TOTALIZING COUNTERS

The Trusted Source for Innovative Control Solutions

1-717-767-6511

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<table>
<thead>
<tr>
<th>Description</th>
<th>CUB7</th>
<th>CUB7P</th>
<th>CUB4</th>
<th>PAXLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (Height) x (Width)</td>
<td>28 mm (H) x 51mm (W)</td>
<td>28 mm (H) x 51mm (W)</td>
<td>39 mm (H) x 75mm (W)</td>
<td>50 mm (H) x 97mm (W)</td>
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<tr>
<td>Display</td>
<td>8 Digit, .35' (9mm) Reflective, Green and Red Backlight LCD</td>
<td>8 Digit, .35' (9mm) Reflective, Green and Red Backlight LCD</td>
<td>6 Digit, .46' (12mm), 8 Digit, .46' (12mm) Reflective, Green and Red Backlight LCD</td>
<td>6 Digit, .56' (14mm) 8 Digit, .4' (10mm) Red LED</td>
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<tr>
<td>Counting Capability</td>
<td>Uni-Directional</td>
<td>Uni-Directional</td>
<td>Uni-Directional</td>
<td>Uni-Directional Up/Down Inhibit Store</td>
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<tr>
<td>Max. Input Frequency</td>
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<td>10,000 Counts/Sec.</td>
<td>5000 Counts/Sec.</td>
<td>25,000 Counts/Sec.</td>
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<td>Yes</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Reset Capability</td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
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<tr>
<td>Sensor Power</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes, with Micro Line Power Supply 9 to 17.5 VDC @ 100 mA</td>
</tr>
<tr>
<td>Setpoint Capability</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Communications</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Power Source</td>
<td>3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA</td>
<td>3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA</td>
<td>3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA</td>
<td>115/230 VAC 10 to 16 VDC</td>
</tr>
<tr>
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## QUICK Specs

### Totalizing Counters

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<tr>
<th>Description</th>
<th>CUB5 Counter/Rate Meter With Output Option Card Capability</th>
<th>PAXLCR 1/8 DIN Counter/Rate Meter With Setpoint Capability</th>
<th>PAXC 1/8 DIN Counter With Setpoint Card Capability</th>
<th>PAXI 1/8 DIN Counter/Rate Meter With Output Option Card Capability</th>
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<tr>
<td><strong>Counter/Rate Meter</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Dimensions (Height)x(Width)</strong></td>
<td>39 mm (H) x 75mm (W)</td>
<td>50 mm (H) x 97mm (W)</td>
<td>50 mm (H) x 97mm (W)</td>
<td>50 mm (H) x 97mm (W)</td>
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<tr>
<td><strong>Display</strong></td>
<td>8 Digit, .35&quot; (9mm) Reflective, Green and Red Backlight LCD</td>
<td>6 Digit, .56&quot; (14mm) Red LED</td>
<td>6 Digit, .56&quot; (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
<td>6 Digit, .56&quot; (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
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<tr>
<td><strong>Counting Capability</strong></td>
<td>Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch</td>
<td>Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch</td>
<td>Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch</td>
<td>Uni-Directional Up/Down Inhibit Add/Subtract Add/Add Quadrature Batch</td>
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<td><strong>Max. Input Frequency</strong></td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Reset Capability</strong></td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
<td>Front Panel, Remote</td>
</tr>
<tr>
<td><strong>Sensor Power</strong></td>
<td>No, with Micro Line Power Supply</td>
<td>24 VDC @ 100 mA, over 50 V 24 VDC @ 50 mA, under 50 V</td>
<td>12 VDC @ 100 mA</td>
<td>12 VDC @ 100 mA</td>
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<tr>
<td><strong>Setpoint Capability</strong></td>
<td>Single Form C Relay Dual Sinking</td>
<td>Dual Form C Relays</td>
<td>Dual Form C Quad Form A Quad Sinking Quad Sourcing</td>
<td>Dual Form C Quad Form A Quad Sinking Quad Sourcing</td>
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<td><strong>Communications</strong></td>
<td>RS485</td>
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<td>No</td>
<td>No</td>
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<td><strong>Power Source</strong></td>
<td>10 to 28 VDC 21.6 to 250 VDC</td>
<td>50 to 250 VAC 11 to 36 VDC 24 VAC</td>
<td>85 to 250 VAC 11 to 36 VDC 24 VAC</td>
<td>85 to 250 VAC 11 to 36 VDC 24 VAC</td>
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<tr>
<td><strong>Page Number</strong></td>
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<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
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<tbody>
<tr>
<td>CUB1</td>
<td></td>
<td>CUB7</td>
<td></td>
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<tr>
<td></td>
<td>Display: .2” (5 mm) Reflective LCD</td>
<td>Display: .35” (9 mm) Reflective LCD</td>
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<td>Power Source: 2 “N” Alkaline Batteries</td>
<td>Power Source: Internal Battery</td>
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<td>Count Speed: 5 KHz Max.</td>
<td>Count Speed: 10 KHz Max.</td>
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<td>CUB2</td>
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<td>CUB4 / CUB4L8</td>
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</tr>
<tr>
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<td>Display: .35” (9 mm) Reflective LCD</td>
<td>Display: .48” (12 mm) Reflective LCD</td>
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<tr>
<td></td>
<td>Power Source: Battery Powered</td>
<td>Power Source: Internal Battery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Count Speed: 5 KHz Max.</td>
<td>Count Speed: 10 KHz Max.</td>
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<tr>
<td>CUB3</td>
<td></td>
<td>CUB7</td>
<td></td>
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<td>Display: .2” (5 mm) Reflective LCD</td>
<td>Display: .35” (9 mm) Reflective LCD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Source: 2 “N” Alkaline Batteries</td>
<td>Power Source: Internal Battery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Count Speed: 100 Hz Max.</td>
<td>Count Speed: 10 KHz Max.</td>
<td></td>
</tr>
<tr>
<td>APLT</td>
<td></td>
<td>PAXLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display: 6 Digit, .56” (14 mm) Red LED, 8 Digit, .36” (9 mm) Red LED</td>
<td>Display: 6 Digit, .56” (14 mm) Red LED, 8 Digit, .4” (10 mm) Red LED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Source: 115/230 VAC, 11 to 14 VDC</td>
<td>Power Source: 115/230 VAC, 10 to 16 VDC</td>
<td></td>
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<tr>
<td></td>
<td>Count Speed: 10 KHz Max.</td>
<td>Count Speed: 25 KHz Max.</td>
<td></td>
</tr>
<tr>
<td>SCT</td>
<td></td>
<td>PAXLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display: 6 Digit, .43” (11 mm) Red LED</td>
<td>Display: 6 Digit, .56” (14 mm) Red LED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Source: 115/230 VAC, 12 VDC</td>
<td>Power Source: 115/230 VAC, 10 to 16 VDC</td>
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</tr>
<tr>
<td></td>
<td>Count Speed: 10 KHz Max.</td>
<td>Count Speed: 25 KHz Max.</td>
<td></td>
</tr>
</tbody>
</table>

Note: Refer to the current product literature, as some differences may exist.
**MODEL CUB7 - MINIATURE ELECTRONIC 8 DIGIT COUNTER**

- LCD, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING (9-28 VDC power supply required for versions with LED backlighting)
- 0.35” (8.90 mm) HIGH DIGITS
- REPLACEABLE INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF UNINTERRUPTED OPERATION (Battery included)
- NEMA 4X/IP65 SEALED FRONT BEZEL
- COUNT SPEEDS UP TO 10 KHz (CUB7)
- WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS
- FITS DIN STANDARD CUT-OUT 1.77” (45 mm) x 0.874” (22.2 mm)

**DESCRIPTION**

The CUB7 series is an 8-digit miniature counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting or red backlighting. The backlight versions require an external 9 to 28 VDC power supply.

The CUB7 series use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7 series is housed in 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.

**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.

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.

**SPECIFICATIONS**

1. **DISPLAY:** 8-digit LCD, 0.35” (8.90 mm) high digits.
2. **POWER SOURCE:** Replaceable Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. (Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.)
3. **BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC; 35 mA, typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use a Class 2 or SELV rated power supply.
4. **INPUTS:**  
   - **VIL (low) =** 0.5 V max  
   - **VIL (high) =** 2.0 V min. (3 V max). 10KHz max from 3.0 V bipolar output with a 50% duty cycle
5. **REMOTE RESET:** 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7 *</td>
<td>Counter Positive Image Reflective</td>
<td>CUB70000</td>
</tr>
<tr>
<td></td>
<td>Counter W/Yel-Grn Backlighting</td>
<td>CUB70010</td>
</tr>
<tr>
<td></td>
<td>Counter W/Red Backlighting</td>
<td>CUB70020</td>
</tr>
<tr>
<td>BNL</td>
<td>3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

*Battery is included with unit.

**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.

**PANEL CUT-OUT**

1-717-767-6511
6. CERTIFICATIONS AND COMPLIANCES:

SAFETY
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
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 Indoor Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2
Electrostatic discharge EN 61000-4-2 Level 2: 4 Kv contact Level 3: 8 Kv air
Electromagnetic RF fields EN 61000-4-3 Level 3: 10 V/m 80 MHz - 1 GHz
Fast transients (burst) EN 61000-4-4 Level 4: 2 K V/μs ¹ Level 3: 2 K v power
RF conducted interference EN 61000-4-6 Level 3: 10 V/μs ² 150 KHz - 80 MHz
Power frequency magnetic fields EN 61000-4-8 Level 4: 30 A/m Level 3: 10 V/m 900 MHz ± 5 MHz 200 Hz, 50% duty cycle
Simulation of cordless telephone ENV 50204 Level 3: 30 A/m

Emissions to EN 50081-1
RF interference EN 55022 Enclosure class B Power mains class B

Notes:
1. Burst to DC backlight power had a power line filter installed RLC #LFIL0000 or equivalent at the unit.

2. Self-recoverable loss of performance during EMI disturbance at 10 Vrms to backlight power lines.
   LCD segments may flicker during EMI disturbance.
   For operation without loss of performance:
   Install power line filter RLC #LFIL0000 or equivalent at the unit.
   Refer to the EMC Installation Guidelines section of this bulletin for additional information.

7. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC. (Backlight versions)
Storage Temperature Range: -30 to 80°C
Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.

Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g’s.
Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
Altitude: Up to 2000 meters

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: High impact plastic case with clear viewing window.
   The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.

10. WEIGHT: 2 oz. (57 grams) [with battery]

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CUB7 LOW SPEED COUNT INPUT, 30 Hz MAX.

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter (2.2 MΩ resistor and 0.0068 μF capacitor) used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 6 μA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 μA.

Motor starter contacts, tungsten contacts, and brush-type contacts should not be used.

CUB7 HIGH SPEED COUNT INPUT, 10 KHz MAX.

The “H.S. CNT.” Input allows the CUB7 to operate at speeds up to 10 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL Logic outputs can be loaded with a resistor (R₀) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. Transistor output.

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R values for Fig 2 & 3

<table>
<thead>
<tr>
<th>Voltage</th>
<th>R</th>
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<tr>
<td>+5 V</td>
<td>22 K</td>
</tr>
<tr>
<td>+12 V</td>
<td>10 K</td>
</tr>
<tr>
<td>+18 V</td>
<td>16 K</td>
</tr>
<tr>
<td>+24 V</td>
<td>24 K</td>
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</table>
EMC INSTALLATION GUIDELINES

Although this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. The unit 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 installation or a troublesome installation. Listed below are some EMC guidelines for 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 #FCCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward #23B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (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.

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. 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. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wire should be tinned with solder). Insert the wire under the screw-clamp and tighten the screw. Do NOT use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

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 4XF/JP65 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 an insetwashdown 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. Tip of screw should NOT project from hole in mounting clip.
3. Install CUB7 unit through the panel cut-out until 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.

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**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove battery cover, push upward in the direction of the arrow on rear cover (See drawing at right), until the cover unlatches. Pull cover straight out from unit to fully remove.
3. Remove old battery* and replace with an RLC battery (BNL10000).
4. Replace cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7 series when properly installed.

* - Dispose of properly.

**WARNING:** Lithium battery may explode if incinerated.

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**RESET OPTIONS (CUB7 SERIES)**

Connecting a wire from the RST. EN. (Reset Enable) Input terminal to Common will enable the front panel Reset button.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load is 15 μA (max. voltage drop 0.5 V) when on. The off-state leakage current must be less than 2 μA.

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

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**BACKLIGHT OPTION (CUB7 SERIES)**

Optional backlight versions of the CUB7 series require an external 9-28 VDC power supply. The external supply is connected between V+ and Common terminals as shown by the solid line in the drawing.

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**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL CUB7W - MINIATURE ELECTRONIC 8 DIGIT COUNTER

- LCD, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING (9-28 VDC power supply required for versions with LED backlighting)
- 0.35” (8.90 mm) HIGH DIGITS
- REPLACEABLE INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF UNINTERRUPTED OPERATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- COUNT INPUT FROM 10 to 300 VAC/DC (CUB7W)
- WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS
- FITS DIN STANDARD CUT-OUT 1.77” (45 mm) x 0.874” (22.2 mm)

DESCRIPTION
The CUB7 series is an 8-digit miniature counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting or red backlighting. The backlight versions require an external 9 to 28 VDC power supply.

The CUB7 series use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7 series is housed in 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.

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.

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.

SPECIFICATIONS
1. DISPLAY: 8-digit LCD, 0.35” (8.90 mm) high digits.
2. POWER SOURCE: Replaceable Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. (Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.)
3. BACKLIGHT POWER REQUIREMENTS: 9 to 28 VDC; 35 mA. typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C
4. INPUTS: VIL (low) = 0.5 V max
   - Low speed input: 10 to 300 VAC/DC, 50/60 Hz, 30 cps max. 150 V max for backlight versions. Unit counts on positive going edge.
5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7W *</td>
<td>Counter Positive Image Reflective</td>
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<td>Counter w/Yel-Grn Backlighting</td>
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<td>CUB7W020</td>
<td>Counter w/Red Backlighting</td>
<td></td>
</tr>
<tr>
<td>BNL10000</td>
<td>3 V Lithium Battery</td>
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</tr>
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</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

*Battery is included with unit.

DIMENSIONS In inches (mm)

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<tr>
<th>Size</th>
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<tr>
<td>Height</td>
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<td>Height</td>
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<td>1.77 (45.0)</td>
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<tr>
<td>Panel Cut-Out</td>
<td>0.03 (0.8)</td>
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</tbody>
</table>

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 this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. The unit 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 installation or a troublesome installation. Listed below are some EMC guidelines for 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:
     - Ferrite Suppression Cores (FSC #1VR3)
     - Schaffner # FN610-1/R (RLC #LFL0000)
     - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Corcom #3VR3

   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.

