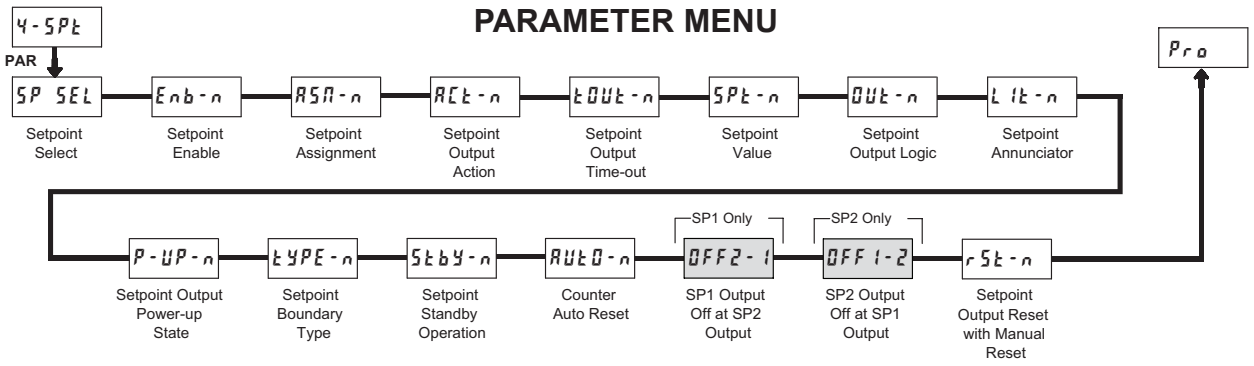
RESTORE FACTORY DEFAULT SETTINGS

CodE / 66

Entering Code 66 will overwrite all user settings with the factory default settings. The meter will display rESEt and then return to CodE 00. Press the **PAR** button to exit the module.

5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPt)

PARAMETER MENU



Some Setpoint parameters will not appear depending on the Setpoint Assignment and Setpoint Output Action selected. The Setpoint Parameter Availability chart below illustrates this.

PARAMETER	DESCRIPTION	COUNTER ASSIGNMENT (A or B)*			RATE ASSIGNMENT		
		TIMED OUT t-Out	BOUNDARY bOUnd	LATCH LAtCH	TIMED OUT t-Out	BOUNDARY bOUnd	LATCH LAtCH
tOUt-n	Setpoint Output Time-out Value	Yes	No	No	Yes	No	No
SPt-n	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
Out-n	Setpoint Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
Lit-n	Setpoint Annunciator	Yes	Yes	Yes	Yes	Yes	Yes
P-UP-n	Setpoint Output Power-up State	No	No	Yes	No	No	Yes
tYPE-n	Setpoint Boundary Type	No	Yes	No	Yes	Yes	Yes
StbY-n	Standby Operation (Low ActingOnly)	No	Yes	No	Yes	Yes	Yes
AUtO-n	Counter Auto Reset	Yes	No	Yes	No	No	No
OFF2-1	SP1 Output Off at SP2 (SP1 only)	Yes	No	Yes	No	No	No
OFF1-2	SP2 Output Off at SP1 (SP2 only)	Yes	No	Yes	No	No	No
rSt-n	Output Reset with Manual Reset	Yes	No	Yes	Yes	No	Yes

* BOUNDARY Setpoint Action not applicable for Counter B assignment.

SETPOINT SELECT

SP SEL / no — no, SP-1, SP-2

Select the Setpoint Output to be programmed, starting with Setpoint 1. The "n" in the following parameters reflects the chosen Setpoint number. After the selected setpoint is completely programmed, the display returns to SP SEL. Repeat steps for Setpoint 2 if both Setpoints are being used. Select no to exit the Setpoint programming module.

SETPOINT ENABLE

Enb-n / no — no yes

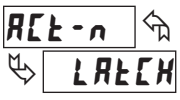
Select YES to enable the chosen setpoint and access the setup parameters. If no is selected, the unit returns to SP SEL and the setpoint is disabled.

SETPOINT ASSIGNMENT

ASn-n / Cnt A — Cnt A, Cnt b, rAtE

Select the display to which the Setpoint is assigned.

SETPOINT OUTPUT ACTION



LAtCH
t-OUt
bOUNd

This parameter selects the action of the Setpoint output as described in the chart below. Boundary mode is not applicable for Counter B assignment.

SPT ACTION	DESCRIPTION	OUTPUT ACTIVATES	OUTPUT DEACTIVATES
LAtCH	Latched Output Mode	When Count = Setpoint	At Manual Reset (if rSt-n=YES)
t-OUt	Timed Output Mode	When Count = Setpoint	After Setpoint Output Time-Out
bOUNd	Boundary Mode (High Acting)	When Count ≥ Setpoint	When Count < Setpoint
	Boundary Mode (Low Acting)	When Count ≤ Setpoint	When Count > Setpoint

SETPOINT OUTPUT TIME-OUT

0.01 to 599.99 seconds

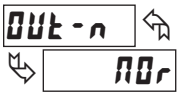
This parameter is only active if the Setpoint Action is set to timed output mode (t-OUt). Enter the value in seconds that the output will be active, once the Setpoint Value is reached.

SETPOINT VALUE

Count A: -99999 to 999999
Count B: 0 to 999999
Rate: 0 to 999999

Enter the desired Setpoint value. To enter a negative setpoint value, increment digit 6 to display a "-" sign (Counter A only).

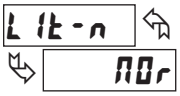
SETPOINT OUTPUT LOGIC



NOr rEU

Normal (NOr) turns the output "on" when activated and "off" when deactivated. Reverse (rEU) turns the output "off" when activated and "on" when deactivated.

SETPOINT ANNUNCIATOR



NOr rEU

Normal (NOr) displays the setpoint annunciator when the corresponding output is "on". Reverse (rEU) displays the setpoint annunciator when the output is "off".

SETPOINT OUTPUT POWER-UP STATE

OFF
nn
SAVE

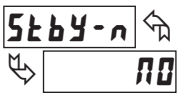
SAVE will restore the output to the same state it was at before the meter was powered down. On will activate the output at power up. OFF will deactivate the output at power up.

SETPOINT BOUNDARY TYPE

HI-ACt LO-ACt

High Acting Boundary Type activates the output when the assigned display value (ASn-n) equals or exceeds the Setpoint value. Low Acting activates the output when the assigned display value is less than or equal to the Setpoint.

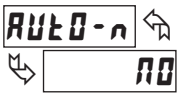
SETPOINT STANDBY OPERATION



no YES

This parameter only applies to Low Acting Boundary Type setpoints. Select YES to disable a Low Acting Setpoint at power-up, until the assigned display value crosses into the output "off" area. Once in the output "off" area, the Setpoint will then function per the description for Low Acting Boundary Type.

COUNTER AUTO RESET

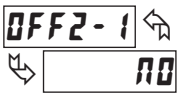


no 2Er-St CLd-St
2Er-En CLd-En

This parameter automatically resets the Setpoint Assigned Counter (A or B) each time the Setpoint value is reached. The automatic reset can occur at output start, or output end if the Setpoint Output Action is programmed for timed output mode. The Reset-to-Count Load selections ("CLd-") only apply to Counter A assignment. This reset may be different from the Counter A Reset Action selected in Module 1.

SELECTION	ACTION
no	No Auto Reset
2Er-St	Reset to Zero at the Start of output activation
CLd-St	Reset to Count Load value at the Start of output activation
2Er-En	Reset to Zero at the End of output activation (timed out only)
CLd-En	Reset to Count Load at the End of output activation (timed out only)

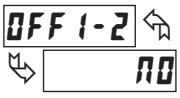
SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)



no
O2-Str
O2-End

This parameter will deactivate Setpoint 1 output at the Start or End of Setpoint 2 output (O1 off at O2). The "-End" setting only applies if Setpoint 2 Output Action is programmed for timed output.

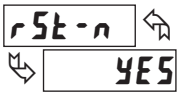
SETPOINT 2 OUTPUT OFF AT SETPOINT 1 (SP2 Only)



no
O1-Str
O1-End

This parameter will deactivate Setpoint 2 output at the Start or End of Setpoint 1 output (O2 off at O1). The "-End" setting only applies if Setpoint 1 Output Action is programmed for timed output.

SETPOINT OUTPUT RESET WITH MANUAL RESET



no YES

Selecting YES causes the Setpoint output to deactivate (reset) when the Setpoint Assigned Counter is reset. The counter reset can occur by the **RST** button, User Input or Counter Reset at Power-up.

This output reset will not occur when the Assigned Counter is reset by a Setpoint generated Counter Auto Reset.

MODEL PAX - 1/8 DIN DIGITAL INPUT PANEL METERS

MODELS: Counter/Rate (PAXI) Counter (PAXC) Rate (PAXR)

- *COUNT, DUAL COUNTER, RATE AND SLAVE DISPLAY*
- *0.56" RED SUNLIGHT READABLE DISPLAY*
- *VARIABLE INTENSITY DISPLAY*
- *10 POINT SCALING FOR NON-LINEAR PROCESSES (PAXI)*
- *FOUR SETPOINT ALARM OUTPUTS (W/Option Card)*
- *RETRANSMITTED ANALOG OUTPUT (W/Option Card) (PAXI)*
- *COMMUNICATION AND BUS CAPABILITIES (W/Option Card) (PAXI)*
- *BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP*
- *CRIMSON® PROGRAMMING SOFTWARE (PAXI)*
- *ETHERNET(W/ External Gateway) (PAXI)*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*

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51EB

CE

GENERAL DESCRIPTION

The PAX Digital Input Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. Available in three different models, PAXC Counter/Dual Counter, PAXR Rate Meter and the PAXI which offers both counting and rate in the same package. Refer to pages 4 - 5 for the details on the specific models. The PAXC and PAXR offer only the Setpoint Option, while the PAXI is the fully featured version offering all the capabilities as outlined in this bulletin as well as a slave display feature. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

The meters employ a bright 0.56" LED display. The meters are available with a red sunlight readable or standard green LED display. The intensity of the display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The meters accept digital inputs from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups and all standard RLC sensors. The meter can accept directional, uni-directional or Quadrature signals simultaneously. The maximum input signal varies up to 34 KHz depending on the count mode and function configurations programmed. Each input signal can be independently scaled to various process values.

The Rate Meters provide a MAX and MIN reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The meters have four setpoint outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and Bus Capabilities are also available as option cards for the PAXI only. These include RS232, RS485, Modbus, DeviceNet, and Profibus-DP. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meters have a feature that allows a remote computer to directly control the outputs of the meter. With an RS232 or RS485 card installed, it is possible to configure the meter using Red Lion's Crimson software. The configuration data can be saved to a file for later recall.

A linear DC output signal is available as an optional Plug-in card for the PAXI only. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track any of the counter or rate displays.

Once the meters have been initially configured, the parameter list may be locked out from further modification in its entirety or only the setpoint values can be made accessible.

The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this 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 meter 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 meter.

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

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.

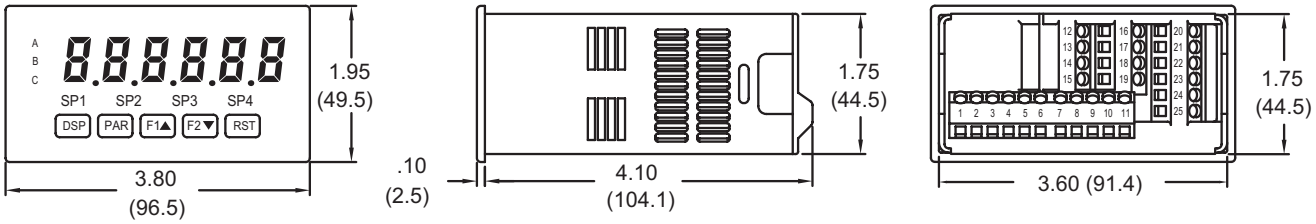
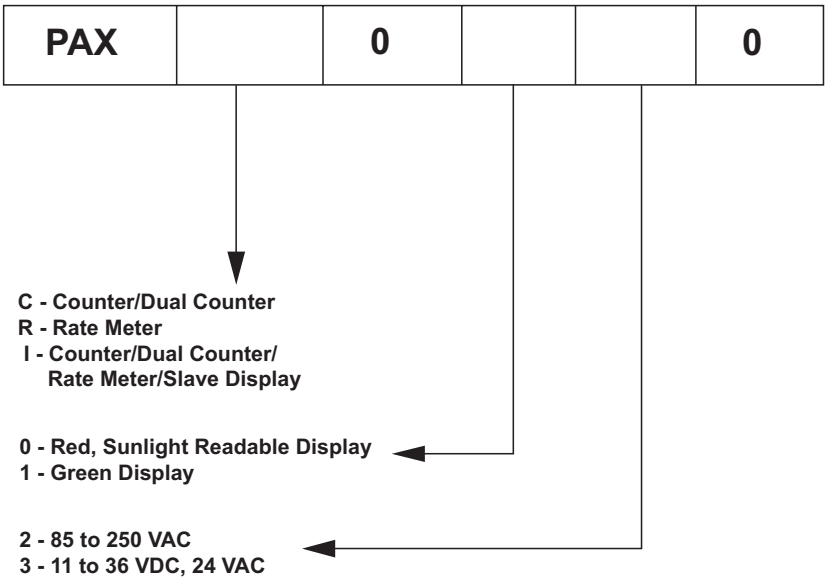


Table Of Contents

Ordering Information

Meter Part Numbers



Option Card and Accessories Part Numbers

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
Optional Plug-In Cards	PAXCDS	Dual Setpoint Relay Output Card	PAXCDS10
		Quad Setpoint Relay Output Card	PAXCDS20
		Quad Setpoint Sinking Open Collector Output Card	PAXCDS30
		Quad Setpoint Sourcing Open Collector Output Card	PAXCDS40
	PAXCDC[1]	RS485 Serial Communications Card with Terminal Block	PAXCDC10
		Extended RS485 Serial Communications Card with Dual RJ11 Connector	PAXCDC1C
		RS232 Serial Communications Card with Terminal Block	PAXCDC20
		Extended RS232 Serial Communications Card with 9 Pin D Connector	PAXCDC2C
		DeviceNet Communications Card	PAXCDC30
		Profibus-DP Communications Card	PAXCDC50
	PAXUSB	PAX USB Programming Card (Not included in PAX product UL E179259 file).	PAXUSB00
	PAXCDL	Analog Output Card	PAXCDL10
Accessories	SFCRD[2]	Crimson PC Configuration Software for Windows 2000, XP and Windows 7	SFCRD200
	ICM8	Communication Gateway	ICM80000

Notes:
1. For Modbus communications use RS485 Communications Card and configure Communication Type parameter (tYPE) for Modbus.
2. Crimson software is available for free download from http://www.redlion.net/
3. Shaded areas are only available for the PAXI

General Meter Specifications

1. **DISPLAY:** 6 digit, 0.56" (14.2 mm) red sunlight readable or standard green LED
2. **POWER:**
   AC Versions:
   AC Power: 85 to 250 VAC, 50/60 Hz, 18 VA
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs. (300 V working)
   DC Versions:
   DC Power: 11 to 36 VDC, 14 W
   (derate operating temperature to 40° C if operating <15 VDC and three plug-in option cards are installed)
   AC Power: 24 VAC, ± 10%, 50/60 Hz, 15 VA
   Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).
3. **SENSOR POWER:** 12 VDC, ±10%, 100 mA max. Short circuit protected
4. **KEYPAD:** 3 programmable function keys, 5 keys total
5. **USER INPUTS:** Three programmable user inputs
   Max. Continuous Input: 30 VDC
   Isolation To Sensor Input Commons: Not isolated
   Logic State: Jumper selectable for sink/source logic

INPUT STATE	SINKING INPUTS 5.1 KΩ pull-up to +12 V	SOURCING INPUTS 5.1 KΩ pull-down
Active	V_{IN} < 0.9 VDC	V_{IN} > 2.4 VDC
Inactive	V_{IN} > 2.4 VDC	V_{IN} < 0.9 VDC

   Response Time: 6 msec. typical; function dependent. Certain resets, stores and inhibits respond within 25 µsec if an edge occurs with the associated counter or within 6 msec if no count edge occurs with the associated counter. These functions include CtrStL, CtrStE, HLrStL, HLrStE, InHibt, StOrE, and PrMrSt. Once activated, all functions are latched for 50 msec min. to 100 msec max. After that period, another edge/level may be recognized.
6. **MEMORY:** Nonvolatile memory retains all programmable parameters and display values when power is removed.
7. **CERTIFICATIONS AND COMPLIANCES:**
   SAFETY
   UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
   Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529
   IP20 Enclosure rating (Rear of unit), IEC 529

ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN 61326:2006: 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 (80 MHz to 1 GHz) 3 V/m (1.4 GHz to 2 GHz) 1 V/m (2 GHz to 2.7 GHz)
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV I/O signal 2 kV I/O signal connected to power
Surge	EN 61000-4-5 power signal	Criterion A 1 kV L to L, 2 kV L to G 1 kV
RF conducted interference	EN 61000-4-6	Criterion A 3 Vrms
Power freq magnetic fields	EN 61000-4-8	Criterion A 30 A/m
AC power	EN 61000-4-11	
Voltage dip		Criterion A 0% during 1 cycle 40% during 10/12 cycle 70% during 25/30 cycle
Short interruptions		Criterion C 0% during 250/300 cycles

Emissions:

Emissions	EN 55011	Class A

Notes:
1. Criterion A: Normal operation within specified limits.
2. Criterion C: Temporary loss of function where system reset occurs.

Refer to EMC Installation Guidelines section of the bulletin for additional information.

8. **ENVIRONMENTAL CONDITIONS:**
   Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in cards installed)
   Storage Temperature Range: -40 to 60°C
   Operating and Storage Humidity: 0 to 85% max. relative humidity non-condensing
   Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g.
   Shock According to IEC 68-2-27: Operational 25 g (10 g relay), 11 msec in 3 directions.
   Altitude: Up to 2000 meters
9. **CONNECTIONS:** High compression cage-clamp terminal block
   Wire Strip Length: 0.3" (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 4.5 inch-lbs (0.51 N-m) max.
10. **CONSTRUCTION:** This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.
11. **WEIGHT:** 10.1 oz. (286 g)

MODEL PAXC - 1/8 DIN COUNTER

- *6-DIGIT LED DISPLAY (Alternating 8 digits for counting)*
- *DUAL COUNT QUAD INPUTS*
- *UP TO 3 COUNT DISPLAYS*
- *SETPOINT ALARM OUTPUTS (W/Plug-in card)*

PAXC SPECIFICATIONS

MAXIMUM SIGNAL FREQUENCIES:

To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

FUNCTION QUESTIONS	**Single**: Counter A or B				**Dual**: Counter A & B			
Are any setpoints used?	N	N	Y	Y	N	N	Y	Y
Is Counter C used?	N	Y	N	Y	N	Y	N	Y
COUNT MODE	(Values are in KHz)				(Values are in KHz)			
Count x1	34	25	18	15	13	12	9	7.5
Count x2	17	13	9	7	9	7	5	4
Quadrature x1	22	19	12	10	7	6	4	3.5
Quadrature x2	17	13	9	7	7	6	4	3.5
Quadrature x4	8	6	4	3				

Notes:

1. Counter Modes are explained in the Module 1 programming section.
2. Listed values are with frequency DIP switch set on HI frequency.

ANNUNCIATORS:

A - Counter A
B - Counter B
C - Counter C
OF - Upper significant digit display of counter
SP1 - setpoint 1 output state
SP2 - setpoint 2 output state
SP3 - setpoint 3 output state
SP4 - setpoint 4 output state

COUNTER DISPLAYS:

Maximum display: 8 digits: ± 99999999 (greater than 6 digits, display alternates between high order and low order.)

INPUTS A and B:

DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.

LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, I_{MAX} = 1.9 mA.
Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.
Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.

DUAL COUNT MODES:

When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

MODEL PAXR - 1/8 DIN RATE METER

- *5-DIGIT LED DISPLAY*
- *RATE INDICATION*
- *MINIMUM/MAXIMUM RATE DISPLAYS*
- *SETPOINT ALARM OUTPUTS (W/Plug-in card)*

PAXR SPECIFICATIONS

ANNUNCIATORS:

r - Rate
H - Maximum (High) Rate
L - Minimum (Low) Rate
SP1 - setpoint 1 output state
SP2 - setpoint 2 output state
SP3 - setpoint 3 output state
SP4 - setpoint 4 output state

RATE DISPLAY:

Accuracy: ±0.01%
Minimum Frequency: 0.01 Hz
Maximum Frequency: 34 KHz
Maximum Display: 5 Digits: 99999
Adjustable Display (low) Update: 0.1 to 99.9 seconds
Over Range Display: "r OLOL"

INPUT A:

DIP switch selectable to accept pulses from a variety of sources including TTL outputs, magnetic pickups and all standard RLC sensors.

LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, I_{MAX} = 1.9 mA.
Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.

MAGNETIC PICKUP:
Sensitivity: 200 mV peak
Hysteresis: 100 mV
Input impedance: 3.9 KΩ @ 60 Hz
Maximum input voltage: ±40 V peak, 30 Vrms

MODEL PAXI - 1/8 DIN COUNTER/RATE METER

- *COUNT, RATE AND SLAVE DISPLAY*
- *6-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY*
- *VARIABLE INTENSITY DISPLAY*
- *10 POINT SCALING (FOR NON-LINEAR PROCESSES)*
- *FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)*
- *RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)*
- *COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)*
- *BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP*
- *CRIMSON PROGRAMMING SOFTWARE*

PAXI SPECIFICATIONS

MAXIMUM SIGNAL FREQUENCIES TABLE

To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

FUNCTION QUESTIONS	**Single**: Counter A or B (with/without rate) or Rate only								**Dual**: Counter A & B or Rate not assigned to active single counter							
Are any setpoints used?	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
Is Prescaler Output used?	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Is Counter C used?	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
COUNT MODE	(Values are in KHz)				(Values are in KHz)				(Values are in KHz)				(Values are in KHz)			
Count x1	34	25	21	17	18	15	13	11	13	12	13	11	9	7.5	9	7
Count x2	17	13	16	12	9	7	8	7	9 *	7 *	9 *	7 *	5 *	4 *	5 *	4 *
Quadrature x1	22	19	20	17	12	10	11	10	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x2	17	13	16	12	9	7	8	6	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x4	8	6	8	6	4	3	4	3								
Rate Only	34	N/A	21	N/A	34	N/A	21	N/A								

Notes:
1. Counter Modes are explained in the Module 1 programming section.
2. If using Rate with single counter with direction or quadrature, assign it to Input A for the listed frequency.
3. * Double the listed value for Rate frequency.
4. Listed values are with frequency DIP switch set on HI frequency.
5. Derate listed frequencies by 20% during serial communications. (Placing a 5 msec. delay between serial characters will eliminate the derating.)

ANNUNCIATORS:
A - Counter A
B - Counter B
C - Counter C
r - Rate
H - Maximum (High) Rate
L - Minimum (Low) Rate
OF - Upper significant digit display of counter
SP1 - setpoint 1 output state
SP2 - setpoint 2 output state
SP3 - setpoint 3 output state
SP4 - setpoint 4 output state

RATE DISPLAY:
Accuracy: ±0.01%
Minimum Frequency: 0.01 Hz
Maximum Frequency: see Max Signal Frequencies Table.
Maximum Display: 5 Digits: 99999
Adjustable Display (low) Update: 0.1 to 99.9 seconds
Over Range Display: "r OLOL"

COUNTER DISPLAYS:
Maximum display: 8 digits: ± 99999999 (greater than 6 digits, the display alternates between high order and low order.)

INPUTS A and B:
DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.
LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, I_{MAX} = 1.9 mA.
Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.
Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.
MAGNETIC PICKUP:
Sensitivity: 200 mV peak
Hysteresis: 100 mV
Input impedance: 3.9 KΩ @ 60 Hz
Maximum input voltage: ±40 V peak, 30 Vrms
DUAL COUNT MODES:
When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

PRESCALER OUTPUT:
NPN Open Collector: I_{SNK} = 100 mA max. @ V_{OL} = 1 VDC max. V_{OH} = 30 VDC max. With duty cycle of 25% min. and 50 % max.

Optional Plug-in Output Cards

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

Adding Option Cards

The PAX and MPAX series meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

PAXI COMMUNICATION CARDS (PAXCDC)

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232, RS485 or USB Cards must be used. *Note: For Modbus communications use RS485 Communications Output Card and configure Communication Type parameter* (tYPE) *for Modbus.*

PAXCDC10 - RS485 Serial (Terminal)
PAXCDC1C - RS485 Serial (Connector)
PAXCDC20 - RS232 Serial (Terminal)
PAXCDC2C - RS232 Serial (Connector)
PAXCDC30 - DeviceNet
PAXCDC50 - Profibus-DP
PAXUSB00 - USB (Mini B)

SERIAL COMMUNICATIONS CARD

Type: RS485 or RS232
Communication Type: RLC Protocol (ASCII), Modbus RTU, and Modbus ASCII
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Data: 7/8 bits
Baud: 1200 to 38,400
Parity: no, odd or even
Bus Address: Selectable 0 to 99 (RLC Protocol), or 1 to 247 (Modbus Protocol), Max. 32 meters per line (RS485)
Transmit Delay: Selectable for 0 to 0.250 sec (+2 msec min)

DEVICENET™ CARD

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 I 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.

PAXUSB PROGRAMMING CARD

Type: USB Virtual Comms Port
Connection: Type mini B
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Baud Rate: 1200 to 38,400
Unit Address: Selectable 0 to 99 (RLC Protocol), or 1 to 247 (Modbus Protocol)

PROFIBUS-DP CARD

Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rates: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud
Station Address: 0 to 125, set by rotary switches.
Connection: 9-pin Female D-Sub connector
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

PROGRAMMING SOFTWARE

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

SETPOINT CARDS (PAXCDS)

The PAX and MPAX series has 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
PAXCDS20 - Quad Relay, FORM-A, Normally open only
PAXCDS30 - Isolated quad sinking NPN open collector
PAXCDS40 - Isolated quad sourcing PNP open collector

DUAL RELAY CARD

Type: Two FORM-C relays
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min.
Working Voltage: 240 Vrms
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
Response Time: 5 msec. nominal pull-in with 3 msec. nominal release
Timed Output Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD RELAY CARD

Type: Four FORM-A relays
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min.
Working Voltage: 250 Vrms
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: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads
Response Time: 5 msec. nominal pull-in with 3 msec. nominal release
Timed Output Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD SINKING OPEN COLLECTOR CARD

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
Response Time: Counter = 25 µsec; Rate = Low Update time
Timed Output Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD SOURCING OPEN COLLECTOR CARD

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: 24 VDC ± 10% , 30 mA max. total
External supply: 30 VDC max., 100 mA max. each output
Response Time: Counter = 25 µsec; Rate = Low Update time
Timed Output Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

PAXI ANALOG OUTPUT CARD (PAXCDL)

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

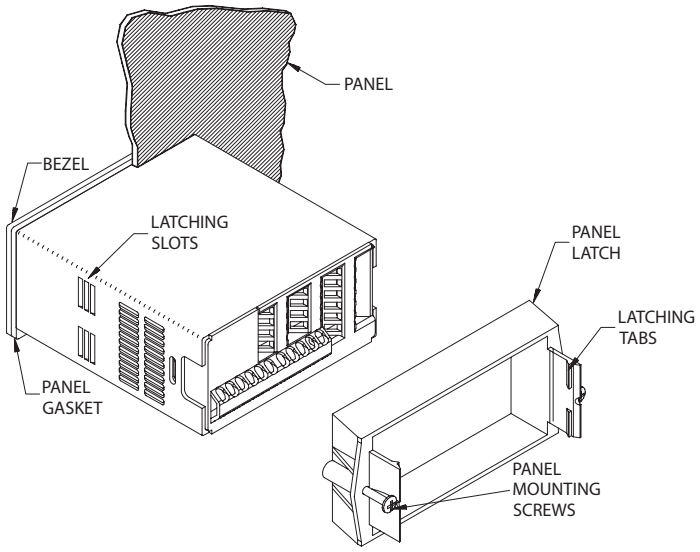
ANALOG OUTPUT CARD - Self-Powered Output (Active)

Types: 0 to 20 mA, 4 to 20 mA or 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.
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.
Response Time: 50 msec. max., 10 msec. typ.

1.0 Installing the Meter

Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

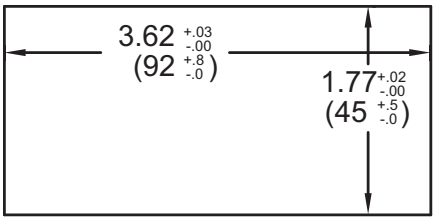
Installation Environment

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

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



2.0 Setting the Jumper and DIP Switches

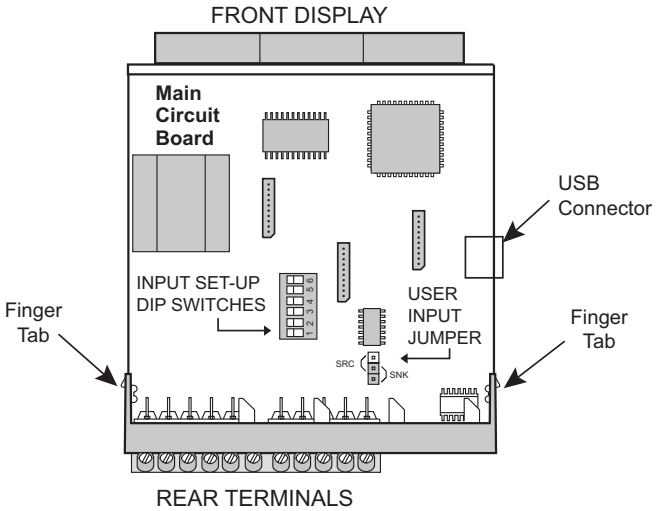
To access the jumper and switches, remove the meter base from the meter case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

2.1 SETTING THE JUMPER

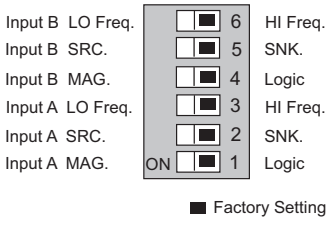
The meter has one jumper for user input logic. When using the user inputs this jumper must be set before applying power. The Main Circuit Board figure shows the location of the jumper and DIP switch.

The user input jumper determines signal logic for the user inputs, when they are used with user functions or for input signal direction. All user inputs are set by this jumper.



2.2 SETTING THE INPUT DIP SWITCHES

The meter has six DIP switches for Input A and Input B terminal set-up that must be set before applying power. NOTE: The PAXR only uses switches 1-3.



SWITCHES 1 and 4

LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
MAG: 200 mV peak input (must also have SRC on). Not recommended with counting applications.

SWITCHES 2 and 5

SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.
SNK.: Adds internal 7.8 KΩ pull-up resistor to +12 VDC, I_{MAX} = 1.9 mA.

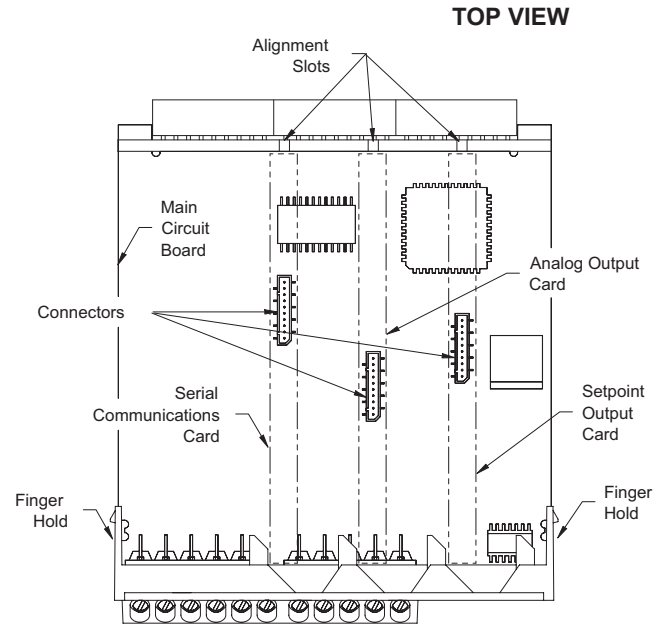
SWITCHES 3 and 6

HI Frequency: Removes damping capacitor and allows max. frequency.
LO Frequency: Adds a damping capacitor for switch contact bounce. Also limits input frequency to 50 Hz and input pulse widths to 10 msec.

3.0 Installing Plug-In Cards

The Plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The Plug-in cards have many unique functions when used with the PAX.
Note: The PAXC and PAXR only use the setpoint option card.

CAUTION: The Plug-in card 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.

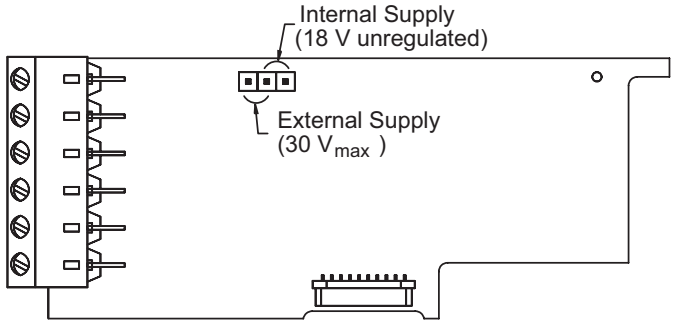


To Install:

1. With the case open, locate the Plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.*
2. Install the Plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the Plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the Plug-in card label to the bottom side of the meter in the designated area. 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.

Quad Sourcing Open Collector Output Card Supply Select

* If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.



4.0 WIRING THE METER

A

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

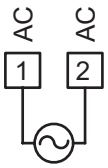
EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

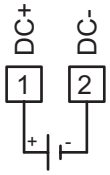
1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN2010-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC# SNUB0000.

4.1 POWER WIRING

AC Power
Terminal 1: VAC
Terminal 2: VAC



DC Power
Terminal 1: +VDC
Terminal 2: -VDC



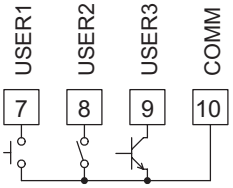
4.2 USER INPUT WIRING

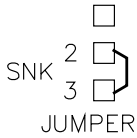
Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If User Input 1 and/or 2 are wired for quadrature or directional counting, an additional switching device should not be connected to that User Input terminal. Only the appropriate User Input terminal has to be wired.

Sinking Logic

Terminals 7-9 } Connect external switching device between the
Terminal 10 } appropriate User Input terminal and User Comm.

The user inputs of the meter are internally pulled up to +12 V with 5.1 K resistance. The input is active when it is pulled low (<0 .9 V).

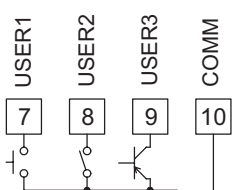




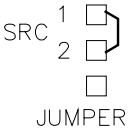
Sourcing Logic

Terminals 7-9:
+ VDC through external switching device
Terminal 10:
-VDC through external switching device

The user inputs of the meter are internally pulled down to 0 V with 5.1 K resistance. The input is active when a voltage greater than 2.4 VDC is applied.



V_{SUPPLY} (30V max.)

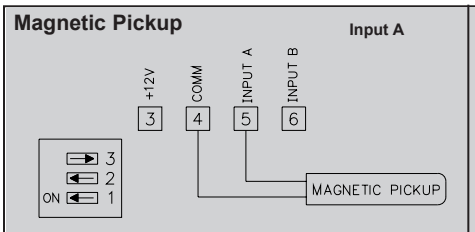


4.3 INPUT WIRING

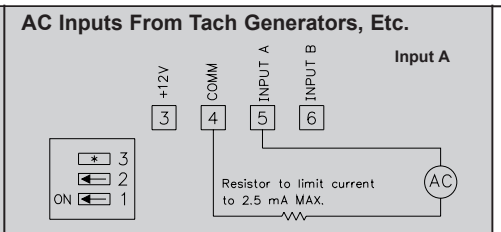
CAUTION: Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth ground; and the common of the isolated plug-in cards with respect to input common.

If you are wiring Input B, connect signal to Terminal 6 instead of 5, and set DIP switches 4, 5, and 6 to the positions shown for 1, 2, and 3.

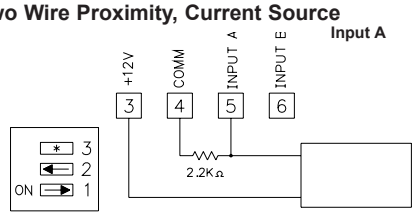
Magnetic Pickup



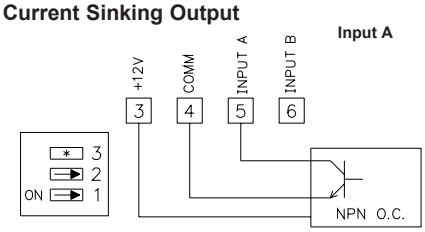
AC Inputs From Tach Generators, Etc.



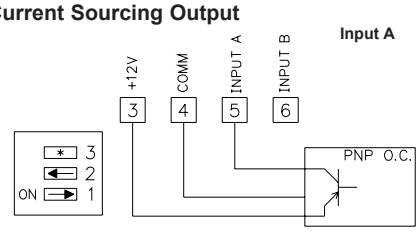
Two Wire Proximity, Current Source



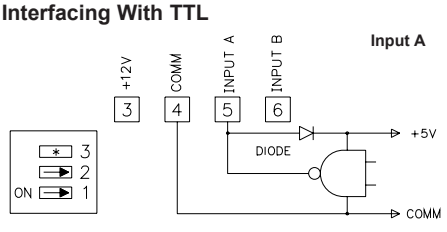
Current Sinking Output



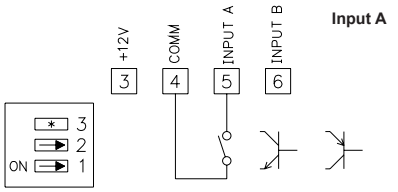
Current Sourcing Output



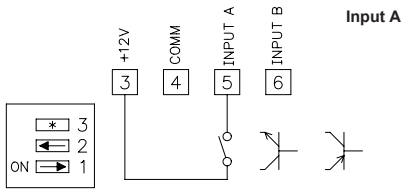
Interfacing With TTL



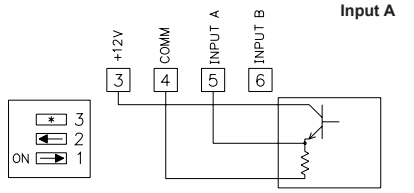
Switch or Isolated Transistor; Current Sink



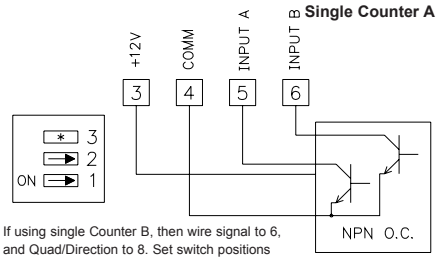
Switch or Isolated Transistor; Current Source



Emitter Follower; Current Source

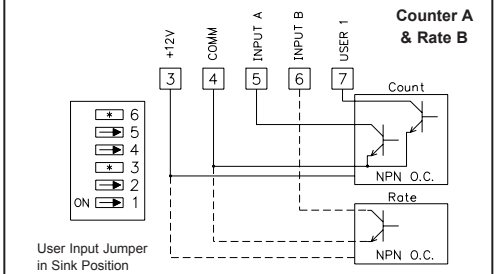


Current Sink Output; Quad/Direction



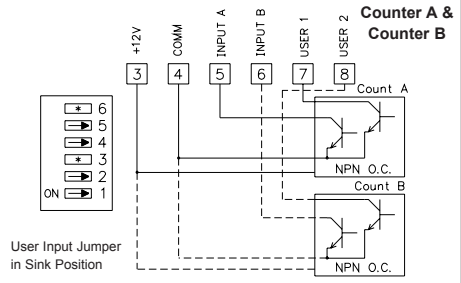
If using single Counter B, then wire signal to 6, and Quad/Direction to 8. Set switch positions 4, 5, and 6 as shown for 1, 2, and 3.

Current Sink Output; Quad/Direction



User Input Jumper in Sink Position

Current Sink Output; Quad/Direction

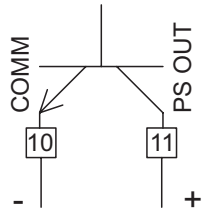


User Input Jumper in Sink Position

** Switch position is application dependent.*

Shaded areas not recommended for counting applications.

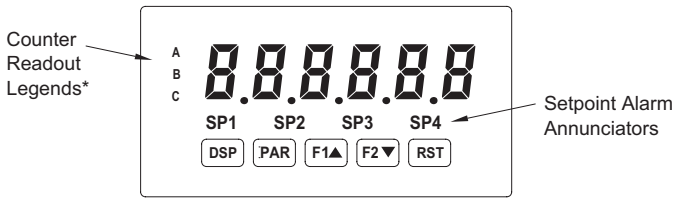
4.4 PAXI PRESCALER OUTPUT WIRING (NPN O.C.)



4.5 SETPOINT (ALARMS) WIRING
4.6 SERIAL COMMUNICATION WIRING
4.7 ANALOG OUTPUT WIRING

See appropriate plug-in card bulletin for wiring details.

5.0 Reviewing the Front Buttons and Display



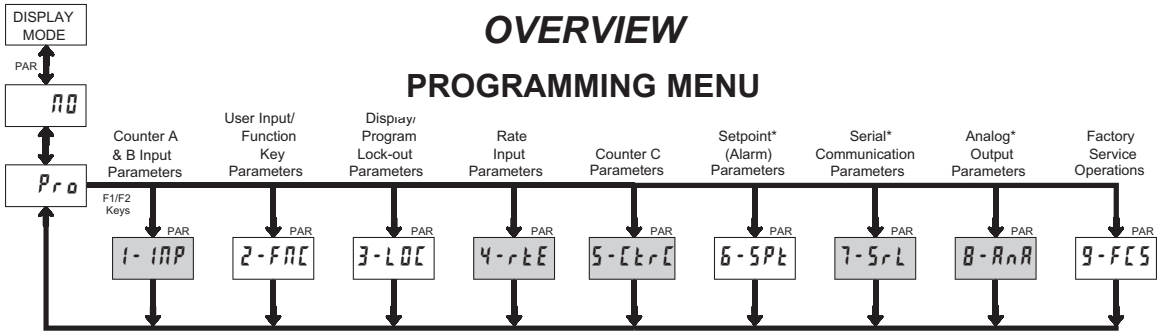
KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
DSP	Index display through the selected displays.	Quit programming and return to Display Mode
PAR	Access Programming Mode	Store selected parameter and index to next parameter
F1▲	Function key 1; hold for 3 seconds for Second Function 1 **	Increment selected parameter value or selections
F2▼	Function key 2; hold for 3 seconds for Second Function 2 **	Decrement selected parameter value or selections
RST	Reset (Function key) ***	Advances digit location in parameter values

* Counters B, and C are locked out in Factory Settings (PAXC and PAXI only).
** Factory setting for the F1, and F2 keys is NO mode.
*** Factory setting for the RST key is dSPrSt (Reset Display).

6.0 Programming the Meter

OVERVIEW

PROGRAMMING MENU



Shaded areas represent program access that is model dependent.

* Only accessible with appropriate plug-in card.

PROGRAMMING MODE ENTRY (PAR KEY)

The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the **PAR** key. If it is not accessible then it is locked by either a security code, or a hardware lock.

Two types of programming modes are available. Quick Programming Mode permits only certain parameters to be viewed and/or modified. All meter functions continue to operate except the front panel keys change to Programming Mode Operations. Quick Programming Mode is configured in Module 3. Full Programming Mode permits all parameters to be viewed and modified. In this mode, incoming counts may not be recognized correctly, the front panel keys change to Programming Mode Operations and certain user input functions are disabled. Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming.

MODULE ENTRY (ARROW & PAR KEYS)

The Programming Menu is organized into nine modules. These modules group together parameters that are related in function. The display will alternate between Pro and the present module. The arrow keys (**F1▲** and **F2▼**) are used to select the desired module. The displayed module is entered by pressing the **PAR** key.

MODULE MENU (PAR KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The **PAR** key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro no. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The arrow keys (**F1▲** and **F2▼**) are used to move through the selections/values for that parameter. Pressing the **PAR** key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the **RST** key may be used to select a specific digit to be changed. Once a digit is selected, the arrow keys are used to increment or decrement that digit to the desired number.

PROGRAMMING MODE EXIT (DSP KEY or at Pro no PAR KEY)

The Programming Mode is exited by pressing the **DSP** key (from anywhere in the Programming Mode) or the **PAR** key (with Pro no displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the **PAR** key should be pressed to store the change before pressing the **DSP** key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

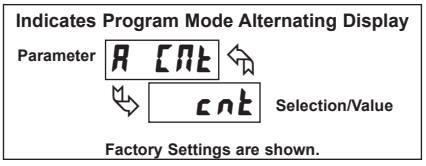
It is recommended to start with Module 1 for counting and Module 4 for rate. If lost or confused while programming, press the **DSP** key and start over. When programming is complete, it is recommended to record the parameter programming on the Parameter User Chart and lock out parameter programming with a user input or lock-out code.

FACTORY SETTINGS

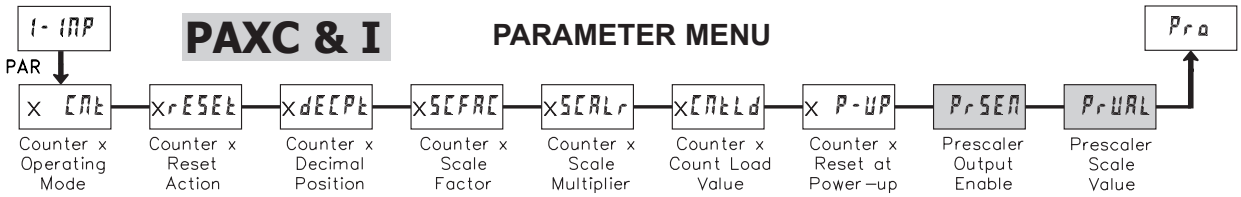
Factory Settings may be completely restored in Module 9. This is a good starting point for programming problems. Most parameters can be left at their Factory Settings without affecting basic start-up.

ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.

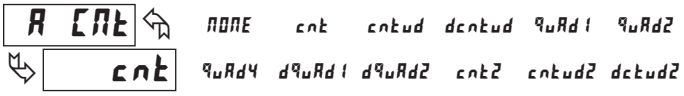


6.1 MODULE 1 - COUNT A & B INPUT PARAMETERS (1- INP)



Module 1 is the programming for Counter A, Counter B and the Prescaler Output. Counter B parameters follow the Prescaler parameters. For maximum input frequency, the counters should be set to mode NONE and the Prescaler to NO when they are not in use. When set to NONE or NO, the remaining related parameters are not accessible. A corresponding annunciator indicates the counter being shown in the Display Mode. An Exchange Parameter Lists feature for scale factors and count load values is explained in Module 2.

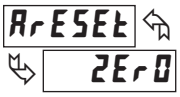
COUNTER A OPERATING MODE



Select the operating mode for Counter A.

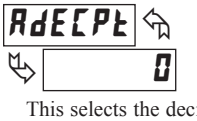
SELECTION	MODE	DESCRIPTION
NONE		Does not count.
cnt	Count X1	Adds Input A falling edge.
cntUd	Count X1 w/direction	Adds Input A falling edge if Input B is high. Subtracts Input A falling edge if Input B is low.
dcntUd	Count X1 w/direction	Adds Input A falling edge if User 1 is high. Subtracts Input A falling edge if User 1 is low.
9uAd1	Quad X1	Adds Input A rising edge when Input B is high. Subtracts Input A falling edge when Input B is high.
9uAd2	Quad X2	Adds Input A rising edge when Input B is high and Input A falling edge when Input B is low. Subtracts Input A falling edge when Input B is high and Input A rising edge when Input B is low.
9uAd4	Quad X4	Adds Input A rising edge when Input B is high, Input A falling edge when Input B is low, Input B rising edge when Input A is low, and Input B falling edge when Input A is high. Subtracts Input A falling edge when Input B is high, Input A rising edge when Input B is low, Input B rising edge when Input A is high, and Input B falling edge when Input A is low.
d9uAd1	Quad X1	Adds Input A rising edge when User 1 is high. Subtracts Input A falling edge when User 1 is high.
d9uAd2	Quad X2	Adds Input A rising edge when User 1 is high and Input A falling edge when User 1 is low. Subtracts Input A falling edge when User 1 is high and Input A rising edge when User 1 is low.
cnt2	Count X2	Adds Input A rising and falling edges.
cntUd2	Count X2 w/direction	Adds Input A rising and falling edges if Input B is high. Subtracts Input A rising and falling edge if Input B is low.
dctUd2	Count X2 w/direction	Adds Input A rising and falling edges if User 1 is high. Subtracts Input A rising and falling edge if User 1 is low.

COUNTER A RESET ACTION



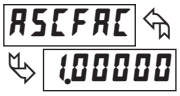
When Counter A is reset, it returns to zero or Counter A count load value. This reset action affects all Counter A resets, except the Setpoint Counter Auto Reset in Module 6.

COUNTER A DECIMAL POSITION



This selects the decimal point position for Counter A and any setpoint value assigned to Counter A. The selection will also affect Counter A scale factor calculations.

COUNTER A SCALE FACTOR



The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)

COUNTER A SCALE MULTIPLIER

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

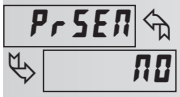
COUNTER A COUNT LOAD VALUE

When reset to count load action is selected, Counter A will reset to this value.

COUNTER A RESET POWER-UP

Counter A may be programmed to reset at each meter power-up.

PAXI: PRESCALER OUTPUT ENABLE

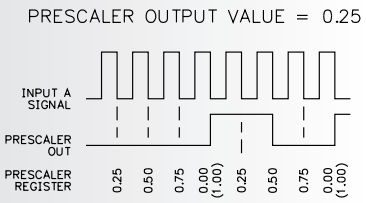


This enables the prescaler output. The prescaler output is useful for providing a lower frequency scaled pulse train to a PLC or another external counter. On each falling edge of Input A, the prescaler output register increments by the prescaler scale value (PrUAL). When the register equals or exceeds 1.0000, a pulse is output and the register is lowered by 1.0000. The prescaler register is reset to zero whenever Counter A is reset (except for Setpoint Counter Auto Reset). (See Prescaler Output Figure.)

PAXI: PRESCALER SCALE VALUE

PrUAL ↺ 0.0001 to 1.0000
1.0000 ↻

The prescaler output frequency is the Input A frequency times the prescaler scale value.



COUNTER B OPERATING MODE

b CNt ↺ nONE cnt dcntud d9uRd1 d9uRd2 cnt2 dctud2
nONE ↻

Select the operating mode for Counter B.

SELECTION	MODE	DESCRIPTION
nONE		Does not count.
cnt	Count X1	Adds Input B falling edge.
dcntud	Count X1 w/direction	Adds Input B falling edge if User 2 is high. Subtracts Input B falling edge if User 2 is low.
d9uRd1	Quad X1	Adds Input B rising edge when User 2 is high. Subtracts Input B falling edge when User 2 is high.
d9uRd2	Quad X2	Adds Input B rising edge when User 2 is high and Input B falling edge when User 2 is low. Subtracts Input B falling edge when User 2 is high and Input B rising edge when User 2 is low.
cnt2	Count X2	Adds Input B rising and falling edges.
dctud2	Count X2 w/direction	Adds Input B rising and falling edges if User 2 is high. Subtracts Input B rising and falling edge if User 2 is low.

COUNTER B RESET ACTION

brESEt ↺ 2Er0 CNtLd
2Er0 ↻

When Counter B is reset, it returns to zero or Counter B count load value. This reset action affects all Counter B resets, except the Setpoint Counter Auto Reset Action in Module 6.

COUNTER B DECIMAL POSITION

bdECPt ↺ 0 0.00 0.0000 0.0 0.000 0.00000
0 ↻

This selects the decimal point position for Counter B and any setpoint value assigned to Counter B. The selection will also affect Counter B scale factor calculations.

COUNTER B SCALE FACTOR

bSCFAC ↺ 0.0001 to 9.99999
1.00000 ↻

The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)

COUNTER B SCALE MULTIPLIER

bSCALr ↺ 1 0.1 0.01
1 ↻

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

COUNTER B COUNT LOAD VALUE

bCNtLd ↺ -99999 to 999999
500 ↻

When reset to count load action is selected, Counter B will reset to this value.

COUNTER B RESET POWER-UP

b P-UP ↺ YES nO
nO ↻

Counter B may be programmed to reset at each meter power-up.

8 DIGIT COUNT VALUES

Any counter display value below -99999 or above 999999 (less decimal point) will consist of a two part display. This display alternates between the least 6 significant digits and the remaining most significant digits beginning with "oF" in the display. If the display exceeds ± 99999999 the display will roll to zero and continue counting. Outputs cannot be set to counter values above 6 digits. The annunciator, indicating the counter being displayed, will flash when the value is above 6 digits.

SCALING CALCULATIONS

Each counter has the ability to scale an input signal to a desired display value. This is accomplished by the counter mode (x-CNt), scale factor (xSCFAC), scale multiplier (xSCALr) and decimal point (xdECPt). The scale factor is calculated using:

$$SF\ (xSCFAC) = \frac{\text{Desired Display Decimal DDD}}{\text{(Number of pulses per 'single' unit x CM x SM)}}$$

Where:

Desired Display Decimal DDD	xdECPt	Counter Decimal Selection
1	0	None
10	0.0	Tenths
100	0.00	Hundredths
1000	0.000	Thousandths
10000	0.0000	Ten Thousandths
100000	0.00000	Hundred Thousandths

Number of pulses per 'single' unit: pulses per unit generated by the process (i.e. # of pulses per foot)
CM: Counter Mode(x-CNt) times factor of the mode 1,2 or 4.
SM: Scale Multiplier (xSCALr) selection of 1, 0.1 or 0.01.

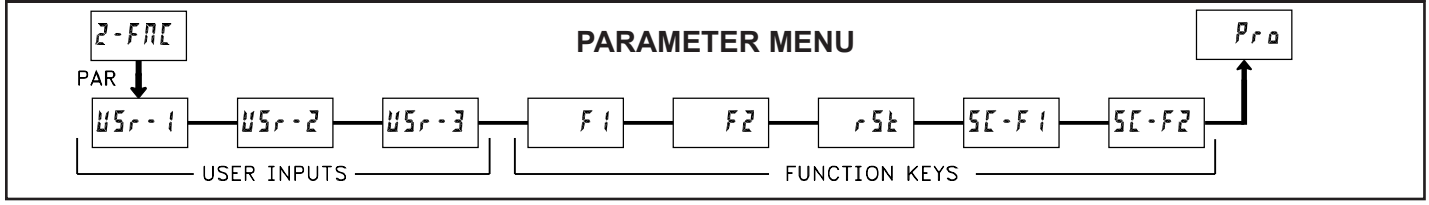
Example:

1. Show feet to the hundredths (0.00) with 100 pulses per foot:
   Scale Factor would be 100 / (100 x 1 x 1) = 1
   (In this case, the scale multiplier and counter mode factor are 1)
2. Show feet with 120 pulses per foot: Scale Factor would be 1 / (120 x 1 x 1) = 0.0083333. (In this case, the scale multiplier of 0.01 could be used: 1 / (120 x 1 x 0.01) = 0.83333 or show to hundredths (0.00): 100 / (120 x 1 x 1) = 0.8333.)

General Rules on Scaling

1. It is recommended that, the scale factor be as close as possible to, but not exceeding 1.00000. This can be accomplished by increasing or decreasing the counter decimal point position, using the scale multiplier, or selecting a different count mode.
2. To double the number of pulses per unit, use counter modes direction X2 or quad X2. To increase it by four times, use counter mode quad X4. Using these modes will decrease the maximum input frequency.
3. A scale factor greater than 1.00000 will cause Counter display rounding. In this case, digit jumps could be caused by the internal count register rounding the display. The precision of a counter application cannot be improved by using a scale factor greater than 1. 00000.
4. The number of pulses per single unit must be greater than or equal to the DDD value for the scale factor to be less than or equal to one.
5. Lowering the scale factor can be accomplished by lowering the counter decimal position. (Example: 100 (Hundredths)/10 pulses = 10.000 lowering to 10 (Tenths)/10 = 1.000.)

6.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FNC)



Module 2 is the programming for rear terminal user inputs and front panel function keys.

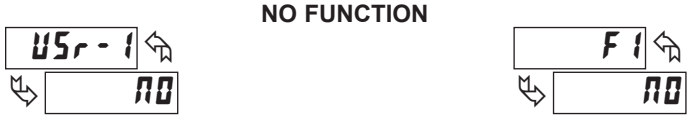
Three rear terminal user inputs are individually programmable to perform specific meter control functions. While in the Display Mode, the function is executed when the user input transitions to the active state. (Refer to the user input specifications for active state response times.) Certain user input functions are disabled in "full" Programming Mode.

Three front panel function **F1**, **F2** and **RST** keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed when the key is pressed. Holding the **F1** and **F2** function keys for three seconds executes a secondary function. It is possible to program a secondary function without a primary function. The front panel key functions are disabled in both Programming Modes.

In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions are performed every time any of those user inputs or function keys transition to the active state. All functions are available to both user inputs and function keys.

Some of the user functions have a sublist of parameters. The sublist is accessed when **PAR** is pressed at the listed function. The function will only be performed for the parameters entered as YES. If a user input or function key is configured for a function with a sublist, then that sublist will need to be scrolled through each time to access the following user inputs or function keys parameters.

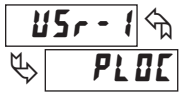
NO FUNCTION



With this selection, NO function is performed. This is the factory setting for all user inputs and function keys except the Reset (**RST**) Key.

NOTE: When a user input is used to accept a quad or directional input signal, then that user input should be programmed for NO function.

PROGRAMMING MODE LOCK-OUT



Programming Mode is locked-out, as long as activated (maintained action). In Module 3, certain parameters can be setup where they are still accessible during Programming Mode Lockout. A security code can be configured to allow complete programming access during user input lockout. Function keys should not be programmed for PLOC.

ADVANCE DISPLAY

When activated (momentary action), the display advances to the next display that is not locked out from the Display Mode.

RESET DISPLAY

When activated (momentary action), the shown display is reset. This is the factory setting for the Reset (**RST**) Key.

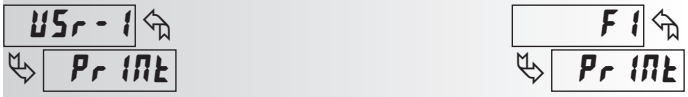
EXCHANGE PARAMETER LISTS

Two lists of values are available for SP-1, SP-2, SP-3, SP-4, ASCFAC, bSCFAC, CSCFAC, ACntLd, bCntLd, CCntLd. The two lists are named LISt-A and LISt-b. If a user input is used to select the list then LISt-A is selected when the user input is not active and and LISt-b is selected when the user input is active, (maintained action). If a front panel key is used to select the list then the list will toggle for each key press, (momentary action). The meter will suspend ALL operations for approximately 1 msec. while the new values are loaded. The display will only indicate which list is active when the list is changed or when entering any Programming Mode.

To program the values for LISt-A and LISt-b, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the values for SP-1, SP-2, SP-3, SP-4, ASCFAC, bSCFAC, CSCFAC, ACntLd, bCntLd, CCntLd. If any other parameters are changed then the other list values must be reprogrammed.

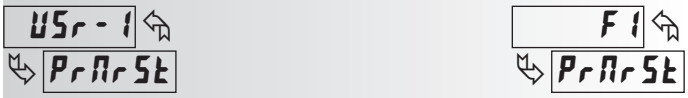
Shaded parameters do not apply to the PAXR.

PAXI: PRINT REQUEST



The meter issues a block print through the serial port when activated. The data transmitted during the print request is configured in Module 7. If the user input is still active after the transmission is complete (about 100 msec.), an additional transmission will occur. Only one transmission will take place with each function key depression. This selection will only function when a serial communications Plug-in card is installed in the meter.

PAXI: PRINT REQUEST AND RESET DISPLAYS



The meter issues a block print through the serial port when activated just like the Print Request function. In addition, when activated (momentary action), the meter performs a reset of the displays configured as YES. The print aspect of this action only functions when a serial communication plug-in card is installed. The reset action functions regardless.

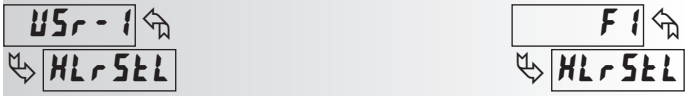
DISPLAY	DESCRIPTION	FACTORY
A Cnt	Counter A	no
b Cnt	Counter B	no
C Cnt	Counter C	no
HI	Maximum	no
LO	Minimum	no

MAINTAINED (LEVEL) RESET AND INHIBIT

The meter performs a reset and inhibits the displays configured as YES, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
A CNt	Counter A	NO
b CNt	Counter B	NO
C CNt	Counter C	NO
HI	Maximum	NO
LO	Minimum	NO

PAXR: MAINTAINED (LEVEL) RESET AND INHIBIT



The meter performs a reset and inhibits the displays configured as YES, as long as activated (maintained action).

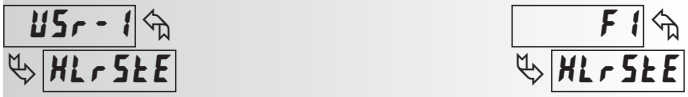
DISPLAY	DESCRIPTION	FACTORY
HI	Maximum	NO
LO	Minimum	NO

MOMENTARY (EDGE) RESET

When activated (momentary action), the meter resets the displays configured as YES. (Momentary resets improve max. input frequencies over maintained resets.)

DISPLAY	DESCRIPTION	FACTORY
A CNt	Counter A	NO
b CNt	Counter B	NO
C CNt	Counter C	NO
HI	Maximum	NO
LO	Minimum	NO

PAXR: MOMENTARY (EDGE) RESET



When activated (momentary action), the meter resets the displays configured as YES. (Momentary resets improve max. input frequencies over maintained resets.)

DISPLAY	DESCRIPTION	FACTORY
HI	Maximum	NO
LO	Minimum	NO

INHIBIT

The meter inhibits the displays configured as YES, as long as activated (maintained action).

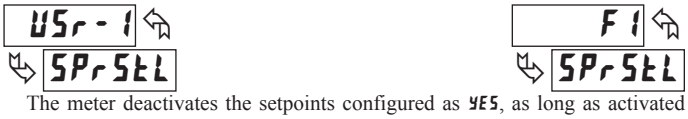
DISPLAY	DESCRIPTION	FACTORY
A CNt	Counter A	NO
b CNt	Counter B	NO
C CNt	Counter C	NO
HI	Maximum	NO
LO	Minimum	NO

STORE DISPLAY

The meter holds (freeze) the displays configured as YES, as long as activated (maintained action). Internally the counters and max. and min. values continue to update.

DISPLAY	DESCRIPTION	FACTORY
A CNt	Counter A	NO
b CNt	Counter B	NO
C CNt	Counter C	NO
HI	Maximum	NO
LO	Minimum	NO

DEACTIVATE SETPOINT MAINTAINED (LEVEL)



The meter deactivates the setpoints configured as YES, as long as activated (maintained action). This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	NO
SP-2	Setpoint 2	NO
SP-3	Setpoint 3	NO
SP-4	Setpoint 4	NO

DEACTIVATE SETPOINT MOMENTARY (EDGE)

When activated (momentary action), the meter deactivates the setpoints configured as YES. This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	NO
SP-2	Setpoint 2	NO
SP-3	Setpoint 3	NO
SP-4	Setpoint 4	NO

HOLD SETPOINT STATE

The meter holds the state of the setpoints configured as YES, as long as activated (maintained action). This action only functions with a Setpoint plug-in card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	NO
SP-2	Setpoint 2	NO
SP-3	Setpoint 3	NO
SP-4	Setpoint 4	NO

ACTIVATE SETPOINT MAINTAINED (LEVEL)

The meter activates the setpoints configured as YES, as long as activated (maintained action). This action only functions with a Setpoint card installed.

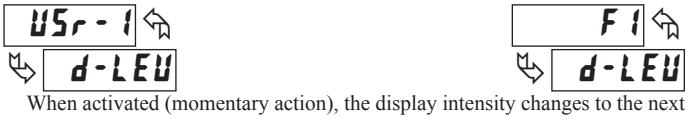
DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	NO
SP-2	Setpoint 2	NO
SP-3	Setpoint 3	NO
SP-4	Setpoint 4	NO

ACTIVATE SETPOINT MOMENTARY (EDGE)

When activated (momentary action), the meter activates the setpoints configured as YES. This action only functions with a Setpoint card installed.