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. 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. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

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

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.
**L. S. INPUT, 30 CPS MAX.**

The CUB7W 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.

**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 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 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. Tip of screw should **NOT** project from hole in mounting clip.
3. Install CUB7 unit through the panel cut-out until 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.

**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove battery cover, push upward in the direction of the arrow on rear cover (See drawing at right), until the cover unlatches. Pull cover straight out from unit to fully remove.
3. Remove old battery* and replace with an RLC battery (BNL10000). Observe proper polarity when replacing battery as shown in drawing.
4. Replace cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7 series when properly installed.

* - Dispose of properly.

**WARNING:** Lithium battery may explode if incinerated.
**BACKLIGHT OPTION (CUB7 SERIES)**

Optional backlight versions of the CUB7 series require an external 9-28 VDC power supply. The external supply is connected between V+ and Common terminals as shown by the solid line in the drawing.

**WARNING:** When connecting the signal wiring for a backlit CUB7W 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 4 (LS) as shown by the dashed line in the drawing. The DC supply for the backlighting is connected between V+ and Common as shown by the solid line in the drawing. Three phase AC applications require an isolation transformer.

---

**RESET OPTIONS (CUB7 SERIES)**

Connecting a wire from the RST. EN. (Reset Enable) Input terminal to Common will enable the front panel Reset button.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load is 15 μA (max. voltage drop 0.5 V) when on. The off-state leakage current must be less than 2 μA.

*Note: The RC protection circuit on the “RST.” Input causes a delay of approximately 15 msec in Reset response.*
MODEL CUB7W3 - MINIATURE ELECTRONIC 8 DIGIT COUNTER

- LCD, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING (9-28 VDC power supply required for versions with LED backlighting)
- 0.35" (8.90 mm) HIGH DIGITS
- REPLACEABLE INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF UNINTERRUPTED OPERATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- COUNT INPUT FROM 10 to 30 VAC/DC
- WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS
- FITS DIN STANDARD CUT-OUT 1.77" (45 mm) x 0.874" (22.2 mm)

DESCRIPTION
The CUB7 series is an 8-digit miniature counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting or red backlighting. The backlight versions require an external 9 to 28 VDC power supply.

The CUB7 series use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7 series is housed in 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.

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.

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.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7W3</td>
<td>Counter Positive Image Reflective</td>
<td>CUB7W300</td>
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<tr>
<td></td>
<td>Counter w/Yel-Grn Backlighting</td>
<td>CUB7W310</td>
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<tr>
<td></td>
<td>Counter w/Red Backlighting</td>
<td>CUB7W320</td>
</tr>
<tr>
<td>BNL</td>
<td>3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

SPECIFICATIONS
1. DISPLAY: 8-digit LCD, 0.35" (8.90 mm) high digits.
2. POWER SOURCE: Replaceable Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. (Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.)
3. BACKLIGHT POWER REQUIREMENTS: 9 to 28 VDC; 35 mA, typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use a NEC Class 2 or SELV rated power supply.
4. INPUTS: \( V_\text{IL} \) (low) = 0.5 V max
   Low speed input: 10 to 30 VAC/DC, 50/60 Hz, 30 cps max. Unit counts on positive going edge.
5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

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.
6. CERTIFICATIONS AND COMPLIANCES:
SAFETY
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 Indoor 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

Immunity to EN 50082-2

Electrostatic discharge EN 61000-4-2
Level 2: 4 Kv contact
Level 3: 8 Kv air
Electromagnetic RF fields EN 61000-4-3
Level 3: 10 V/m
80 MHz - 1 GHz
Fast transients (burst) EN 61000-4-4
Level 4: 2 Kv I/O
Level 3: 2 Kv power
RF conducted interference EN 61000-4-6
Level 3: 10 V/rms
150 KHz - 80 MHz
Power frequency magnetic fields EN 61000-4-8
Level 4: 30 A/m
Level 3: 10 V/m
900 MHz ± 5 MHz
200 Hz, 50% duty cycle
Simulation of cordless telephone ENV 50204
EMI field of 1 MHz

Emissions to EN 50081-1
RF interference EN 55022
Enclosure class B
Power mains class B

Notes:
1. Burst to DC backlight power had a power line filter installed RLC
#LFIL0000 or equivalent at the unit.
2. Self-recoverable loss of performance during EMI disturbance at 10
V/rms to backlight power lines.
LCD segments may flicker during EMI disturbance.
For operation without loss of performance:
Install power line filter RLC #LFIL0000 or equivalent at the unit.
Refer to the EMC Installation Guidelines section of this bulletin for
additional information.

EMC INSTALLATION GUIDELINES

Although this unit is 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 the unit may be different for
various installations. In extremely high EMI environments, additional measures
may be needed. The unit 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 installation or a troublesome
installation. Listed below are some EMC guidelines for 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 contacts, 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 # FN610-1/07 (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.

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the
back of the unit. 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. When wiring
the unit, use the battery cover to identify the wire position with the proper
function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded
wires should be tinned with solder). Insert the wire under the screw-clamp and
tighten down the screw until the wire is clamped in tightly. Each terminal can
accept up to two #14 AWG wires.
**L. S. INPUT, 30 CPS MAX.**

The CUB7W3 accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 30 V at count speeds up to 30 cps. The unit counts on the positive going edge of the input signal.

**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 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 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. Tip of screw should NOT project from hole in mounting clip.
3. Install CUB7 unit through the panel cut-out until 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.

**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove battery cover, push upward in the direction of the arrow on rear cover (See drawing at right), until the cover unlatches. Pull cover straight out from unit to fully remove.
3. Remove old battery* and replace with an RLC battery (BNL10000). Observe proper polarity when replacing battery as shown in drawing.
4. Replace cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7 series when properly installed

* - Dispose of properly.

**WARNING:** Lithium battery may explode if incinerated.
**RESET OPTIONS (CUB7 SERIES)**

Connecting a wire from the RST. EN. (Reset Enable) Input terminal to Common will enable the front panel Reset button.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load is 15 μA (max, voltage drop 0.5 V) when on. The off-state leakage current must be less than 2 μA

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

**BACKLIGHT OPTION (CUB7 SERIES)**

Optional backlight versions of the CUB7 series require an external 9-28 VDC power supply. The external supply is connected between V+ and Common terminals as shown by the solid line in the drawing.

**TROUBLESHOOTING**

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

The CUB7P is an 8-digit miniature programmable counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting, or red backlighting. Backlight units require an external 9 to 28 VDC power supply.

The CUB7P is available in either Low Speed Contact or High Speed Logic. The Contact versions (CUB7P0xxx) operate from a switch contact or an NPN open collector transistor. The Logic versions (CUB7P2xx) operate from 3 VDC logic output or from an NPN open collector transistor.

The CUB7P has a programmable prescaler that can be set for any value between 0.0001 and 1.9999. The decimal point position can be set anywhere from 0 (no D.P.) to 0.000000 or no Leading Zero Blanking. Both the prescaler and DP selection are accessed using the front panel PGM and RESET push buttons. See Programming for details. Note that the count, prescaler and DP values will be lost if the battery is removed. See BATTERY INSTALLATION for additional information.

The CUB7P counters use a CMOS LSI chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7P series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber buttons meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

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.

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.

ORDERING INFORMATION

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<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<tr>
<td>*CUB7P</td>
<td>LOW SPEED CONTACT INPUT</td>
<td>CUB7P000</td>
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<tr>
<td></td>
<td>Counter; Positive Image Reflective</td>
<td>CUB7P010</td>
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<tr>
<td></td>
<td>Counter, w/Yel-Grn Backlighting</td>
<td>CUB7P020</td>
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<tr>
<td></td>
<td>High Speed Logic INPUT</td>
<td>CUB7P210</td>
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<tr>
<td></td>
<td>Counter, Positive Image Reflective</td>
<td>CUB7P220</td>
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<td>Counter, w/Yel-Grn Backlighting</td>
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</tr>
<tr>
<td></td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

* Battery is included with unit.

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.
**SPECIFICATIONS**

1. **DISPLAY:** 8-digit LCD, 0.35” (8.90 mm) high digits.

2. **POWER SOURCE:** Replaceable Internal 3.0 V lithium battery to provide up to 6 years of continuous operation. (Battery life is dependent upon usage. Contacts that remain closed for long periods of time reduce battery life.)

3. **BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC; 35 mA; typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use NEC Class 2 or SELV rated power supply.

4. **SIGNAL INPUT:** (LS terminal #4) See **Count Edge** under Programming for incrementing edge of input signal.

   **Contact Input** (CUB7P0xx): 30 Hz max. from Switch Contact or solid state Transistor Switch to Common with ≤50% duty cycle. Contact burden 7 μA max.

   **Logic Input** (CUB7P2xx): 10 KHz max. from a 3.0V bipolar output or 200 Hz max. from a solid state Transistor Switch to Common with a 50% duty cycle. Contact burden 7 μA max.

5. **REMOTE RESET:** 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

6. **ENVIRONMENTAL CONDITIONS:**

   **Operating Temperature Range:** 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC (Backlight versions).

   **Storage Temperature:** -30 to 80°C

   **Operating and Storage Humidity:** 85% max. relative humidity (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, 5g’s.

   **Shock According to IEC 68-2-27:** Operational 30 g, 11 msec in 3 directions. **Altitude:** Up to 2000 meters

7. **CERTIFICATIONS AND COMPLIANCES:**

   **SAFETY**
   - 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 Indoor Enclosure rating (Face only), UL50, IP65 Enclosure rating (Face only), IEC 529

   **CONSTRUCTION**

   **ELECTROMAGNETIC COMPATIBILITY**

   **Immunity to EN 50082-2**
   - Electrostatic discharge
   - EN 61000-4-2 Level 2; 4 Kv contact
   - Level 3; 8 Kv air
   - Electrostatic RF fields
   - EN 61000-4-3 Level 3; 10 V/m
   - 80 MHz - 1 GHz
   - Fast transients (burst)
   - EN 61000-4-4 Level 4; 2 Kv I/O
   - Level 3; 2 Kv power
   - RF conducted interference
   - EN 61000-4-6 Level 3; 10 V/rms
   - 150 KHz - 80 MHz
   - Simulation of cordless telephone
   - ENV 50204 Level 3; 10 V/m
   - 900 MHz ± 5 MHz
   - 200 Hz, 50% duty cycle

   **Emissions to EN 50081-1**
   - RF interference
   - EN 55022 Enclosure class B

   **Notes**
   - 1. Backlit powered units require a power line filter to be installed. RLC LFIL0000 or equivalent, so as not to impair the function of the backlighting.
   - Refer to EMC Installation Guidelines for additional information.

8. **CONNECTIONS:**

   **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:** High impact plastic case with clear viewing window.

   The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.

10. **WEIGHT:** 0.2 oz. (57 grams) [with battery]

**PROGRAMMING**

The CUB7P has programmable prescale values and decimal point positions. These values are changed using the front panel push buttons. Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front panel push buttons.

**Note:** Upon entering the PGM mode for the first time, the Prescaler value is set to 0.0000. Some value between 0.0001 and 1.9999 must be entered in order for the CUB7P to operate properly. Previously stored values are retained until changed by the user.

![PGM](image1)

With the front panel push buttons enabled, press the PGM button to enter the program mode. The CUB7P display will change to the current prescale value, with the least significant digit flashing at a 2 Hz rate. The prescale value can be set to any value between 0.0001 and 1.9999. Press the RST button to increment the flashing digit to the desired value. Pressing the PGM button will lock in the value of the flashing digit and advance to the next significant digit. The most significant digit can only be set to 0 or 1. When the entire prescale value has been programmed, press the PGM button once to enable decimal point selection. Any new count pulses will be accumulated using the new prescale value.

![RST](image2)

After performing the prescale selection, the display will show 0.0000. Decimal point positions can be set for:

- 0
- 0.0
- 0.00
- 0.000
- 0.0000
- 0.00000
- 0.000000
- 0.0000000

Press the RST button until the desired decimal point position is displayed. Press the PGM button to select that position and return to the counter mode. Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the programmed values.

**Note:** The incrementing edge of the count signal will change when the PGM button is pressed for the first time. To avoid incorrect display information, it is recommended that the CUB7P be reset after making programming changes.

**COUNT EDGE**

Accessing program mode for the first time will complement the incrementing edge of the count signal. The table below shows the incrementing edge of the count signal for the different versions of the CUB7P.

<table>
<thead>
<tr>
<th>VERSION</th>
<th>AFTER INSTALLING OR REPLACING BATTERY</th>
<th>AFTER ENTERING PROGRAM MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7P0</td>
<td>Rising Edge</td>
<td>Falling Edge</td>
</tr>
<tr>
<td>CUB7P2</td>
<td>Rising Edge</td>
<td>Falling Edge</td>
</tr>
</tbody>
</table>

- After entering the PGM mode for the first time, the prescaler value is set to 0.0000. Some value between 0.0001 and 1.9999 must be entered in order for the CUB7P to operate properly. Previously stored values are retained until changed by the user.

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This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
EMC INSTALLATION GUIDELINES

Although this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. The unit 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 a troublesome installation. Listed below are some EMC guidelines for 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 # FN610-1/07 (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.

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. 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 be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

WARNING: Lithium battery may explode if incinerated.

BATTERY INSTALLATION

1. Remove all power to the unit before removing battery cover.
2. To remove the battery cover, push upward in the direction of the arrow on the rear cover (See drawing below), until the cover unlatches. Pull the cover straight out from unit to fully remove.
3. Remove old battery* and replace it with an RLC battery (BNL10000). Observe proper polarity when replacing the battery as shown in the drawing.
4. Replace the cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7P when properly installed.

* - Dispose of properly.

WARNING: Lithium battery may explode if incinerated.

1-717-767-6511
**RESET AND PROGRAM OPTIONS**

Connecting a wire from the RST EN (Reset Enable) or the HS (Program Enable) Input terminals to Common will enable the front panel Reset or Program buttons respectively.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. The Switch load is $15 \mu A$ (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than $2 \mu A$.

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

**L.S. INPUT; LOGIC VERSIONS (10 KHz MAX.)**

The “L.S.” Input allows the CUB7P to operate at speeds up to 10 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL Logic outputs can be loaded with a resistor ($R_L$) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. Transistor output.