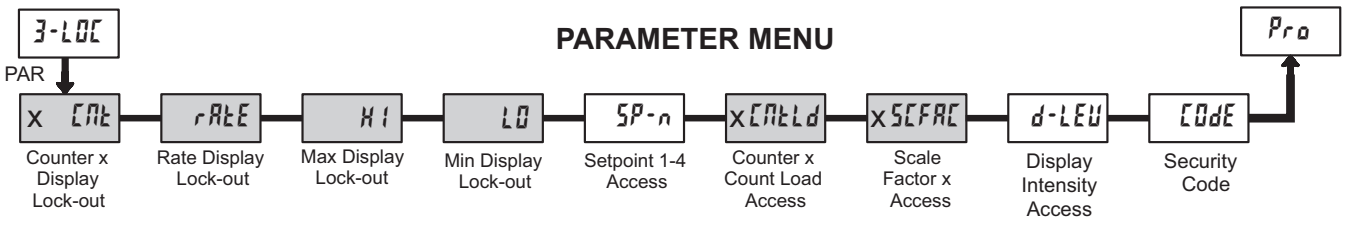
DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	NO
SP-2	Setpoint 2	NO
SP-3	Setpoint 3	NO
SP-4	Setpoint 4	NO

CHANGE DISPLAY INTENSITY LEVEL



When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEU) settings of 0, 3, 8 & 15.

6.3 MODULE 3 - DISPLAY AND PROGRAM LOCK-OUT PARAMETERS (3-LOC)



x = Counter A , Counter B, and then Counter C
n = Setpoints 1 to 4

Shaded areas represent program access that is model dependent.

Module 3 is the programming for Display lock-out and "Full" and "Quick" Program lock-out.

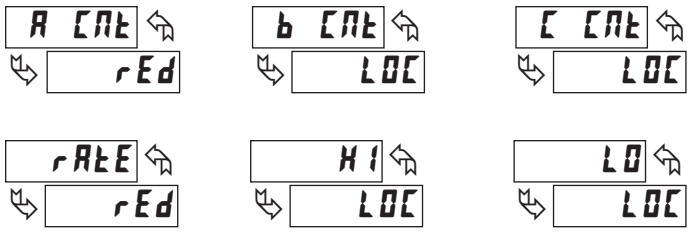
When in the Display Mode, the available displays can be read consecutively by repeatedly pressing the **DSP** key. An annunciator indicates the display being shown. These displays can be locked from being visible. It is recommended that the display be set to LOC when the corresponding function is not used.

SELECTION	DESCRIPTION
rEd	Visible in Display Mode
LOC	Not visible in Display Mode

"Full" Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the **PAR** key is pressed, the meter enters a Quick Programming Mode. In this mode, setpoint, count load, scale factor values, and the Display Intensity Level (d-LEU) parameter can still be read and/or changed per the selections below.

SELECTION	DESCRIPTION
rEd	Visible but not changeable in Quick Programming Mode
ENt	Visible and changeable in Quick Programming Mode
LOC	Not visible in Quick Programming Mode

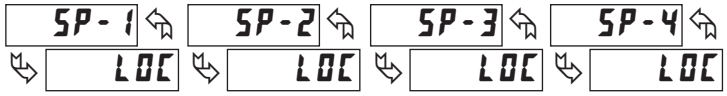
COUNTER A B C DISPLAY LOCK-OUT
RATE DISPLAY LOCK-OUT
MAX. MIN. DISPLAY LOCK-OUT



These displays can be programmed for LOC or rEd.

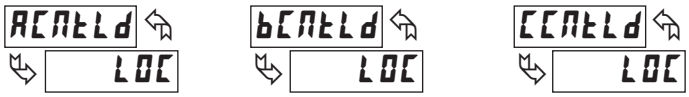
Shaded areas are model dependent.

SETPOINT 1 to 4 ACCESS LOCK-OUT



The setpoint displays can be programmed for LOC, rEd, or ENt (See the following table). Accessible only with the Setpoint Plug-in card installed.

COUNT LOAD A B C ACCESS LOCK-OUT



The Count Load Values can be programmed for LOC, rEd, or ENt.

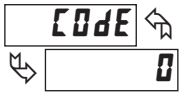
SCALE FACTOR A B C ACCESS LOCK-OUT

The Scale Factor values can be programmed for LOC, rEd, or ENt.

DISPLAY INTENSITY ACCESS LOCK-OUT

The Display Intensity Level can be programmed for LOC, rEd, or ENt.

SECURITY CODE



0 to 999

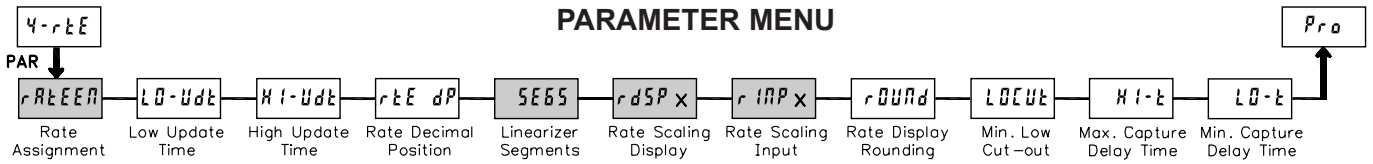
Entry of a non-zero value will cause the prompt CodE to appear when trying to access the "Full" Programming Mode. Access will only be allowed after entering a matching security code or universal code of 222. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out is overridden by an inactive user input configured for Program Lock-out.

PROGRAMMING MODE ACCESS

SECURITY CODE	USER INPUT CONFIGURED	USER INPUT STATE	WHEN PAR KEY IS PRESSED	"FULL" PROGRAMMING MODE ACCESS
0	not PLOC	————	"Full" Programming	Immediate access.
>0	not PLOC	————	Quick Programming	After Quick Programming with correct code # at CodE prompt.
>0	PLOC	Active	Quick Programming	After Quick Programming with correct code # at CodE prompt.
>0	PLOC	Not Active	"Full" Programming	Immediate access.
0	PLOC	Active	Quick Programming	No access
0	PLOC	Not Active	"Full" Programming	Immediate access.

Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming (all meter parameters are accessible).

6.4 MODULE 4 - RATE INPUT PARAMETERS (4-rtE) - PAXR & I



Module 4 is the programming for the Rate parameters. For maximum input frequency, Rate assignment should be set to **no** when not in use. When set to **no**, the remaining related parameters are not accessible. The Rate value is shown with an annunciator of '**r**' in the Display Mode.

*Note: For PAXR, **r InP** is actually **rtE InP** on the unit's display and **rdSP** is actually **rtEdSP** on the unit's display.*

PAXI: RATE ASSIGNMENT

rAtEEn → **no** **rAtE-A** **rAtE-b** → **rAtE-A**

For measuring the rate (speed) of pulses on Input A, select **rAtE-A**. For Input B select **rAtE-b**. This assignment is independent of the counting modes.

LOW UPDATE TIME (DISPLAY UPDATE)

LO-Udt → **1.0**

0.1 to **99.9** seconds

The Low Update Time is the minimum amount of time between display updates for the Rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady. The factory setting of 1.0 will update the display every second minimum.

HIGH UPDATE TIME (DISPLAY ZERO)

HI-Udt → **2.0**

0.2 to **99.9** seconds

The High Update Time is the maximum amount of time before the Rate display is forced to zero. (For more explanation, refer to Input Frequency Calculation.) The High Update Time **must** be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

RATE DECIMAL POSITION

rtE dP → **0**

0 **0.00** **0.0000**
0.0 **0.000**

This selects the decimal point position for Rate, Minimum and Maximum rate displays and any setpoint value assigned to these displays. This parameter does not affect rate scaling calculations.

PAXI: LINEARIZER SEGMENTS

SEGS → **0**

0 to **9**

This parameter specifies the number of linear segments used for the Rate Scaling function. Each linear segment has two scaling points which define the upper and lower endpoints of the segment. The number of segments used depends on the linearity of the process and the display accuracy required as described below.

Linear Application – 2 Scaling Points

Linear processes use a single segment (two scaling points) to provide a linear Rate display from 0 up to the maximum input frequency. For typical zero based frequency measurements (0 Hz = 0 on display), leave **SEGS:0** (factory setting). For non-zero based 2 scaling point applications, set **SEGS: 1**, to enter both the zero segment (**r InP 0** & **rdSP 0**) and segment 1 (**r InP 1** & **rdSP 1**).

Non-linear Application – Up to 10 Scaling Points

Non-linear processes may utilize up to nine segments (ten scaling points) to provide a piece-wise linear approximation representing the non-linear function. The Rate display will be linear throughout each individual segment (i.e. between sequential scaling points). Thus, the greater the number of segments, the greater the conformity accuracy. Several linearization equations are available in the software.

About Scaling Points

Each Scaling Point is specified by two programmable parameters: A desired Rate Display Value (**rdSP**) and a corresponding Rate Input Value (**r InP**). Scaling points are entered sequentially in ascending order of Rate Input Value.

Two scaling points must be programmed to define the upper and lower endpoints of the first linear segment. Setting **SEGS:0**, automatically factory sets the first scaling point to 0.0 for typical single segment, zero based applications. When multiple segments are used, the upper scaling point for a given segment becomes the lower scaling point for the next sequential segment. Thus, for each additional segment used, only one additional scaling point must be programmed.

The following chart shows the Scaling Points, the corresponding Parameter mnemonics, and the Factory Default Settings for each point.

SEGMENT	SCALING POINT	DISPLAY PARAMETER	DISPLAY DEFAULT	INPUT PARAMETER	INPUT DEFAULT
	1	rdSP 0	000000	r InP 0	00000.0
1	2	rdSP 1	001000	r InP 1	01000.0
2	3	rdSP 2	002000	r InP 2	02000.0
3	4	rdSP 3	003000	r InP 3	03000.0
4	5	rdSP 4	004000	r InP 4	04000.0
5	6	rdSP 5	005000	r InP 5	05000.0
6	7	rdSP 6	006000	r InP 6	06000.0
7	8	rdSP 7	007000	r InP 7	07000.0
8	9	rdSP 8	008000	r InP 8	08000.0
9	10	rdSP 9	009000	r InP 9	09000.0

PAXI: RATE DISPLAY VALUE FOR SCALING POINT 1

rdSP 0 → **0**

0 to **999999**

Confirm the Rate Display Value for the first Scaling Point is 0. This parameter is automatically set to 0 and does not appear when **SEGS:0**. *(See Note)*

PAXI: RATE INPUT VALUE FOR SCALING POINT 1

r InP 0 → **0.0**

0 to **99999.9**

Confirm the Rate Input Value for the first Scaling Point is 0.0. *(See Note)*

*Note: For all linear and most non-linear applications, the Scaling Point 1 parameters (**rdSP 0** and **r InP 0**) should be set to 0 and 0.0 respectively. Consult the factory before using any non-zero values for Scaling Point 1. These parameters are automatically set to 0 and do not appear when **SEGS:0**.*

RATE DISPLAY VALUE FOR SCALING POINT 2

rdSP 1 → **1000**

0 to **999999**

Enter the desired Rate Display Value for the second Scaling Point by using the arrow keys.

RATE INPUT VALUE FOR SCALING POINT 2

r INP 1 → 1000.0 ← 0 to 99999.9

Enter the corresponding Rate Input Value for the second Scaling Point by using the arrow keys. Rate Input values for scaling points can be entered by using the Key-in or the Applied method described below.

Key-in Method:

Enter the Rate Input value (r INP) that corresponds to the entered Rate Display value (rdSP) by pressing the **F1** or **F2** keys. This value is always in pulses per second (Hz).

Applied Method:

Apply an external rate signal to the appropriate input terminals. At the Rate Input Value (r INP) press and hold the **F1** and **F2** keys at the same time. The applied input frequency (in Hz) will appear on the display. (To verify correct reading wait for at least the length of the Low Update Time. Then press and hold the **F1** and **F2** keys at the same time again. The new value should be ± 0.1% of the previous entered value.) Press **PAR** to enter the displayed frequency as the Rate Input value. To prevent the displayed value from being entered, press **DSP**. This will take the meter out of Programming Mode and the previous Rate Input value will remain.

RATE DISPLAY ROUND

rOUNd → 1 ← 1 2 5 10 20 50 100

Rounding values other than one round the Rate display to the nearest increment selected (e.g. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Rate display.

LOW CUT OUT

LOCUt → 0 ← 0 to 999999

The Low Cut Out value forces the Rate display to zero when the Rate display falls below the value entered.

MAXIMUM CAPTURE DELAY TIME

HI-t → 2.0 ← 0.0 to 999.9 seconds

When the Rate value is above the present Maximum rate value for the entered amount of time, the meter will capture that Rate value as the new Maximum value. A delay time helps to avoid false captures of sudden short spikes. Maximum detection will only function if Rate is assigned to Input A or B. The Maximum rate value is shown with an annunciator of 'H' in the display and will continue to function independent of being displayed.

MINIMUM CAPTURE DELAY TIME

LO-t → 2.0 ← 0.0 to 999.9 seconds

When the Rate value is below the present Minimum rate value for the entered amount of time, the meter will capture that Rate value as the new Minimum value. A delay time helps to avoid false captures of sudden short spikes. Minimum detection will only function if Rate is assigned to Input A or B. The Minimum rate value is shown with an annunciator of 'L' in the display and will continue to function independent of being displayed.

RATE DISPLAY EXCEEDED

If the rate of the input signal causes a display that exceeds the capacity of the Rate display (5 digits, 99999), then the display will indicate an overflow condition by showing "r OLOL". During this overflow condition, the Minimum and Maximum rate values will stay at their values even during resets.

RATE SCALING

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. (The Display and Input values can be entered by Key-in or Applied Methods.) These values are internally plotted to a Display value of 0 and Input value of 0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The PAXI and PAXR are capable of showing a rate display value for any linear process.

KEY-IN SCALING METHOD CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (rdSPx) and Scaling Input (r INPx). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY (rdSPx)	INPUT (r INPx)
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

NOTES:

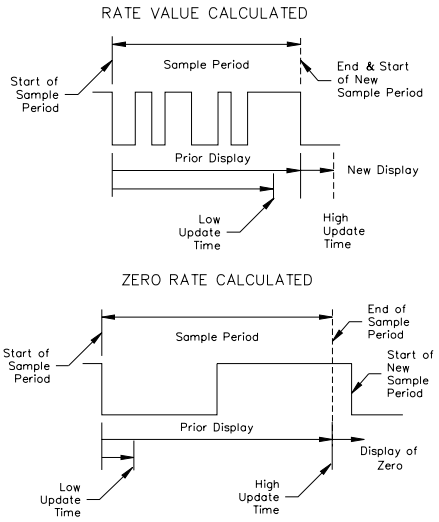
1. If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

EXAMPLE:

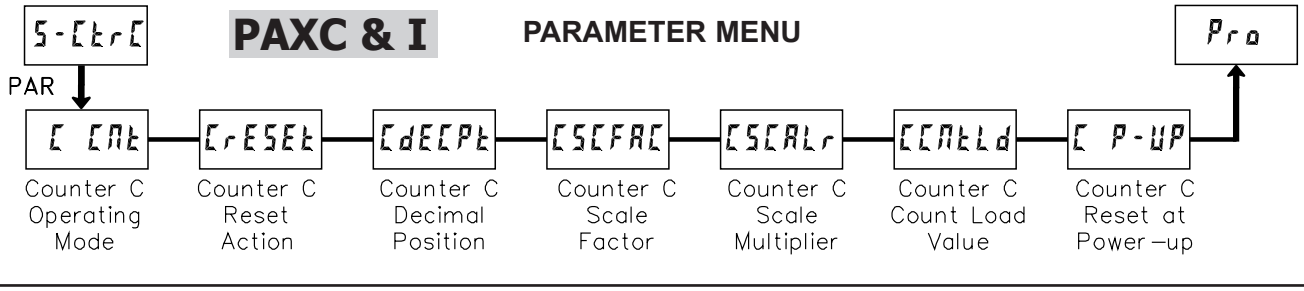
1. With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by either scaling method.



6.5 MODULE 5 - COUNTER C INPUT PARAMETERS (5-CtrC)



Module 5 is the programming for Counter C. For maximum input frequency, the counter operating mode should be set to **NONE** when not in use. When set to **NONE** the remaining related parameters are not accessible. The C annunciator indicates that Counter C is being shown in the Display Mode. An Exchange Parameter List feature for scale factor and count load values is explained in Module 2.

COUNTER C OPERATING MODE

C CNt → NONE

NONE A Add Ab Sub Ab SLAVE

Select the operating mode for Counter C.

NONE Does not count.

A Counter C counts the incoming pulses from Counter A input as per Counter A mode of operation. The signal is scaled only according to Counter C parameters.

Add Ab Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and increment by 2 for each pulse received on Input B. Counter C scale settings are then applied and the result is displayed.)

Sub Ab Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation and subtracts the B counts from the A counts. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and decrement by 2 for each pulse received on Input B. Counter C scale settings are then applied and the result is displayed.)

Note: When using Add Ab or Sub Ab, Counter A, B and C must all be reset at the same time for the math to be performed on the display values.

SLAVE (PAXI only) See Serial Communications for details.

COUNTER C RESET ACTION

CrESEt → 2Er0

2Er0 CNtLd

When Counter C is reset, it returns to zero or Counter C count load value. This reset action affects all Counter C resets, except the Setpoint Counter Auto Reset Action in Module 6.

COUNTER C DECIMAL POSITION

CdECPt → 0

0 0.00 0.0000
0.0 0.000 0.00000

This selects the decimal point position for Counter C and any setpoint value assigned to Counter C. The selection will also affect Counter C scale factor calculations.

COUNTER C SCALE FACTOR

CSCFAC → 1.00000

0.00001 to 9.99999

The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. For the **A** mode of operation, the input signal is scaled directly. For **Add Ab** and **Sub Ab** modes of operation, the math is performed on the input signals and then the result is scaled. To achieve correct results, both Input A and Input B must provide the same amount of pulses per unit of measurement. (Details on scaling calculations are explained at the end of Module 1 section.)

COUNTER C SCALE MULTIPLIER

CSCALr → 1

1 0.1 0.01

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of Module 1 section.)

COUNTER C COUNT LOAD VALUE

CCNtLd → 500

-99999 to 999999

When reset to count load action is selected, Counter C will reset to this value.

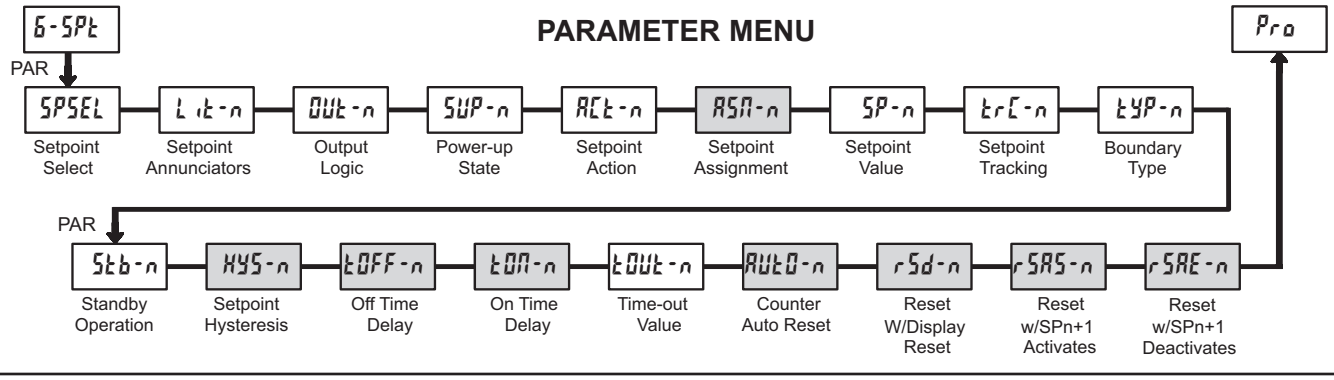
COUNTER C RESET POWER-UP

C P-UP → no

YES no

Counter C may be programmed to reset at each meter power-up.

6.6 MODULE 6 - SETPOINT (ALARM) PARAMETERS (6-SPt)



Module 6 is the programming for the setpoint (alarms) output parameters. To have setpoint outputs, a setpoint Plug-in card needs to be installed into the PAX (see Ordering Information). Depending on the card installed, there will be two or four setpoint outputs available. For setpoint hardware and wiring details, refer to the bulletin shipped with the plug-in card. For maximum input frequency, unused Setpoints should be configured for OFF action.

The setpoint assignment and the setpoint action determine certain setpoint feature availability. The chart below illustrates this.

SETPOINT PARAMETER AVAILABILITY

PARAMETER	DESCRIPTION	RATE			COUNTER		
		TIMED OUT tOUt	BOUNDARY bOUNd	LATCH LAtCH	TIMED OUT tOUt	BOUNDARY bOUNd	LATCH LAtCH
Lit-n	Annunciators	Yes	Yes	Yes	Yes	Yes	Yes
OUt-n	Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
SUP-n	Power Up State	Yes	Yes	Yes	Yes	Yes	Yes
SP-n	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
trC-n	Setpoint Tracking	Yes	Yes	Yes	Yes	Yes	Yes
tYP-n	Boundary Type	Yes	Yes	Yes	No	Yes	No
Stb-n	Standby Operation	Yes	Yes	Yes	No	Yes	No
HYS-n	Setpoint Hysteresis	No	Yes	No	No	No	No
tOFF-n	Setpoint Off Delay	No	Yes	No	No	No	No
tOn-n	Setpoint On Delay	Yes	Yes	Yes	No	No	No
tOUt-n	Setpoint Time Out	Yes	No	No	Yes	No	No
AUtO-n	Counter Auto Reset	No	No	No	Yes	No	Yes
rSd-n	Reset With Display Reset	No	No	No	Yes	No	Yes
rSAS-n	Reset When SPn+1 Activates	No	No	No	Yes	No	Yes
rSAE-n	Reset When SPn+1 Deactivates	No	No	No	Yes	No	Yes

SETPOINT SELECT

SPSEL / nO — nO SP-1 SP-2 SP-3 SP-4

Select a setpoint (alarm output) to open the remaining module menu. (The "n" in the following parameters will reflect the chosen setpoint number.) After the chosen setpoint is programmed, the display will default to SPSEL nO. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing **PAR** at SPSEL nO will exit Module 6.

SETPOINT ANNUNCIATORS

Lit-n / nOr — OFF nOr rEU FLASH

OFF disables the display of the setpoint annunciator. Normal (nOr) displays the corresponding setpoint annunciator of an "on" alarm output. Reverse (rEU) displays the corresponding setpoint annunciator of an "off" alarm output. FLASH flashes the display and the corresponding setpoint annunciator of an "on" alarm output.

SETPOINT OUTPUT LOGIC

OUt-n / nOr — nOr rEU

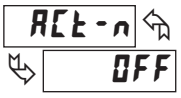
Normal (nOr) turns the output "on" when activated and "off" when deactivated. Reverse (rEU) turns the output "off" when activated and "on" when deactivated.

SETPOINT POWER UP STATE

SUP-n / OFF — SAVE On OFF

SAVE will restore the output to the same state it was at before the meter was powered down. On will activate the output at power up. OFF will deactivate the output at power up.

SETPOINT ACTION



OFF tOUt bOUnd LAtCH

OFF: When not using a setpoint, it should be set to OFF (no action).

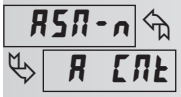
For Counter Assignments:

- **tOUt** With Timed Out action, the setpoint output activates when the count value equals the setpoint value and deactivates after the Time Out value. This action is not associated with Boundary types.
- **bOUnd** With boundary action, the setpoint output activates when the count value is greater than or equal to (for tYP = Hi) or less than or equal to (for tYP = Lo) the setpoint value. The setpoint output will deactivate when the count value is less than (for tYP = Hi) or greater than (for tYP = Lo) the setpoint value.
- **LAtCH** With Latch action, the setpoint output activates when the count value equals the setpoint value. The output remains active until reset. This action is not associated with Boundary types.

For Rate Assignments:

- **tOUt** With Timed Out action, the setpoint output cycles when the rate value is greater than or equal to (for tYP = Hi) or less than or equal to (for tYP = Lo) the setpoint value. The Setpoint Time Out (tOUt-n) and Setpoint On Delay (tOn-n) values determine the cycling times.
- **bOUnd** With Boundary action, the setpoint output activates when the rate value is greater than or equal to (for tYP = Hi) or less than or equal to (for tYP = Lo) the setpoint value. The setpoint output will deactivate (Auto reset) as determined by the hysteresis value.
- **LAtCH** With Latch action, the setpoint output activates when the rate value is equal to the setpoint value. The setpoint output remains active until reset. If after reset, the rate value is greater than or equal to (for tYP = Hi) or less than or equal to (for tYP = Lo) the setpoint value, the output will reactivate.

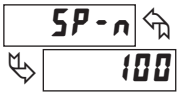
PAXC & I: SETPOINT ASSIGNMENT



A Cnt b Cnt C Cnt rAtE

Select the display that the setpoint is to be assigned.

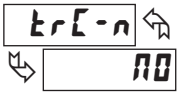
SETPOINT VALUE



-99999 to 999999

Enter the desired setpoint value. Setpoint values can also be entered in the Quick Programming Mode when the setpoint is configured as Ent in Module 3. (See Module 2 for Exchange Parameter Lists explanation.)

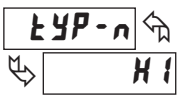
SETPOINT TRACKING



no SP-1 SP-2 SP-3
SP-4 ACntLd bCntLd CCntLd

If a selection other than NO is chosen, then the value of the setpoint being programmed ("n") will track the entered selection's value. Tracking means that when the selection's value is changed, the "n" setpoint value will also change (or follow) by the same amount.

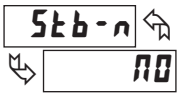
SETPOINT BOUNDARY TYPE



Hi Lo

Hi activates the output when the assigned display value (ACt-n) equals or exceeds the setpoint value. Lo activates the setpoint when the assigned display value is less than or equal to the setpoint.

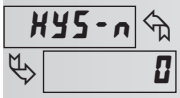
SETPOINT STANDBY OPERATION



YES no

Selecting YES will disable low acting setpoints at a power up until the display value crosses into the alarm "off" area. Once in the alarm "off" area, the setpoint will function according to the configured setpoint parameters.

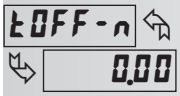
PAXI & R: SETPOINT HYSTERESIS



0 to 9999

The hysteresis value is added to (for tYP = Lo), or subtracted from (for tYP = Hi), the setpoint value to determine at what value to deactivate the associated setpoint output. Hysteresis is only available for setpoints assigned to the Rate with boundary action.

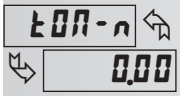
PAXI & R: SETPOINT OFF DELAY



0.00 to 99.99 seconds

This is the amount of time the Rate display must meet the setpoint deactivation requirements (below hysteresis for high acting and above hysteresis for low acting) before the setpoint's output deactivates.

PAXI & R: SETPOINT ON DELAY



0.00 to 99.99 seconds

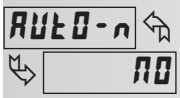
This is the amount of time the Rate display must meet the setpoint activation requirements (below setpoint for tYP = Lo and above setpoint for tYP = Hi) before the setpoint's output activates. If the Rate Setpoint Action is Timed Out, this is the amount of time the output is off during the on / off output cycling.

SETPOINT TIME OUT

0.00 to 99.99 seconds

If the setpoint action is Timed Out and the setpoint is assigned to Rate, then this is the amount of time the output is on during the on / off output cycling. If the setpoint action is Timed Out and the setpoint is assigned to Count, then this is the amount of time the output will activate once the count value equals the setpoint value.

PAXC & I: COUNTER AUTO RESET



no 2Er0AS CLdAS
2Er0AE CLdAE

This automatically resets the display value of the Setpoint Assignment (ASn-n) counter each time the setpoint value is reached. This reset may be different than the Counter's Reset Action (xrESEt) in Module 1 or 5.

SELECTION	ACTION
no	No auto reset.
2Er0AS	Reset to zero at the start of output activation.
CLdAS	Reset to count load value at the start of output activation.
2Er0AE	Reset to zero at the end of output activation. (tOUt action only).
CLdAE	Reset to count load value at the end of output activation. (tOUt action only).

PAXC & I: SETPOINT RESET WITH DISPLAY RESET

rSd-n / nO — YES NO

Select YES, so the setpoint output will deactivate (reset) when the Setpoint Assignment (ASn-n) counter display resets. The only exception is if the assigned counter is reset by a Counter Auto reset generated by another setpoint.

PAXC & I: SETPOINT RESET WHEN SPn+1 ACTIVATES

rSAS-n / nO — YES NO

Select YES, so the setpoint output will deactivate (reset) when SPn +1 activates. (Example: SP1 deactivates when SP2 activates and SP4 when SP1 activates.) The last setpoint will wrap around to the first.

PAXC & I: SETPOINT RESET WHEN SPn+1 DEACTIVATES

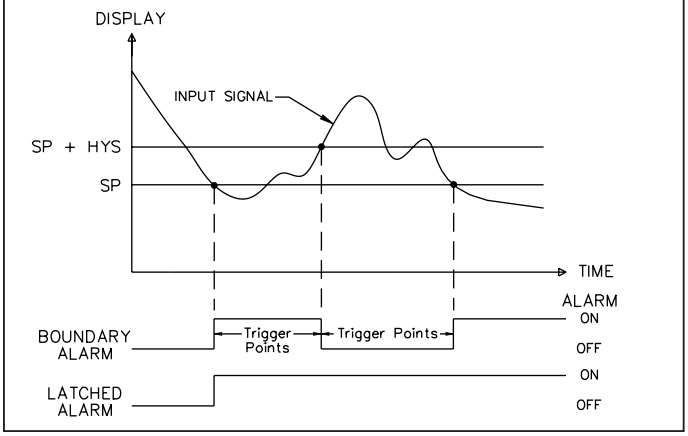
rSAE-n / nO — YES NO

Select YES, so the setpoint output will deactivate (reset) when SPn +1 activates and then times out (deactivates). This function may only be used if the SPn+1 is programmed for Setpoint Action of tOUt. (Example SP1 deactivates when SP2 is activated and then times out.) The last setpoint will wrap around to the first.

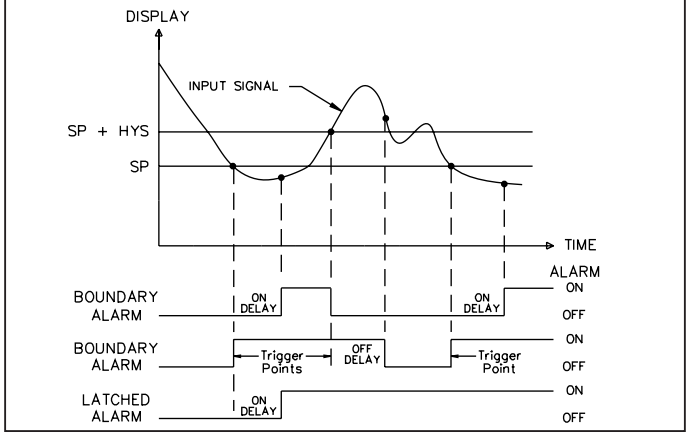
PAXR & I: SETPOINT (ALARM) FIGURES FOR RATE

(For Reverse Action, The Alarm state is opposite.)

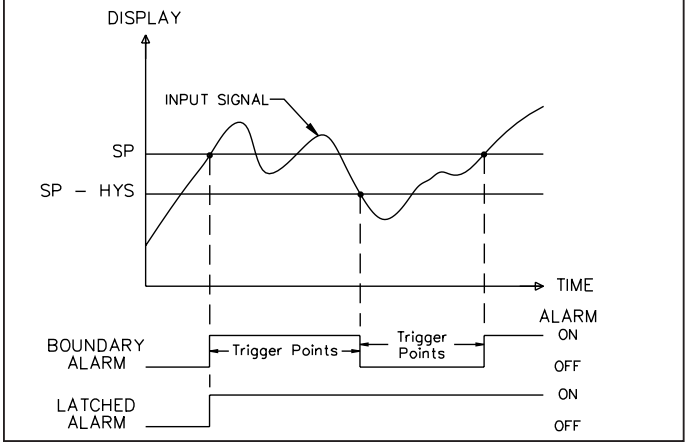
LOW ACTING WITH NO DELAY



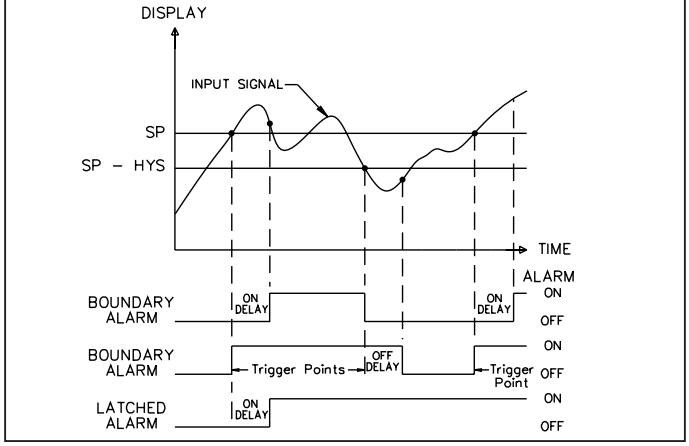
LOW ACTING WITH DELAY



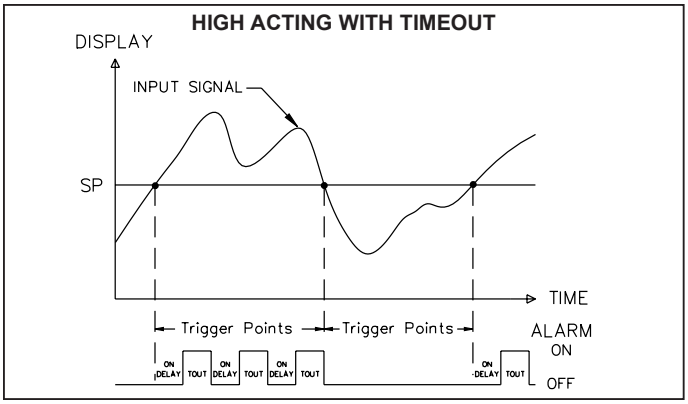
HIGH ACTING WITH NO DELAY



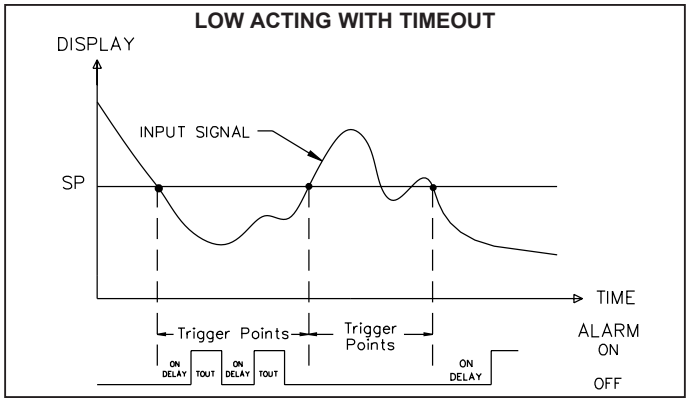
HIGH ACTING WITH DELAY



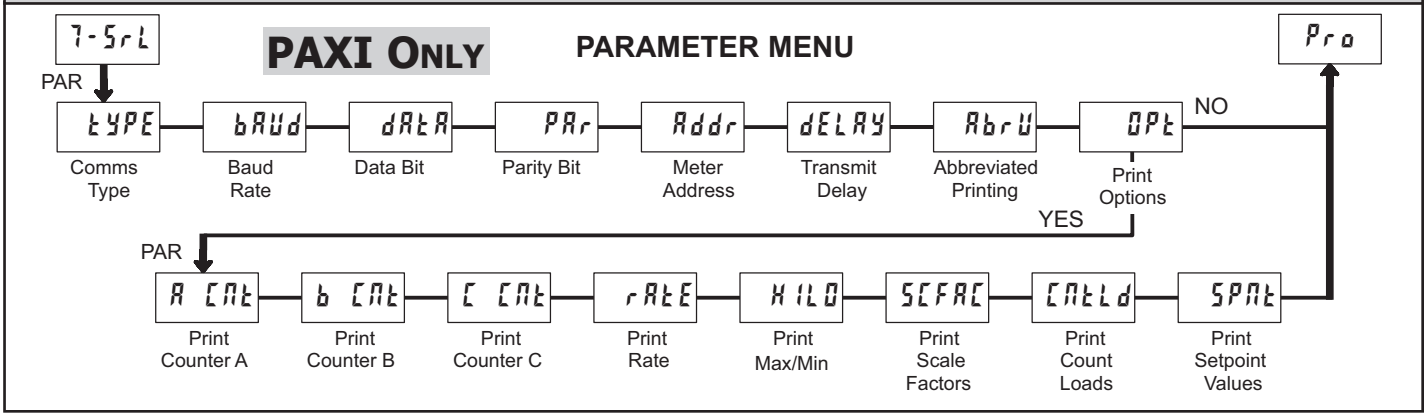
HIGH ACTING WITH TIMEOUT



LOW ACTING WITH TIMEOUT



6.7 MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS (7-SrL)



Module 7 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the PAXI with those of the host computer or other serial device, such as a terminal or printer. This programming module can only be accessed if an RS232 or RS485 Serial Communications card is installed.

This section also includes an explanation of the commands and formatting required for communicating with the PAXI. In order to establish serial communications, the user must have host software that can send and receive ASCII characters or Modbus protocol. Red Lion's Crimson software can be used for configuring the PAXI (See Ordering Information). For serial hardware and wiring details, refer to the bulletin shipped with the plug-in card.

This section does NOT apply to the DeviceNet or Profibus-DP communication cards. For details on the operation of the Fieldbus cards, refer to the bulletin shipped with each card.

COMMUNICATIONS TYPE

tYPE / Mbrtu

Mbrtu - Modbus RTU
MbASC - Modbus ASCII
rLC - RLC Protocol (ASCII)

Select the desired communications protocol. Modbus protocol provides access to all meter values and parameters. Since Modbus is included within the PAXI, the PAX Modbus option card, PAXCDC4, should not be used. The PAXCDC1 (RS485), or PAXCDC2 (RS232) card should be used instead.

BAUD RATE

bAUd / 38400

1200 2400 4800
9600 19200 38400

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

DATA BIT

dAtA / 8

7 8

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

PARITY BIT

PAr / nO

nO Odd EVEN

Set the parity bit to match that of the other serial communications equipment on the serial link. 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, an additional stop bit is used to force the frame size to 10 bits.

METER ADDRESS

Addr / 247

1 to 247 - Modbus
0 to 99 - RLC Protocol

Enter the serial meter (node) address. The address range is dependent on the tYPE parameter. With a single unit, configured for RLC protocol (tYPE = rLC), an address is not needed and a value of zero can be used. With multiple units (RS485 applications), a unique 2 digit address number must be assigned to each meter.

TRANSMIT DELAY

dELAY / 0.010

0.000 to 0.250 seconds

Following a transmit value ('*' terminator) or Modbus command, the PAXI will wait this minimum amount of time before issuing a serial response.

Parameters below only appear when Communications Type parameter (tYPE) is set to rLC.

ABBREVIATED PRINTING

AbrU / nO

YES nO

Select nO for full print or Command T transmissions (meter address, parameter data and mnemonics) or YES for abbreviated print transmissions (parameter data only). This will affect all the parameters selected in the print options. (If the meter address is 0, it will not be sent during a full transmission.)

PRINT OPTIONS

OPt / nO

YES - Enters the sub-menu to select the meter parameters to appear during a print request. For each parameter in the sub-menu, select YES for that parameter information to be sent during a print request or nO for that parameter information not to be sent. A print request is sometimes referred to as a block print because more than one parameter information (meter address, parameter data and mnemonics) can be sent to a printer or computer as a block.

PARAMETER	DESCRIPTION	FACTORY	MNEMONIC
A CNt	Counter A	YES	CTA
b CNt	Counter B	nO	CTB
C CNt	Counter C	nO	CTC
rAtE	Rate	nO	RTE
HILO	Max. & Min.	nO	MIN MAX
SCFAC	A B C Scale Factors	nO	SFA SFB SFC
CNtLd	A B C Count Load	nO	LDA LDB LDC
SPNt	1 2 3 4 Setpoints *	nO	SP1 SP2 SP3 SP4

**Setpoints are plug-in card dependent.*

SERIAL MODBUS COMMUNICATIONS

Modbus Communications requires that the Serial Communications Type Parameter (tYPE) be set to Modbus RTU (Mbrtu) or Modbus ASCII (MbASC).

PAXI CONFIGURATION USING CRIMSON AND SERIAL COMMUNICATIONS CARD

1. Install Crimson software.
2. Install RS232 or RS485 card and connect communications cable from PAXI to PC.
3. Supply power to PAXI.
4. Configure serial parameters to Modbus RTU (Mbrtu), 38,400 baud, address 247. (Note:These are the factory default settings.)
5. Create a new file (File, New) or open an existing PAXI V3.0+ database.
6. Configure Crimson Link options (Link, Options) to the serial port which the communication cable is attached (in step 2).

SUPPORTED FUNCTION CODES

FC03: Read Holding Registers

1. Up to 64 registers can be requested at one time.
2. HEX <8000> is returned for non-used registers.

FC04: Read Input Registers

1. Up to 64 registers can be requested at one time.
2. Block starting point can not exceed register boundaries.
3. HEX <8000> is returned in registers beyond the boundaries.
4. Input registers are a mirror of Holding registers.

FC06: Preset Single Register

1. HEX <8001> is echoed back when attempting to write to a read only register.
2. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit. It is also returned in the response.

FC16: Preset Multiple Registers

1. No response is given with an attempt to write to more than 64 registers at a time.
2. Block starting point cannot exceed the read and write boundaries (40001-41280).
3. If a multiple write includes read only registers, then only the write registers will change.
4. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit.

FC08: Diagnostics

The following is sent upon FC08 request:

Module Address, 08 (FC code), 04 (byte count), “Total Comms” 2 byte count, “Total Good Comms” 2 byte count, checksum of the string

“Total Comms” is the total number of messages received that were addressed to the PAXI. “Total Good Comms” is the total messages received by the PAXI with good address, parity and checksum. Both counters are reset to 0 upon response to FC08 and at power-up.

FC17: Report Slave ID

The following is sent upon FC17 request:

RLC-PAXI_V3 <a><b><0300h><0040h><0040h><0010h>

<a> = SP Card Status. “0”-None, “2”-Dual, “4”-Quad

<b> = Linear Card Status. “0”-Not Installed, “1”-Installed

<0300h> = Software Version Number (e.g. 3.00)

<0040h><0040h> = Max Register Reads/Writes (64)

<0010h> = Number of GUID/Scratch Pad Registers (16)

SUPPORTED EXCEPTION CODES

01: Illegal Function

Issued whenever the requested function is not implemented in the meter.

02: Illegal Data Address

Issued whenever an attempt is made to access a single register that does not exist (outside the implemented space) or to access a block of registers that falls completely outside the implemented space.

03: Illegal Data Value

Issued when an attempt is made to read or write more registers than the meter can handle in one request.

07: Negative Acknowledge

Issued when a write to a register is attempted with an invalid string length.

PAXI MODBUS REGISTER TABLE

This table shows the most commonly used registers for the PAXI. The complete register table listing is available at http://www.redlion.net.

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). The PAXI should not be powered down while parameters are being changed. Doing so may corrupt the non-volatile memory resulting in checksum errors.

REGISTER ADDRESS	REGISTER NAME	LOW LIMIT	HIGH LIMIT	FACTORY SETTING	ACCESS	COMMENTS
	FREQUENTLY USED REGISTERS					
40001	Counter A Value (Hi word)	-99999999	999999999	0	Read/Write	1 = 1 Display Unit
40002	Counter A Value (Lo word)					
40003	Counter B Value (Hi word)	-99999999	999999999	0	Read/Write	1 = 1 Display Unit
40004	Counter B Value (Lo word)					
40005	Counter C Value (Hi word)	-99999999	999999999	0	Read/Write	1 = 1 Display Unit
40006	Counter C Value (Lo word)					
40007	Rate Value (Hi word)	0	99999	0	Read/Write	1 = 1 Display Unit
40008	Rate Value (Lo word)					
40009	Min (Lo) Value (Hi word)	0	99999	0	Read/Write	1 = 1 Display Unit
40010	Min (Lo) Value (Lo word)					
40011	Max (Hi) Value (Hi word)	0	99999	0	Read/Write	1 = 1 Display Unit
40012	Max (Hi) Value (Lo word)					
40013	Counter A Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40014	Counter A Scale Factor (Lo word)					
40015	Counter B Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40016	Counter B Scale Factor (Lo word)					
40017	Counter C Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40018	Counter C Scale Factor (Lo word)					
40019	Counter A Count Load (Hi word)	-99999	999999	500	Read/Write	Active List (A or B)
40020	Counter A Count Load (Lo word)					
40021	Counter B Count Load (Hi word)	-99999	999999	500	Read/Write	Active List (A or B)
40022	Counter B Count Load (Lo word)					
40023	Counter C Count Load (Hi word)	-99999	999999	500	Read/Write	Active List (A or B)
40024	Counter C Count Load (Lo word)					
40025	Setpoint 1 Value (Hi word)	-199999	999999	100	Read/Write	Active List (A or B)
40026	Setpoint 1 Value (Lo word)					

REGISTER ADDRESS	REGISTER NAME	LOW LIMIT	HIGH LIMIT	FACTORY SETTING	ACCESS	COMMENTS
40027	Setpoint 2 Value (Hi word)	-199999	999999	200	Read/Write	Active List (A or B)
40028	Setpoint 2 Value (Lo word)					
40029	Setpoint 3 Value (Hi word)	-199999	999999	300	Read/Write	Active List (A or B)
40030	Setpoint 3 Value (Lo word)					
40031	Setpoint 4 Value (Hi word)	-199999	999999	400	Read/Write	Active List (A or B)
40032	Setpoint 4 Value (Lo word)					
	Manual Mode Registers					
40036	Manual Mode Register (MMR)	0	31	0	Read/Write	Bit State: 0 = Auto Mode, 1 = Manual Mode Bit 4 = S1, Bit 3 = S2, Bit 2 = S3, Bit 1 = S4, Bit 0 = Linear Output
40037	Analog Output Register (AOR)	0	4095	0	Read/Write	Linear Output Card written to only if Linear Output is in Manual Mode (MMR bit 0 = 1).
40038	Setpoint Output Register (SOR)	0	15	N/A	Read/Write	Status of Setpoint Outputs. Bit State: 0=Off, 1=On. Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4. Outputs can only be activated/reset with this register when the respective bits in the Manual Mode Register (MMR) are set.
40039	Reset Output Register	0	15	0	Read/Write	Bit State: 1= Reset Output, bit is returned to zero following reset processing; Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4

SERIAL RLC PROTOCOL COMMUNICATIONS

RLC Communications requires the Serial Communications Type Parameter (tYPE) be set to RLC Protocol (rLC).

SENDING SERIAL COMMANDS AND DATA TO THE METER

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 $. The <CR> is also available as a terminator when Counter C is in the SLAVE mode.

Command Chart

COMMAND	DESCRIPTION	NOTES
N	Node (Meter) Address Specifier	Address a specific meter. Must be followed by a two digit node address. Not required when address = 00.
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	Initiates a block print output. Registers are defined in programming.

Command String Construction

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

1. The first characters consist of the Node Address Specifier (N) followed by a 1 or 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. For node address 1 through 9, a leading zero character is not required. (The only exception is a numeric transmission when Counter C is set for slave mode.) 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 when Counter C is set for slave mode <CR>. The meter does not begin processing the command string until this character is received. See Timing Diagram figure for differences between terminating characters.

Sending Numeric Data

Numeric data sent to the meter must be limited to the digit range shown under transmit details 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 = 0.0 and 25 is written to a register. The value of the register is now 2.5.

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

Register Identification Chart

ID	VALUE DESCRIPTION	MNEMONIC	COMMAND	TRANSMIT DETAILS
A	Count A	CTA	T, V, R	6 digit (V), 8 digit (T)
B	Count B	CTB	T, V, R	6 digit (V), 8 digit (T)
C	Count C	CTC	T, V, R	6 digit (V), 8 digit (T)
D	Rate	RTE	T, V	5 digit, positive only
E	Min (Lo) Value	MIN	T, V, R	6 digit, positive only
F	Max (Hi) Value	MAX	T, V, R	6 digit, positive only
G	Scale Factor A	SFA	T, V	6 digit, positive only
H	Scale Factor B	SFB	T, V	6 digit, positive only
I	Scale Factor C	SFC	T, V	6 digit, positive only
J	Counter Load A	LDA	T, V	5 negative / 6 positive
K	Counter Load B	LDB	T, V	5 negative / 6 positive
L	Counter Load C	LDC	T, V	5 negative / 6 positive
M	Setpoint 1	SP1	T, V, R	5 negative / 6 positive
O	Setpoint 2	SP2	T, V, R	5 negative / 6 positive
Q	Setpoint 3	SP3	T, V, R	5 negative / 6 positive
S	Setpoint 4	SP4	T, V, R	5 negative / 6 positive
U	Auto/Manual Register	MMR	T, V	0 – auto, 1 - manual
W	Analog Output Register	AOR	T, V	0 – 4095 normalized
X	Setpoint Register	SOR	T, V	0 – not active, 1 – active

Command String Examples:

1. Address = 17, Write 350 to Setpoint 1.
   String: N17VM350$
2. Address = 5, Read Count A value.
   String: N5TA*
3. Address = 0, Reset Setpoint 4 output.
   String: RS*

RECEIVING DATA FROM THE METER

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. The meter response mode is established in Module 7.

Full Field Transmission (Address, Mnemonic, Numeric data)

Byte	Description
1, 2	2 byte Node (meter) 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
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 (bytes 1 and 2) are the unit address. If the address assigned is 00, two spaces are substituted. A space (byte 3) follows the unit address field. The next three characters (bytes 4 to 6) are the register mnemonic. The numeric data is transmitted next.

The numeric field (bytes 7 to 18) is 12 characters long. When the requested value exceeds eight digits for count values or five digits for rate values, an * (used as an overflow character) replaces the space in byte 7. Byte 8 is always a space. The remaining ten positions of this field (bytes 9 to 18) consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with <CR> (byte 19), and <LF> (byte 20). When a block print is finished, an extra <SP> (byte 21), <CR> (byte 22), and <LF> (byte 23) are used to provide separation between the transmissions.

Abbreviated Transmission (Numeric data only)

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.*

Meter Response Examples:

1. Address = 17, full field response, Count A = 875
   17 CTA 875 <CR><LF>
2. Address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5<CR><LF>
3. Address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

AUTO/MANUAL MODE REGISTER (MMR) ID: U

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint and analog output. In Manual Mode (1) the outputs are defined by the registers SOR and AOR. 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. In a write command string (VU), any character besides 0 or 1 in a field will not change the corresponding output mode.

U abcde
- e = Analog Output
- d = SP4
- c = SP3
- b = SP2
- a = SP1

Example: VU00011* places SP4 and Analog in manual.

ANALOG OUTPUT REGISTER (AOR) ID: W

This register stores the present signal value of the analog output. The range of values of this register is 0 to 4095, which corresponds to the analog output range per the following chart:

Register Value	Output Signal*		
	0-20 mA	4-20 mA	0-10 V
0	0.00	4.00	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, 4-20 mA or 0-10 V).*

Writing to this register (VW) while the analog output is in the Manual Mode causes the output signal level to update immediately to the value sent. While in the Automatic Mode, this register may be written to, but it has no effect until the analog output is placed in the manual mode. When in the Automatic Mode, the meter controls the analog output signal level. Reading from this register (TW) will show the present value of the analog output signal.

Example: VW2047* will result in an output of 10.000 mA, 12.000 mA or 5.000V depending on the range selected.

SETPOINT OUTPUT REGISTER (SOR) ID: X

This register stores the states of the setpoint outputs. Reading from this register (TX) will show the present state of all the setpoint outputs. A “0” in the setpoint location means the output is off and a “1” means the output is on.

X abcd
- d = SP4
- c = SP3
- b = SP2
- a = SP1

In Automatic Mode, the meter controls the setpoint output state. In Manual Mode, writing to this register (VX) will change the output state. Sending any character besides 0 or 1 in a field or if the corresponding output was not first in manual mode, the corresponding output value will not change. (It is not necessary to send least significant 0s.)

Example: VX10* will result in output 1 on and output 2 off.

COUNTER C SLAVE COMMUNICATIONS

Counter C may be programmed for **SLAVE**, to act as a serial slave display. By doing this, the carriage return <CR> is added as a valid command terminator character for all serial command strings. The <CR> as a terminator may be very useful for standard serial commands, even if Counter C is never displayed or sent a slave message. The $ terminator should not be used in the slave mode. If numeric values are not to be saved to memory, then send the value as a literal transmission with <CR> terminator.

The Counter C slave display is right aligned. It has a capacity of displaying six characters. When less than six characters are received, blank spaces will be placed in front of the characters. If more than six characters are sent, then only the last six are displayed. The meter has a 192 character buffer for the slave display. If more than 192 characters are sent, the additional characters are discarded until a terminator is received. Counter C processes numeric and literal transmissions differently.

Numeric Transmissions

When a string that does not begin with #, T, V, P or R is received, the meter processes it as a Numeric transmission. In this case, only the recognized numbers and punctuation are displayed. All other characters in the string are discarded. If a negative sign appears anywhere in the string the resulting number will be negative. Only the most significant decimal point is retained. If no numerical characters are received, then the numeric value will be zero. The numeric display can be used for setpoint (boundary action only) and analog output functions. When using this display for setpoint and analog output values, the decimal point position must match the programming entered through the front panel. The numeric value is retained in Counter C memory until another Numeric transmission is received.

Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Recognized Punctuation = period, comma, minus

Literal Transmissions

When a string that begins with # is received, the meter processes it as a Literal transmission. In this case, any unrecognized characters will be replaced with a space. A Literal display will replace a Numeric value in the Counter C display. However, it will not remove a previous Numeric value from Counter C memory or prevent the Counter C outputs from functioning with the Numeric value. Literal transmissions are only possible when using RS232 or RS485 cards.

Recognized Characters = a, b, c, d, e, f, g, h, i, j, l, n, o, p, q, r, s, t, u, y, z (in upper or lower case)
Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Recognized Punctuation = period, comma, minus, blank

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 slave only <CR>) 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 from 2 msec to 15 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 and the Serial Transmit Delay parameter (dELAY). The '*' or '<CR>' terminating character results in a response time window of the Serial Transmit Delay time (dELAY) plus 15 msec. maximum. The dELAY parameter should be programmed to a value that 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 15 msec maximum. The response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

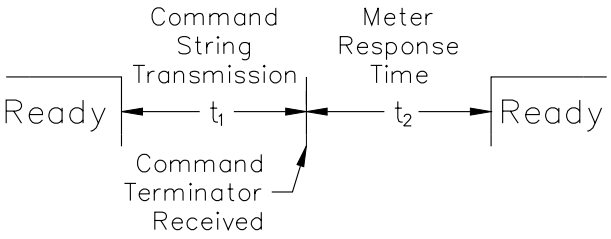
At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel. At the end of t_3, the meter is ready to receive the next command.

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

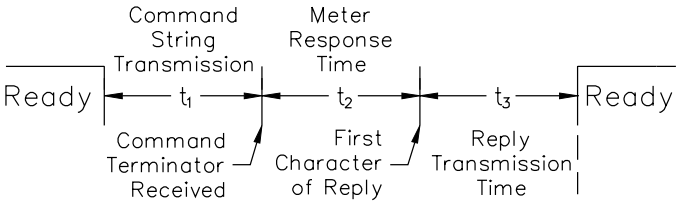
The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.

Timing Diagrams

NO REPLY FROM METER



RESPONSE FROM METER



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.

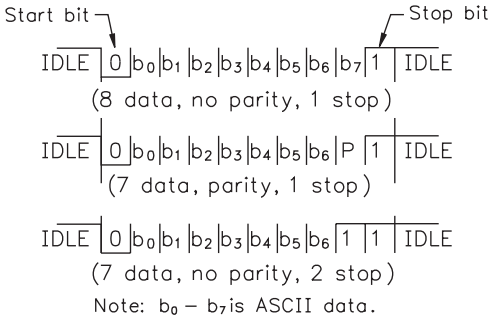
The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

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.

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.



Character Frame Figure

Parity bit

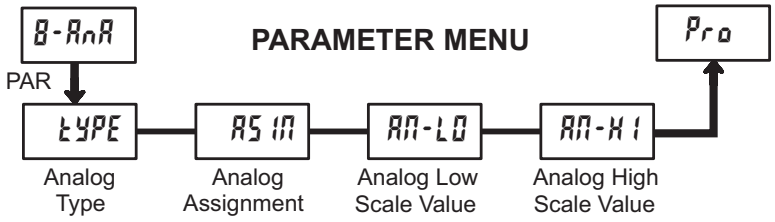
After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits 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. If 7 data bits and no parity is selected, then 2 stop bits are sent from the PAXI.

6.8 MODULE 8 - ANALOG OUTPUT PARAMETERS (8-AnA)

PAXI ONLY



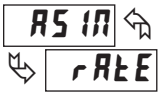
Module 8 is the programming for the analog output parameters. To have an analog output signal, an analog output plug-in card needs to be installed (See Ordering Information). For analog output hardware and wiring details, refer to the bulletin shipped with the plug-in card.

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 voltage output use terminals 16 and 17. For current output use terminals 18 and 19. Only one range can be used at a time.

ANALOG ASSIGNMENT

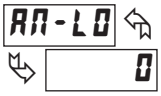


A CNt b CNt C CNt
rAtE LO HI

Select the display that the analog output is to follow:

A CNt = Counter A Value
b CNt = Counter B Value
C CNt = Counter C Value
rAtE = Rate Value
LO = Minimum Value
HI = Maximum Value

ANALOG LOW SCALE VALUE

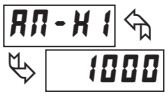


-99999 to 999999

Enter the display value within the selected Analog Assignment that corresponds to the low limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

ANALOG HIGH SCALE VALUE

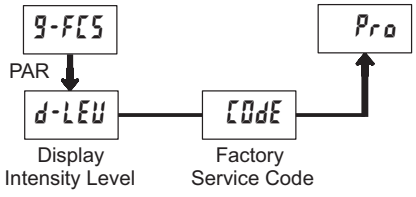


-99999 to 999999

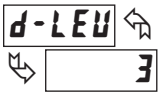
Enter the display value within the selected Analog Assignment that corresponds to the high limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

6.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FCS)

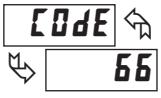


DISPLAY INTENSITY LEVEL



Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

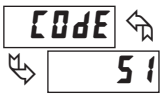
RESTORE FACTORY DEFAULTS



Use the arrow keys to display CodE 66 and press **PAR**. The meter will display rESEt and then returns to CodE 50. Press **DSP** key to return to the Display Mode. This will overwrite all user settings with the factory settings.

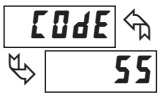
Pressing the **PAR** and **DSP** keys at the same time on power-up will load the factory settings and display Err4. This allows operation in the event of a memory failure or corrupted data. Immediately press **RST** key and reprogram the meter. If the meter is powered down again before pressing the **RST** key, the existing dynamic data will not be overwritten.

UNIT TYPE AND VERSION



The meter briefly displays the unit type followed by the current firmware version (VEr x.x), and then returns to CodE 50. This information is also displayed during the meter power-up sequence.

INPUT A AND B LOGIC SELECTION

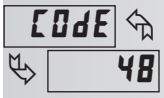


The Count Inputs A and B are factory configured for falling edge triggered (active low) operation in single edge count modes. The Counter Operating Mode descriptions in the Input programming section reflect this logic. If an application is better suited to use rising edge triggered (active high) operation, the Input Logic for Input A and/or Input B can be changed by entering Code 55.

Selecting HI-ACt sets the Input A logic to rising edge triggered (active high) operation. Be advised that all references to Input A falling edge and Input A rising edge will be reversed for the Counter Operating Mode descriptions.

Selecting HI-ACt sets the Input B logic to rising edge triggered (active high) operation. Be advised that all references to Input B falling edge and Input B rising edge will be reversed for the Counter Operating Mode descriptions.

PAXI: CALIBRATION



The only item in the PAXI meter that can be calibrated is the Analog Output. The Count A and B values are scaled using the parameters in Module 1, Counter C value is scaled using Module 5 and the Rate value is scaled using Module 4. If the meter appears to be indicating incorrectly or inaccurately, refer to the Troubleshooting section.

When Analog Out recalibration is required (generally every 2 years), it should be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

***Note**: Allow a 30 minute warm-up period before staring calibration.*

Analog Output Card Calibration

Before starting, verify that a precision meter with an accuracy of 0.05% or better (voltmeter for voltage output and/or current meter for current output) is connected and ready. Then perform the following procedure:

1. Use the arrow keys to display CodE 48 and press **PAR**.
2. CALOUt is displayed. Use the arrow keys to select YES and press **PAR**.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAXI arrow keys to adjust the output so that the external meter display matches the selection being calibrated. When the external reading matches, or if the range is not being calibrated, press **PAR**.

SELECTION	EXTERNAL METER	ACTION
0.0_A	0.00	Adjust if necessary, press **PAR**
4.0_A	4.00	Adjust if necessary, press **PAR**
20.0_A	20.00	Adjust if necessary, press **PAR**
0.0u	0.00	Adjust if necessary, press **PAR**
10.0u	10.00	Adjust if necessary, press **PAR**

4. When CodE 50 appears, press **PAR** twice and remove the external meters.

TROUBLESHOOTING

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

PROBLEM	REMEDIES
NO DISPLAY	**CHECK**: Power level, power connections
PROGRAM LOCKED-OUT	**CHECK**: Active (lock-out) user input **ENTER**: Security code requested
CERTAIN DISPLAYS ARE LOCKED OUT	**CHECK**: Module 3 programming
INCORRECT DISPLAY VALUE or NOT COUNTING	**CHECK**: Input wiring, DIP switch setting, input programming, scale factor calculation, input signal level, user input jumper, lower input signal frequency
USER INPUT NOT WORKING CORRECTLY	**CHECK**: User input wiring, user input jumper, user input being used for signal, Module 2
OUTPUT DOES NOT WORK	**CHECK**: Corresponding plug-in card installation, output configuration, output wiring
JITTERY DISPLAY	**CHECK**: Wiring is per EMC installation guidelines, input signal frequency, signal quality, scaling, update time, DIP switch setting
"r OLOL" **RATE**	**CHECK**: Lower input signal frequency, reduce rate scaling
MODULES or PARAMETERS NOT ACCESSIBLE	**CHECK**: Corresponding plug-in card installation, related controlling parameter selected
ERROR CODE (Err 1-4)	**PRESS**: Reset key (if unable to clear contact factory.)
SERIAL COMMUNICATIONS	**CHECK**: Wiring, connections, meter and host settings

Shaded areas are model dependent.

Model PAXI - 1/8 DIN Dual Counter/Rate Meter

This is a brief overview of the PAXI. For complete specifications and programming information, see the **PAX Digital Input Panel Meters Bulletin** starting on **page 68**.

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CE

- *COUNTER, DUAL COUNTER, RATE AND SLAVE DISPLAY*
- *6-DIGIT 0.56" RED SUNLIGHT READABLE OR STANDARD GREEN DISPLAY*
- *VARIABLE INTENSITY DISPLAY*
- *10 POINT SCALING (FOR NON-LINEAR PROCESSES)*
- *FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)*
- *RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)*
- *COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)*
- *BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP*
- *CRIMSON PROGRAMMING SOFTWARE*

PAXI SPECIFICATIONS

MAXIMUM SIGNAL FREQUENCIES TABLE

To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

FUNCTION QUESTIONS	**Single**: Counter A or B (with/without rate) or Rate only								**Dual**: Counter A & B or Rate not assigned to active single counter							
Are any setpoints used?	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
Is Prescaler Output used?	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Is Counter C used?	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
COUNT MODE	(Values are in KHz)				(Values are in KHz)				(Values are in KHz)				(Values are in KHz)			
Count x1	34	25	21	17	18	15	13	11	13	12	13	11	9	7.5	9	7
Count x2	17	13	16	12	9	7	8	7	9 *	7 *	9 *	7 *	5 *	4 *	5 *	4 *
Quadrature x1	22	19	20	17	12	10	11	10	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x2	17	13	16	12	9	7	8	6	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x4	8	6	8	6	4	3	4	3								
Rate Only	34	N/A	21	N/A	34	N/A	21	N/A								

ANNUNCIATORS:
A - Counter A
B - Counter B
C - Counter C
r - Rate
H - Maximum (High) Rate
L - Minimum (Low) Rate
OF - Upper significant digit display of counter
SP1 - setpoint 1 output state
SP2 - setpoint 2 output state
SP3 - setpoint 3 output state
SP4 - setpoint 4 output state

RATE DISPLAY:
Accuracy: ±0.01%
Minimum Frequency: 0.01 Hz
Maximum Frequency: see Max Signal Frequencies Table.
Maximum Display: 5 Digits: 99999
Adjustable Display (low) Update: 0.1 to 99.9 seconds
Over Range Display: "r OLOL"

COUNTER DISPLAYS:
Maximum display: 8 digits: ± 99999999 (greater than 6 digits display Alternates between high order and low order.)