<table>
<thead>
<tr>
<th>$R$ values for $+V$ &amp; $-V$</th>
<th>$R$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$+5 V$</td>
<td>2.2 K</td>
</tr>
<tr>
<td>$+12 V$</td>
<td>10 K</td>
</tr>
<tr>
<td>$+18 V$</td>
<td>16 K</td>
</tr>
<tr>
<td>$+24 V$</td>
<td>24 K</td>
</tr>
</tbody>
</table>

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.
3. Slide the panel gasket over the rear of the counter body to the back of the bezel. Install CUB7P unit through the panel cut-out.
4. Insert the mounting screws onto both sides of mounting clip. Tip of screw should NOT project from hole in mounting clip.
5. 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 CUB7P housing.
6. Note: It is necessary to hold the unit in place when sliding mounting clip into position.
7. 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.
8. If the gasket is not adequately compressed and the mounting screws can no longer be turned, loosen mounting screws, and check that the mounting clip is latched as close as possible to the panel.
9. Repeat from step #5 for tightening mounting 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 push buttons of the unit.
**L.S. INPUT; CONTACT VERSIONS (30 Hz MAX.)**

Connecting the “L.S.” Input to Common with a mechanical or solid-state switch increments the counter. The switch load is 7 μA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 μA.

**REED SWITCHES, MERCURY WETTED CONTACTS, SNAP ACTION LIMIT SWITCHES, AND SILVER ALLOY RELAY CONTACTS WITH WIPING ACTION ARE USUALLY SATISFACTORY FOR INPUT ACTIVATION. MOTOR STARTER CONTACTS, TUNGSTEN CONTACTS, AND BRUSH-TYPE CONTACTS SHOULD NOT BE USED.**

**BACKLIGHT OPTION**

Optional backlight versions of the CUB7P require an external 9 to 26 VDC power supply. The external supply is connected between the V+ and common terminals as shown in the drawing.

**APPLICATION - TOTAL YARDS OF MATERIAL**

A fabric manufacturer wants to know, as economically as possible, how many whole yards of material his lines are running. The CUB7P000 will meet his process requirements. The encoder measuring the material, generates a one pulse per foot output signal. To obtain the desired display of yards measured, a prescale value of 0.3333 is programmed. To program the prescale value, connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable the front panel push buttons (See PROGRAMMING for more details.). Remove these wires after programming to prevent accidental changes to the prescale value. At the end of each shift, the machine operator records the total shown on the display and resets the counter to zero via key switch.

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
**MODEL CUB7P - PROGRAMMABLE ELECTRONIC 8-DIGIT COUNTER**

![Image of CUB7P counter]

**DESCRIPTION**

The CUB7P is an 8-digit miniature programmable counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting, or red backlighting. Backlight units require an external 9 to 28 VDC power supply. The CUB7P versions operate from a signal voltage of 10 to 300 V (AC 50/60 Hz or DC).

The CUB7P1 has a programmable prescaler that can be set for any value between 0.0001 and 1.9999. The decimal point position can be set anywhere from 0 (no D.P.) to 0.000000 or no Leading Zero Blanking. Both the prescaler and DP selection are accessed using the front panel PGM and RESET push buttons. See Programming for details. Note that the count, prescaler and DP values will be lost if the battery is removed. See BATTERY INSTALLATION for additional information.

The CUB7P counters use a CMOS LSI chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7P series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber buttons meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

**SAFETY SUMMARY**

All instructions that appear in the bulletin or on equipment, all safety related regulations, and all local codes 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.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CUB7P</td>
<td>Counter; Positive Image Reflective</td>
<td>CUB7P100</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Yel-Grn Backlighting</td>
<td>CUB7P110</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Red Backlighting</td>
<td>CUB7P120</td>
</tr>
<tr>
<td>BNL</td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

* Battery is included with unit.

**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.
EN 61000-4-2
Level 3; 10 V/rms
Enclosure class B

EN 61000-4-4
ENV 50204
Level 3; 10 V/m
Level 3; 10 V/m

EN 61000-4-3
Level 2; 4 Kv contact

EN 61000-4-6

6. Press the PGM button to select that position and return to the counter mode. Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the programmed values.

5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

ENVIRONMENTAL CONDITIONS:
Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC (Backlight versions).
Storage Temperature: -30 to 80°C
Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g’s.
Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
Altitude: Up to 2000 meters.

CERTIFICATIONS AND COMPLIANCES:
SAFETY
IEC-1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529
Type 4X Enclosure rating (Face only), UL50

EMISSIONS
Voltage Input (CUB7P1x): 10 V min. to 300 V max. (AC 50/60 Hz. or DC) to Common, 150 V max. for backlight versions. 30 cps max. Input current 0.5 mA.max. ANY off-state leakage current may prevent counter from activating.

6. Remote Control: During remote control, the front panel backlighting will not function. To resume backlighting, press the PGM button to exit program mode.

5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2
Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
Level 3; 8 Kv air
Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
80 MHz - 1 GHz
Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv I/O
Level 3; 2 Kv power 1
RF conducted interference EN 61000-4-6 Level 3; 10 V/m
150 KHz - 80 MHz
Simulation of cordless telephone ENV 50204 Level 3; 10 V/m
900 MHz ± 5 MHz
200 Hz, 50% duty cycle

Emissions to EN 50081-1
RF interference EN 55022 Enclosure class B

Notes
1. Backlit powered units require a power line filter to be installed, RLC LFIL0080 or equivalent, so as not to impair the function of the backlighting.
2. Refer to EMC Installation Guidelines for additional information.

8. CONSTRUCTION: High impact plastic case with clear viewing window.
The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.

9. WEIGHT: 2 oz. (57 grams) [with battery]

PROGRAMMING

The CUB7P has programmable prescale values and decimal point positions. These values are changed using the front panel push buttons. Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front panel push buttons.

Note: Upon entering the PGM mode for the first time, the Prescaler value is set to 0.0001. Some values between 0.0001 and 1.9999 must be entered in order for the CUB7P to operate properly. Previously stored values are retained until changed by the user.

With the front panel push buttons enabled, press the PGM button to enter the program mode. The CUB7P display will change to the current prescale value, with the least significant digit flashing at a 2 Hz rate. The prescale value can be set to any value between 0.0001 and 1.9999. Press the RST button to increment the flashing digit to the desired value. Pressing the PGM button will lock in the value of the flashing digit and advance to the next significant digit. The most significant digit can only be set to 0 or 1. When the entire prescale value has been programmed, press the PGM button once to enable decimal point selection. Any new count pulses will be accumulated using the new prescale value.

After performing the prescale selection, the display will show 0.0000. Decimal point positions can be set for:

- 0
- 0.0
- 0.00
- 0.000
- 0.0000
- 0.00000
- 0.000000
- 0.0000000
- 0.00000000

Press the RST button until the desired decimal point position is displayed. Press the PGM button to select that position and return to the counter mode. Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the programmed values.

Note: The incrementing edge of the count signal will change when the PGM button is pressed for the first time. To avoid incorrect display information, it is recommended that the CUB7P be reset after making programming changes.

COUNT EDGE
Accessing program mode for the first time will complement the incrementing edge of the count signal. See below for the incrementing edge of the count signal for the CUB7P1:

1. After installing or replacing battery: Falling Edge
2. After entering program mode: Rising Edge

EMC INSTALLATION GUIDELINES

Although this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. The unit 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 a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail 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 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 #28B2029-0A
Line Filters for input power cables:
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.

WARNING: Lithium battery may explode if incinerated. To prevent damage to the unit, the voltage on all inputs must not exceed 3.0 VDC with the following exceptions: V+ (all models - 28 VDC max.) and LS (voltage versions - 300 V max.).

**WIRING CONNECTIONS**

The electrical connections are made via screw-clamp terminals located on the back of the unit. 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 be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

WARNING: Lithium battery may explode if incinerated.

CAUTION: All leads will be at the same line potential as the input leads.

**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove the battery cover, push upward in the direction of the arrow on the rear cover (See drawing below), until the cover unlatches. Pull the cover straight out from unit to fully remove. 
3. Remove old battery* and replace it with an RLC battery (BNL10000). Observe proper polarity when replacing the battery as shown in the drawing. 
4. Replace the cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7P when properly installed.

* - Dispose of properly.

WARNING: Lithium battery may explode if incinerated.

**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 push buttons of the unit.

**INSTALLATION**

The CUB7P 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 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.
3. Slide the panel gasket over the rear of the counter body to the back of the bezel. Install CUB7P unit through the panel cut-out.
4. Insert the mounting screws onto both sides of mounting clip. Tip of screw should NOT project from hole in mounting clip.
5. 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 CUB7P housing.
6. Note: It is necessary to hold the unit in place when sliding mounting clip into position.
7. 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.
8. If the gasket is not adequately compressed and the mounting screws can no longer be turned, loosen mounting screws, and check that the mounting clip is latched as close as possible to the panel.
9. Repeat from step #5 for tightening mounting screws.

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
L.S. INPUT; VOLTAGE VERSIONS (30 Hz MAX.)

The CUB7P accepts most machine control voltage signals. The input accepts single phase AC (50/60 Hz) or DC control voltages from 10 to 300 V at count speeds up to 30 Hz. The counter increments when voltage is applied between the LS input and Common. Any off-state leakage current may prevent the counter from operating properly.

WARNING: If voltage input is connected to circuits above 30 Vrms, 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 AND PROGRAM OPTIONS

Connecting a wire from the RST EN (Reset Enable) or the HS (Program Enable) Input terminals to Common will enable the front panel Reset or Program buttons respectively.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. The Switch load is 15 μA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 μA.

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

PROGRAMMING EXAMPLES

SCALING A COUNTER

Example: An encoder generates 600 pulses per foot. The Desired Display is tenths of inches. The Prescaler is determined using the formula below.

\[
\text{Prescaler} = \frac{\text{Desired Display} \times \text{Decimal Point Value}}{\text{Number of Pulses}}
\]

Where:

- Desired Display = The number of Desired Display units (revolutions, feet, 10ths of feet, meters, etc.).
- Number of Pulses = The number of pulses required to achieve the Desired Display
- Decimal Point Value = The desired decimal point placement on the display.

Example: Display tenths of inches when using

\[
\text{Prescaler} = \frac{1 \text{ (inch)} \times 10 \text{ (Decimal Point Value)}}{600 \text{ pulses/foot} \times 1 \text{ foot/12 inches}} = \frac{10}{50} = 0.2
\]

APPLICATION - TOTAL YARDS OF MATERIAL

The management at an amusement park wants to know how many miles (in tenths) each of their parking lot trams travel. They know that a 24 VDC input pulse is given for each revolution of the 6 foot in circumference wheel. The small CUB7P100 can meet this need. There are 5280 feet in one mile and with 6 feet per revolution; there would be 880 revolutions or pulses in a mile. To obtain the desired display of miles in tenths, the CUB7P100 decimal point would be programmed for 0.0 either the prescale value of 0.0114 (1 x 10 decimal point value /880 pulses per mile). TO program these values, connect wires between RST EN (Reset Enable) and COM (Common); and between HS (Program Enable) and COM (Common) to enable the front panel push buttons. (See PROGRAMMING for more details) Remove these wires after programming to prevent the mileage from being reset.
MODEL CUB7P3 - PROGRAMMABLE ELECTRONIC 8-DIGIT COUNTER

DESCRIPTION

The CUB7P3 is an 8-digit miniature programmable counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting, or red backlighting. Backlight units require an external 9 to 28 VDC power supply. The CUB7P3 versions operate from a signal voltage of 10 to 30 V (AC 50/60 Hz or DC).

The CUB7P3 has a programmable prescaler that can be set for any value between 0.0001 and 1.9999. The decimal point position can be set anywhere from 0 (no D.P.) to 0.000000 or no Leading Zero Blanking. Both the prescaler and DP selection are accessed using the front panel PGM and RESET push buttons. See Programming for details. Note that the count, prescaler and DP values will be lost if the battery is removed. See BATTERY INSTALLATION for additional information.

The CUB7P counters use a CMOS LSI chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7P series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber buttons meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

SAFETY SUMMARY

All instructions that appear in the bulletin or on equipment, all safety related regulations, and all local codes 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.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7P3</td>
<td>Counter; Positive Image Reflective</td>
<td>CUB7P300</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Yel-Grn Backlighting</td>
<td>CUB7P310</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Red Backlighting</td>
<td>CUB7P320</td>
</tr>
<tr>
<td>BNL</td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

* Battery is included with unit.

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.
1. **DISPLAY**: 8-digit LCD, 0.35" (8.90 mm) high digits.

2. **POWER SOURCE**: Replaceable Internal 3.0 V lithium battery to provide up to 6 years of continuous operation. (Battery life is dependent upon usage. Contacts that remain closed for long periods of time reduce battery life.)

3. **BACKLIGHT POWER REQUIREMENTS**: 9 to 28 VDC; 35 mA, typical; 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use a NEC Class 2 or SELV rated power supply.

4. **SIGNAL INPUT**: (LS terminal #4) See Count Edge under Programming for incrementing edge of input signal. Voltage Input (CUB7P3xx): 10 V min. to 30 V max. (AC 50/60 Hz. or DC) to Common. 30 cpm max. ANY off-state leakage current may prevent counter from activating.

5. **REMOTE RESET**: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

6. **ENVIRONMENTAL CONDITIONS**:
   - Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC (Backlight versions).
   - Storage Temperature: -30 to 80°C
   - Operating and Storage Humidity: 85% max. relative humidity (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’s.
   - Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
   - Altitude: Up to 2000 meters

7. **CERTIFICATIONS AND COMPLIANCES**:

   **SAFETY**
   - UL Listed, File # E137806, UL508, CSA C22.2 No. 14-M95
   - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   - Type-4X Indoor 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

8. **ELECTROMAGNETIC COMPATIBILITY**

   **Immunity to EN 50082-2**
   - Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
   - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m 80 MHz - 1 GHz
   - Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv/D
   - RF conducted interference EN 61000-4-6 Level 3; 3.2 V power
   - Simulation of cordless telephone ENV 50204 Level 3; 10 V/m 900 MHz ± 5 MHz
   - 200 Hz, 50% duty cycle

   **Emissions to EN 50081-1**
   - RF interference EN 55022 Level 3; 10 V/m 200 Hz, 50% duty cycle

   **Notes**
   1. Backlit powered units require a power line filter to be installed, RLC LFIL000 or equivalent, so as not to impair the function of the backlighting. Refer to EMC Installation Guidelines for additional information.

9. **CONSTRUCTION**:

   **High impact plastic case with clear viewing window.**

10. **CONNECTIONS**:

    **Wire clamping screw terminals**
    - Wire Strip Length: 0.3" (7.5 mm).
    - Wire Gage: 30-14 AWG copper wire
    - Torque: 5 inch-pounds (0.565 N-m) max.

11. **WEIGHT**: 2 oz. (57 grams) [with battery]

**PROGRAMMING**

The CUB7P has programmable prescale values and decimal point positions. These values are changed using the front panel push buttons. Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front panel push buttons.

**Note**: Upon entering the PGM mode for the first time, the Prescaler value is set to 0.0000. Some value between 0.0001 and 1.9999 must be entered in order for the CUB7P to operate properly. Previously stored values are retained until changed by the user.