INPUTS A and B:
DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.
LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, I_{MAX} = 1.9 mA.
Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.
Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.
MAGNETIC PICKUP:
Sensitivity: 200 mV peak
Hysteresis: 100 mV
Input impedance: 3.9 KΩ @ 60 Hz
Maximum input voltage: ±40 V peak, 30 Vrms
DUAL COUNT MODES:
When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

PRESCALER OUTPUT:
NPN Open Collector: I_{SNK} = 100 mA max. @ V_{OL} = 1 VDC max. V_{OH} = 30 VDC max. With duty cycle of 25% min. and 50 % max.

MODEL PAX2D – 1/8 DIN DIGITAL INPUT PANEL METER

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3RSD
PROCESS CONTROL EQUIPMENT

COUNT, DUAL COUNTER WITH MATH FUNCTIONS

RATE, DUAL RATE WITH MATH FUNCTIONS

SLAVE DISPLAY

UNIVERSAL AC/DC POWER SUPPLY

6 / 9 DIGIT DUAL LINE/TRI-COLOR DISPLAY WITH 0.71" & 0.35" DIGITS

10 POINT RATE SCALING FOR NON-LINEAR PROCESSES

PROGRAMMABLE UNITS DISPLAY

BUS CAPABILITIES; DEVICENET, Modbus, AND PROFIBUS-DP

BUILT-IN USB PROGRAMMING PORT ENABLING UNIT CONFIGURATION WITH CRIMSON PROGRAMMING SOFTWARE

NEMA 4X/IP65 SEALED FRONT BEZEL

DESCRIPTION

The PAX2D Digital Panel Meter offers many features and performance capabilities that are not available on standard panel meters. The basic meter is a dual counter and dual rate meter all in the same package. A third counter and third rate display allows the user to do simple math functions. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

Highlighting the PAX2D is a dual line, display with a large 0.71" tri-color 6 digit top display line and a 0.35", 9 digit green bottom display line. The meter also offers programmable units display providing the ability to tag the display with units of measure. Display color change capability provides machine operators a visual indication of changing conditions, even when the operator is not close enough to read the actual display value. In addition, a universal power supply provides the ultimate in flexibility for both AC and DC power.

The meter accepts digital inputs from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups and all standard RLC sensors. The meter can process directional, uni-directional or Quadrature signals simultaneously. The meter accepts input signals up to 50 KHz maximum depending on the count mode and function configurations programmed. Each input signal can be independently scaled to various process values.

The meter provides a MAX and MIN rate reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The meter has up to four setpoint outputs, implemented on plug-in option cards. The plug-in cards provide dual FORM-C relays, quad FORM-A, or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

The PAX2 can be programmed to utilize Modbus protocol. With Modbus, the user has access to most configuration parameters. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meter has a feature that allows a remote computer to directly control the outputs of the meter. Communication and bus capabilities are also available as option cards. These include RS232, RS485, DeviceNet, and Profibus-DP.

The PAX2 includes a built-in USB programming port. With a Windows® based program, made available by Red Lion Controls, configuration data can be downloaded to the PAX2 without the need of any additional option cards.

A linear DC output signal is available as an optional plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track any of the counter, rate, max or min displays, or any setpoint value.

After the meter has been initially configured, the parameter programming may be locked out from further modification in its entirety, or allowing selected values accessible for quick entry.

The meter has been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel,extensive testing of noise effects with regard to CE requirements, the meter provides a tough reliable application solution.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this 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.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.5" (140) W.

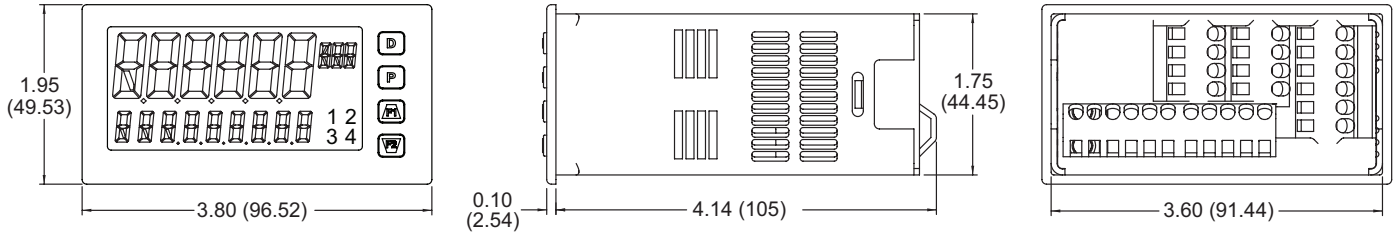


Table Of Contents

Ordering Information

Meter Part Numbers

MODEL NO.	DESCRIPTION	PART NUMBER
PAX2D	Digital Input Panel Meter	PAX2D000

Option Card and Accessories Part Numbers

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
Optional Plug-In Cards	PAXCDS	Dual Setpoint Relay Output Card	PAXCDS10
		Quad Setpoint Relay Output Card	PAXCDS20
		Quad Setpoint Sinking Open Collector Output Card	PAXCDS30
		Quad Setpoint Sourcing Open Collector Output Card	PAXCDS40
	PAXCDC [1]	RS485 Serial Communications Card with Terminal Block	PAXCDC10
		Extended RS485 Serial Communications Card with Dual RJ11 Connector	PAXCDC1C
		RS232 Serial Communications Card with Terminal Block	PAXCDC20
		Extended RS232 Serial Communications Card with 9 Pin D Connector	PAXCDC2C
		DeviceNet Communications Card	PAXCDC30
		Profibus-DP Communications Card	PAXCDC50
	PAXCDL	Analog Output Card	PAXCDL10
Accessories	SFCRD[2]	Crimson PC Configuration Software for Windows 2000, XP and Windows 7	SFCRD200
	CBLUSB	USB Programming Cable Type A-Mini B	CBLUSB01

Notes:
1. For Modbus communications use RS485 Communications Output Card and configure communication (tYPE) parameter for Modbus.
2. Crimson software is available for free download from http://www.redlion.net/

General Meter Specifications

A

1. **DISPLAY**: Negative image LCD
   Top Line - 6 digit, 0.71" (18 mm), with tri-color backlight (red, green or orange), display range: -199,999 to 999,999;
   Bottom Line - 9 digit, 0.35" (8.9 mm), with green backlight, display range: - 199,999,999 to 999,999,999
2. **POWER**:
   AC Power: 40 to 250 VAC, 50/60 Hz, 20 VA
   DC Power: 21.6 to 250 VDC, 8 W
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs.
3. **SENSOR POWER**: +18 VDC, ±5% @ 60 mA max., short circuit protected
4. **ANNUNCIATORS**:
   Line 1 Units Display – Programmable 3 digit units annunciator with tri-color backlight (red, green or orange)
   Setpoint Output Status Indicators - Red backlight color
   1 - Setpoint 1 output
   2 - Setpoint 2 output
   3 - Setpoint 3 output
   4 - Setpoint 4 output
5. **KEYPAD**: 2 programmable function keys, 4 keys total
6. **COUNTER DISPLAYS**: 6-digit (top line) or 9-digit (bottom line)
   Top Line Display Range: -199,999 to 999,999
   Bottom Line Display Range: -199,999,999 to 999,999,999
   Over Range Display: OVEr
   Under Range Display: UndEr
   Display Designators: CtA, Ctb, CtC (top line), A, b, C (bottom line)
   Maximum Count Rates: 50% duty cycle, count mode dependent
   If setpoints disabled: 35 KHz for all modes except Quadrature x4 (32 KHz)
   If setpoint(s) enabled: 20 KHz for any mode except Quadrature x1 (19 KHz), Quadrature x2 (17 KHz) and Quadrature x4 (10 KHz)
7. **RATE DISPLAYS**: 6-digit (top or bottom line)
   Rate A or Rate B Display Range: 0 to 999,999
   Rate C, Rate Max (High) or Min (Low) Display Range: -199,999 to 999,999
   Over Range Display: OVEr
   Under Range Display: UndEr
   Display Designators: rtA, rtb, rtC, Hi, Lo (top or bottom line)
   Maximum Frequency: 50 KHz
   Minimum Frequency: 0.001 Hz
   Display Update Time: 0.1 to 999.9 seconds
   Accuracy: ±0.01%
8. **SIGNAL INPUTS (INPUT A and INPUT B)**:
   See Section 2.0 Setting the DIP Switches for complete input specifications. DIP switch selectable inputs accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors. Inputs accept current sinking or current sourcing outputs and provide selectable input filtering for low frequency signals or switch contact debounce.
   DUAL COUNT MODES:
   When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Input Active parameter (USrACt) .
9. **USER INPUTS**: Three programmable user inputs
   Max. Continuous Input: 30 VDC
   Isolation To Sensor Input Common: Not isolated.
   Response Time: 12 msec. max.
   Logic State: User Selectable for sinking (active low) or sourcing (active high)

INPUT STATE	SINKING INPUTS	SOURCING INPUTS
	20KΩ pull-up to +3.3V	20KΩ pull-down
Active	V_{IN} < 1.1 VDC	V_{IN} > 2.2 VDC
Inactive	V_{IN} > 2.2 VDC	V_{IN} < 1.1 VDC

10. **PRESCALER OUTPUT:**
    NPN Open Collector: I_{SNK} = 100 mA max. @ V_{OL} = 1 VDC max. V_{OH} = 30 VDC max. Duty cycle 25% min. and 50 % max.
11. **MEMORY**: Nonvolatile memory retains all programmable parameters and count values when power is removed.
12. **ENVIRONMENTAL CONDITIONS**:
    Operating Temperature Range: 0 to 50 °C
    Storage Temperature Range: -40 to 60 °C
    Vibration to IEC 68-2-6: Operational 5-150 Hz, 2 g
    Shock to IEC 68-2-27: Operational 25 g (10 g relay)
    Operating and Storage Humidity: 0 to 85% max. RH non-condensing
    Altitude: Up to 2000 meters
13. **CERTIFICATIONS AND COMPLIANCES**:
    CE Approved
    EN 61326-1 Immunity to Industrial Locations
    Emission CISPR 11 Class A
    IEC/EN 61010-1
    RoHS Compliant
    UL Listed: File #E179259
    Type 4X Indoor Enclosure rating (Face only)
    IP65 Enclosure rating (Face only)
    IP20 Enclosure rating (Rear of unit)
    Refer to EMC Installation Guidelines section of the bulletin for additional information.
14. **CONNECTIONS**: High compression cage-clamp terminal block
    Wire Strip Length: 0.3" (7.5 mm)
    Wire Gauge Capacity: One 14 AWG (2.55 mm) solid, two 18 AWG (1.02 mm) or four 20 AWG (0.61 mm)
15. **CONSTRUCTION**: This unit is rated NEMA 4X/IP65 for indoor use only. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/ case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.
16. **WEIGHT**: 8 oz. (226.8 g)

Optional Plug-in Output Cards

WARNING: Disconnect all power to the unit before installing plug-in cards.

Adding Option Cards

The PAX2D meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

COMMUNICATION CARDS (PAXCDC)

A variety of communication protocols are available for the PAX2D meter. Only one PAXCDC card can be installed at a time. *Note: For Modbus communications use RS485 Communications Output Card and configure communication (tYPE) parameter for Modbus.*

PAXCDC10 - RS485 Serial (Terminal)
PAXCDC1C - RS485 Serial (Connector)
PAXCDC20 - RS232 Serial (Terminal)
PAXCDC2C - RS232 Serial (Connector)
PAXCDC30 - DeviceNet
PAXCDC50 - Profibus-DP

SERIAL COMMUNICATIONS CARD

Type: RS485 or RS232
Communication Type: RLC Protocol (ASCII), Modbus RTU, and Modbus ASCII
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min. Working Voltage: 50 V. Not Isolated from all other commons.
Data: 7/8 bits
Baud: 1200 to 38,400
Parity: no, odd or even
Bus Address: Selectable 0 to 99 (RLC Protocol), or 1 to 247 (Modbus Protocol), Max. 32 meters per line (RS485)
Transmit Delay: Selectable for 0 to 0.250 sec (+2 msec min)

DEVICENET™ CARD

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 I 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.

PROFIBUS-DP CARD

Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rates: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud
Station Address: 0 to 125, set by rotary switches.
Connection: 9-pin Female D-Sub connector
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

PROGRAMMING SOFTWARE

Crimson® software is a Windows® based program that allows configuration of the PAX® meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter's program can then be saved in a PC file for future use. Crimson can be downloaded at www.redlion.net

SETPOINT CARDS (PAXCDS)

The PAX2D meter has 4 available setpoint alarm output plug-in cards. Only one PAXCDS card can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
PAXCDS20 - Quad Relay, FORM-A, Normally open only
PAXCDS30 - Isolated quad sinking NPN open collector
PAXCDS40 - Isolated quad sourcing PNP open collector

DUAL RELAY CARD

Type: Two FORM-C relays
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min. Working Voltage: 240 Vrms
Contact Rating:
One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive 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

Type: Four FORM-A relays
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min. Working Voltage: 250 Vrms
Contact Rating:
One Relay Energized: 3 amps @ 240 VAC or 30 VDC (resistive load).
Total current with all four relays energized not to exceed 4 amps
Life Expectancy: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

QUAD SINKING OPEN COLLECTOR CARD

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 CARD

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 VDC unregulated, 30 mA max. total
External supply: 30 VDC max., 100 mA max. each output

LINEAR DC OUTPUT (PAXCDL)

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

ANALOG OUTPUT CARD

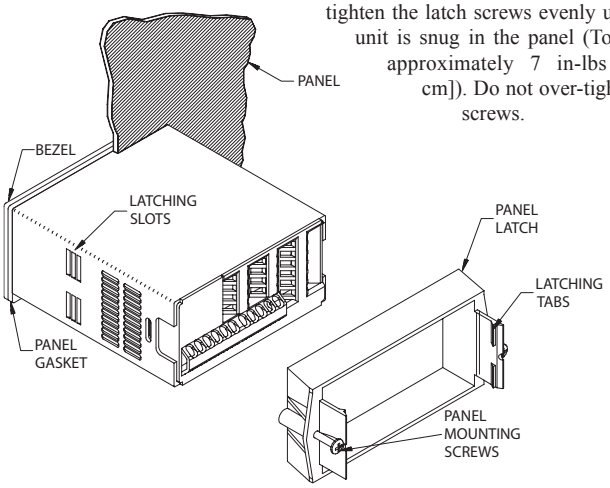
Types: 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min. Working Voltage: 50 V. Not Isolated from all other commons.
Accuracy: 0.17% of FS (18 to 28 °C); 0.4% of FS (0 to 50 °C)
Resolution: 1/3500
Compliance: 10 VDC: 10 KΩ load min., 20 mA: 500 Ω load max.
Powered: Self-powered
Response Time: 50 msec max., 10 msec typicat

1.0 Installing the Meter

Installation

The PAX2D meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.

While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.



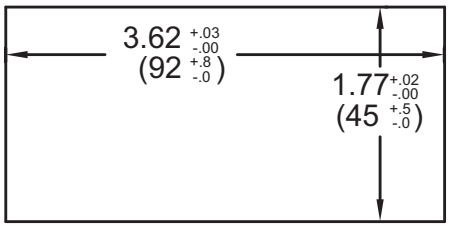
Installation Environment

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

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

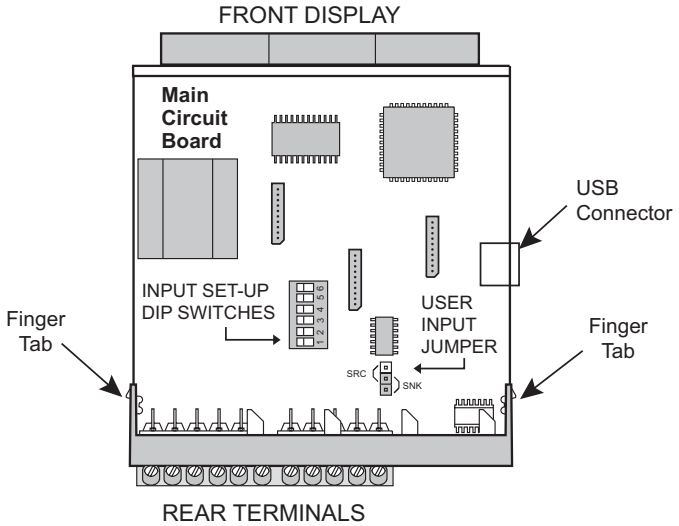
PANEL CUT-OUT



2.0 Setting the DIP Switches

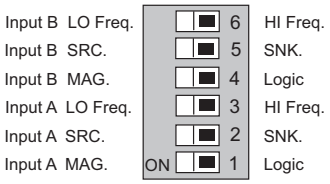
To access the switches, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.



SETTING THE INPUT DIP SWITCHES

The meter has six DIP switches for Input A and Input B terminal set-up that must be set before applying power.



■ Factory Setting

SWITCHES 1 and 4

LOGIC: Input trigger levels V_{IL} = 1.5 V max.; V_{IH} = 3.75 V min.
MAG: 200 mV peak input sensitivity; 100 mV hysteresis; maximum voltage: ± 40 V peak (28 Vrms); Input impedance: 3.9 KΩ @ 60 Hz; Must also have SRC switch ON. (Not recommended with counting applications.)

SWITCHES 2 and 5

SNK.: Adds internal 7.8 KΩ pull-up resistor to +5 VDC, I_{MAX} = 0.7 mA.
SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.3 mA max. @ 28 VDC, V_{MAX} = 30 VDC.

SWITCHES 3 and 6

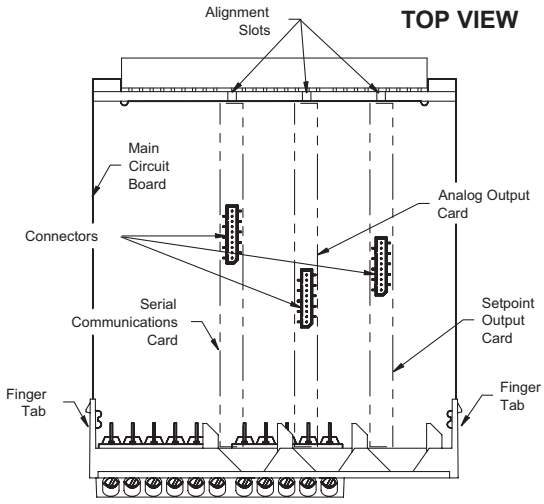
HI Frequency: Removes damping capacitor and allows max. frequency.

LO Frequency: Adds a damping capacitor for switch contact bounce. Also limits input frequency to maximum 50 Hz and input pulse widths to minimum 10 msec.

3.0 Installing Plug-In Cards

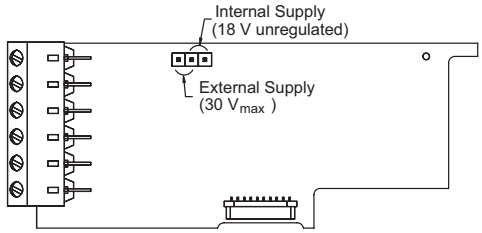
The plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The plug-in cards have many unique functions when used with the PAX2D.

CAUTION: The plug-in card 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.



To Install:

1. With the meter removed from the case, locate the plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.
   If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.



2. Install the plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the plug-in card label to the bottom side of the meter in the designated area. 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.

4.0 Wiring the Meter

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure (Pull wire to verify tightness). Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

EMC INSTALLATION GUIDELINES

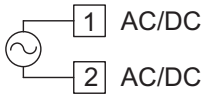
Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. Long cable runs are more susceptible to EMI pickup than short cable runs.
5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:
   Fair-Rite part number 0443167251 (RLC part number FCOR0000)
   Line Filters for input power cables:
   Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)
6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
   a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
   b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.
   RLC part numbers: Snubber: SNUB0000
   Varistor: ILS11500 or ILS23000
7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit RLC's web site at http://www.redlion.net/Support/InstallationConsiderations.html for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

4.1 POWER WIRING

AC Power



DC Power

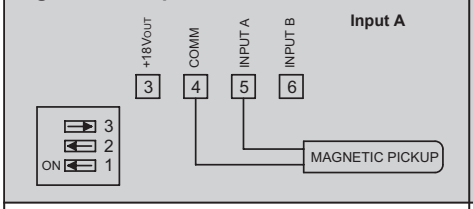
The power supplied to the meter shall employ a 15 Amp UL approved circuit breaker for AC input and a 1 Amp, 250 V UL approved fuse for DC input. It shall be easily accessible and marked as a disconnecting device to the installed unit. This device is not directly intended for connection to the mains without a reliable means to reduce transient over-voltages to 1500 V.

4.2 INPUT SIGNAL WIRING

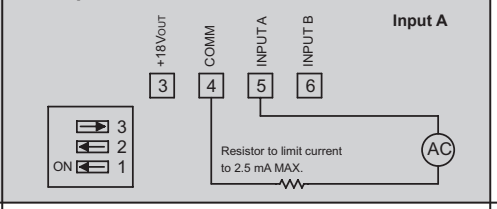
CAUTION: Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth ground; and the common of the isolated plug-in cards with respect to input common.

If you are wiring Input B, connect signal to Terminal 6 instead of 5, and set DIP switches 4, 5, and 6 to the positions shown for 1, 2, and 3.

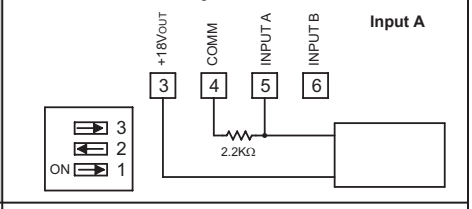
Magnetic Pickup



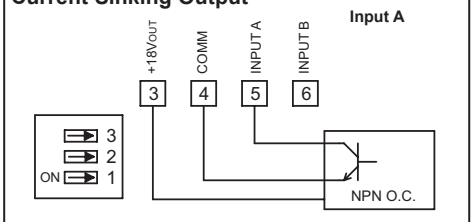
AC Inputs From Tach Generators, Etc.



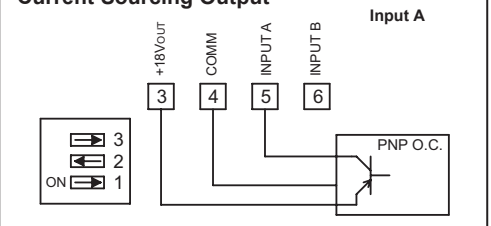
Two Wire Proximity, Current Source



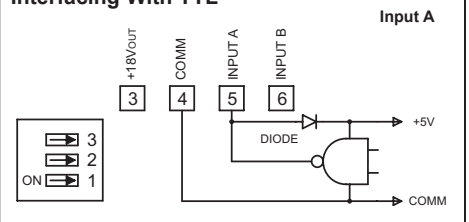
Current Sinking Output



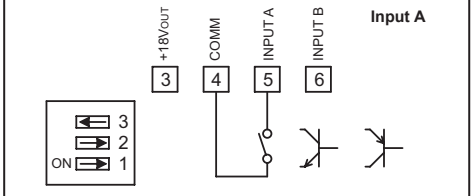
Current Sourcing Output



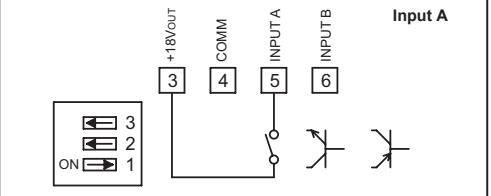
Interfacing With TTL



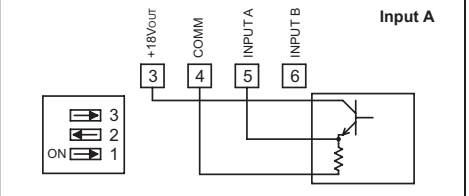
Switch or Isolated Transistor; Current Sink



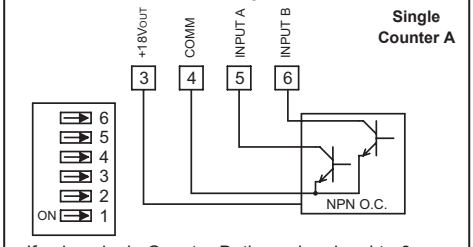
Switch or Isolated Transistor; Current Source



Emitter Follower; Current Source

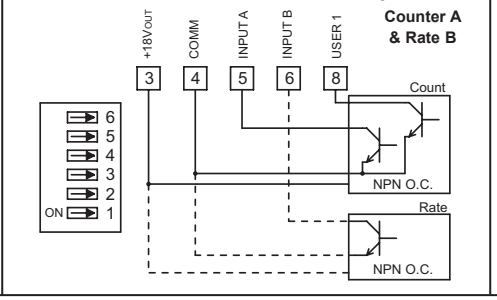


Quad; Current Sink Output

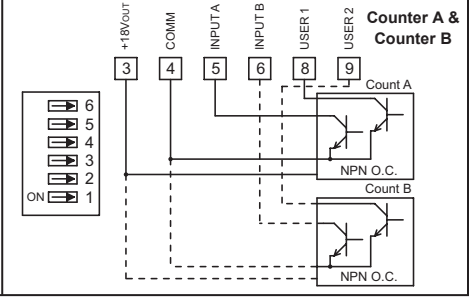


If using single Counter B, then wire signal to 6, and Quad/Direction to 9. Set switches as shown.

Dual Quad/Count; Current Sink Output



Dual Quad/Quad; Current Sink Output



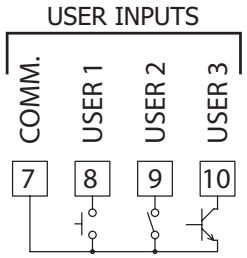
Shaded areas not recommended for counting applications.

4.3 USER INPUT WIRING

If User Input 1 and/or 2 are wired for quadrature or directional counting, an additional switching device should not be connected to that User Input terminal. User Input terminal does not need to be wired in order to remain in inactive state.

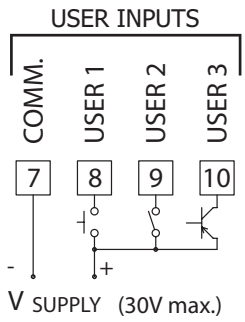
Sinking Logic (USrACt LO)

When the USrACt parameter is programmed to LO, the user inputs of the meter are internally pulled up to +3.3 V with 20 KΩ resistance. The input is active when it is pulled low (<1.1 V).



Sourcing Logic (USrACt HI)

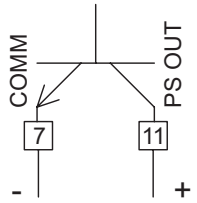
When the USrACt parameter is programmed to HI, the user inputs of the meter are internally pulled down to 0 V with 20 KΩ resistance. The input is active when a voltage greater than 2.2 VDC is applied.



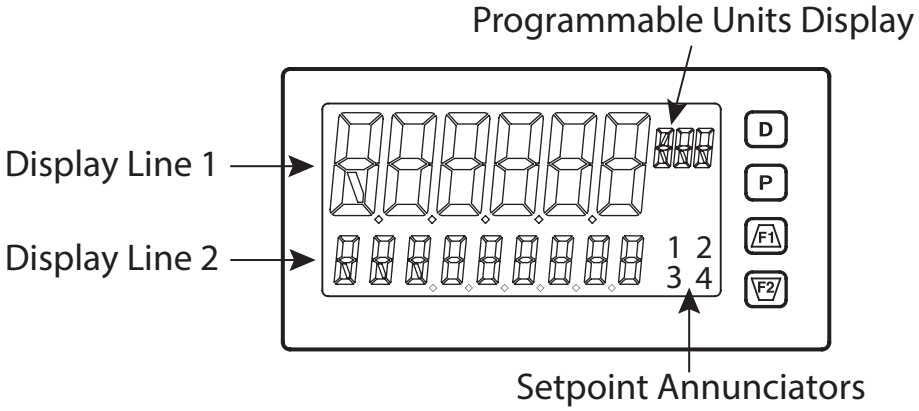
4.4 SETPOINT (ALARMS) WIRING
4.5 SERIAL COMMUNICATION WIRING
4.6 ANALOG OUTPUT WIRING

See appropriate plug-in card bulletin for wiring details.

4.7 PRESCALER OUTPUT WIRING (NPN O.C.)



5.0 FRONT PANEL KEYS AND DISPLAY OVERVIEW



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
D	Index through enabled Line 2 display values	Return to the previous menu level (momentary press) Quick exit to Display Mode (press and hold)
P	Enter full programming mode or access the parameter and hidden display loops; Press and hold to skip parameters and go directly to Code or Programming Menu	Access the programming parameter menus, store selected parameter and index to next parameter
F1	User programmable Function key 1; hold for 3 seconds for user programmable second function 1 Index through enabled Line 1 values (factory setting)	Increment selected parameter value; Hold F1 and momentarily press F2 key to increment next decade or **D** key to increment by 1000's
F2	User programmable Function key 2; hold for 3 seconds for user programmable second function 2 Reset Line 1 (factory setting)	Decrement selected parameter value; Hold F2 and momentarily press F1 key to decrement next decade or **D** key to decrement by 1000's

DISPLAY LINE 1

Line 1 is the large, 6-digit top line display. Counter values, rate values and the maximum (Hi) and minimum (Lo) rate capture values can be shown on Line 1. The 3-digit Units mnemonic characters can be used to indicate which Line 1 display value is shown. Standard or custom mnemonics are available for the Line 1 values. See Line 1 parameters in the Display Parameters programming section for configuration details.

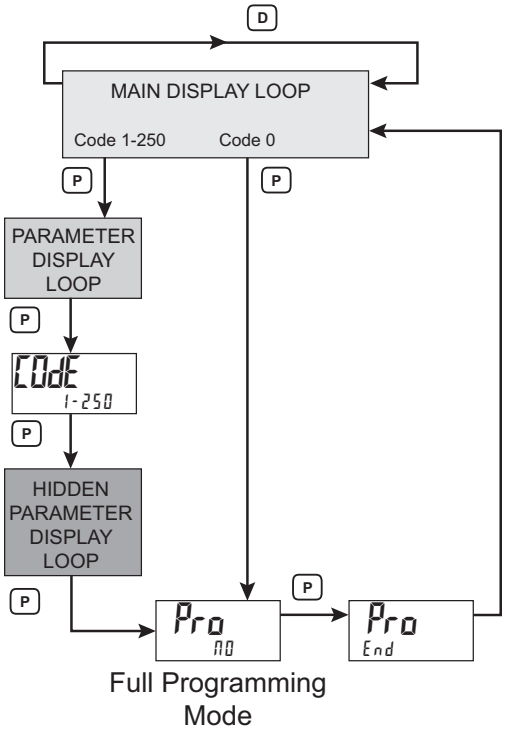
DISPLAY LINE 2

Line 2 is the smaller, 9-digit bottom line display. Counter values, rate values, rate capture values, setpoint values and parameter List A/B status can all be shown on the Line 2 display. The display loops described below are used to view, reset and modify the selected display values, based on the Line 2 Value Access setting programmed for each available value. See Line 2 parameters in the Display Parameters programming section for configuration details.

LINE 2 DISPLAY LOOPS

A

The PAX2D offers three display loops to allow users quick access to needed information.



Main Display Loop

In the Main display loop, the D key is pressed to sequence through the selected Line 2 values. A left justified 2 or 3-character mnemonic indicates which Line 2 value is currently shown. When in the Main display loop, the Function keys F1 and F2 perform the user functions programmed in the User Input parameter section.

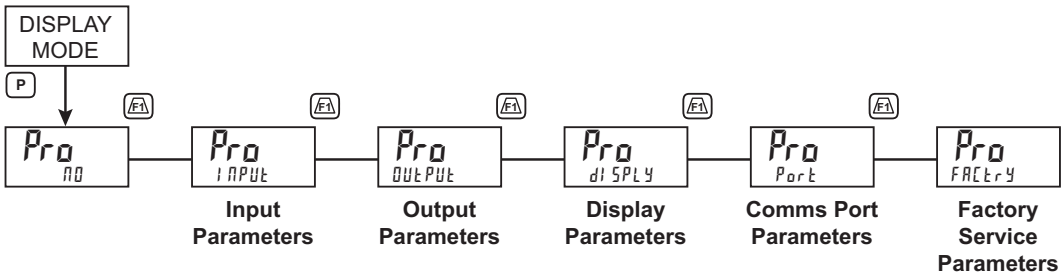
Parameter and Hidden Parameter Display Loops

These Display loops provide quick access to selected parameters that can be viewed and modified on Line 2 without having to enter Full Programming mode. These values include Parameter List A/B selection, setpoints, scale factors, counter load values and display (color, intensity and contrast) settings. To utilize the Parameter or Hidden Parameter Display Loops, a security code (1-250) must be programmed. (See Programming Security Code in the Display Parameters programming section for details.)

The Parameter Display Loop is accessed by pressing the **P** key. The selected Parameter Display Loop values can be viewed and/or changed per the Line 2 Value Access setting programmed for each available value. The Hidden Parameter Display Loop follows the Parameter display loop, and can only be accessed when the correct security code is entered at the Code prompt. Combining the two parameter loops provides an area for parameters that require general access and/or protected or secure access depending on the application needs.

While in the Parameter and Hidden Parameter loops, pressing the **D** key will return the meter to the Main Display Loop. To directly access the Code prompt, press and hold the **P** key. This can be done from the Main display loop or at any point during the Parameter display loop. Also, to directly access Full Programming mode while in the Hidden Parameter loop, press and hold the **P** key to bypass any remaining Hidden Parameter loop values.

6.0 PROGRAMMING THE PAX2D



It is recommended that program settings be recorded as programming is performed. A blank Parameter Value Chart is provided at the end of this bulletin.

PROGRAMMING MODE ENTRY

The Programming Mode is entered by pressing the **P** key. Full Programming Mode will be accessible unless the meter is programmed to use the Parameter loop or Hidden Parameter loop on the Line 2 display. In this case, programming access will be limited by a security code and/or a hardware program lock. (Refer to the previous section for details on Line 2 display loops and limited programming access.) Full Programming Mode permits all parameters to be viewed and modified. In this mode, the front panel keys change to Programming Mode Operations and certain user input functions are disabled.

MODULE ENTRY

The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The F1 and F2 keys are used to select the desired module. The displayed module is entered by pressing the **P** key.

MODULE MENU

Upon entering a module, a parameter selection sub-menu is provided to choose the specific parameter type for programming. For example, this includes counter, rate and user input under the Input Parameter menu. Use the F1 and F2 keys to select the desired parameter type, and press the **P** key to enter the parameter menu.

PARAMETER MENU

Upon entering the Parameter Menu, the **P** key is pressed to advance to a specific parameter to be changed. After completing the parameter menu, or upon pressing the **D** key, the display returns to the initial entry point for the parameter menu. For each additional press of the **D** key, the display returns to the previous level within the module until exiting the module entirely.

SELECTION/VALUE ENTRY

For each parameter, the top line display shows the parameter while the bottom line shows the selections/value for that parameter. The F1 and F2 keys are used to move through the selections/values for the parameter. Pressing the **P** key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

Numerical Value Entry

If the parameter is programmed for enter (Entr), the F1 and F2 keys are used to change the parameter values in any of the display loops.

The F1 and F2 keys will increment or decrement the parameter value. When the F1 or F2 key is pressed and held, the value automatically scrolls. The longer the key is held the faster the value scrolls.

For large value changes, press and hold the F1 or F2 key. While holding that key, momentarily press the opposite arrow key (F2 or F1) to shift decades (10's 100's, etc), or momentarily press the **D** key and the value scrolls by 1000's as the arrow key is held. Releasing the arrow key removes the decade or 1000's scroll feature. The arrow keys can then be used to make small value changes as described above.

As an alternative, a Select and Set value entry method is provided. This can be used in combination with the value scrolling described above. To change the selected digit in the numerical value, press both the F1 and F2 keys simultaneously. The next digit to the left will be selected (flashing). If both keys are pressed and held, the selected digit will scroll from right to left until one or both keys are released.

Once a digit is selected, the arrow keys are used to increment or decrement that digit to the desired number.

PROGRAMMING MODE EXIT

To exit the Programming Mode, press and hold the **D** key (from anywhere in the Programming Mode) or press the **P** key with Pro no displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the **P** key must be pressed to store the change before pressing the **D** key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

It is recommended to start with the Input Parameters and proceed through each module in sequence. If lost or confused while programming, press and hold the **D** key to exit programming mode and start over. It is recommended that program settings be recorded as programming is performed. When programming is complete lock out programming with a user input or lock-out code.

Factory Settings may be completely restored in the Factory Service Operations module. This is useful when encountering programming problems.

A

INPUT PARAMETERS (INPUT)

INPUT SELECT

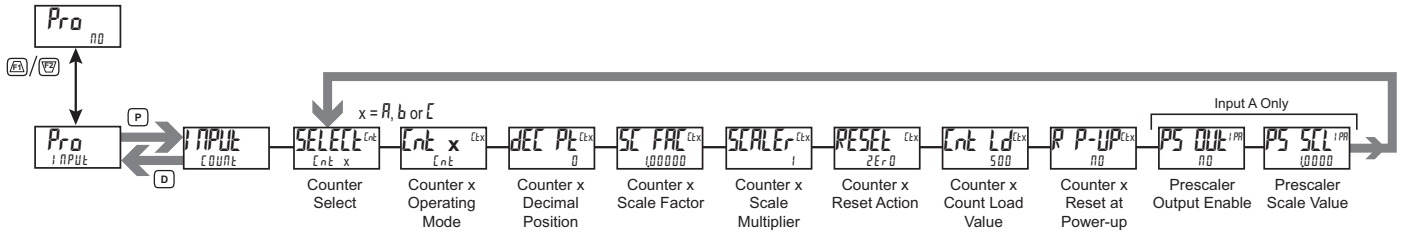
COUNT RATE USER

Select the Count, Rate or User Input to be programmed.

COUNTER INPUT PARAMETERS (COUNT)

This section details the programming for Counter A and the Prescaler Output, Counter B, and Counter C. For maximum input frequency, the counters not being used should be set to mode NONE. The Prescaler should be set to no when it is not in use. When set to NONE or no, the remaining related parameters are not accessible. A Select Parameter List feature for Scale Factors and Count Load values is explained in the User Input programming section.

In the display depictions shown in this section, "x" represents A, B, or C for the counter being programmed.

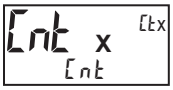


COUNTER SELECT

Cnt A Cnt b Cnt C

Select the Counter to be programmed.

COUNTER OPERATING MODE



Choose the operating mode for the selected counter.

Counter A Selections

SELECTION	MODE	DESCRIPTION
NONE	None	Does not count.
Cnt	Count X1	Adds Input A falling edge.
CntUd	Count X1 w/direction	Adds Input A falling edge if Input B is high. Subtracts Input A falling edge if Input B is low.
dCntUd	Dual Count X1 w/direction	Adds Input A falling edge if User 1 is high. Subtracts Input A falling edge if User 1 is low.
AddAdd	Dual Input X1 Add/Add	Adds Input A falling edge and Input B falling edge.
AddSub	Dual Input X1 Add/Subtract	Adds Input A falling edge. Subtracts Input B falling edge.
QUAd1	Quad X1	Adds Input A rising edge when Input B is high. Subtracts Input A falling edge when Input B is high
QUAd2	Quad X2	Adds Input A rising edge when Input B is high and Input A falling edge when Input B is low. Subtracts Input A falling edge when Input B is high and Input A rising edge when Input B is low.
QUAd4	Quad X4	Adds Input A rising edge when Input B is high, Input A falling edge when Input B is low, Input B rising edge when Input A is low, and Input B falling edge when Input A is high. Subtracts Input A falling edge when Input B is high, Input A rising edge when Input B is low, Input B rising edge when Input A is high, and Input B falling edge when Input A is low.
dQUAd1	Dual Count Quad X1	Adds Input A rising edge when User 1 is high. Subtracts Input A falling edge when User 1 is high.
dQUAd2	Dual Count Quad X2	Adds Input A rising edge when User 1 is high and Input A falling edge when User 1 is low. Subtracts Input A falling edge when User 1 is high and Input A rising edge when User 1 is low.
Cnt2	Count X2	Adds Input A rising and falling edges.
CntUd2	Count X2 w/direction	Adds Input A rising and falling edges if Input B is high. Subtracts Input A rising and falling edge if Input B is low.
dCtUd2	Dual Count X2 w/direction	Adds Input A rising and falling edges if User 1 is high. Subtracts Input A rising and falling edge if User 1 is low.

A

Counter B Selections

SELECTION	MODE	DESCRIPTION
nonE	None	Does not count.
bAtCH	Batch	Counter B internally counts the number of output activations of the selected setpoint(s). The count source is selected in the Yes/No sub-menu shown for each setpoint (bAt S1 thru bAt S4).
Cnt	Count X1	Adds Input B falling edge.
dCntUd	Dual Count X1 w/direction	Adds Input B falling edge if User 2 is high. Subtracts Input B falling edge if User 2 is low.
dqUAd1	Dual Count Quad X1	Adds Input B rising edge when User 2 is high. Subtracts Input B falling edge when User 2 is high.
dqUAd2	Dual Count Quad X2	Adds Input B rising edge when User 2 is high and Input B falling edge when User 2 is low. Subtracts Input B falling edge when User 2 is high and Input B rising edge when User 2 is low.
Cnt2	Count X2	Adds Input B rising and falling edges.
dCtUd2	Dual Count X2 w/direction	Adds Input B rising and falling edges if User 2 is high. Subtracts Input B rising and falling edge if User 2 is low.

Counter C Selections

SELECTION	MODE	DESCRIPTION
nonE	None	Does not count.
Cnt A	Counter A	Counter C counts the incoming pulses from Counter A input as per Counter A mode of operation. The signal is scaled only according to Counter C parameters.
Cnt b	Counter B	Counter C counts the incoming pulses from Counter B input as per Counter B mode of operation. The signal is scaled only according to Counter C parameters.
Add Ab	Counter A + Counter B	Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and increment by 2 for each pulse received on Input B. Counter C scale settings are then applied and the result displayed.)
Sub Ab	Counter A – Counter B	Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation and subtracts the B counts from the A counts. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and decrement by 2 for each pulse received on Input B. Counter C scale settings are then applied and the result displayed.)

Note: Counter A, B and C must all be reset at the same time for the math to be performed on the display values.

bAtCH	Batch	Counter C internally counts the number of output activations of the selected setpoint(s). The count source is selected in the Yes/No sub-menu shown for each setpoint (bAt S1 thru bAt S4).
SLAUE	Slave	Counter C functions as a serial slave display. See Serial Communications section for details.

COUNTER DECIMAL POSITION

dEC Pt Ctx
0

0 0.0 0.00 0.000 0.0000 0.00000

This selects the decimal point position for the selected counter, and any setpoint value assigned to that counter. The selection will also affect that counter's scale factor calculations.

COUNTER SCALE FACTOR

SC FAC Ctx
1.00000

0.00001 to 9.99999

The number of input counts for the selected counter is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. For **Add Ab** and **Sub Ab** modes of operation, the math is performed on the input signals and then the result is scaled by Counter C scaling. To achieve correct results, both Input A and Input B must provide the same amount of pulses per unit of measurement. (Details on scaling calculations are explained at the end of this section.) Scale Factor values can also be entered during Program Lockout, if enabled in the Parameter Display loop. See "Line 2 Display Access" in the Display Parameter Module.

COUNTER SCALE MULTIPLIER

SCALEr Ctx
1

10 1 0.1 0.01

The number of input counts for the selected counter is multiplied by the scale multiplier and the scale factor to obtain the desired process value. (Details on scaling calculations are explained at the end of this section.)

COUNTER RESET ACTION

RESEt Ctx
ZEr0

ZEr0 Cnt Ld

When the selected counter is reset, it returns to zero or the counter count load value. This reset action applies to all selected counter resets, except a setpoint generated counter auto reset programmed in the Setpoint Output Parameter Module.

COUNTER COUNT LOAD VALUE

Cnt Ld Ctx
500

-199999 to 999999

When Reset To Count Load action is chosen, the selected counter will reset to this value. Count Load values can also be entered during Program Lockout, if enabled in the Parameter Display loop. See "Line 2 Display Access" in the Display Parameter Module.

COUNTER RESET AT POWER-UP

R P-UP Ctx
n0

n0 YES

The selected counter may be programmed to reset at each meter power-up.

◇◇

The next two parameters will only appear when programming Counter A.

PRESCALER OUTPUT ENABLE

PS OUt 1PA
n0

n0 YES

This enables the prescaler output. The prescaler output is useful for providing a lower frequency scaled pulse train to a PLC or another external counter. On each falling edge of Input A, the prescaler output register increments by the prescaler scale value (PS SCL). When the register equals or exceeds 1.0000, a pulse is output and the register is lowered by 1.0000. The prescaler register is reset to zero whenever Counter A is reset (except for Setpoint Counter Auto Reset). (See Prescaler Output Figure.)

PRESCALER SCALE VALUE

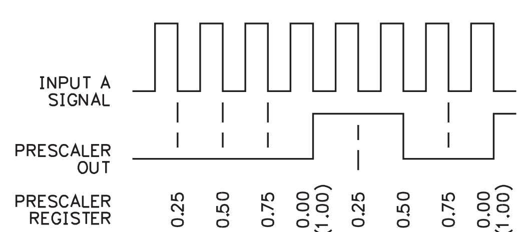
PS SCL 1PA
1.0000

0.0001 to 1.0000

The prescaler output frequency is the Input A frequency times the prescaler scale value.

PRESCALER OUTPUT FIGURE

Prescaler Output Value = 0.25



SCALING CALCULATION

Each counter has the ability to scale an input signal to a desired display value. This is accomplished by the counter mode (Cnt x), decimal point (dEC Pt), scale factor (SC FAC), and scale multiplier (SCALEr). The scale factor is calculated using:

$$SF\ (SC\ FAC) = \frac{DDD}{(\text{Number of pulses per 'single' unit} \times CMF \times SM)}$$

Where:

Number of pulses per 'single' unit: pulses per unit generated by the process (i.e. # of pulses per foot)

CMF: Counter Mode(Cnt x) times factor of the mode 1,2 or 4.

SM: Scale Multiplier (SCALEr) selection of 10, 1, 0.1 or 0.01.

DDD: Desired Display Decimal (1 =1, 1.0 = 10, 1.00 = 100, etc.)

Example:

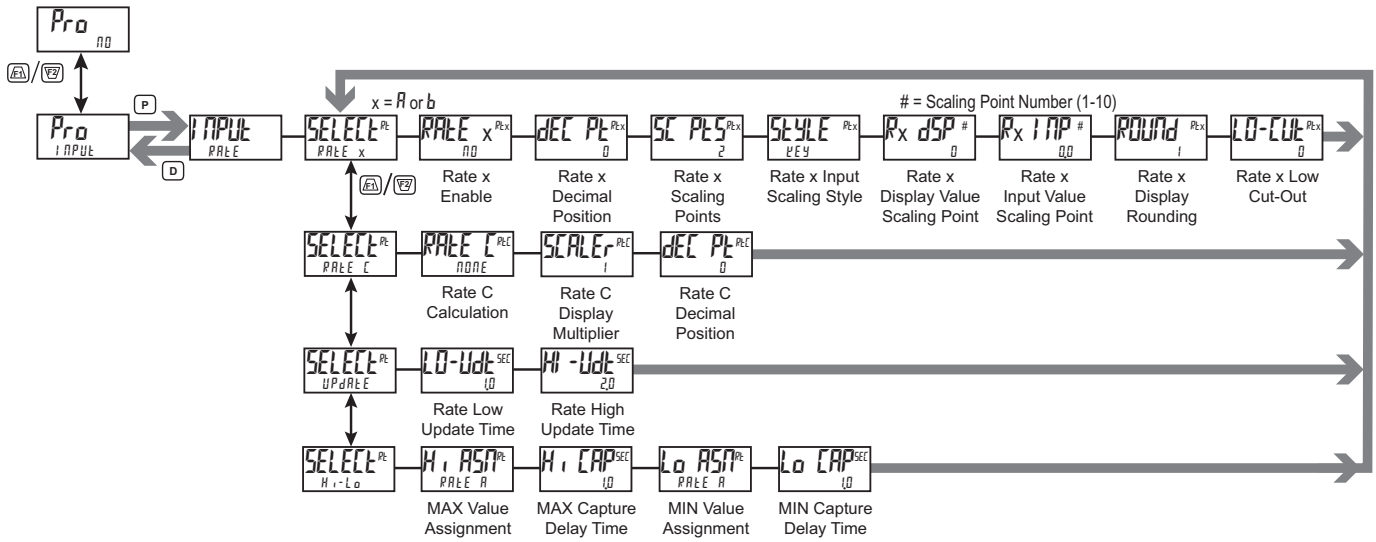
1. Indicate feet to the hundredths (0.00) with 100 pulses per foot: Scale Factor would be 100 / (100 x 1 x 1) = 1 (In this case, the scale multiplier and counter mode factor are 1)
2. Indicate feet with 120 pulses per foot: Scale Factor would be 1 / (120 x 1 x 1) = 0.0083333. (In this case, the scale multiplier of 0.01 could be used: 1 / (120 x 1 x 0.01) = 0.83333 or show to hundredths (0.00): 100 / (120 x 1 x 1) = 0.8333.)

General Rules on Scaling

1. It is recommended that, the scale factor be as close as possible to, but not exceeding 1.00000. This can be accomplished by increasing or decreasing the counter decimal point position, using the scale multiplier, or selecting a different count mode.
2. To double the number of pulses per unit, use counter modes direction X2 or quad X2. To increase it by four times, use counter mode quad X4. Using these modes will decrease the allowable maximum input frequency.
3. A scale factor greater than 1.00000 will cause Counter display rounding. In this case, digit jumps could be caused by the internal count register rounding the display. The precision of a counter application cannot be improved by using a scale factor greater than 1. 00000.
4. The number of pulses per single unit must be greater than or equal to the DDD value in order for the scale factor to be less than or equal to one.
5. Lowering the scale factor can be accomplished by lowering the counter decimal position. (Example: 100 (Hundredths)/10 pulses = 10.000 lowering to 10 (Tenths)/10 = 1.000.)

RATE INPUT PARAMETERS (RATE)

This section details programming for the Rate indicators (A, B and C) and the Maximum and Minimum Rate Capture displays. For maximum input frequency, the Rate indicators should be disabled when they are not in use. When Rate Enable (Rate A and B) or Rate Calculation (Rate C) is set to NO or NONE, the remaining related parameters are not accessible. In the display depictions shown in this section, "x" represents A or B for the rate indicator being programmed.



RATE SELECTION

RATE A RATE C Hi-Lo
RATE b UPdATE

Select the Rate parameters to be programmed.

RATE ENABLE

NO YES

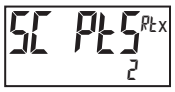
Select YES to measure the rate (speed) of pulses on the corresponding Input. Rate measurement is independent of the corresponding Counter count modes.

RATE DECIMAL POSITION

0 0.00 0.0000
0.0 0.000

This selects the decimal point position for the selected Rate indicator.

RATE SCALING POINTS



2 to 10

This parameter sets the number of scaling points for the Rate Scaling function. The number of scaling points used depends on the linearity of the process and the display accuracy required.

About Scaling Points

Each scaling point is specified by two programmable parameters: A desired Rate Display Value (Rx dSP) and a corresponding Rate Input Value (Rx INP). Scaling points are entered sequentially in ascending order of Rate Input value. Each scaling point defines the upper endpoint of a linear segment, with the lower endpoint being the previous scaling point.

Linear Application – 2 Scaling Points

Linear processes use two scaling points to provide a linear Rate display from 0 up to the maximum input frequency. For typical zero based frequency measurements, the lower point is set to display 0 for 0 Hz input (factory setting) and the upper point set to display the desired value for a given input frequency. For non-zero based applications, the lower point is set to the desired display for 0 Hz input.

Non-linear Application – Up to 10 Scaling Points

For non-linear processes, up to 10 scaling points may be used to provide a piece-wise linear approximation representing the non-linear function. The Rate Display will be linear between sequential scaling points. Thus, the greater the number of scaling points, the greater the conformity accuracy. The Crimson software provides several linearization equations for common Rate applications.

RATE INPUT SCALING STYLE

KEy APPLy

Rate Input values for scaling points can be entered by using the Key-in or the Applied style described below.

Key-in:

Enter the Rate Input value by pressing the F1 or F2 keys. This value is always in pulses per second (Hz).

Applied:

The existing programmed Rate Input value will appear. To retain this value, press the **P** key to continue to the next parameter. To enter a new value, apply an external rate signal to the appropriate input terminal. Press the F2 key and the applied input frequency (in Hz) will be displayed. To insure the correct reading, wait until a consistent reading is displayed, then press the **P** key to accept this value as the Rate Input Value and continue to the next parameter. Follow the same procedure if using more than 2 scaling points.

RATE DISPLAY VALUE SCALING POINT 1

0 to 999999

For all zero-based applications (display value 0 for 0 Hz input), the Display Value and Input Value for Scaling Point 1 should be set to 0 and 0.0 respectively. For non-zero based applications, enter the desired Display Value for a 0 Hz input.

RATE INPUT VALUE SCALING POINT 1

0.0 to 999999

Normally the Rate Input Value for Scaling Point 1 is 0.0.

RATE DISPLAY VALUE SCALING POINT 2

0 to 999999

Enter the desired Rate Display Value for Scaling Point 2.

RATE INPUT VALUE SCALING POINT 2

0.0 to 99999.9

Enter the corresponding Rate Input Value for Scaling Point 2, by using the Input Scaling Style selected.

RATE DISPLAY ROUNDING

1 5 20 100
2 10 50

Rounding values other than '1' round the Rate display to the nearest increment selected (e.g. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Rate display.

RATE LOW CUT-OUT

0 to 999999

The Low Cut Out value forces the Rate display to zero when the Rate display falls below the value entered.

RATE SCALING

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. (The Display and Input values can be entered by Key-in or Applied Methods.) These values are internally plotted to a Display value of 0 and Input value of 0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate.

KEY-IN SCALING METHOD CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (Rx dSP) and Scaling Input (Rx InP). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY (Rx dSP)	INPUT (Rx InP)
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

NOTES:

1. If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.

EXAMPLE:

1. With 15.1 pulses per foot, indicate feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
2. With 0.25 pulses per gallon, indicate whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

RATE C PARAMETERS

RATE C CALCULATION

Select the calculation for the Rate C display.

SELECTION	MODE	DESCRIPTION
NONE	None	Rate C disabled.
Add Ab	SUM (A+B)	Rate C shows the sum of Rate A and Rate B.
Sub Ab	DIFFERENCE (A-B)	Rate C shows the difference of Rate A and Rate B.
Pct Ab	RATIO (A/B)	Rate C shows the percentage of Rate A to Rate B.
Pct At	PERCENT OF TOTAL (A/A+B)	Rate C shows the percentage of Rate A to the total of Rate A and Rate B.
Pct dr	PERCENT DRAW (A-B/B)	Rate C shows the percent draw between Rate A and Rate B.

RATE C DISPLAY MULTIPLIER

SCALEr RtE
1

1 10 100 1000

Set the Display Multiplier to obtain the desired Rate C display resolution. For Rate C percentage calculations, the result is internally multiplied by 100 to show percent as a whole number. By using a Display Multiplier of 10, 100 or 1000, along with the proper decimal point position, percentage can be shown in tenths, hundredths or thousandths respectively.

RATE C DECIMAL POSITION

dEC Pt RtE
0

0 0.00 0.0000
0.0 0.000

Select the decimal point position for Rate C.

RATE UPDATE PARAMETERS

SELECt Rt
UPdAtE

RATE LOW UPDATE TIME (DISPLAY UPDATE)

LO-Udt SEC
1.0

0.1 to 999.9 seconds

The Low Update Time is the minimum amount of time between display updates for all enabled Rate displays. Small Low Update Time values may increase the possibility of the display indicating an unstable input (jittery display). The factory setting of 1.0 will update the display at a minimum of every second.

RATE HIGH UPDATE TIME

HI -Udt SEC
2.0

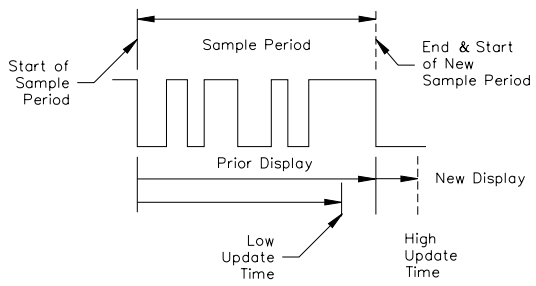
0.2 to 999.9 seconds

The High Update Time is the maximum amount of time before the enabled Rate displays are forced to zero. (For more explanation, refer to Input Frequency Calculation.) The High Update Time must be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

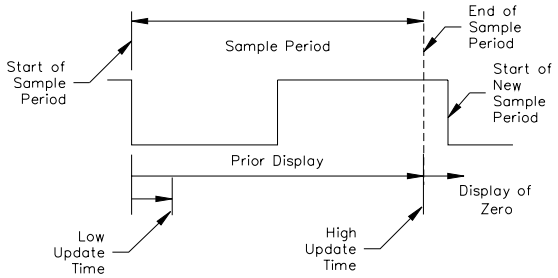
INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by either scaling method.

RATE VALUE CALCULATED



ZERO RATE CALCULATED



RATE MAXIMUM/MINIMUM CAPTURE PARAMETERS

SELECt Rt
Hi-Lo

MAXIMUM CAPTURE VALUE ASSIGNMENT

Hi ASN Rt
RAtE A

RAtE A RAtE b RAtE C

Select the Rate display to which the Maximum Capture value is assigned.

MAXIMUM CAPTURE DELAY TIME

Hi CAP SEC
1.0

0.0 to 999.9 seconds

When the assigned Rate value is above the present Maximum rate value for the entered amount of time, the meter will capture that Rate value as the new Maximum value. A delay time helps to avoid false captures of sudden short spikes.

MINIMUM CAPTURE VALUE ASSIGNMENT

Lo ASN Rt
RAtE A

RAtE A RAtE b RAtE C

Select the Rate display to which the Minimum Capture value is assigned.

MINIMUM CAPTURE DELAY TIME

Lo CAP SEC
1.0

0.0 to 999.9 seconds

When the assigned Rate value is below the present Minimum rate value for the entered amount of time, the meter will capture that Rate value as the new Minimum value. A delay time helps to avoid false captures of sudden short spikes.

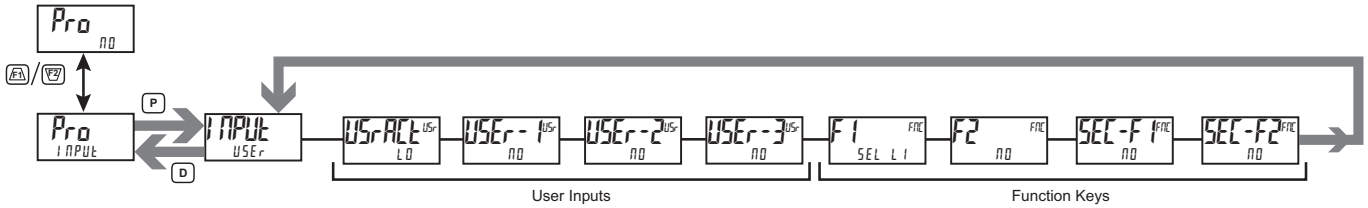
USER INPUT/FUNCTION KEY PARAMETERS (USEr)

This section details the programming for the rear terminal User Inputs and front panel Function Keys. Three user inputs are individually programmable to perform specific meter control functions. While in the Display Mode, the function is executed when the user input transitions to the active state. (Refer to the user input specifications for response times.) Certain User input functions are disabled in Programming Mode. Two front panel function keys, F1 and F2, are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed when the key is pressed. Holding the F1 or F2 function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function. The front panel key functions are disabled while in Programming Mode.

In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions are performed every time any of those user inputs or function keys transition to the active state.

The List user function has a value assignment sublist, which appears when the **P** key is pressed and LIST is selected. The function will only be performed for the assignment values selected as YES. If a user input or function key is configured for a function with a sublist, then that sublist will need to be scrolled through each time to access the remaining user inputs or function keys following the sublist.

Note: In the following explanations, not all selections are available for both user inputs and front panel function keys. Displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. In the parameter explanations, USEr-n represents all user inputs. Fn represents both function keys and second function keys.



USER INPUT ACTIVE STATE

USrACt LO LO HI

Select the desired active state for the User Inputs. Select LO for sink input, active low. Select HI for source input, active high.

NO FUNCTION

USEr-n no

Fn no

No function is performed if activated. This is the factory setting for all user inputs and second function keys.

PROGRAMMING MODE LOCK-OUT

USEr-n PLOC

Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.

SELECT LINE 1 DISPLAY

USEr-n SEL L1

Fn SEL L1

When activated (momentary action), the display advances to the next Line 1 display that has been made available (in the Display Module, Line 1/Select sub-menu). This is the factory setting for function key F1.

SELECT LINE 2 DISPLAY

USEr-n SEL L2

Fn SEL L2

When activated (momentary action), the display advances to the next Line 2 display that has been made available (in the Display Module, Line 2/Access sub-menu).

RESET LINE 1 DISPLAY

USEr-n RSt L1

Fn RSt L1

When activated (momentary action), resets the current Line 1 Display value. This is the factory setting for function key F2.

RESET LINE 2 DISPLAY

USEr-n RSt L2

Fn RSt L2

When activated (momentary action), resets the current Line 2 Display value.

RESET LINE 1 AND LINE 2 DISPLAYS

USEr-n RStL 12

Fn RStL 12

When activated (momentary action), resets both the current Line 1 Display value and Line 2 Display value.

CHANGE DISPLAY COLOR

USEr-n Color

Fn Color

When activated (momentary action), Line 1 will change color green to red, red to orange, orange to green.

ADJUST DISPLAY INTENSITY LEVEL

USEr-n d-LEU

Fn d-LEU

When activated (momentary action), the display intensity changes to the next intensity level.

ADJUST DISPLAY CONTRAST LEVEL

USEr-n d-Cont

Fn d-Cont

When activated (momentary action), the display contrast changes to the next higher level.

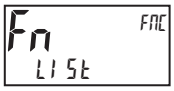
TURN OFF METER DISPLAY

USEr-n d-OFF

Fn d-OFF

Turns off the display backlight when activated. If a user input is used, the backlight is off when the user input is active (maintained action). If a front panel key is used, the backlight will toggle for each key press (momentary action). The backlight is always on in programming mode.

SELECT PARAMETER LIST



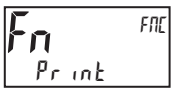
Two lists of values are available to allow the user to switch between two sets of Setpoints, Scale Factors, Counter Load values and Units mnemonics. The two lists are List A and List B. If a user input is used to select the list then List A is selected when the user input is not active and List B is selected when the user input is active (maintained action). If a front panel key is used to select the list then the list will toggle for each key press (momentary action). The display will only indicate which list is active when the list is changed.

A submenu is used to select whether the programmed Units Mnemonics are included in the List function. Select YES in the submenu to have different Units Mnemonics for List A and List B. Select NO to display the same mnemonics regardless of the list selected.

To program the values for List A and List B, first complete the programming of all the parameters with List A selected. Exit programming and switch to List B. Re-enter programming and program the desired values for the parameters included in the List.

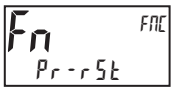
DISPLAY	DESCRIPTION	FACTORY
UNITS	Units Mnemonics	NO

PRINT REQUEST



The meter issues a block print through the serial port when activated, and the serial type is set to rLC. The data transmitted during a print request and the serial type is programmed in Port (Serial) module. If the user input is still active after the transmission is complete (about 100 msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.