With the front panel push buttons enabled, press the PGM button to enter the program mode. The CUB7P display will change to the current prescale value, with the least significant digit flashing at a 2 Hz rate. The prescale value can be set to any value between 0.0001 and 1.9999. Press the RST button to increment the flashing digit to the desired value. Pressing the PGM button will lock in the value of the flashing digit and advance to the next significant digit. The most significant digit can only be set to 0 or 1. When the entire prescale value has been programmed, press the PGM button once to enable decimal point selection. Any new count pulses will be accumulated using the new prescale value.

After performing the prescale selection, the display will show 0.0000. Decimal point positions can be set for:

- 0
- 0.0
- 0.00
- 0.000
- 0.0000
- 0.00000
- 0.000000

Press the RST button until the desired decimal point position is displayed. Press the PGM button to select that position and return to the counter mode. Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the programmed values.

**Note**: The incrementing edge of the count signal will change when the PGM button is pressed for the first time. To avoid incorrect display information, it is recommended that the CUB7P be reset after making programming changes.

**COUNT EDGE**

Accessing program mode for the first time will complement the incrementing edge of the count signal. See below for the incrementing edge of the count signal for the CUB7P:

- After installing or replacing battery: Falling Edge
- After entering program mode: Rising Edge

**EMC INSTALLATION GUIDELINES**

Although this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. The unit 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 a troublesome installation. Listed below are some EMC guidelines for 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 # FN610-1/07 (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.

**WARNING:** Lithium battery may explode if incinerated. To prevent damage to the unit, the voltage on all inputs must not exceed 3.0 VDC with the following exceptions: V+ (all models: 28 VDC max.) and LS (voltage versions: 30 V max.).

**WIRING CONNECTIONS**

The electrical connections are made via screw-clamp terminals located on the back of the unit. 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 be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

**WARNING:** Lithium battery may explode if incinerated.

---

**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove the battery cover, push upward in the direction of the arrow on the rear cover (See drawing below), until the cover unlatches. Pull the cover straight out from unit to fully remove.
3. Remove old battery* and replace it with an RLC battery (BNL10000). Observe proper polarity when replacing the battery as shown in the drawing.
4. Replace the cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7P when properly installed.

* - Dispose of properly.

**WARNING:** Lithium battery may explode if incinerated.

---

**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 push buttons of the unit.

**INSTALLATION**

The CUB7P 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 installing the unit in the panel cut-out.

---

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
**L.S. INPUT; VOLTAGE VERSIONS (30 Hz MAX.)**

The CUB7P3 accepts most machine control voltage signals. The input accepts single phase AC (50/60 Hz) or DC control voltages from 10 to 30 V at count speeds up to 30 Hz. The counter increments when voltage is applied between the LS input and Common. Any off-state leakage current may prevent the counter from operating properly.

**RESET AND PROGRAM OPTIONS**

Connecting a wire from the RST EN (Reset Enable) or the HS (Program Enable) Input terminals to Common will enable the front panel Reset or Program buttons respectively.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. The Switch load is 15 μA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 μA.

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

**APPLICATION - TOTAL YARDS OF MATERIAL**

The management at an amusement park wants to know how many miles (in tenths) each of their parking lot trams travel. They know that a 24 VDC input pulse is given for each revolution of the 6 foot in circumference wheel. The small CUB7P300 can meet this need. There are 5280 feet in one mile and with 6 feet per revolution; there would be 880 revolutions or pulses in a mile. To obtain the desired display of miles in tenths, the CUB7P300 decimal point would be programmed for 0.0 either the prescale value of 0.0114 (1 x 10 decimal point value /880 pulses per mile). TO program these values, connect wires between RST EN (Reset Enable) and COM (Common); and between HS (Program Enable) and COM (Common) to enable the front panel push buttons. (See PROGRAMMING for more details) Remove these wires after programming to prevent the mileage from being reset.

**PROGRAMMING EXAMPLES**

**SCALING A COUNTER**

**Example:** An encoder generates 600 pulses per foot. The Desired Display is tenths of inches. The Prescaler is determined using the formula below.

\[
\text{Prescaler} = \frac{\text{Desired Display Units} \times \text{Decimal Point Value}}{\text{Number of Pulses}}
\]

Where:

- **Desired Display** = The number of Desired Display units (revolutions, feet, 10ths of feet, meters, etc.).
- **Number of Pulses** = The number of pulses required to achieve the Desired Display
- **Decimal Point Value** = The desired decimal point placement on the display.

Example: Display tenths of inches when using

\[
\text{Prescaler} = \frac{1 \text{ (inch)} \times 10 \text{ (Decimal Point Value)}}{600 \text{ pulses/foot} \times 1 \text{ foot/12 inches}}
\]

\[
= \frac{10}{50} = 0.2
\]
MODEL CUB4L, CUB4L8 & CUB4L8W - MINIATURE ELECTRONIC COUNTERS

DESCRIPTION
The CUB4 offers a large display in a miniature package. There are three CUB4 counters to choose from: the CUB4L (6-digit counter), CUB4L8 (8-digit counter), and the CUB4L8W (8-digit counter with voltage input). You also have 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 (MLPS1000) is designed to be attached directly to the rear of the CUB4 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 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

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB4L (6-digit)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L000</td>
</tr>
<tr>
<td></td>
<td>Counter w/Yel-Grn Backlighting</td>
<td>CUB4L010</td>
</tr>
<tr>
<td></td>
<td>Counter with Red Backlighting</td>
<td>CUB4L020</td>
</tr>
<tr>
<td></td>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L000</td>
</tr>
<tr>
<td>CUB4L8 (8-digit)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L800</td>
</tr>
<tr>
<td></td>
<td>Counter with Yel-Grn Backlighting</td>
<td>CUB4L810</td>
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<tr>
<td></td>
<td>Counter with Red Backlighting</td>
<td>CUB4L820</td>
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<tr>
<td></td>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L800</td>
</tr>
<tr>
<td>CUB4L8W (8-digit w/VCM)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L8W0</td>
</tr>
<tr>
<td></td>
<td>Counter with Yel-Grn Backlighting</td>
<td>CUB4L8W1</td>
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<tr>
<td></td>
<td>Counter with Red Backlighting</td>
<td>CUB4L8W2</td>
</tr>
<tr>
<td></td>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L8WM</td>
</tr>
<tr>
<td>MLPS</td>
<td>Micro Line/Sensor Power Supply</td>
<td>MLPS1000</td>
</tr>
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</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

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.

SPECIFICATIONS

1. DISPLAY:
   CUB4L: 6-Digit, LCD, 0.48"(12.2 mm) high digits.
   CUB4L8 & CUB4L8W: 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.

4. INPUTS:
   All Inputs: \( V_{IL} (\text{low}) = 0.5 \text{ V max.} \)
   Low Speed Input (CUB4L & CUB4L8): 30 Hz from switch contact or open collector transistor with a 50% duty cycle.
   Low Speed Input (CUB4L8W): 10 to 300 VAC/DC, 50/60 Hz, 30 cps max. \( V_{IL} = 0.5 \text{ VDC max.} \) Unit counts on positive going edge. Will not operate with Triac outputs.
   High Speed Input (CUB4L): 5 KHz from 4.0 V to 28.0 V bipolar output with a 50% duty cycle.
   High Speed Input (CUB4L8): 5 KHz at 2.0 V (3 V max) bipolar output with a 50% duty cycle.
   Remote Reset:
   CUB4L: 15 msec min. pulse width (active low) from 4.0 V to 28.0 V bipolar output or an open collector transistor or a switch contact to common.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15&quot; (54.6) H x 3.00&quot; (76.2) W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANEL CUT-OUT</td>
</tr>
<tr>
<td>REDLINE</td>
</tr>
</tbody>
</table>
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 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.

7. Construction:

This unit is rated for NEMA 4X/IP65 indoor use. Installation Category I, Pollution Degree 2.

8. 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. 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.

5. 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.

6. Ferrite Suppression Cores for signal and control cables:
   - Fair-Rite # 0443167251 (RLC #FCOR0000)
   - TDK # ZCAT3035-1330A
   - Steward #28B2029-0A0

7. Ferrite Suppression Cores for signal and control cables:
   - Schaffner # FN610-1/07 (RLC #FLI0000)
   - Schaffner # FN670-1/07
   - 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.
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.

CUB4L AND CUB4L8 LOW SPEED COUNT INPUT, 30 Hz MAX.

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 14 μA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 μA. Motor starter contacts, tungsten contacts, and brush-type contacts should NOT be used.

CUB4L8W 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.

CUB4L HIGH SPEED COUNT INPUT, 5 KHz MAX.

The “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs. Input drive voltage must be limited to 28.0 V maximum to avoid damage to the counter.

INPUT PULSE EXCURSION LIMITS

V_{in} (High) = +4.0 V min., +28.0 V max.
V_{in} (Low) = +0.5 V max.
The “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL logic outputs can be loaded with a resistor (R) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. transistor output.

**INPUT PULSE EXCURSION LIMITS**

- \( V_{IH} \) (High) = 2.0 V min., 3.0 V max.
- \( V_{IL} \) (Low) = ±0.5 V max.

**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 V AC 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.
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 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 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 2.15” (54.6) H x 3.00” (76.2) W.
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 MLPS1 or a Class 2 or SELV rated power supply.

3. COUNTER DISPLAYS:
   - Counter A: 8-digits, enabled in all count modes
     Display Range: -9999999 to 99999999
     Overflow Indication: Display flashes "OL" and "OE".
   - 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 99999999 (positive count only)
     Overflow Indication: Display flashes "OL" and "OE".
   - 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: "########".
   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: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 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 A and INP B) to activate function. Internal 10KΩ pull-up resistor to +9 to 28 VDC.

7. MEMORY: Nonvolatile EPROM memory retains all programming parameters and count values when power is removed.

8. CONNECTIONS:
   - Wire: 24 AWG copper wire
   - 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 indoor 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

11. SAFETY:
    - UL Recognized Component, File #E179259, UL61010A-1, CSA22.2 No. 61010-1
    - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriter's Laboratories, Inc.
    - UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M05
    - LISTED by Under. Lab. Inc. to U.S. and Canadian safety standards
    - Type 4X Indoor Enclosure rating (Face only), UL50
    - Issued by Underwriters Laboratories, Inc.
    - IEC61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    - IP65 Enclosure rating (Face only), IEC 529

12. ELECTROMAGNETIC COMPATIBILITY:
    Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

13. IMMUNITY TO INDUSTRIAL LOCATIONS:
    Operating Temperature Range for CUB5B000 depends on display color and intensity level as per below:

    | Display | INTENSITY LEVEL | TEMPERATURE |
    |---------|----------------|-------------|
    | Red | 1 & 2 | -35 to 75°C |
    | Green | 1 & 2 | -35 to 75°C |

    Storage Temperature: -35 to 85°C
    Operating and Storage Humidity: 0 to 85% max. relative humidity (non-condensing)
    Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g’s.
    Shock According to IEC 68-2-7: Operational 40 g, 11 msec in 3 directions.
    Altitude: Up to 2000 meters

14. CERTIFICATIONS AND COMPLIANCES:
    - Electromagnetic RF fields
    - Fast transients (burst)
    - Electromagnetic RF fields
    - Immunity to Industrial Locations:
    - Safety
    - Shock
    - Vibration
    - Electromagnetic RF fields
    - Fast transients (burst)
    - Electromagnetic RF fields
    - Immunity to Industrial Locations:
    - Safety
    - Shock
    - Vibration
    - Electromagnetic RF fields

15. NOTES:
    I. Criterion A: Normal operation within specified limits.
    Refer to EMC Installation Guidelines for additional information.

16. WEIGHT: 3.2 oz (100 g)
1.0 INSTALLING THE METER

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.

DUAL SINKING OUTPUT CARD (One or two setpoints)

Type: Non-isolated switched DC, N Channel open drain MOSFET
Current Rating: 100 mA max.
VDS ON: 0.7 V @ 100 mA
VDS MAX: 30 VDC
Offset 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
**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.

**Comms Card**

**Setpoint Card**

**Locking Tab**

---

**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 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 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. (Pull wire to verify tightness.)
   b. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
   c. Connect the shield to protective earth.
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. 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.
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.

**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 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).

---

**5.0 Line Filters for Input Power Cables:**

- Schaffner # FN610-1/07 (RLC# LFIL0000)
- Schaffner # FN670-1-807
- Corcom # 1 VR3

**Note:** Reference manufacturer’s instructions when installing a line filter.

**Ferrite Suppression Cores for Signal and Control Cables:**

- Fair-Rite # 1443167251 (RLC# FCOR0000)
- Steward # 28B2029-0A0
- Schaffner # FN610-1/07 (RLC# LFIL0000)
- Fair-Rite # 0443167251 (RLC# FCOR0000)
- Schaffner # FN670-1.8/07
- TDK # ZCAT3035-130A
- Steward # 28B2029-0A0
- Corcom # 1 VR3

**Corcom # 1 VR3**

**Fair-Rite # 0443167251 (RLC# FCOR0000)**

**Steward # 28B2029-0A0**

**TDK # ZCAT3035-130A**

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**Line Filters for Input Power Cables:**

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**Corcom # 1 VR3**

**Schaffner # FN610-1/07 (RLC# LFIL0000)**

**Schaffner # FN670-1-807**

**Corcom # 1 VR3**

**Note:** Reference manufacturer’s instructions when installing a line filter.

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- Steward # 28B2029-0A0
- Schaffner # FN610-1/07 (RLC# LFIL0000)
- Schaffner # FN670-1-807
- Corcom # 1 VR3

**Note:** Reference manufacturer’s instructions when installing a line filter.

---

**6.0 Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.**

---

**7.0 Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.**

Snubber: RLC# SNUB0000.

---

**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.
4.3 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.

### AC Inputs From Tach Generators, Etc.

**Input A**
- Current Sourcing Output
- Interfacing With TTL

**Current Sourcing Output**

**Current Sinking Output**

**Switch or Isolated Transistor; Current Sink**

**Switch or Isolated Transistor; Current Source**

**Current Sink Output; Quad/Direction**

* Switch position is application dependent.

### 4.4 SETPOINT (OUTPUT) WIRING

#### SINGLE SETPOINT RELAY PLUG-IN CARD

**ELECTRICAL CONNECTIONS**

```
+--------+  N.O.  +--------+
|        |         |        |
|        |         |        |
|        |         |        |
|        |         |        |
|        |         |        |
|        |         |        |
|        |         |        |
|        |         |        |
```

#### DUAL SETPOINT N-FET OPEN DRAIN PLUG-IN CARD

**ELECTRICAL CONNECTIONS**

```
+--------+  OSNK 1(2)  +--------+
|        |   (30 V MAX.)  |        |
|        |                  |        |
|        |                  |        |
|        |                  |        |
|        |                  |        |
|        |                  |        |
```

*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
5.0 Reviewing the Front Buttons and Display

**KEY**
- **SEL**: Index display through enabled values
- **RST**: Resets count display(s) and/or outputs

**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.

---

6.0 Programming the Meter

**OVERVIEW**

**PROGRAMMING MENU**

<table>
<thead>
<tr>
<th>DISPLAY MODE</th>
<th>PROGRAMMING MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEL</strong></td>
<td>Input Setup Parameters</td>
</tr>
<tr>
<td><strong>RST</strong></td>
<td>Rate Setup Parameters</td>
</tr>
<tr>
<td><strong>PRO</strong></td>
<td>Display and Front Panel Key Parameters</td>
</tr>
<tr>
<td><strong>RST</strong></td>
<td>Setpoint Output Parameters</td>
</tr>
<tr>
<td><strong>RST</strong></td>
<td>Serial Setup Parameters</td>
</tr>
</tbody>
</table>

**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.
6.1 MODULE 1 - INPUT SETUP PARAMETERS (I-INPUT)

PARAMETER MENU

COUNT MODE

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

<table>
<thead>
<tr>
<th>DISPLAY MODE</th>
<th>INPUT A ACTION</th>
<th>INPUT B ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count with Direction</td>
<td>Counter A</td>
<td>Counter A Direction</td>
</tr>
<tr>
<td>Rate/Counter</td>
<td>Rate only</td>
<td>Counter A Add</td>
</tr>
<tr>
<td>Dual Counter</td>
<td>Counter A Add</td>
<td>Counter B Add</td>
</tr>
<tr>
<td>Quadrature x1</td>
<td>Count A</td>
<td>Quad A</td>
</tr>
<tr>
<td>Quadrature x2</td>
<td>Count A</td>
<td>Quad A</td>
</tr>
<tr>
<td>Quadrature x4</td>
<td>Count A</td>
<td>Quad A</td>
</tr>
<tr>
<td>2 Input Add/Add</td>
<td>Counter A Add</td>
<td>Counter A Add</td>
</tr>
<tr>
<td>2 Input Add/Subtract</td>
<td>Counter A Add</td>
<td>Counter A Subtract</td>
</tr>
</tbody>
</table>

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

COUNTER A DECIMAL POSITION

This selects the decimal point position for 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 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

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

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

COUNTER A COUNT LOAD VALUE

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

COUNTER B BATCH COUNT ENABLE

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

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

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

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.
SCALING FOR COUNT INDICATION

The CUBS'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 CUBS 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.

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.

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.

Scale Factor = \frac{1}{128} \times 100
Scale Factor = 0.007812 \times 100
Scale Factor = 0.7812

6.2 MODULE 2 - RATE SETUP PARAMETERS (\textbf{2-rAtE})

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

RATE ENABLE

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

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

RATE SCALING INPUT VALUE

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

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

1-717-767-6511
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.

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:

<table>
<thead>
<tr>
<th>Rate Per</th>
<th>Display (RAtE dSP)</th>
<th>Input (RAtE INP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second</td>
<td>1</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Minute</td>
<td>60</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Hour</td>
<td>3600</td>
<td># of pulses per unit</td>
</tr>
</tbody>
</table>

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

![Rate Low Update Time Diagram]

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

![Rate High Update Time Diagram]

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

**PARAMETER MENU**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Settings</th>
<th>Mode When &quot;SEL&quot; Key is Pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-dsPLAy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>d-COLOR</strong></td>
<td>Red, Green</td>
<td></td>
</tr>
<tr>
<td><strong>d-LEVEL</strong></td>
<td>1-5</td>
<td></td>
</tr>
<tr>
<td><strong>d-Scroll</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Front Panel Display Select Enable (SEL) | YES | YES

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

**FRONT PANEL COUNTER RESET ENABLE (RST)**

| Counter Enable | YES, NO, Both A-B, Display A | YES, NO |

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**

| Enable | 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)**

| Color | Red, Green |

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

**DISPLAY INTENSITY LEVEL (BACKLIGHT UNIT ONLY)**

| Level | 1-5 |

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**

| Code | 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 (Pro Loc) in the User Input Function parameter (Module 1).

Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only the setpoint output time-out and counter load values (when applicable) to be modified, but allows direct access to these values without having to enter Full Programming mode.

Programming a Security Code other than 0, requires this code to be entered at the Pro CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the Pro CodE prompt appears (see chart).

**SOFTWARE VERSION DISPLAY**

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**

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.
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

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)

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

Select the display to which the Setpoint is assigned.

## SETPOINT PARAMETER AVAILABILITY

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

### SETPOINT OUTPUT ACTION

<table>
<thead>
<tr>
<th>SPT ACTION</th>
<th>DESCRIPTION</th>
<th>OUTPUT ACTIVATES</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCH</td>
<td>Latched Output Mode</td>
<td>When Count = Setpoint</td>
<td>At Manual Reset (if SPn rSt = YES)</td>
</tr>
<tr>
<td>time-out</td>
<td>Timed Output Mode</td>
<td>When Count = Setpoint</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>boundary</td>
<td>Boundary Mode (High Acting Type)</td>
<td>When Count ≥ Setpoint</td>
<td>When Count &lt; Setpoint</td>
</tr>
<tr>
<td></td>
<td>Boundary Mode (Low Acting Type)</td>
<td>When Count ≤ Setpoint</td>
<td>When Count &gt; Setpoint</td>
</tr>
</tbody>
</table>

* BOUNDARY Setpoint Action not applicable for Counter B Assignment
SETPOINT OUTPUT TIME-OUT

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

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

SETPOINT OUTPUT LOGIC

Normal (NO) turns the output “on” when activated and “off” when deactivated. Reverse (REV) turns the output “off” when activated and “on” when deactivated.

SETPOINT ANNUNCIATOR

Normal (NO) 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

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

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

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

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

Reset to Zero at the start of output activation.
Reset to Count Load value at the start of output activation.
Reset to Count Load value at the end of output activation (timed out only).
Reset to Count Load value at the end of output activation (timed out only).

SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)

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)

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

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

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.
The Serial Communications Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.

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**

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.

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>300</th>
<th>600</th>
<th>1200</th>
<th>2400</th>
<th>4800</th>
<th>9600</th>
</tr>
</thead>
<tbody>
<tr>
<td>9600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DATA 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.

<table>
<thead>
<tr>
<th>Data Bit</th>
<th>7-bit</th>
<th>8-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-bit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-bit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PARITY BIT**

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.

<table>
<thead>
<tr>
<th>Parity Bit</th>
<th>Odd</th>
<th>Even</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Even</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**METER ADDRESS**

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.

<table>
<thead>
<tr>
<th>Address</th>
<th>0 to 99</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td></td>
</tr>
</tbody>
</table>

**ABBREVIATED PRINTING**

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**

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” (Print 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.
Sending Serial Commands and Data

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

Command Chart

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

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.

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

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>2 byte Node Address field [00-99]</td>
</tr>
<tr>
<td>3</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>4-6</td>
<td>3 byte Register Mnemonic field</td>
</tr>
<tr>
<td>7-18</td>
<td>12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>21</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>22</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>23</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

* 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
   0 SFB -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.

$$t_1 = \frac{10 \times \text{# of characters}}{\text{baud rate}}$$

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. 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 $t_3$ 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 ($t_3$) 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.

$$t_3 = \frac{10 \times \text{# of characters}}{\text{baud rate}}$$

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

**Communication Format**

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

<table>
<thead>
<tr>
<th>LOGIC</th>
<th>INTERFACE STATE</th>
<th>RS232*</th>
<th>RS485*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mark (idle)</td>
<td>TXD,RXD: -3 to -15 V</td>
<td>a-b &lt; -200 mV</td>
</tr>
<tr>
<td>0</td>
<td>space (active)</td>
<td>TXD,RXD: +3 to +15 V</td>
<td>a-b &gt; +200 mV</td>
</tr>
</tbody>
</table>

* Voltage levels at the Receiver

Data is transmitted one byte at a time with a variable idle period between characters (0 to $\infty$). 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.

**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.
Press and hold SEL key to enter Programming Mode.
MODEL PAXLC - PAX® LITE COUNTER

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>
<thead>
<tr>
<th>PAR</th>
<th>1.95 (49.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.80 (96.5)</td>
<td>.10 (2.5)</td>
</tr>
<tr>
<td>4.10 (104.1)</td>
<td>1.75 (44.5)</td>
</tr>
<tr>
<td>3.60 (91.4)</td>
<td>1.75 (44.5)</td>
</tr>
</tbody>
</table>
ORDERING INFORMATION

Meter Part Numbers

| PAXL | 0 | 0 |

C6 - 6 Digit Counter
C8 - 8 Digit Counter
1. DISPLAY: 6-digit, 0.56" (14.2 mm) or 8-digit, 0.4" (10.1 mm) 
   7-segment LED 
Display Range: 6-digit, -999999 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. 
   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 \( V_{IL} = 1.5 \text{ V max.} \); \( V_{IH} = 3.75 \text{ V min.} \) 
Current Sinking: Internal 7.8 \( \Omega \) pull-up to +12 VDC, 1 max = 1.9 mA 
Current Sourcing: Internal 3.9 \( \Omega \) pull-down, 8 A max. @ 30 VDC max. 
Filter: Damping capacitor provided for switch contact bounce. Limits input 
   frequency to 50 Hz and input pulse widths to 10 ms: 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 \( \Omega \) pull-up to +12 V 
   Active: \( V_{IN} < 0.9 \text{ VDC} \) 
   Inactive: \( V_{IN} > 3.6 \text{ VDC} \) 
Response Time: 
   Up/Down and Inhibit: 25 \( \mu \text{sec} \) max. 
   Reset and Store: 10 \( \text{msec} \), max. 
8. MEMORY: Nonvolatile E/PROM 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 
   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. 
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards 
   Type 4X Enclosure rating (Face only), UL50 
   IEC61010-1, 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/\text{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: 
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-clip 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 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 

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.
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, IMAX = 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.

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.

1. The meter should be mounted in a metal enclosure, which 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.
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. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
4. 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

<table>
<thead>
<tr>
<th>Two Wire Proximity, Current Source</th>
<th>Current Sinking Output</th>
<th>Current Sourcing Output</th>
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<td>Switch or Isolated Transistor; Current Sink</td>
<td>Switch or Isolated Transistor; Current Source</td>
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<tr>
<td>Emitter Follower; Current Source</td>
<td></td>
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*Switch position is application dependent.
### 4.0 Reviewing the Front Buttons and Display

![Front Panel Reset](image)

<table>
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<tr>
<th>KEY</th>
<th>DISPLAY MODE OPERATION</th>
<th>PROGRAMMING MODE OPERATION</th>
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<tr>
<td>PAR</td>
<td>Access Programming Mode</td>
<td>Store selected parameter and index to next parameter</td>
</tr>
<tr>
<td>▲</td>
<td>No Function</td>
<td>Increment selected digit of parameter value</td>
</tr>
<tr>
<td>▼</td>
<td>Front Panel Reset</td>
<td>Select digit position in parameter value</td>
</tr>
</tbody>
</table>

### 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.

#### 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.

\[
SF = \frac{DR}{EPU}
\]

\[
DR = 1 \text{ case}
\]

\[
EPU = 12 \text{ cans/case}
\]

\[
SF = \frac{1}{12}
\]

\[
SF = 0.08333
\]

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.

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 than 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.
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

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

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 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

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 rSET 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

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.

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 “0000” 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).

NOTES: This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123  www.barr-thorp.com
4. RATE DISPLAY: 6-digits, may be enabled or disabled in any count mode
   Display Range: 0 to 999999
   Over Range Display: "FULL"
   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: VIL = 1.25 V max; VIH = 2.75 V min; VMAX = 28 VDC
       Mag. pickup sensitivity: 200 mV peak, 100 mV hysteresis, 40 V peak max.
   Input B: Logic level signals only.
       Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 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: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
       Response Time: 10 msec typ.; 50 msec debounce (activation and release)

7. MEMORY: Nonvolatile E²PROM 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 V AC (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
    IEC 61000-1, EN 61000-1: Safety requirements for electrical equipment for
    measurement, control, and laboratory use, Part 1.
    IP65 Enclosure rating (Face only), IEC 529
    Type 4X Enclosure rating (Face only), UL50

    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
                      0.5 cycle
    Voltage dip/interruptions EN 61000-4-11 Criterion A
                             50 cycle
      Notes:
      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.
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 \( V_{IL} = 1.25 \text{ V max.}; V_{IH} = 2.75 \text{ V min.}; V_{MAX} = 28 \text{ VDC} \)
- **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. \( I_{MAX} = 0.7 \text{ mA} \).
- **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. \( I_{MAX} = 0.7 \text{ mA} \).
- **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.

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 0.5” (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.
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 # 28B2029-0A
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC# LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom # 1 VR3
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.

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

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<th>BUTTON</th>
<th>DISPLAY MODE OPERATION</th>
</tr>
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<td>Access Programming Mode</td>
</tr>
<tr>
<td>SEL</td>
<td>Index display through enabled values</td>
</tr>
<tr>
<td>RST</td>
<td>Resets count display(s) and/or outputs</td>
</tr>
</tbody>
</table>

PROGRAMMING MODE OPERATION
- Store selected parameter and index to next parameter
- Advance through selection list/select digit position in parameter value
- 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

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 Prag 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 Prag  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 Prag  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.

Indicates Program Mode Alternating Display
Parameter | Selection/Value
---------|------------------
           | Factory Settings are shown.
5.1 MODULE 1 - INPUT SETUP PARAMETERS (i-1 INP)

PARAMETER MENU

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

COUNTER A RESET ACTION

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

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

COUNTER A COUNT LOAD VALUE

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

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

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.
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.)*

**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.

Scale Factor = Desired Display Units / Number of Pulses

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.

- Scale Factor = \( \frac{1.00}{128} \times 100 \)
- Scale Factor = \( \frac{0.007812}{100} \times 1 \)
- 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.

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

- Scale Factor = \( \frac{12}{1} \times 1 \)
- Scale Factor = 12.0000

*For value entry instructions, refer to selection/value entry in the Programming The Meter section.
5.2 MODULE 2 - RATE SETUP PARAMETERS (Z·rRkE)

PARAMETER MENU

RATE ENABLE

This parameter enables the Rate display. For maximum input frequency, Rate Enable should be set to \textbf{no} when not in use. When set to \textbf{yes}, the remaining rate parameters are not accessible.

RATE DECIMAL POINT

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

RATE INPUT SCALING STYLE

If a Rate Input value (in Hz) and the corresponding Rate Display value are known, the Key-in (\textbf{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 (\textbf{apply}) Scaling Style should be used.