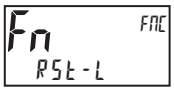
PRINT REQUEST AND RESET DISPLAYS



The meter issues a block print through the serial port when activated just like the Print Request function. In addition, when activated (momentary action), the meter performs a reset of the displays configured as YES in the sublist. Both the Print and Reset actions will only function when the serial type parameter (tYPE) is set to Red Lion protocol (rLC).

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

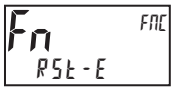
MAINTAINED (LEVEL) RESET AND INHIBIT



The meter performs a reset and inhibits the displays configured as YES in the sublist, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

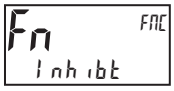
MOMENTARY (EDGE) RESET



When activated (momentary action), the meter resets the displays configured as YES in the sublist.

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

INHIBIT



The meter inhibits the displays configured as YES in the sublist, as long as activated (maintained action).

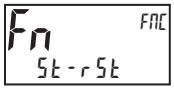
DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

STORE DISPLAY

The meter holds (freezes) the displays configured as YES in the sublist, as long as activated (maintained action). Internally, the counters and max and min values continue to update.

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

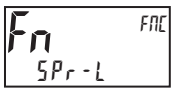
STORE AND RESET DISPLAY



The meter holds (freezes) the displays and then performs a reset of the displays configured as YES in the sublist, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	NO
Cnt b	Counter B	NO
Cnt C	Counter C	NO
Hi	Maximum	NO
Lo	Minimum	NO

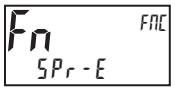
SETPOINT DEACTIVATE (RESET) MAINTAINED (LEVEL)



The meter deactivates (resets) the setpoint outputs configured as YES in the sublist, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
S1	Setpoint 1	NO
S2	Setpoint 2	NO
S3	Setpoint 3	NO
S4	Setpoint 4	NO

SETPOINT DEACTIVATE (RESET) MOMENTARY (EDGE)



When activated (momentary action), the meter deactivates (resets) the setpoint outputs configured as YES in the sublist.

DISPLAY	DESCRIPTION	FACTORY
S1	Setpoint 1	NO
S2	Setpoint 2	NO
S3	Setpoint 3	NO
S4	Setpoint 4	NO

SETPOINT ACTIVATE (SET) MOMENTARY (EDGE)

When activated (momentary action), the meter activates (sets) the setpoint outputs configured as YES in the sublist.

DISPLAY	DESCRIPTION	FACTORY
S1	Setpoint 1	NO
S2	Setpoint 2	NO
S3	Setpoint 3	NO
S4	Setpoint 4	NO

SETPOINT ACTIVATE (SET) MAINTAINED (LEVEL)

The meter activates (sets) the setpoint outputs configured as YES in the sublist, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
S1	Setpoint 1	NO
S2	Setpoint 2	NO
S3	Setpoint 3	NO
S4	Setpoint 4	NO

HOLD SETPOINT STATE

The meter holds the state of the setpoint outputs configured as YES in the sublist, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
S1	Setpoint 1	NO
S2	Setpoint 2	NO
S3	Setpoint 3	NO
S4	Setpoint 4	NO

OUTPUT PARAMETERS (OUtPUt)

OUTPUT SELECT

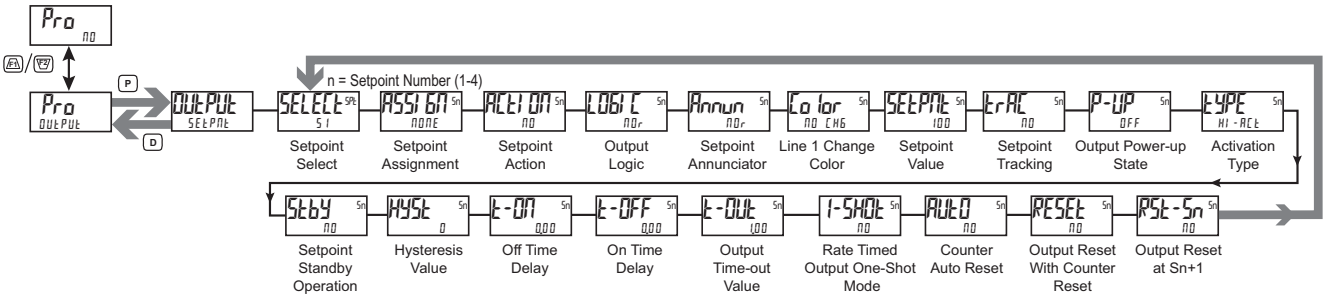
SEtPnt ANALOG

Select the Setpoint or Analog output to be programmed. The Analog output selection only appears if an analog output plug-in card is installed in the meter.

SETPOINT OUTPUT PARAMETERS (SEtPnt)

This section details the programming for the setpoints. To have output capabilities, a setpoint Plug-in card needs to be installed into the PAX2D (see Ordering Information). Depending on the card installed, there will be two or four setpoint outputs available. If no output card is installed, programming for the setpoints is still available. An Exchange Parameter Lists feature for setpoint values is explained in User Input programming. For maximum input frequency, unused setpoints should be configured for NO action.

The Setpoint Assignment and Setpoint Output Action determine setpoint feature availability. The Setpoint Parameter Availability chart illustrates this.



SETPOINT PARAMETER AVAILABILITY

PARAMETER	DESCRIPTION	COUNTER ASSIGNMENT			RATE ASSIGNMENT		
		TIMED OUT t-Out	BOUNDARY bOUnd	LATCH LAtCH	TIMED OUT t-Out	BOUNDARY bOUnd	LATCH LAtCH
LOGIC	Setpoint Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
Annun	Setpoint Annunciator	Yes	Yes	Yes	Yes	Yes	Yes
Color	Setpoint Line 1 Color	Yes	Yes	Yes	Yes	Yes	Yes
SEtPnt	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
trAC	Setpoint Tracking	Yes	Yes	Yes	Yes	Yes	Yes
P-UP	Setpoint Output Power-up State	No	No	Yes	No	No	Yes
tYPE	Setpoint Activation Type	No	Yes	No	Yes	Yes	Yes
StbY	Standby Operation	No	Yes	No	Yes	Yes	Yes
HYSt	Setpoint Hysteresis	No	No	No	Yes	Yes	No
t-On	Setpoint On Time Delay	No	No	No	Yes	Yes	Yes
t-OFF	Setpoint Off Time Delay	No	No	No	No	Yes	No
t-Out	Setpoint Output Time-out Value	Yes	No	No	Yes	No	No
1-SHOt	Rate Timed Output One-shot	No	No	No	Yes	No	No
AUtO	Counter Auto Reset	Yes	No	Yes	No	No	No
rESEt	Output Reset with Manual Reset	Yes	No	Yes	No	No	No
rSt-Sn	Setpoint Output Reset at Sn+1	Yes	No	Yes	No	No	No

SETPOINT SELECT

S1 S2 S3 S4

Select the Setpoint output to be programmed. The "Sn" in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display returns to the Setpoint Select menu. Repeat steps for each setpoint to be programmed.

The number of outputs available is setpoint output card dependent (2 or 4). If no output card is installed, programming is still available for all setpoints. This allows the Line 1 color change feature to provide a visual indication when a setpoint value has been reached, even if no setpoint output card is being used.

SETPOINT ASSIGNMENT

NONE Cnt x RATE x

Select the display to which the setpoint is assigned.

SELECTION	DISPLAY VALUE
NONE	Manual Mode operation (See SERIAL RLC PROTOCOL)
Cnt x	Counter Display Value (x = A, B or C)
RATE x	Rate Display Value (x = A, B or C)

SETPOINT ACTION

NO LATCH t-OUt bOUNd

Select the desired Setpoint Output Action. Choose NO (no action) if a setpoint is unused or for manual mode operation. See "Setpoint (Alarm) Figures for Rate" for a visual detail of Rate Assigned setpoint actions.

For Counter Assignments:

LATCH	LATCH Action - The setpoint output activates when the count value equals the setpoint value. The output remains active until reset.
t-OUt	TIMED OUT Action - The setpoint output activates when the count value equals the setpoint value and deactivates after the Time Out value.
bOUNd	BOUNDARY Action - The setpoint output activates when the count value is greater than or equal to (for tYPE = HI-ACt) or less than or equal to (for tYPE = LO-ACt) the setpoint value. The setpoint output will deactivate when the count value is less than (for tYPE = HI-ACt) or greater than (for tYPE = LO-ACt) the setpoint value.

For Rate Assignments:

LATCH	LATCH Action - The setpoint output activates when the rate value is equal to the setpoint value. The setpoint output remains active until reset. If after reset, the rate value is greater than or equal to (for tYPE = HI-ACt) or less than or equal to (for tYPE = LO-ACt) the setpoint value, the output will reactivate.
t-OUt	TIMED OUT Action - The setpoint output cycles when the rate value is greater than or equal to (for tYPE = HI-ACt) or less than or equal to (for tYPE = LO-ACt) the setpoint value. The Setpoint Time Out (t-OUt) and Setpoint On Delay (t-On) values determine the cycling times. One-shot mode provides a single output pulse (t-OUt) rather than on/off cycling.
bOUNd	BOUNDARY Action - The setpoint output activates when the rate value is greater than or equal to (for tYPE = HI-ACt) or less than or equal to (for tYPE = LO-ACt) the setpoint value. The setpoint output will deactivate (Auto reset) as determined by the Hysteresis value.

OUTPUT LOGIC

NOr rEU

Enter the output logic of the alarm output. The NOr logic leaves the output operation as normal. The rEu logic reverses the output logic. In rEU, the alarm states in the Setpoint Alarm Figures are reversed.

SETPOINT ANNUNCIATOR

NOr rEU FLASH OFF

The NOr mode displays the corresponding setpoint annunciators of "on" alarm outputs. The rEU mode displays the corresponding setpoint annunciators of "off" alarms outputs. The FLASH mode flashes the corresponding setpoint annunciators of "on" alarm outputs. The OFF mode disables display setpoint annunciators.

LINE 1 CHANGE COLOR

NO CHG GrEEN OrANGE rEd
GrnOrG rEdOrG rEdGrn LINE 1

This parameter allows the Line 1 Display to change color, or alternate between two colors, when the alarm is activated. When multiple alarms are programmed to change color, the highest numbered active alarm (S4-S1) determines the display color.

The NO CHG selection will maintain the color displayed prior to the alarm activation. The LINE 1 selection sets the display to the Display (Line 1) Color (Color).

SETPOINT VALUE

-199999 to 999999

Enter desired setpoint alarm value. Setpoint values can also be entered in the Display Mode during Program Lockout when the setpoint is programmed as Entr in the Display (Line 2) Access parameters. The decimal point position is determined by the Setpoint Assignment value.

SETPOINT TRACKING

NO S2 S4 CLd b
S1 S3 CLd A CLd C

If a selection other than NO is chosen, then the value of the setpoint being programmed ("n") will track the entered selection's value. Tracking means that when the selection's value is changed, the "n" setpoint value will also change (or follow) by the same amount.

OUTPUT POWER-UP STATE

OFF ON SAVE

OFF will deactivate the output at power up. ON will activate the output at power up. SAVE will restore the output to the same state it was at before the meter was powered down.

ACTIVATION (BOUNDARY) TYPE

HI-ACt LO-ACt

HI-ACt activates the output when the assigned display value (ASSIGN) equals or exceeds the setpoint value. LO-ACt activates the output when the assigned display value is less than or equal to the setpoint.

SETPOINT STANDBY OPERATION

NO YES

This parameter only applies to low acting setpoint activation (boundary) type setpoints. Select YES to disable a low acting setpoint at power-up, until the assigned display value crosses into the output "off" area. Once in the output "off" area, the setpoint will function per the description for low acting activation (boundary) type.

HYSTERESIS VALUE

0 to 59999

The hysteresis value is added to (for tYPE = LO-ACt), or subtracted from (for tYPE = HI-ACt), the setpoint value to determine at what value to deactivate the associated setpoint output. Hysteresis is only available for Rate assigned setpoints.

ON TIME DELAY

0.00 to 599.99 seconds

This is the amount of time the assigned Rate display must meet the setpoint activation requirements (below setpoint for Low Acting and above setpoint for High Acting), before the setpoint output activates. If the Rate Setpoint Action is Timed-Out, this is the amount of time the output is OFF during the ON/OFF output cycling. This parameter is only available for Rate assigned setpoints.

OFF TIME DELAY

0.00 to 599.99 seconds

This is the amount of time the assigned Rate display must meet the setpoint deactivation requirements (below hysteresis for High Acting and above hysteresis for Low Acting), before the setpoint output deactivates. This parameter is only available for Rate assigned setpoints.

OUTPUT TIME-OUT

0.00 to 599.99 seconds

If the setpoint action is Timed Out and the setpoint is assigned to Counter, then this is the amount of time the output will activate once the count value equals the setpoint value. If the setpoint action is Timed Out and the setpoint is assigned to Rate, then this is the amount of time the output is ON during the ON / OFF output cycling. If Rate Timed Output One-Shot mode is enabled, then this is the time duration for the one-shot output pulse.

RATE TIMED OUTPUT ONE-SHOT

no YES

If the setpoint action is Timed Out and the setpoint is assigned to Rate, select YES to have the output activate for a single pulse (one-shot) when the assigned Rate display meets the setpoint activation requirements. Select no for ON / OFF output cycling per the "Setpoint (Alarm) Figures For Rate" diagram.

COUNTER AUTO RESET

no 2Er-St CLd-St 2Er-En CLd-En

This automatically resets the display value of the Setpoint Assigned Counter each time the setpoint value is reached. The automatic reset can occur at output start or output end if the setpoint output action is programmed for timed output mode. The counter may be reset to zero or the count load value. This reset may be different from the counter reset action programmed in the Input Parameter (inPUt) menu section.

SELECTION	ACTION
no	No Auto Reset
2Er-St	Reset to Zero at the Start of output activation
CLd-St	Reset to Count Load value at the Start of output activation
2Er-En	Reset to Zero at the End of output activation (timed out only)
CLd-En	Reset to Count Load at the End of output activation (timed out only)

OUTPUT RESET WITH COUNTER RESET

no YES

Selecting YES causes the Setpoint output to deactivate (reset) when the Setpoint Assigned Counter is reset. The only exception is when the assigned counter is reset by a setpoint generated counter auto reset.

OUTPUT RESET AT Sn+1

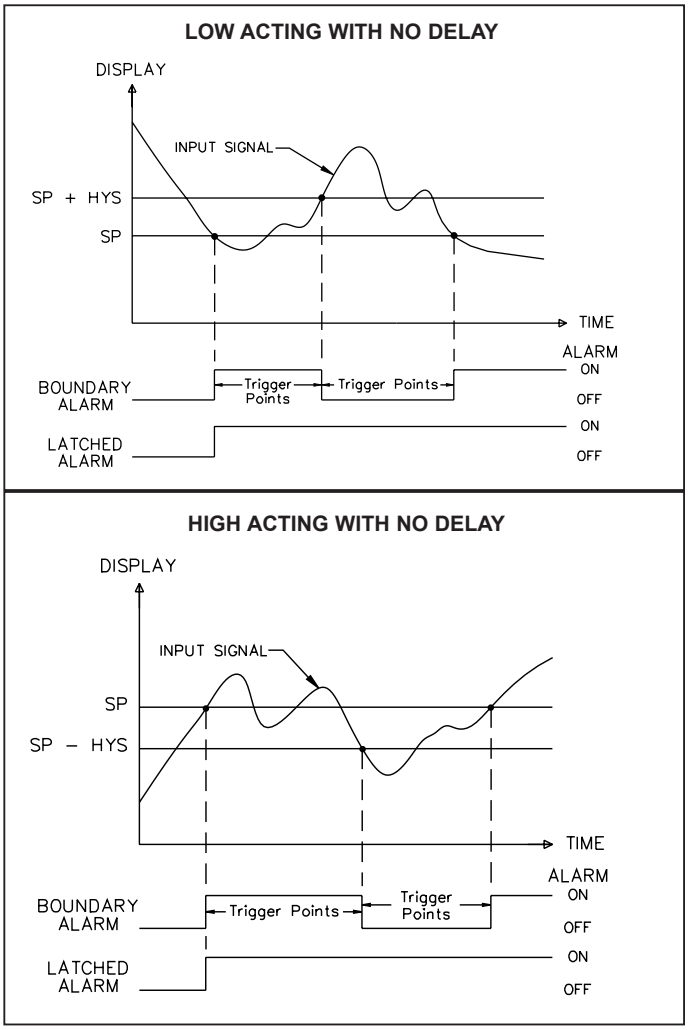
no Sn-Str Sn-End

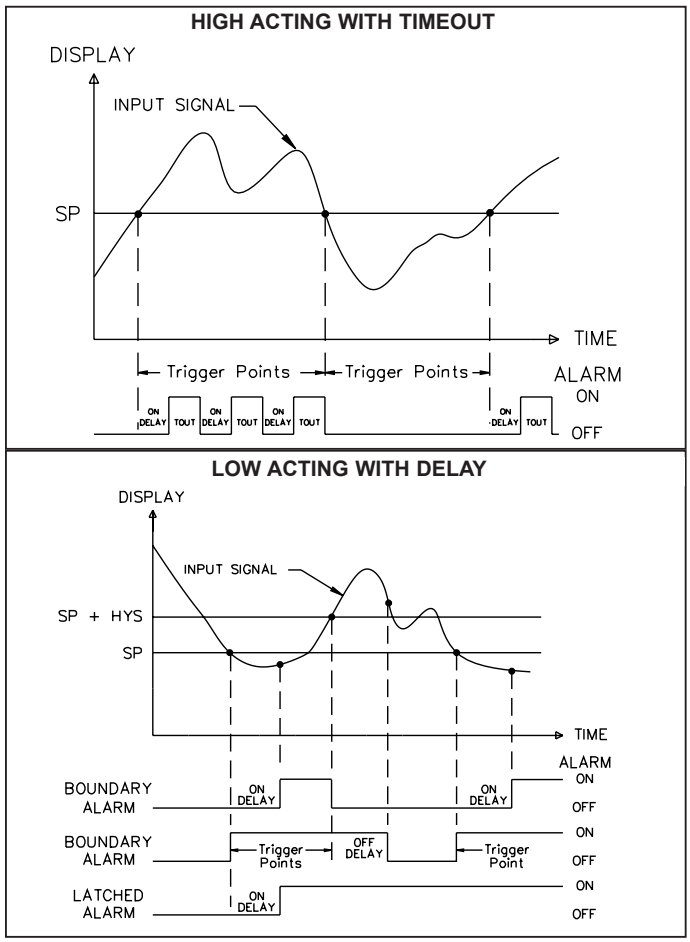
Selecting Sn-Str causes the setpoint output to deactivate (reset) when setpoint Sn + 1 activates. (Example: S1 deactivates when S2 activates, and S4 when S1 activates.) The last setpoint will wrap around to the first.

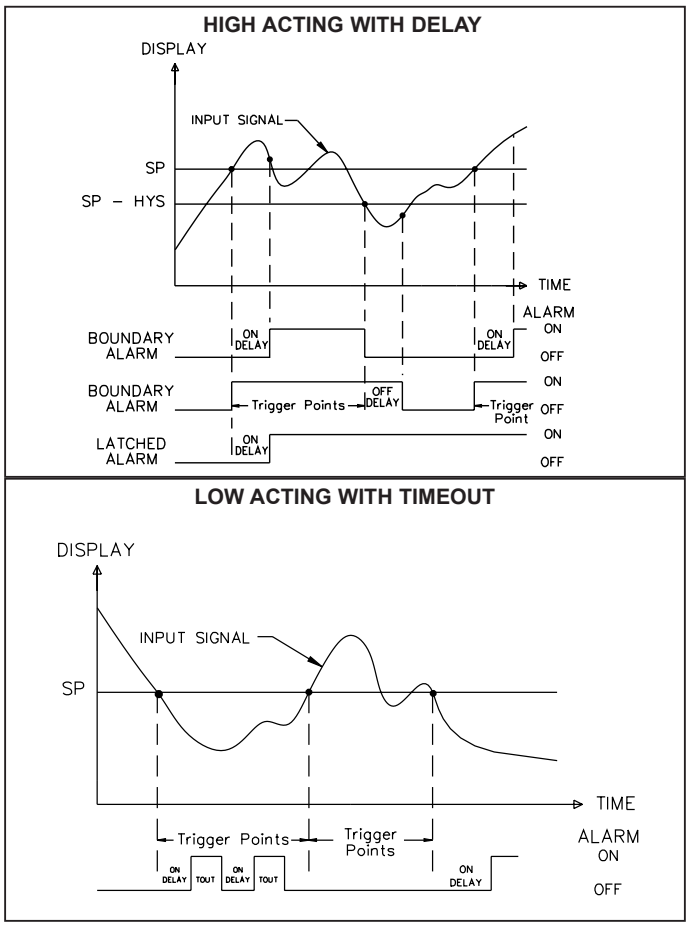
Selecting Sn-End causes the setpoint output to deactivate (reset) when setpoint Sn + 1 activates and then times out (deactivates). This selection only applies if the Sn + 1 setpoint action is Timed Out. (Example: S1 deactivates when S2 is activated and then times out.) The last setpoint will wrap around to the first. This parameter is only available for Counter assigned setpoints.

Setpoint (Alarm) Figures for Rate

(For Reverse Logic, The Alarm state is opposite.)

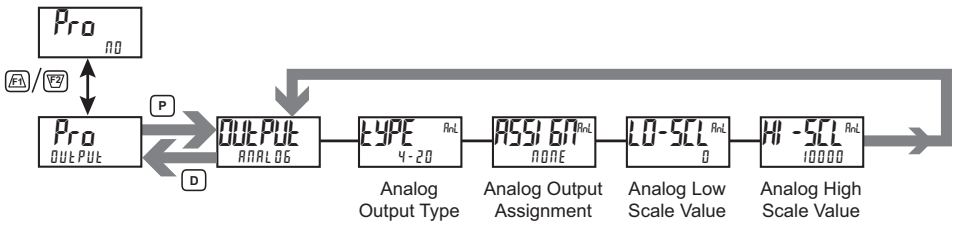






ANALOG OUTPUT PARAMETERS (ANALOG)

This section is only accessible with the optional PAXCDL Analog card installed (see Ordering Information).



ANALOG OUTPUT TYPE

4-20 0-10 0-20

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 OUTPUT ASSIGNMENT

Enter the source for the analog output to retransmit:

SELECTION	DISPLAY VALUE
NONE =	Manual Mode operation . (See Serial RLC Protocol in the Communications Port module).
Cnt x =	Counter Display Value (x = A, B or C)
RATE x =	Rate Display Value (x = A, B or C)
Hi =	Maximum Display Value
Lo =	Minimum Display Value
S1-S4 =	Setpoint Value (S1-S4)

ANALOG LOW SCALE VALUE

-199999 to 999999

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

-199999 to 999999

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

DISPLAY PARAMETERS (dISPLY)

A

DISPLAY LINE SELECT

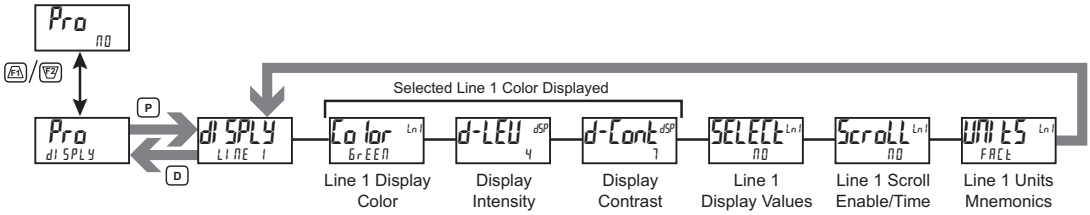
dISPLY
LINE 1

LINE 1 LINE 2

Select the Display Line to be programmed.

LINE 1 PARAMETERS (LINE 1)

This section details programming for the Line 1 (Top Line) Display. The Input, Gross, Tare, Total, Maximum (HI) and Minimum (LO) capture values and setpoints can be shown on the Line 1 display. The 3-digit Units mnemonic characters can be used to indicate which Line 1 display value is shown. Standard or custom mnemonics are available for Line 1 values.



LINE 1 DISPLAY COLOR

Color Ln1
GrEEN

GrEEN rEd OrANGE

Enter the desired Display Line 1 and programmable Units Display color.

DISPLAY INTENSITY LEVEL

d-LEV dSP
4

1 to 4

Enter the desired Display Intensity Level (1-4) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter can also be accessed in the Parameter display loop when enabled.

DISPLAY CONTRAST LEVEL

d-Cont dSP
7

0 to 15

Enter the desired Display Contrast Level (0-15) by using the arrow keys. The display contrast / viewing angle will actively adjusts up or down as the levels are changed. This parameter can also be accessed in the Parameter display loop when enabled.

LINE 1 DISPLAY VALUE SELECT/ENABLE

SELECt Ln1
nO

nO YES

Enter YES to select which values will be shown on the Line 1 display. A sub-menu provides Yes/No selection for each available Line 1 value. Values set to YES in the sub-menu will be displayable on Line 1.

DISPLAY	DESCRIPTION	FACTORY
Cnt A	Counter A	YES
Cnt b	Counter B	nO
Cnt C	Counter C	nO
RAtE A	Rate A	nO
RAtE b	Rate B	nO
RAtE C	Rate C	nO
Hi	Max Value	nO
Lo	Min Value	nO

LINE 1 DISPLAY SCROLL ENABLE/TIME

ScroLL Ln1
nO

nO 1 to 15 seconds

If Line 1 Display Scrolling is desired, set the scroll time in seconds.

LINE 1 UNITS MNEMONIC(S)

UNItS Ln1
FACt

OFF LAbEL CUSt FACt

Select the mode for Line 1 Units Mnemonic(s). See LINE 1 UNITS MNEMONIC DIAGRAM for programming details.

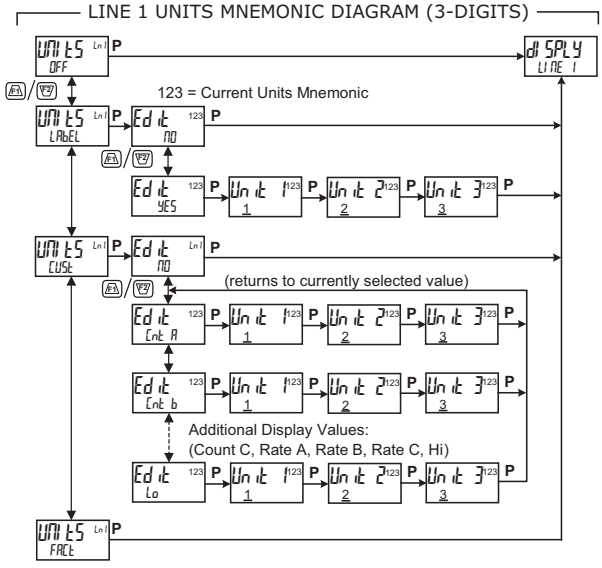
SELECTION	MODE	DESCRIPTION
OFF	OFF	No Line 1 mnemonic shown.
LAbEL	LABEL	Single programmable mnemonic shown for all Line 1 values.
CUSt	CUSTOM	Custom programmable mnemonics shown for each Line 1 value.
FACt	FACTORY	Factory default mnemonics shown for each Line 1 value.

The characters available for the programmable modes include:

A b C d E F G H I J K L M n O P Q R S t U v W y 2 0 1
2 3 4 5 6 7 8 9 a c e g h i m n o q r u w - = [ ] ' ° _ blank

Two character spaces are required to display this character.

LINE 1 UNITS MNEMONIC DIAGRAM (3-DIGITS)



LINE 2 PARAMETERS (LINE 2)

This section details programming for the Line 2 (Bottom Line) Display. The Counter values, Rate values, Rate Capture values, Setpoint values and Parameter List A/B status can all be shown on the Line 2 display. The display loops described below are used to view, reset and modify the selected display values, based on the Line 2 Value Access setting programmed for each available value.

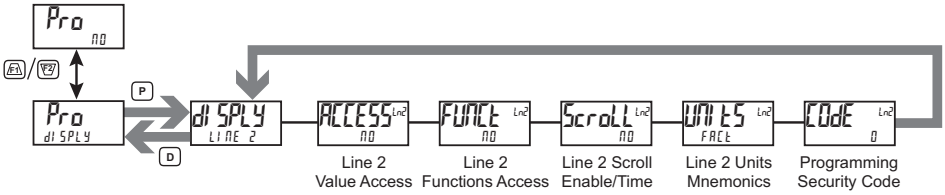
Main Display Loop

In the Main Display Loop, the selected values can be consecutively read on Line 2 by pressing the **D** key. A left justified 2 or 3-character mnemonic indicates which Line 2 value is currently shown. When in the Main display loop, the Function keys F1 and F2 perform the User functions programmed in the User Input program section.

Parameter Display Loop and Hidden Parameter Loop

These display loops provide quick access to selected parameters that can be viewed and modified on Line 2 without having to enter Full Programming Mode. These values include Parameter List A/B selection, Setpoints, Scale Factors, Counter Load values and Display Settings (color, intensity and contrast). To utilize the Parameter or Hidden Parameter loops, a security code (1-250) must be programmed. (See Programming Security Code at the end of this section.)

The Parameter display loop is accessed by pressing the **P** key. The selected Parameter display loop values can be viewed and/or changed per the Line 2 Value Access setting programmed for each available value. The Hidden Parameter Loop follows the Parameter display loop, and can only be accessed when the correct security code is entered at the Code prompt.



LINE 2 VALUE ACCESS

ACCESS Ln2 no — no yES

Select yES to program the Value Access setting for each available Line 2 parameter. Line 2 values can be made accessible in either the Main (**D** key), Parameter (**P** key) or Hidden (**P** key following code entry) display loops.

Each parameter must be configured for one of the following settings. Not all settings are available for each parameter, as shown in the Parameter Value Access table.

SELECTION	DESCRIPTION
LOC	Not viewed on Line 2 Display (Factory Default Setting)
d-rEAd	View in Main display loop. Cannot change or reset.
d-rSt	View and reset in Main display loop.
d-Entr	View and change in Main display loop
P-rEAd	View in Parameter display loop. Cannot change or reset.
P-Entr	View and change in Parameter display loop
HidE	View and change in Hidden Parameter display loop

LINE 2 FUNCTIONS ACCESS

FUNCt Ln2 no — no yES

Select yES to display the following list of functions that can be made available at the end of the Parameter (P-Entr) or Hidden (HidE) display loops. Each Line 2 Function can be programmed for LOC, P-Entr, or HidE.

The more critical and frequently used functions should be first assigned to the User Inputs and User Function keys, however if more functions are needed than what can be obtained with user inputs and function keys, these will provide a means to provide that access. Refer to Input module, User sub-menu section for a description of the function.

SELECTION	DESCRIPTION
r-L1	Reset Line 1 Display Value
r-CtA	Reset Counter A
r-Ctb	Reset Counter B
r-CtC	Reset Counter C
r-AbC	Reset Counters A, B and C
r-Hi	Reset Maximum Rate Capture Value
r-Lo	Reset Minimum Rate Capture Value
r-HL	Reset Max and Min Rate Capture Values
Print	Print Request (Block Print)

LINE 2 PARAMETER VALUE ACCESS

DISPLAY	DESCRIPTION	NOT VIEWED	MAIN DISPLAY LOOP (D KEY)			PARAMETER DISPLAY LOOP (P KEY)		HIDDEN LOOP
		LOC	d-rEAd	d-rSt	d-Entr	P-rEAd	P-Entr	HidE
Cnt A	Counter A	X	X	X				
Cnt b	Counter B	X	X	X				
Cnt C	Counter C	X	X	X				
RAtE A	Rate A	X	X					
RAtE b	Rate B	X	X					
RAtE C	Rate C	X	X					
Hi	Max Value	X	X	X				
Lo	Min Value	X	X	X				
LISt	Parameter List A/B	X	X		X	X	X	X
Sn	Setpoint Value (S1-S4) *	X	X		X	X	X	X
SC FAC	Scale Factor A, B, C *	X				X	X	X
Cnt Ld	Counter Load A, B, C *	X				X	X	X
Color	Line 1 Display Color	X				X	X	X
d-LEV	Display Intensity Level	X				X	X	X
d-Cont	Display Contrast Level	X				X	X	X

* Indicates multiple value entries.

LINE 2 DISPLAY SCROLL ENABLE/TIME

no 1 to 15 seconds

If Line 2 Display Scrolling is desired, set the scroll time in seconds.