RATE SCALING DISPLAY VALUE

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

RATE SCALING INPUT VALUE

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 \textbf{PAR} to advance to the next parameter. To enter a new value, apply the rate input signal to Input A. Press \textbf{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 \textbf{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.

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.
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)**

<table>
<thead>
<tr>
<th>Parameter Menu</th>
<th>3-dSP</th>
<th>PAR</th>
<th>SEL-En</th>
<th>RST-En</th>
<th>Scroll</th>
<th>d-LEU</th>
<th>E41</th>
<th>FCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display Select Enable (SEL)</strong></td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Front Panel Display Select Enable (SEL)</strong></td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>both</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Front Panel Counter Reset Enable (RST)</strong></td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Display Scroll Enable</strong></td>
<td>NO</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Display Intensity Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 to 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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).

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

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

**PROGRAMMING SECURITY CODE**

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 (**Prolac**) in the User Input 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 (**41**), Output Time-outs (**U06U**), Count Load Value (**E-7**), and Display Intensity (**E-7**).

Programming any Security Code other than 0, requires this code to be entered at the **E41** prompt in order to access Full Programming mode. Quick Programming mode, if enabled, is accessed before the **E41** prompt appears.

<table>
<thead>
<tr>
<th>USER INPUT FUNCTION</th>
<th>USER INPUT STATE</th>
<th>SECURITY CODE</th>
<th>MODE WHEN &quot;PAR&quot; KEY IS PRESSED</th>
<th>FULL PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>not <strong>Prolac</strong></td>
<td></td>
<td>0</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code entry at <strong>E41</strong> prompt *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td><strong>E41</strong> prompt</td>
<td>With correct code entry at <strong>E41</strong> prompt *</td>
</tr>
<tr>
<td><strong>Prolac</strong> Active</td>
<td></td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td><strong>E41</strong> prompt</td>
<td>With correct code entry at <strong>E41</strong> prompt *</td>
</tr>
<tr>
<td>Not Active</td>
<td></td>
<td>0-999</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
</tbody>
</table>

* Entering Code 222 allows access regardless of security code.
5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPk)

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>COUNTER ASSIGNMENT (A or B)*</th>
<th>RATE ASSIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>tOut</code>-n</td>
<td>Setpoint Output Time-out Value</td>
<td>TIMED OUT: Yes, BOUNDARY bound: No, LATCH: No</td>
<td>TIMED OUT: Yes, BOUNDARY bound: No, LATCH: No</td>
</tr>
<tr>
<td><code>SPk</code>-n</td>
<td>Setpoint Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><code>Out</code>-n</td>
<td>Setpoint Output Logic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><code>Lk</code>-n</td>
<td>Setpoint Annunciator</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><code>P-UP</code>-n</td>
<td>Setpoint Output Power-up State</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><code>type</code>-n</td>
<td>Setpoint Boundary Type</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><code>Stby</code>-n</td>
<td>Standby Operation (Low Acting Only)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><code>Auto</code>-n</td>
<td>Counter Auto Reset</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><code>OFF2</code>-1</td>
<td>SP1 Output Off at SP2 (SP1 only)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><code>OFF1-2</code></td>
<td>SP2 Output Off at SP1 (SP2 only)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><code>rSk</code>-n</td>
<td>Output Reset with Manual Reset</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

* BOUNDARY Setpoint Action not applicable for Counter B assignment.

**SETPOINT SELECT**

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**

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**

Select the display to which the Setpoint is assigned.
**SETPOINT OUTPUT ACTION**

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

<table>
<thead>
<tr>
<th>SPT ACTION</th>
<th>DESCRIPTION</th>
<th>OUTPUT ACTIVATES</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latch</td>
<td>Latched Output Mode</td>
<td>When Count = Setpoint</td>
<td>At Manual Reset (if ( \text{RST} \cdot \text{n}=\text{YES} ))</td>
</tr>
<tr>
<td>Timed</td>
<td>Timed Output Mode</td>
<td>When Count = Setpoint</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>Bound</td>
<td>Boundary Mode (High Acting)</td>
<td>When Count ≥ Setpoint</td>
<td>When Count &lt; Setpoint</td>
</tr>
<tr>
<td></td>
<td>Boundary Mode (Low Acting)</td>
<td>When Count ≤ Setpoint</td>
<td>When Count &gt; Setpoint</td>
</tr>
</tbody>
</table>

**SETPOINT OUTPUT TIME-OUT**

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

**SETPOINT VALUE**

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

**SETPOINT OUTPUT LOGIC**

Normal (\( \text{Nor} \)) turns the output “on” when activated and “off” when deactivated. Reverse (\( \text{rEU} \)) turns the output “off” when activated and “on” when deactivated.

**SETPOINT ANNUNCIATOR**

Normal (\( \text{Nor} \)) displays the setpoint annunciator when the corresponding output is “on”. Reverse (\( \text{rEU} \)) displays the setpoint annunciator when the output is “off”.

**SETPOINT OUTPUT POWER-UP STATE**

\( \text{SAVE} \) will restore the output to the same state it was at before the meter was powered down. \( \text{ON} \) will activate the output at power up. \( \text{OFF} \) will deactivate the output at power up.

**SETPOINT BOUNDARY TYPE**

High Acting Boundary Type activates the output when the assigned display value (\( \text{AS} \cdot \text{n} \)) 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**

This parameter applies to Low Acting Boundary Type setpoints. Select \( \text{YES} \) 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**

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 (\( \text{CLd} \cdot \text{n} \)) only apply to Counter A assignment. This reset may not be different from the Counter A Reset Action selected in Module 1.

**SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)**

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)**

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**

Selecting \( \text{YES} \) causes the Setpoint output to deactivate (reset) when the Setpoint Assigned Counter is reset. The counter reset can occur by the \( \text{RST} \) 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.
Press PAR key to enter Programming Mode.
MODEL PAX - 1/8 DIN DIGITAL INPUT PANEL METERS

MODELS: COUNTER/RATE (PAXI)       COUNTER (PAXC)       RATE (PAXR)

- COUNTER, 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

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.
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ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>PAX</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
</table>
| C - Counter/Dual Counter
R - Rate Meter
I - Counter/Dual Counter/
Rate Meter/Slave Display
0 - Red, Sunlight Readable Display
1 - Green Display
0 - 85 to 250 VAC
1 - 11 to 36 VDC, 24 VAC |

Option Card and Accessories Part Numbers

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional</td>
<td>PAXCDS</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
</tr>
<tr>
<td>Plug-In Cards</td>
<td></td>
<td>Quad Setpoint Relay Output Card</td>
<td>PAXCDS20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sinking Open Collector Output Card</td>
<td>PAXCDS30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sourcing Open Collector Output Card</td>
<td>PAXCDS40</td>
</tr>
<tr>
<td></td>
<td>PAXCDC</td>
<td>RS485 Serial Communications Card with Terminal Block</td>
<td>PAXCDC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS485 Serial Communications Card with Dual RJ11 Connector</td>
<td>PAXCDC1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS485 Serial Communications Card with Terminal Block</td>
<td>PAXCDC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS232 Serial Communications Card with 9 Pin D Connector</td>
<td>PAXCDC2C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DeviceNet Communications Card</td>
<td>PAXCDC30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modbus Communications Card</td>
<td>PAXCDC40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended Modbus Communications Card with Dual RJ11 Connector</td>
<td>PAXCDC4C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profibus-DP Communications Card</td>
<td>PAXCDC50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog Output Card</td>
<td>PAXCDL10</td>
</tr>
<tr>
<td>Accessories</td>
<td>SFCRD*</td>
<td>Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP</td>
<td>SFCRD200</td>
</tr>
<tr>
<td></td>
<td>ICMB</td>
<td>Communication Gateway</td>
<td>ICMB0000</td>
</tr>
</tbody>
</table>

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

Shaded areas are only available for the PAXI!
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
   - Response Time: 6 msec. typical; function dependent. Certain resets, stores and inhibits respond within 25 usec if an edge occurs with the associated counter or within 6 msec if no count edge occurs with the associated counter. These functions include $\text{CTR-SH}, \text{CTR-SH}$, $\text{MTR-SH}$, $\text{MTR-SH}$, $\text{MTR-SE}$, $\text{MTR-SE}$, $\text{MTR-SE}$, $\text{MTR-SE}$, $\text{MTR-SE}$, $\text{MTR-SE}$, and $\text{MTR-SE}$. 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 E²PROM retains all programmable parameters and display values.

7. **CERTIFICATIONS AND COMPLIANCES**:
   - **SAFETY**
     - UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 1010-1
     - 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
     - IEECE CB Scheme Test Certificate #US8843/UL
     - 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**
     - Immunity to EN 50082-2
       - Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
       - Level 3; 8 Kv air
       - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
       - 80 MHz - 1 GHz Level 4; 2 Kv I/O
       - Fast transients (burst) EN 61000-4-4 Level 3; 2 Kv power
       - RF conducted interference EN 61000-4-6 Level 3; 10 V/rms
       - 150 KHz - 80 MHz Level 4; 2 Kv power
       - Simulation of cordless telephones ENV 50204 Level 3; 10 V/m
       - 900 MHz ±5 MHz
       - 200 Hz, 50% duty cycle
   - Emissions to EN 50081-2
     - RF interference EN 55011 Enclosure class A
     - Power mains class A
   - **NOTE**:
     - 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
   - **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.

11. **WEIGHT**:
    - 10.1 oz. (286 g)
MODEL PAXC - 1/8 DIN COUNTER

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

<table>
<thead>
<tr>
<th>Are any setpoints used?</th>
<th>Single: Counter A or B</th>
<th>Dual: Counter A &amp; B</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is Counter C used?</th>
<th>(Values are in KHz)</th>
<th>(Values are in KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>34</td>
<td>17</td>
</tr>
<tr>
<td>N</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>N</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>N</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Y</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Y</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Y</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>N</td>
<td>7.5</td>
<td>5</td>
</tr>
<tr>
<td>N</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Y</td>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>Y</td>
<td>5</td>
<td>3.5</td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Y</td>
<td>3.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

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

- 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)

MODEL PAXR - 1/8 DIN RATE METER

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

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

**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 $V_{IL} = 1.5 \text{ V max.}$; $V_{IH} = 3.75 \text{ V min.}$
- Current sinking: Internal 7.8 kΩ pull-up to +12 VDC, $I_{MAX} = 1.9 \text{ mA}.$
- Current sourcing: Internal 3.9 kΩ pull-down, 7.3 mA max. @ 28 VDC, $V_{MAX} = 30 \text{ VDC}.$
- 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.

**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: “**OL**, **OL**”

**INPUT B:**
- 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

**INPUT C:**
- **UF** - 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

**INPUT D:**
- **UF** - 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

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

**INPUT:**
- 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 $V_{IL} = 1.5 \text{ V max.}$; $V_{IH} = 3.75 \text{ V min.}$
- Current sinking: Internal 7.8 kΩ pull-up to +12 VDC, $I_{MAX} = 1.9 \text{ mA}.$
- Current sourcing: Internal 3.9 kΩ pull-down, 7.3 mA max. @ 28 VDC, $V_{MAX} = 30 \text{ VDC}.$
- 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.

**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: “**OL**, **OL**”

**INPUT:**
- 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 $V_{IL} = 1.5 \text{ V max.}$; $V_{IH} = 3.75 \text{ V min.}$
- Current sinking: Internal 7.8 kΩ pull-up to +12 VDC, $I_{MAX} = 1.9 \text{ mA}.$
- Current sourcing: Internal 3.9 kΩ pull-down, 7.3 mA max. @ 28 VDC, $V_{MAX} = 30 \text{ VDC}.$
- 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.

**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: “**OL**, **OL**”

**INPUT:**
- 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 $V_{IL} = 1.5 \text{ V max.}$; $V_{IH} = 3.75 \text{ V min.}$
- Current sinking: Internal 7.8 kΩ pull-up to +12 VDC, $I_{MAX} = 1.9 \text{ mA}.$
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- 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.

**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: “**OL**, **OL**”

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

<table>
<thead>
<tr>
<th></th>
<th>Single: Counter A or B (with/without rate) or Rate only</th>
<th>Dual: Counter A &amp; B or Rate not assigned to active single counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are any setpoints used?</td>
<td>N N N N</td>
<td>Y Y Y Y</td>
</tr>
<tr>
<td>Is Prescaler Output used?</td>
<td>N N Y Y</td>
<td>N N Y Y</td>
</tr>
<tr>
<td>Is Counter C used?</td>
<td>N Y N Y</td>
<td>N Y N Y</td>
</tr>
<tr>
<td>Count x1</td>
<td>34 25 21 17</td>
<td>18 15 13 11</td>
</tr>
<tr>
<td>Count x2</td>
<td>17 13 16 12</td>
<td>9 7 8 7</td>
</tr>
<tr>
<td>Quadrature x1</td>
<td>22 19 20 17</td>
<td>12 10 11 10</td>
</tr>
<tr>
<td>Quadrature x2</td>
<td>17 13 16 12</td>
<td>9 7 8 6</td>
</tr>
<tr>
<td>Quadrature x4</td>
<td>8 6 8 6</td>
<td>4 3 4 3</td>
</tr>
<tr>
<td>Rate Only</td>
<td>34 N/A 21 N/A</td>
<td>34 N/A 21 N/A</td>
</tr>
</tbody>
</table>

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 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
OD - 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

RANGE 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 D L D”

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 VIL = 1.5 V max.; VIH = 3.75 V min.
Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, IMAX = 1.9 mA.
Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, VMAX = 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.

PRESCALE OUTPUT:

NPN Open Collector; ISNK = 100 mA max. @ VGL = 1V DC max. VOH = 30 VDC max. With duty cycle of 25% min. and 50% max.

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
**OPTIONAL PLUG-IN OUTPUT 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 or RS485 Cards must be used.

- **PAXCDC10** - RS485 Serial (Terminal)
- **PAXCDC30** - DeviceNet
- **PAXCDC1C** - RS485 Serial (Connector)
- **PAXCDC40** - Modbus (Terminal)
- **PAXCDC20** - RS232 Serial (Connector)
- **PAXCDC4C** - Modbus (Connector)
- **PAXCDC2C** - RS232 Serial (Connector)
- **PAXCDC50** - Profibus-DP

**SERIAL COMMUNICATIONS CARD**

- **Type**: RS485 or RS232
- **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**: 300 to 19,200
- **Parity**: no, odd, or even
- **Bus Address**: Selectable 0 to 99, Max. 32 meters per line (RS485)
- **Transmit Delay**: Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

**DEVICENET™ CARD**

- **Compatibility**: Group 2 Server Only, not UCMM capable
- **Baud Rates**: 12 5Kbaud, 25 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.

**MODBUS CARD**

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

**PROFIBUS-DP CARD**

- **Fieldbus Type**: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASCI
- **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 126, set by the master over the network. Address stored in non-volatile memory.
- **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 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 PAX meter. The PAX program can then be saved in a PC file for future use. A PAX serial plug-in 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 with 3 msec. nominal release
- **Time 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 with 3 msec. nominal release
- **Time 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 @ Vsa = 0.7 V max. Vmax = 30 V
- **Response Time**: Counter = 25 usec; Rate = Low Update time
- **Time Accuracy**: Counter = ± 0.01% + 10 msec.
  - **Rate = ± 0.01% + 20 msec.**

**QUAD SOURCING OPEN COLLECTOR CARD**

- **Type**: Four isoalted 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 usec; Rate = Low Update time
- **Time Accuracy**: Counter = ± 0.01% + 10 msec.
  - **Rate = ± 0.01% + 20 msec.**

**PAXI 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.
- **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.

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

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 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.

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.

<table>
<thead>
<tr>
<th>Switches 3 and 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI Frequency: Removes damping capacitor and allows max. frequency.</td>
</tr>
<tr>
<td>LO Frequency: Adds a damping capacitor for switch contact bounce. Also limits input frequency to 50 Hz and input pulse widths to 10 msec.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switches 2 and 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRC: Adds internal 3.9 KΩ pull-down resistor, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.</td>
</tr>
<tr>
<td>SNK: Adds internal 7.8 KΩ pull-up resistor to +12 VDC, IMAX = 1.9 mA.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switches 1 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGIC: Input trigger levels VIL = 1.5 V max.; VIH = 3.75 V min.</td>
</tr>
<tr>
<td>MAG: 200 mV peak input (must also have SRC on). Not recommended with counting applications.</td>
</tr>
</tbody>
</table>
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. The literature that comes with these cards should be discarded, unless it specifically states in the Plug-in Card literature that the information applies to 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.

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

Quad Sourcing Open Collector Output Card Supply Select

TOP VIEW

![Diagram of Plug-in Card Installation](image)
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 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 grounded. This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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 # ZCAT035-1330A
     - Steward # 28B0209-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1-07 (RLC# LFIL0000)
     - Schaffner # FN670-1-07
     - 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 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 3.6 VDC is applied.

1-717-767-6511

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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.

<table>
<thead>
<tr>
<th>Magnetic Pickup</th>
<th>AC Inputs From Tach Generators, Etc.</th>
<th>Two Wire Proximity, Current Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
</tr>
</tbody>
</table>

4.4 SETPOINT (ALARMS) WIRING

**SETPOINT PLUG-IN CARD TERMINALS**

<table>
<thead>
<tr>
<th>DUAL RELAY PAXCDS10</th>
<th>QUAD RELAY PAXCDS20</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - RLY1</td>
<td>20 - RLY1</td>
</tr>
<tr>
<td>21 - RLY2</td>
<td>21 - RLY2</td>
</tr>
<tr>
<td>22 - RLY3</td>
<td>22 - RLY3</td>
</tr>
<tr>
<td>23 - RLY4</td>
<td>23 - RLY4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QUAD SINKING PAXCDS30</th>
<th>QUAD SOURCING PAXCDS40</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - COMMON</td>
<td>20 - EXTERNAL SUPPLY</td>
</tr>
<tr>
<td>21 - 01 SNK.</td>
<td>21 - 01 SRC.</td>
</tr>
<tr>
<td>22 - 02 SNK.</td>
<td>22 - 02 SRC.</td>
</tr>
<tr>
<td>23 - 03 SNK.</td>
<td>23 - 03 SRC.</td>
</tr>
<tr>
<td>24 - 04 SNK.</td>
<td>24 - 04 SRC.</td>
</tr>
<tr>
<td>25 - COMMON</td>
<td>25 - COMMON</td>
</tr>
</tbody>
</table>

**SOURCING OUTPUT LOGIC CARD**

![Diagram](image4)

**SINKING OUTPUT LOGIC CARD**

![Diagram](image5)
RS232 Communications

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

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function. As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is “busy”. The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

RS485 Communications

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

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 $5P-ST$ (Reset Display).
Programming the Meter

6.0 Programming the Meter

Overview

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 1SP and the present module. The arrow keys (F1S and F2T) 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 1SP/0. 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/values for that parameter. The arrow keys (F1S and F2T) 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.

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. These parameters are identified throughout the module explanations.

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.

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td></td>
<td>Does not count.</td>
</tr>
<tr>
<td>cnt</td>
<td>Count X1</td>
<td>Adds Input A falling edge.</td>
</tr>
<tr>
<td>cntud</td>
<td>Count X1</td>
<td>Adds Input A falling edge if Input B is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge if Input B is low.</td>
</tr>
<tr>
<td>dcntud</td>
<td>Count X1</td>
<td>Adds Input A falling edge if User 1 is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge if User 1 is low.</td>
</tr>
<tr>
<td>qwRd1</td>
<td>Quad X1</td>
<td>Adds Input A rising edge when Input B is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge when Input B is high.</td>
</tr>
<tr>
<td>qwRd2</td>
<td>Quad X2</td>
<td>Adds Input A rising edge when Input B is high and Input A falling edge when Input B is low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge when Input B is high and Input A rising edge when Input B is low.</td>
</tr>
<tr>
<td>qwRd4</td>
<td>Quad X4</td>
<td>Adds Input A rising edge when Input B is high, Input A falling edge when Input B is low, Input A rising edge when Input A is low, and Input B falling edge when Input A is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge when Input A is high and Input B rising edge when Input A is low, and Input B falling edge when Input A is high, and Input B falling edge when Input A is low.</td>
</tr>
<tr>
<td>dqwRd1</td>
<td>Quad X1</td>
<td>Adds Input A rising edge when User 1 is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge when User 1 is high.</td>
</tr>
<tr>
<td>dqwRd2</td>
<td>Quad X2</td>
<td>Adds Input A rising edge when User 1 is high and Input A falling edge when User 1 is low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A falling edge when User 1 is high and Input A rising edge when User 1 is low.</td>
</tr>
<tr>
<td>cnt2</td>
<td>Count X2</td>
<td>Adds Input A rising and falling edges.</td>
</tr>
<tr>
<td>cntud2</td>
<td>Count X2</td>
<td>Adds Input A rising and falling edges if Input B is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A rising and falling edge if Input B is high.</td>
</tr>
<tr>
<td>dctud2</td>
<td>Count X2</td>
<td>Adds Input A rising and falling edges if User 1 is high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtracts Input A rising and falling edge if User 1 is low.</td>
</tr>
</tbody>
</table>

COUNTER A RESUME 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.)

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 (PrScaL). 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 *

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

PAXI: PRESCALER 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 B OPERATING MODE

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>cnt</td>
<td>Does not count.</td>
</tr>
<tr>
<td>cnt</td>
<td>cnt</td>
<td>Adds Input B falling edge.</td>
</tr>
<tr>
<td>dcntud</td>
<td>cnt</td>
<td>Adds Input B falling edge if User 2 is high. Subtracts Input B falling edge if User 2 is low.</td>
</tr>
<tr>
<td>d9wa1</td>
<td>quint</td>
<td>Adds Input B rising edge when User 2 is high.</td>
</tr>
<tr>
<td>d9wa2</td>
<td>quint</td>
<td>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.</td>
</tr>
<tr>
<td>cnt2</td>
<td>quint</td>
<td>Adds Input B rising and falling edges.</td>
</tr>
<tr>
<td>dcntud2</td>
<td>quint</td>
<td>Adds Input B rising and falling edges if User 2 is high. Subtracts Input B rising and falling edge if User 2 is low.</td>
</tr>
</tbody>
</table>

Select the operating mode for Counter B.

COUNTER B SCALE MULTIPLIER *

bSCALr ↑

The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale multiplier 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 FACTOR

bSCFAC ↑

000001 to 999999

100000

10000

1000

100

10

1

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 RESET POWER-UP *

bP-UP ↑

YES NO

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

* Factory Setting can be used without affecting basic start-up.

8 DIGIT COUNT VALUES

Any counter display value below -999999 or above 9999999 (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 “DF” 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 (xSERLr) and decimal point (xDEEPt). The scale factor is calculated using:

SF (xSCFAC) = Desired Display Decimal DDD
(Number of pulses per ‘single’ unit x CM x SM)

Where:

<table>
<thead>
<tr>
<th>Desired Display Decimal DDD</th>
<th>Counter Decimal Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>Tenths</td>
</tr>
<tr>
<td>100</td>
<td>Hundredths</td>
</tr>
<tr>
<td>1000</td>
<td>Thousandths</td>
</tr>
<tr>
<td>10000</td>
<td>Ten Thousandths</td>
</tr>
<tr>
<td>100000</td>
<td>Hundred Thousandths</td>
</tr>
</tbody>
</table>

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 (xSERLr) 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) = 0.008333. (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.)
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, 4SPFR, 4SPFC, 4SPFR, 4SPFC, 4SPFR, 4SPFC. The two lists are named L ISk-R and L ISk-b. If a user input is used to select the list then L ISk-R is selected when the user input is not active and and L ISk-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 L ISk-R and L ISk-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, 4SPFR, 4SPFC, 4SPFR, 4SPFC, 4SPFR, 4SPFC. If any other parameters are changed then the other list values must be reprogrammed.

**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 data transmitted during the print request is configured in Module 7. If the user input is not active and and

**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 communications Plug-in card is installed in the meter.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A CNk</td>
<td>Counter A</td>
<td>NO</td>
</tr>
<tr>
<td>b CNk</td>
<td>Counter B</td>
<td>NO</td>
</tr>
<tr>
<td>C CNk</td>
<td>Counter C</td>
<td>NO</td>
</tr>
<tr>
<td>M1</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L0</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>
### MAINTAINED (LEVEL) RESET AND INHIBIT

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Factories
- Setpoints

**FACTORY**
- Setpoint 3
- Description
- Factory

**FACTORY**
- Setpoint 4
- Description
- Factory

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

### MOMENTARY (EDGE) RESET

**DISPLAY**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

**DESCRIPTION**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

**FACTORY**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

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

### HOLD SETPOINT STATE

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**FACTORY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

When activated (momentary action), the meter holds the state of the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint card installed.

### DEACTIVATE SETPOINT MAINTAINED (LEVEL)

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**FACTORY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

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

### DEACTIVATE SETPOINT MOMENTARY (EDGE)

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**FACTORY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

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

### ACTIVATE SETPOINT MAINTAINED (LEVEL)

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**FACTORY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

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

### ACTIVATE SETPOINT MOMENTARY (EDGE)

**DISPLAY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**DESCRIPTION**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

**FACTORY**
- Setpoint 1
- Setpoint 2
- Setpoint 3
- Setpoint 4

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

### INHIBIT

**DISPLAY**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

**DESCRIPTION**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

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

### STORE DISPLAY

**DISPLAY**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

**DESCRIPTION**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

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.

### Change Display Intensity Level

**DISPLAY**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

**DESCRIPTION**
- Counter A
- Counter B
- Counter C
- Maximum
- Minimum

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. The intensity level, when changed via the User Input/Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.
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.

“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 and scale factor values can still be read and/or changed per the selections below. The Display Intensity Level (E-7) parameter also appears whenever Quick Programming Mode is enabled, and the security code is greater than zero.

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

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

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.

* Factory Setting can be used without affecting basic start-up.

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 (y-xE) - PAXR & I

Module 4 is the programming for the Rate parameters. For maximum input frequency, Rate assignment should be set to 0 when not in use. When set to 0, 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 IMP is actually r LE IMP on the unit’s display and r DSP is actually r LE DSP on the unit’s display.

PAXI: RATE ASSIGNMENT

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

LOW UPDATE TIME (DISPLAY UPDATE) *

0.1 to 999 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) *

0.2 to 999 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

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

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 IMP 0 & r DSP 0) and segment 1 (r IMP 1 & r DSP 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 SFPAX software.

About Scaling Points

Each Scaling Point is specified by two programmable parameters: A desired Rate Display Value (r DSP) and a corresponding Rate Input Value (r IMP). 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.

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>SCALING POINT</th>
<th>DISPLAY PARAMETER</th>
<th>DISPLAY DEFAULT</th>
<th>INPUT PARAMETER</th>
<th>INPUT DEFAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

PAXI: RATE DISPLAY VALUE FOR SCALING POINT 1

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

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 (r DSP 0 & r IMP 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

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

* Factory Setting can be used without affecting basic start-up.
RATE INPUT VALUE FOR SCALING POINT 2

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 \((r_{\text{INP}})\) that corresponds to the entered Rate Display value \((r_{\text{DSP}})\) 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 \((r_{\text{INP}})\) 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 \(\pm 0.1\%\) 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 *

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 *

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

MAXIMUM CAPTURE DELAY TIME *

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 ‘M’ in the display and will continue to function independent of being displayed.

MINIMUM CAPTURE DELAY TIME *

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 ‘m’ 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 00000”. During this overflow condition, the Minimum and Maximum rate values will stay at their values even during resets.

* Factory Setting can be used without affecting basic start-up.

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 \((r_{\text{DSP}})\) and Scaling Input \((r_{\text{INP}})\). 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:

\[
\begin{array}{|c|c|c|}
\hline
\text{Input} & \text{Display} & \text{Output} \\
\text{Second} & 1 & \# \text{ of pulses per unit} \\
\text{Minute} & 60 & \# \text{ of pulses per unit} \\
\text{Hour} & 3600 & \# \text{ of pulses per unit} \\
\hline
\end{array}
\]

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. (Example: 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 *

Select the operating mode for Counter C.

- **NONE**
- **Add Ab**
- **Sub Ab**
- **SLAVE**

- **NONE**: 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 less any effects of scaling.)
- **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 less any effects of scaling.)

*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.*

### COUNTER C RESET POWER-UP *

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

*Factory Setting can be used without affecting basic start-up.*

---

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C CtrC</strong></td>
<td>Counter C Output Mode</td>
</tr>
<tr>
<td><strong>CrESET</strong></td>
<td>Counter C Reset Action</td>
</tr>
<tr>
<td><strong>CdECPE</strong></td>
<td>Counter C Decimal Position</td>
</tr>
<tr>
<td><strong>CSFAC</strong></td>
<td>Counter C Scale Factor</td>
</tr>
<tr>
<td><strong>CSCLr</strong></td>
<td>Counter C Scale Multiplier</td>
</tr>
<tr>
<td><strong>CCntLd</strong></td>
<td>Counter C Count Load Value</td>
</tr>
<tr>
<td><strong>C P-UP</strong></td>
<td>Counter C Reset at Power-up</td>
</tr>
</tbody>
</table>

---

**COUNTER C 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. For **R** (Numeric transmissions) modes 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**

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 1.00000 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**

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

**COUNTER C RESET POWER-UP**

Counter C may be programmed to reset at each meter power-up.
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. This section replaces the bulletin that comes with the setpoint plug-in card. Please discard the separate literature when using the Plug-in card with the Digital PAX. For maximum input frequency, unused Setpoints should be configured for 0'' action.