LINE 2 UNITS MNEMONIC(S)

OFF CUSt Lb-CSt Lb Ln1
LAbEL FACt Lb-FAC L1-FAC

Select the mode for Line 2 Units Mnemonic(s). See LINE 2 UNITS MNEMONIC DIAGRAM for programming details.

SELECTION	MODE	DESCRIPTION
OFF	OFF	No Line 2 mnemonics shown.
LAbEL	LABEL	Single programmable mnemonic shown as a separate item in the Line 2 Display loop. No individual mnemonics are shown with the other Line 2 Display values.
CUSt	CUSTOM	Individual Custom programmable mnemonics shown with each value in the Line 2 Display loop.
FACt	FACTORY	Individual Factory default mnemonics shown with each value in the Line 2 Display loop.
Lb-CSt	LABEL & CUSTOM	A programmable mnemonic shown as a separate item in the Line 2 Display loop. Also, individual Custom programmable mnemonics shown with each value in the Line 2 Display loop.
Lb-FAC	LABEL & FACTORY	A programmable mnemonic shown as a separate item in the Line 2 Display loop. Also, individual Factory default mnemonics shown with each value in the Line 2 Display loop.
Lb Ln1	LINE 1 INDEXED LABELS	Individual programmable mnemonics, indexed to the Line 1 Display value, are shown as a separate item in the Line 2 Display loop. These same mnemonics are also shown with each value in the Line 2 Display loop.
L1-FAC	LINE 1 INDEXED LABELS & FACTORY	Individual programmable mnemonics, indexed to the Line 1 Display value, are shown as a separate item in the Line 2 Display loop. Also, individual Factory default mnemonics are shown with each value in the Line 2 Display loop.

The characters available for the programmable modes include:

A b C d E F G H I J K L M n O P q r S t U v y Z 0 1
2 3 4 5 6 7 8 9 ∂ c ε 9 h ι m n o u v - = [ ] r ° _ blank

Two character spaces are required to display this character.

PROGRAMMING SECURITY CODE

0 to 250

To activate either the Parameter or Hidden Parameter display loops, a security code (1-250) must be entered. If a "0" security code is programmed, pressing the **P** key takes you directly to the Full Programming Mode.

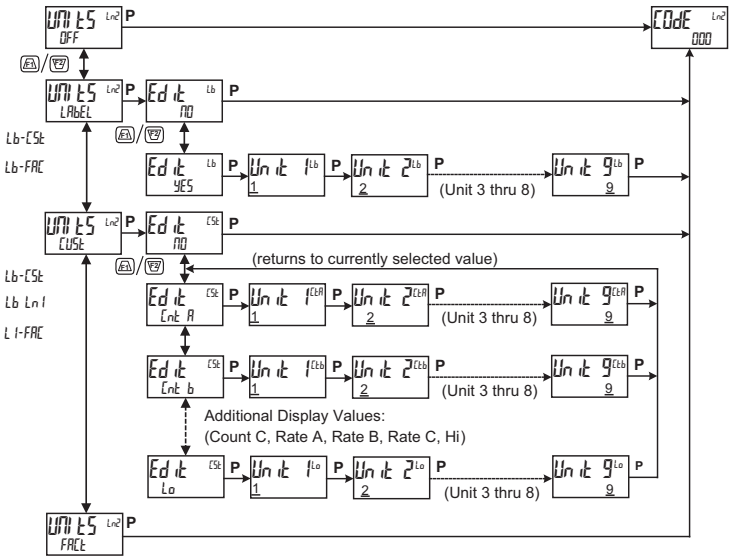
The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (PLOC) in the User Input Function parameter (Input [User] module).

Two programming modes are available. Full Programming Mode allows all parameters to be viewed and modified. Parameter display loop mode provides access to those selected parameters, that can be viewed and/or modified without entering the Full programming mode.

The following chart indicates the levels of access based on various CodE and User Input PLOC settings.

SECURITY CODE	USER INPUT CONFIGURED	USER INPUT STATE	WHEN P KEY IS PRESSED	FULL PROGRAMMING MODE ACCESS
0	not PLOC	————	Full Programming	Immediate Access
0	PLOC	Not Active	Full Programming	Immediate Access
0	PLOC	Active	Enter Parameter Display Loop	No Access
>0	not PLOC	————	Enter Parameter Display Loop	After Parameter Display Loop with correct code # at CodE prompt.
>0	PLOC	Not Active	Full Programming	Immediate Access
>0	PLOC	Active	Enter Parameter Display Loop	After Parameter Display Loop with correct code # at CodE prompt.

LINE 2 UNITS MNEMONIC DIAGRAM (9-DIGITS)



COMMUNICATIONS PORT PARAMETERS (Port)

To select SErIAL, an optional communication card must be installed.

PORT SELECT

USb SErIAL

Select the Communications Port to be programmed.

USB PORT PARAMETERS (USb)

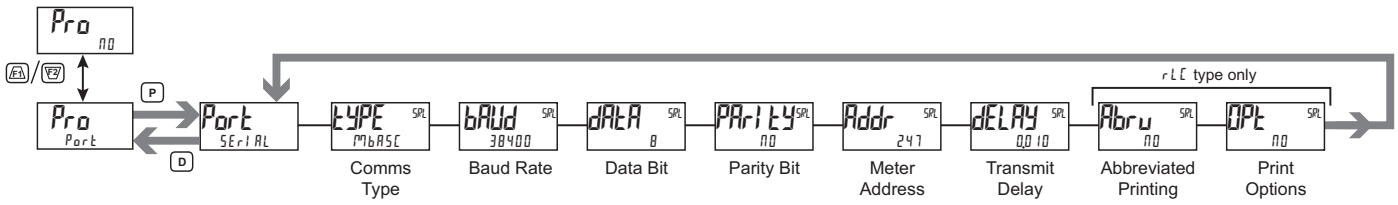
USB CONFIGURATION

AUtO SErIAL

AUtO Meter automatically configures USB port settings to operate with Crimson configuration software. When a USB cable is attached to PAX2S and PC, the port is internally set to Modbus RTU protocol, 38400 baud, 8 bits, and Unit Address 247. The Serial Port settings programmed below will not change, or show this.

SErIAL Configures USB port to utilize the Serial Port settings and protocol programmed below.

SERIAL PORT PARAMETERS (SErIAL)



COMMUNICATIONS TYPE

MbrtU - Modbus RTU
MbASC - Modbus ASCII
rLC - RLC Protocol (ASCII)

Select the desired communications protocol. Modbus is preferred as it provides access to all meter values and parameters. Since the Modbus protocol is included within the PAX2D, the PAX Modbus option card, PAXCDC4, should not be used. The PAXCDC1 (RS485), or PAXCDC2 (RS232) card should be used instead.

BAUD RATE

1200 2400 4800 9600 19200 38400

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

DATA BIT

7 8

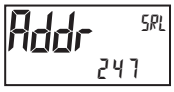
Select either 7 or 8 bit data word lengths. Set the word length to match the other serial communications equipment on the serial link. For MbrtU communication type, data bit setting is fixed at 8 bits.

PARITY BIT

no EVEN Odd

Set the parity bit to match that of the other serial communications equipment on the serial link. 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, an additional stop bit is used to force the frame size to 10 bits. Parity is not available if dAtA is set for 8 bit.

METER UNIT ADDRESS



1 to 247 - Modbus
0 to 99 - RLC Protocol

Select a Unit Address that does not match an address number of any other equipment on the serial link.

TRANSMIT DELAY

0.000 to 0.250 seconds

Following a Modbus command or RLC Transmit Value command, the PAX2D will wait this minimum amount of time in seconds before issuing a serial response

The following programming steps are only available when Communications Type (tYPE) is programmed for rLC.

ABBREVIATED PRINTING

no YES

Select no for full print or Command T transmissions (meter address, mnemonics and parameter data) or YES for abbreviated print transmissions (parameter data only). This will affect all the parameters selected in the print options. If the meter address is 00, it will not be sent during a full transmission.

PRINT OPTIONS

no YES

YES - Enters the sub-menu to select the meter parameters to appear during a print request. For each parameter in the sub-menu, select YES for that parameter information to be sent during a print request or no for that parameter information not to be sent. A print request is sometimes referred to as a block print because more than one parameter information (meter address, mnemonics and parameter data) can be sent to a printer or computer as a block.

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
Cnt A	Counter A	YES	CTA
Cnt b	Counter B	no	CTB
Cnt C	Counter C	no	CTC
rAtE A	Rate A	no	RTA
rAtE b	Rate B	no	RTB
rAtE C	Rate C	no	RTC
Hi	Max Value	no	MAX
Lo	Min Value	no	MIN
SC FAC	Scale Factor A & B	no	SFA, SFB
Cnt Ld	Counter Load A & B	no	CLA, CLB
SEtPnt	Setpoint Values	no	SP1 - SP4

SERIAL COMMUNICATIONS

The PAX2D supports serial communications using the optional serial communication cards or via the USB programming port located on the side of the unit. When USB is being used (connected), the serial communication card is disabled. When using the standard RS232 and RS485 PAX option cards, the PAX2D supports both the RLC protocol and also supports Modbus communications. The PAX Modbus option card should not be used with the PAX2D, as the PAX2D internal Modbus protocol supports complete unit configuration, and is much more responsive.

USB

The USB programming port is primarily intended to be used to configure the PAX2D with the Crimson programming software. It can also be used as a virtual serial communications port following installation of the PAX2D USB drivers that are supplied with the Crimson software. When the USB port is being used, i.e. the USB cable is connected between PAX2D and PC, all serial communications with the serial option card (if used) is disabled.

USB Cable type required: USB A to Mini-B (not supplied)

PAX2D CONFIGURATION USING CRIMSON AND USB

1. Install Crimson software.
2. Supply power to PAX2D.
3. Insure USB Configuration (CONFIG) in USB Port Parameters is set to AUtO (factory default setting).
4. Attach USB cable (USB A to Mini-B) between PC and PAX2D.
5. Create a new file (File, New) or open an existing PAX2D database within Crimson.
6. Configure Crimson Link options (Link, Options) to the serial port which the USB cable is attached (in Step 4).

SERIAL MODBUS COMMUNICATIONS

Modbus Communications requires that the Serial Communications Type Parameter (tYPE) be set to "Mbrtu" or "MbASC".

PAX2D CONFIGURATION USING CRIMSON AND SERIAL COMMUNICATIONS CARD

1. Install Crimson software.
2. Install RS232 or RS485 card and connect communications cable from PAX2D to PC.
3. Supply power to PAX2D.
4. Configure serial parameters (SERIAL) to Modbus RTU "Mbrtu", 38,400 baud, address 247.
5. Create a new file (File, New) or open an existing PAX2D database within Crimson.
6. Configure Crimson Link options (Link, Options) to the serial port which the communication cable is attached (in step 2).

SUPPORTED FUNCTION CODES

FC03: Read Holding Registers

1. Up to 64 registers can be requested at one time.
2. HEX <8000> is returned for non-used registers.

FC04: Read Input Registers

1. Up to 64 registers can be requested at one time.
2. Block starting point can not exceed register boundaries.
3. HEX <8000> is returned in registers beyond the boundaries.
4. Input registers are a mirror of Holding registers.

FC06: Preset Single Register

1. HEX <8001> is echoed back when attempting to write to a read only register.
2. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit. It is also returned in the response.

FC16: Preset Multiple Registers

1. No response is given with an attempt to write to more than 64 registers at a time.
2. Block starting point cannot exceed the read and write boundaries (40001-41280).
3. If a multiple write includes read only registers, then only the write registers will change.
4. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit.

FC08: Diagnostics

The following is sent upon FC08 request:

Module Address, 08 (FC code), 04 (byte count), "Total Comms" 2 byte count, "Total Good Comms" 2 byte count, checksum of the string

"Total Comms" is the total number of messages received that were addressed to the PAX2. "Total Good Comms" is the total messages received by the PAX2D with good address, parity and checksum. Both counters are reset to 0 upon response to FC08 and at power-up.

FC17: Report Slave ID

The following is sent upon FC17 request:

RLC-PAX2D ab<0100h><40h><40h><10h>
a = SP Card, "0"-No SP, "2" or "4" SP
b = Linear Card "0" = None, "1" = Yes
<0100> Software Version Number (1.00)
<40h>Max Register Reads (64)
<40h>Max Register Writes (64)
<10h> Number Guid/Scratch Pad Regs (16)

SUPPORTED EXCEPTION CODES

01: Illegal Function

Issued whenever the requested function is not implemented in the meter.

02: Illegal Data Address

Issued whenever an attempt is made to access a single register that does not exist (outside the implemented space) or to access a block of registers that falls completely outside the implemented space.

03: Illegal Data Value

Issued when an attempt is made to read or write more registers than the meter can handle in one request.

07: Negative Acknowledge

Issued when a write to a register is attempted with an invalid string length.

PAX2D FRERQUENTLY USED MODBUS REGISTER TABLE

Only frequently used registers are shown below. The entire Modbus Register Table can be found at www.redlion.net.
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).
Note 1: The PAX2D should not be powered down while parameters are being changed. Doing so may corrupt the non-volatile memory resulting in checksum errors.

REGISTER ADDRESS	REGISTER NAME	LOW LIMIT	HIGH LIMIT	FACTORY SETTING	ACCESS	COMMENTS
	FREQUENTLY USED REGISTERS					
40001	Counter A Value (Hi word)	-199999999	999999999	0	Read/Write	
40002	Counter A Value (Lo word)					
40003	Counter B Value (Hi word)	-199999999	999999999	0	Read/Write	
40004	Counter B Value (Lo word)					
40005	Counter C Value (Hi word)	-199999999	999999999	0	Read/Write	
40006	Counter C Value (Lo word)					
40007	Rate A Value (Hi word)	N/A	N/A	N/A	Read Only	
40008	Rate A Value (Lo word)					
40009	Rate B Value (Hi word)	N/A	N/A	N/A	Read Only	
40010	Rate B Value (Lo word)					
40011	Rate C Value (Hi word)	N/A	N/A	N/A	Read Only	
40012	Rate C Value (Lo word)					
40013	Max (Hi) Value (Hi word)	-199999	999999	0	Read/Write	
40014	Max (Hi) Value (Lo word)					
40015	Min (Lo) Value (Hi word)	-199999	999999	0	Read/Write	
40016	Min (Lo) Value (Lo word)					
40017	Setpoint 1 Value (Hi word)	-199999	999999	100	Read/Write	Active List (A or B)
40018	Setpoint 1 Value (Lo word)					
40019	Setpoint 2 Value (Hi word)	-199999	999999	200	Read/Write	Active List (A or B)
40020	Setpoint 2 Value (Lo word)					
40021	Setpoint 3 Value (Hi word)	-199999	999999	300	Read/Write	Active List (A or B)
40022	Setpoint 3 Value (Lo word)					
40023	Setpoint 4 Value (Hi word)	-199999	999999	400	Read/Write	Active List (A or B)
40024	Setpoint 4 Value (Lo word)					
40025	Counter A Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40026	Counter A Scale Factor (Lo word)					
40027	Counter B Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40028	Counter B Scale Factor (Lo word)					
40029	Counter C Scale Factor (Hi word)	1	999999	100000	Read/Write	Active List (A or B)
40030	Counter C Scale Factor (Lo word)					
40031	Counter A Count Load (Hi word)	-199999	999999	500	Read/Write	Active List (A or B)
40032	Counter A Count Load (Lo word)					
40033	Counter B Count Load (Hi word)	-199999	999999	500	Read/Write	Active List (A or B)
40034	Counter B Count Load (Lo word)					
40035	Counter C Count Load (Hi word)	-199999	999999	500	Read/Write	Active List (A or B)
40036	Counter C Count Load (Lo word)					
40037	Setpoint Output Register (SOR)	0	15	N/A	Read/Write	Status of Setpoint Outputs. Bit State: 0=Off, 1=On. Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4. Outputs can only be activated/reset with this register when the respective bits in the Manual Mode Register (MMR) are set.
40038	Manual Mode Register (MMR)	0	31	0	Read/Write	Bit State: 0 = Auto Mode, 1 = Manual Mode Bit 4 = S1, Bit 3 = S2, Bit 2 = S3, Bit 1 = S4, Bit 0 = Linear Output
40039	Reset Output Register	0	15	0	Read/Write	Bit State: 1= Reset Output, bit is returned to zero following reset processing; Bit 3 = S1, Bit 2 = S2, Bit 1 = S3, Bit 0 = S4
40040	Analog Output Register (AOR)	0	4095	0	Read/Write	Linear Output Card written to only if Linear Output is in Manual Mode (MMR bit 0 = 1).

SERIAL RLC PROTOCOL COMMUNICATIONS

A

RLC Communications requires the Serial Communications Type Parameter (tYPE) be set to rLC.

SENDING SERIAL COMMANDS AND DATA TO THE METER

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 $. The <CR> is also available as a terminator when Counter C is in the SLAVE mode.

Command Chart

COMMAND	DESCRIPTION	NOTES
N	Node (Meter) Address Specifier	Address a specific meter. Must be followed by a two digit node address. Not required when address = 00.
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	Initiates a block print output. Registers are defined in programming.

Command String Construction

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

1. The first characters consist of the Node Address Specifier (N) followed by a 1 or 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. For node address 1 through 9, a leading zero character is not required. (The only exception is a numeric transmission when Counter C is set for slave mode.) 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 when Counter C is set for slave mode <CR>. The meter does not begin processing the command string until this character is received. See Timing Diagram figure for differences between terminating characters.

Sending Numeric Data

Numeric data sent to the meter must be limited to the digit range shown under transmit details 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 = 0.0 and 25 is written to a register. The value of the register is now 2.5.

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

Register Identification Chart

ID	VALUE DESCRIPTION	MNEMONIC	COMMAND	TRANSMIT DETAILS
A	Count A	CTA	T, V, R	9 positive, 8 ½ negative
B	Count B	CTB	T, V, R	9 positive, 8 ½ negative
C	Count C	CTC	T, V, R	9 positive, 8 ½ negative
D	Rate A	RTA	T	6 digit, positive only
E	Rate B	RTB	T	6 digit, positive only
F	Rate C	RTC	T	6 positive, 5 ½ negative
G	Max (Hi) Value	MAX	T, V, R	6 positive, 5 ½ negative
H	Min (Lo) Value	MIN	T, V, R	6 positive, 5 ½ negative
I	Scale Factor A	SFA	T, V	6 digit, positive only
J	Scale Factor B	SFB	T, V	6 digit, positive only
K	Counter Load A	CLA	T, V	6 positive, 5 ½ negative
L	Counter Load B	CLB	T, V	6 positive, 5 ½ negative
M	Setpoint 1	SP1	T, V, R	6 positive, 5 ½ negative
O	Setpoint 2	SP2	T, V, R	6 positive, 5 ½ negative
Q	Setpoint 3	SP3	T, V, R	6 positive, 5 ½ negative
S	Setpoint 4	SP4	T, V, R	6 positive, 5 ½ negative
U	Auto/Manual Register	MMR	T, V	0 – auto, 1 - manual
W	Analog Output Register	AOR	T, V	0 – 4095 normalized
X	Setpoint Register	SOR	T, V	0 – not active, 1 – active

Command String Examples:

1. Node address = 17, Write 350 to Setpoint 1.
   String: N17VM350$
2. Node address = 5, Read Count A value.
   String: N5TA*
3. Node address = 0, Reset Setpoint 4 output.
   String: RS*

RECEIVING DATA FROM THE METER

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. The meter response mode is selected in Serial Port Parameters (Abru).

Full Field Transmission (Address, Mnemonic, Numeric data)

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
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 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 values 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 (Numeric data only)

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.*

Meter Response Examples:

1. Node address = 17, full field response, Count A = 875
   17 CTA 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>

Auto/Manual Mode Register (MMR) ID: U

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint and analog output. In Manual Mode (1) the outputs are defined by the registers SOR and AOR. 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. In a write command string (VU), any character besides 0 or 1 in a field will not change the corresponding output mode.

U abcde
- e = Analog Output
- d = SP4
- c = SP3
- b = SP2
- a = SP1

Example: VU00011* places SP4 and Analog in manual.

Analog Output Register (AOR) ID: W

This register stores the present signal value of the analog output. The range of values of this register is 0 to 4095, which corresponds to the analog output range per the following chart:

Register Value	Output Signal*		
	0-20 mA	4-20 mA	0-10 V
0	0.00	4.00	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, 4-20 mA or 0-10 V).*

Writing to this register (VW) while the analog output is in the Manual Mode causes the output signal level to update immediately to the value sent. While in the Automatic Mode, this register may be written to, but it has no effect until the analog output is placed in the manual mode. When in the Automatic Mode, the meter controls the analog output signal level. Reading from this register (TW) will show the present value of the analog output signal.

Example: VW2047* will result in an output of 10.000 mA, 12.000 mA or 5.000V depending on the range selected.

Setpoint Output Register (SOR) ID: X

This register stores the states of the setpoint outputs. Reading from this register (TX) will show the present state of all the setpoint outputs. A "0" in the setpoint location means the output is off and a "1" means the output is on.

X abcd
- d = SP4
- c = SP3
- b = SP2
- a = SP1

In Automatic Mode, the meter controls the setpoint output state. In Manual Mode, writing to this register (VX) will change the output state. Sending any character besides 0 or 1 in a field or if the corresponding output was not first in manual mode, the corresponding output value will not change. (It is not necessary to send least significant 0s.)

Example: VX10* will result in output 1 on and output 2 off.

COUNTER C SERIAL SLAVE DISPLAY

Counter C may be programmed for SLAVE to act as a serial slave display. In this mode, the carriage return <CR> is added as a valid command terminator character for all serial command strings. The <CR> as a terminator may be very useful for standard serial commands, even if Counter C is never displayed or sent a slave message. The <*> and <$> are also recognized as valid terminators for the serial slave.

The Counter C slave display is right aligned, and has the capacity of displaying six characters on Line 1 or nine characters on Line 2. When less than the full display of characters is received, blank spaces are placed in front of the characters. If more than the full display of characters is received, only the last six (or nine) characters are displayed. The meter has an internal 300 character buffer for the slave display. If more than 300 characters are received, the additional characters are discarded until a <CR> is received. At that point, the last six (or nine) characters in the buffer are displayed.

Counter C processes Numeric and Literal slave transmissions as follows.

Numeric Transmissions

When a string that does not begin with #, T, V, P or R is received, the meter processes it as a Numeric transmission. In this case, only numbers and a minus sign can be displayed. All other characters in the string are discarded. If a minus sign appears anywhere in the string the resulting number will be negative. If a decimal point is desired, it is programmed in Counter C setup and is ignored in the serial string. If no numerical characters are received, then the numeric value will be zero.

The numeric display can be used for setpoint (boundary action only) and analog output functions. The numeric value is retained in Counter C memory until another Numeric transmission is received. If a numeric values is not to be saved to non-volatile memory, send the value as a literal transmission.

Note: Numeric transmissions sent to meter addresses 1 through 9 must have a leading zero character sent with the address (i.e. N01 through N09).

Literal Transmissions

When a string that begins with # is received, the meter processes it as a Literal transmission. In this case, only numeric and alphabetic characters or a minus sign (dash) will be processed. Any other non-alphanumeric character will be discarded. Non-displayable alphabetic characters (M, W and X) will be replaced with a space. A Literal display overrides any Units Mnemonics characters, when shown on Line 2.

A Literal display will replace a Numeric value in the Counter C display. However, it will not remove a previous Numeric value from Counter C memory or prevent the Counter C assigned outputs from functioning with the previous Numeric value.

Displayable Alphabetic Characters:

ASCII	A	b	C	d	E	F	G	H	I	J	K	L	N	O	P	q	r	S	t	U	V	Y	Z
DISPLAY	A	b	C	d	E	F	G	H	I	J	K	L	N	O	P	q	r	S	t	U	V	Y	Z

(Both uppercase and lowercase ASCII characters are accepted.)

Downloading Data from a G3 to a PAX2D

Communications:
Port: RS232 Comms Raw Serial Port
Port Driver: <system> Raw Serial Port
Programming:

```
PortPrint(2, "N01" + IntToText(Var1, 10, 6) + "\r");
```

This program is called from the Global On Tick. It sends "N01" (the meter address), followed by the ASCII equivalent of Var1, then a carriage return.

COMMAND RESPONSE TIME

The meter can only receive data or transmit data at any one time (half-duplex operation). 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 (*) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel.

$$t_1 = (10 * \#\text{ of characters}) / \text{baud rate}$$

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 15 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 and the Serial Transmit Delay parameter (dELAY). The standard command line terminating character is "*". This terminating character results in a response time window of the Serial Transmit Delay time (dELAY) plus 15 msec. maximum. The dELAY parameter should be programmed to a value that 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 15 msec maximum. The response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

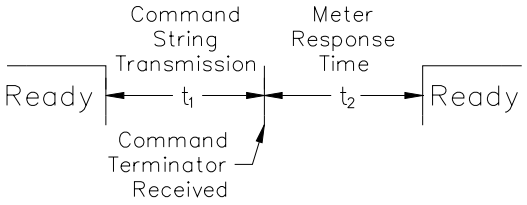
At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel.

$$t_3 = (10 * \#\text{ of characters}) / \text{baud rate.}$$

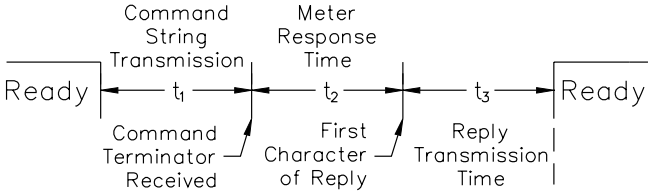
At the end of t_3, the meter is ready to receive the next command. The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.

Timing Diagrams

NO REPLY FROM METER



RESPONSE FROM METER



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.

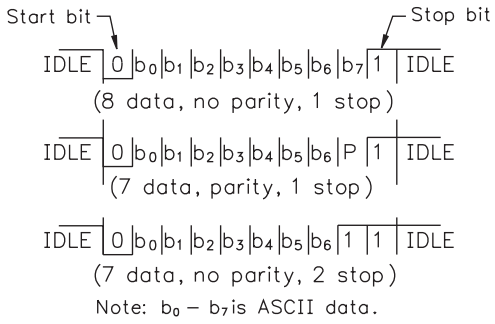
The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

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.

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. If 7 data bits and no parity is selected, then 2 stop bits are sent from the PAX meter.

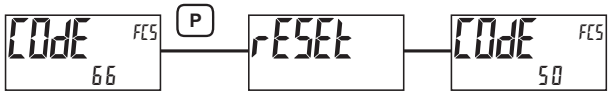
FACTORY SERVICE OPERATIONS (FACtrY)

FACTORY SERVICE CODE

0-250

Enter the Service Code for the desired operation.

RESTORE FACTORY DEFAULTS



Use the F1 and F2 keys to display CodE 66 and press **P**. The meter will flash rESEt and then return to CodE 50. Press the **P** key to return to Display Mode. This will overwrite all user settings with the factory settings. The only exception is the User Mnemonics which retain their programmed values (see Code 69).

RESTORE FACTORY DEFAULTS (w/Units Mnemonics)

Same as Code 66, except the User Mnemonics are also returned to the factory default settings (blank).

MODEL AND CODE VERSION

The meter will briefly display the model (P2d) on Line 1, and the current firmware version (UEr x.xx) on Line 2, and then return to CodE 50.

INPUT A AND B LOGIC SELECTION

The Count Inputs A and B are factory configured for falling edge triggered (active low) operation in single edge count modes. The Counter Operating Mode descriptions in the Input programming section reflect this logic. If an application is better suited to use rising edge triggered (active high) operation, the Input Logic for Input A and/or Input B can be changed by entering Code 55.

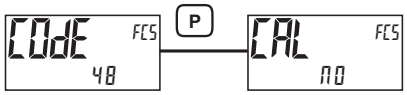
LO-ACt HI-ACt

Selecting HI-ACt sets the Input A logic to rising edge triggered (active high) operation. Be advised that all references to Input A falling edge and Input A rising edge will be reversed for the Counter Operating Mode descriptions.

LO-ACt HI-ACt

Selecting HI-ACt sets the Input B logic to rising edge triggered (active high) operation. Be advised that all references to Input B falling edge and Input B rising edge will be reversed for the Counter Operating Mode descriptions.

METER CALIBRATION



nO rAtE AnLOut

Enter Code 48 and choose Rate or Analog Output calibration.

The only items in the PAX2D meter that can be calibrated are the Rate Indicator accuracy and the Analog Output. The Rate Indicator is scaled in the Rate Input Parameter programming section. The Analog Output signal is scaled in the Analog Output Parameter section. If the Rate display or the Analog Output appears to be indicating incorrectly or inaccurately, refer to the Troubleshooting section to make sure the meter is properly scaled for the application.

If Rate accuracy or Analog Output recalibration is required (generally every 2 years), it should be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters.

Note: Allow a 30 minute warm-up period before staring calibration.

Rate Accuracy Calibration

-0.0100 to 0.0100 percent

Rate Indicator calibration is done by adjusting the Rate Accuracy Offset value. This value provides a Rate calculation adjustment factor expressed in percent of the display reading. An adjustment range of ± 0.01% is provided, which equals ± 1 count for a display reading of 10,000.

The initial offset value is set during factory test. To calibrate, connect a precision signal generator with an accuracy of 0.005% or better to Input A on the PAX2D. (Refer to the Rate Input Parameter programming section for Rate setup details.) Using the Rate A Decimal Point position and Scaling Display parameters, program the meter to read the input frequency with maximum display resolution (i.e. 6-digit display reading). Compare the Rate display to the signal generator output frequency. Adjust the Rate Accuracy Offset value higher (for low Display reading) or lower (for high Display Reading) until the Rate display matches the signal generator.

Analog Output Card Calibration

Before starting, verify that a precision meter with an accuracy of 0.05% or better (voltmeter for voltage output and/or current meter for current output) is connected and ready. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAX2D F1 and F2 keys to adjust the output so that the external meter display matches the selection being calibrated. When the external reading matches, or if the range is not being calibrated, press the **P** key to advance to the next range. When all the desired ranges have been calibrated, exit programming mode and remove the external meters.

DISPLAY	EXTERNAL METER	ACTION
0.000A	0.00 mA	Adjust if necessary, press **P**
0.004A	4.00 mA	Adjust if necessary, press **P**
0.020A	20.00 mA	Adjust if necessary, press **P**
0.0u	0.00 V	Adjust if necessary, press **P**
10.0u	10.00 V	Adjust if necessary, press **P**

TROUBLESHOOTING

PROBLEM	REMEDIES
No Display At Power-Up	Check power level and power connections.
No Display After Power-Up	Check Display Module: d-LEV, d-Cont, and LINE 1 program settings.
Program Locked-Out	Check for Active User Input, programmed for PLOC. Deactivate User Input.
	Enter proper access code at CODE 0 prompt. (Universal access code = 222)
No Line 1 Display	Check program settings for Line 1 Display Value Select/Enable. Confirm at least one Line 1 Display Value is enabled (YES).
No Line 2 Display	Check program settings for Line 2 Value Access. Confirm at least one Line 2 Parameter Value is enabled in Main Display Loop (d-rEAd, d-rSt, d-Entr).
No Line 1 Units Mnemonic Display	Check program settings for Line 1 Units Mnemonic(s).
Display of OVEr or UndEr	Value exceeds Display capacity of the meter. See General Meter Specifications.
Incorrect Display Value or Not Counting	Check Input wiring, DIP switch setting, Input programming, Scale Factor calculation, Input signal level, User Input Logic setting, lower input signal frequency.
User Input Not Functioning	Check User Input wiring, User Logic setting, User Function settings, User Input being used as a signal input in dual count modes (see Counter Operating Modes).
Modules or Parameters Not Accessible	Check for corresponding plug-in option card.
	Verify parameter is valid in regard to previous program settings.
Error Code: ErrKEY	Keypad is active at power up. Check for depressed or stuck keypad. Press any key to clear Error Code.
Error Code: EE PAr Error Code: EE Pdn	Parameter Data Checksum Error. Press any key to clear Error Code, verify all program settings and cycle power. Contact factory if Error Code returns at next power-up.
Error Code: ErrPro	Parameter Data Validation Error. Press any key to clear Error Code, verify all program settings and cycle power. Contact factory if Error Code returns at next power-up.
Error Code: EE Lin	Linear Output Card Data Validation Error. Press any key to clear Error Code and cycle power. If Error Code returns at next power-up, replace Linear Option Card or contact factory.