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

### SETPOINT PARAMETER AVAILABILITY

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>RATE</th>
<th>COUNTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>L IE-n</td>
<td>Annunciators</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>OUT-n</td>
<td>Output Logic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SUP-n</td>
<td>Power Up State</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SP-n</td>
<td>Setpoint Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>lEC-n</td>
<td>Setpoint Tracking</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>lYP-n</td>
<td>Boundary Type</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sbb-n</td>
<td>Standby Operation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>HYS-n</td>
<td>Setpoint Hysteresis</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>tOFF-n</td>
<td>Setpoint Off Delay</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>tON-n</td>
<td>Setpoint On Delay</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>tOUT-n</td>
<td>Setpoint Time Out</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>AUTO-n</td>
<td>Counter Auto Reset</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>rSD-n</td>
<td>Reset With Display Reset</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>rSAS-n</td>
<td>Reset When SPn+1 Activates</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>rSRE-n</td>
<td>Reset When SPn+1 Deactivates</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

### SETPOINT SELECT

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 $P_{SEL}$ NO. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing $PAR$ at $P_{SEL}$ NO will exit Module 6.

### SETPOINT ANNUNCIATORS*

**OFF** disables the display of the setpoint annunciator. Normal ($NO$) 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 *

Normal ($NO$) 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 *

$SAVE$ 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.

* Factory Setting can be used without affecting basic start-up.
**SETPOINT ACTION**

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

  For **Counter Assignments**:
  - **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.
  - **BOUND**: With Boundary action, the setpoint output activates when the count value is greater than or equal to (for \( t \) = \( H \)) or less than or equal to (for \( t \) = \( L \)) the setpoint value. The setpoint output will deactivate when the count value is less than (for \( t \) = \( H \)) or greater than (for \( t \) = \( L \)) the setpoint value.
  - **OUT**: 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.

For **Rate Assignments**:
- **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 \( r \) = \( H \)) or less than or equal to (for \( r \) = \( L \)) the setpoint value, the output will reactivate.
- **BOUND**: With Boundary action, the setpoint output activates when the rate value is greater than or equal to (for \( r \) = \( H \)) or less than or equal to (for \( r \) = \( L \)) the setpoint value. The setpoint output will deactivate (Auto reset) as determined by the hysteresis value.
- **OUT**: With Timed Out action, the setpoint output cycles when the rate value is greater than or equal to (for \( r \) = \( H \)) or less than or equal to (for \( r \) = \( L \)) the setpoint value. The Setpoint Time Out \( t \) and Setpoint On Delay \( t \) values determine the cycling times.

**PAXC & I: SETPOINT ASSIGNMENT**

Select the display that the setpoint is to be assigned.

**SETPOINT VALUE**

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

**SETPOINT TRACKING**

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 (in the Quick Programming Mode), the "n" setpoint value will also change (or follow) by the same amount.

**SETPOINT BOUNDARY TYPE**

- **HI**: Activates the output when the assigned display value \( \text{RCt} \) 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**

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.

**PAX & I: SETPOINT HYSTERESIS**

The hysteresis value is added to (for \( t \) = \( L \)), or subtracted from (for \( t \) = \( H \)), 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.

**PAX & I: SETPOINT OFF DELAY**

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.

**PAX & I: SETPOINT ON DELAY**

This is the amount of time the Rate display must meet the setpoint activation requirements (below setpoint for \( r \) = \( L \) and above setpoint for \( r \) = \( H \)) 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.

**PAX & I: COUNTER AUTO RESET**

This automatically resets the display value of the Setpoint Assignment \( \text{RSn} \) counter each time the setpoint value is reached. This reset may be different than the Counter’s Reset Action (\( \text{REn} \)) in Module 1 or 5.

**SETPOINT TIME OUT**

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.

*Factory Setting can be used without affecting basic start-up.
PAXC & I: SETPOINT RESET WHEN SPn+1 DEACTIVATES *

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

* Factory Setting can be used without affecting basic start-up.

PAXR & I: SETPOINT (ALARM) FIGURES FOR RATE

(For Reverse Action, The Alarm state is opposite.)
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. Red Lion's SFPAX software can be used for configuring the PAXI (See Ordering Information). For serial hardware and wiring details, refer to section 4.5 Serial Communication Wiring.

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

### Baud Rate

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

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

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.

### Abbreviated Printing

Select \(\text{yes}\) for full print or Command T transmissions (meter address, parameter data and mnemonics) or \(\text{no}\) 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

\(\text{yes}\) - Enters the sub-menu to select the meter parameters to appear during a print request. For each parameter in the sub-menu, select \(\text{yes}\) for that parameter information to be sent during a print request or \(\text{no}\) 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.

*Setpoints are plug-in card dependent.*
SENDING SERIAL COMMANDS AND DATA

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character * or $. The <CR> is also available as a terminator when Counter C is in the SLAVE mode.

Command Chart

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Node (Meter) Address Specifier</td>
<td>Address a specific meter. Must be followed by two digit node address. Not required when address = 00.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value change (write)</td>
<td>Write to register of the meter. Must be followed by register ID character and numeric data.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a register or output. Must be followed by register ID character.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request (read)</td>
<td>Initiates a block print output. Registers are defined in programming.</td>
</tr>
</tbody>
</table>

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 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. 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. The command does not require a Register ID character. It prints according to the selections made in print options.

3. If constructing a value change command (writing data), the numeric data is followed by the command terminator character * or $. The <CR> is sent next.

4. All command strings must be terminated with the string termination character, a value identifier, numerical data, and the command character must be constructed. A command string consists of a command character, a value identifier, numerical data, and the command character must be constructed.

5. 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.

Register Identification Chart

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

1. Register Names are also used as Register Mnemonics during full transmission.
2. The registers associated with the P command are set up in Print Options (Module 7).
3. Unless otherwise specified, the Transmit Details apply to both T and V Commands.

Command String Examples:

1. Address = 17, Write 350 to Setpoint 1
   String: N17VM350S

2. Address = 5, Read Count A value, response time of 50 - 100 msec. min.
   String: N05TA*

3. Address = 0, Reset Setpoint 4 output
   String: RS*

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. (ie. 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 25. 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.

Transmitting Data From the Meter

Data is transmitted from 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 is established in Module 7.

Full Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (Carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (Line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt; (Space)²</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt; (Carriage return)³</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt; (Line feed)³</td>
</tr>
</tbody>
</table>

² These characters only appear in the last line of a block print.
³ 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

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (Carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (Line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt; (Space)²</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt; (Carriage return)³</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt; (Line feed)³</td>
</tr>
</tbody>
</table>

² These characters only appear in the last line of a block print.
³ These characters only appear in the last line of a block print.

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

Meter Response Examples:

1. Address = 17, full field response, Count A = 875
   875 <CR><LF>

2. Address = 0, full field response, Setpoint 2 = -250.5
   -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.

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:

<table>
<thead>
<tr>
<th>Register Value</th>
<th>Output Signal*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td>1</td>
<td>0.005</td>
</tr>
<tr>
<td>2047</td>
<td>10.000</td>
</tr>
<tr>
<td>4094</td>
<td>19.995</td>
</tr>
<tr>
<td>4095</td>
<td>20.000</td>
</tr>
</tbody>
</table>

*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).

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, 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.

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.

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 EPROM 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 begins with # is received, the meter processes it as a Literal 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.

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

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

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COMMUNICATION FORMAT

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

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

Data is transmitted one byte at a time with a variable idle period between characters (0 to 总裁). 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.

COMMUNICATION FORMAT

Data is transferred from the meter through a serial communication channel. 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 t₁, the computer program prints or writes the string to the com port, thus initiating a transmission. During t₁, 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 t₁ is dependent on the number of characters and baud rate of the channel.

\[ t₁ = \frac{10 \times \text{# of characters}}{\text{baud rate}} \]

At the start of time interval t₂, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t₂ varies (See Timing Diagrams). 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 t₃ is controlled by the use of the command terminating character. The * or <CR> terminating character results in a response time window of 50 msec. minimum and 100 msec. maximum. This allows time for the release of the sending driver on the RS485 bus. Terminating the command line with $ results in a response time window (t₃) of 2 msec. minimum and 50 msec. maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval t₄, the meter responds with the first character of the reply. As with t₁, the time duration of t₄ is dependent on the number of characters and baud rate of the channel. At the end of t₄, the meter is ready to receive the next command.

\[ t₄ = \frac{10 \times \text{# of characters}}{\text{baud rate}} \]

The maximum serial throughput of the meter is limited to the sum of the times t₁, t₂ and t₃.

### SERIAL TIMING

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>COMMENT</th>
<th>PROCESS TIME (t₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric Slave</td>
<td>1-50 msec.</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>2-50 msec.</td>
</tr>
<tr>
<td>#</td>
<td>Literal</td>
<td>2-50 msec.</td>
</tr>
<tr>
<td>V</td>
<td>Write</td>
<td>100-200 msec.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit</td>
<td>2-50 msec. for $</td>
</tr>
<tr>
<td>P</td>
<td>Print</td>
<td>2-50 msec. for $</td>
</tr>
</tbody>
</table>

### TIMING DIAGRAMS

**NO REPLY FROM METER**

<table>
<thead>
<tr>
<th>Command</th>
<th>String Transmission</th>
<th>Meter Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>t₁</td>
<td>t₂</td>
</tr>
</tbody>
</table>

**RESPONSE FROM METER**

<table>
<thead>
<tr>
<th>Command</th>
<th>String Transmission</th>
<th>Meter Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>t₁</td>
<td>t₂</td>
</tr>
</tbody>
</table>

| t₁ = (10 times the # of characters) / baud rate |
| t₂ = (10 times the # of characters) / baud rate |
| t₃ = (10 times the # of characters) / baud rate |

The maximum serial throughput of the meter is limited to the sum of the times t₁, t₂ and t₃.

### 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, depending on the total number of ones contained in the transmission (including the parity bit) being 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 PAXI 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.
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). This section replaces the bulletin that comes with the analog plug-in card. Please discard the separate literature when using the plug-in card with the PAXI.

### ANALOG TYPE

<table>
<thead>
<tr>
<th>TYPE</th>
<th>SELECTION</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-20</td>
<td>0-20</td>
<td>0 to 20 mA</td>
</tr>
<tr>
<td></td>
<td>4-20</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td></td>
<td>0-10</td>
<td>0 to 10 V</td>
</tr>
</tbody>
</table>

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

Select the display that the analog output is to follow:

- \( A \): Counter A Value
- \( B \): Counter B Value
- \( C \): Counter C Value
- \( R \): Rate Value
- \( L \): Minimum Value
- \( H \): 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 cannot 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 cannot be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

### 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 \( \text{Code} \, 66 \) and press \( \text{PAR} \). The meter will display \( \text{Err} \) and then returns to \( \text{Code} \, 50 \). Press \( \text{DSP} \) key to return to the Display Mode. This will overwrite all user settings with the factory settings.

Pressing the \( \text{PAR} \) and \( \text{DSP} \) keys at the same time on power-up will load the factory settings and display \( \text{Err} \). This allows operation in the event of a memory failure or corrupted data. Immediately press \( \text{RST} \) key and reprogram the meter. If the meter is powered down again before pressing the \( \text{RST} \) key, the existing dynamic data will not be overwritten.
**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 starting 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. Ctrl Out 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.

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>EXTERNAL METER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 R</td>
<td>0.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>4.00 R</td>
<td>4.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>20.0 V</td>
<td>20.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>0.00 u</td>
<td>0.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>10.0 u</td>
<td>10.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO DISPLAY</td>
<td>CHECK: Power level, power connections</td>
</tr>
<tr>
<td>PROGRAM LOCKED-OUT</td>
<td>CHECK: Active (lock-out) user input</td>
</tr>
<tr>
<td></td>
<td>ENTER: Security code requested</td>
</tr>
<tr>
<td>CERTAIN DISPLAYS ARE LOCKED OUT</td>
<td>CHECK: Module 3 programming</td>
</tr>
<tr>
<td>INCORRECT DISPLAY VALUE or NOT COUNTING</td>
<td>CHECK: Input wiring, DIP switch setting, input programming, scale factor calculation, input signal level, user input jumper, lower input signal frequency</td>
</tr>
<tr>
<td>USER INPUT NOT WORKING CORRECTLY</td>
<td>CHECK: User input wiring, user input jumper, user input being used for signal, Module 2</td>
</tr>
<tr>
<td>OUTPUT DOES NOT WORK</td>
<td>CHECK: Corresponding plug-in card installation, output configuration, output wiring</td>
</tr>
<tr>
<td>JITTERY DISPLAY</td>
<td>CHECK: Wiring is per EMC installation guidelines, input signal frequency, signal quality, scaling, update time, DIP switch setting</td>
</tr>
<tr>
<td>&quot;r DOL&quot; RATE</td>
<td>CHECK: Lower input signal frequency, reduce rate scaling</td>
</tr>
<tr>
<td>MODULES or PARAMETERS NOT ACCESSIBLE</td>
<td>CHECK: Corresponding plug-in card installation, related controlling parameter selected</td>
</tr>
<tr>
<td>ERROR CODE (Err 1-4)</td>
<td>PRESS: Reset key (if unable to clear contact factory.)</td>
</tr>
<tr>
<td>SERIAL COMMUNICATIONS</td>
<td>CHECK: Wiring, connections, meter and host settings</td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.
### Display and Program Lockout Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Cnt</td>
<td>COUNTER A DISPLAY LOCK-OUT</td>
<td>rEd</td>
<td></td>
</tr>
<tr>
<td>b Cnt</td>
<td>COUNTER B DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>r EEE</td>
<td>RATE DISPLAY LOCK-OUT</td>
<td>rEd</td>
<td></td>
</tr>
<tr>
<td>Hi</td>
<td>MAX DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>LO</td>
<td>MIN DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>5P-1</td>
<td>SETPOINT 1 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>5P-2</td>
<td>SETPOINT 2 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>5P-3</td>
<td>SETPOINT 3 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>5P-4</td>
<td>SETPOINT 4 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>6CMLd</td>
<td>COUNT LOAD A ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>bCMLd</td>
<td>COUNT LOAD B ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>cCMLd</td>
<td>COUNT LOAD C ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>rSCFAC</td>
<td>SCALE FACTOR A ACCESS</td>
<td>Enb</td>
<td></td>
</tr>
<tr>
<td>bSCFAC</td>
<td>SCALE FACTOR B ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>cSCFAC</td>
<td>SCALE FACTOR C ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>CdE</td>
<td>SECURITY CODE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.

### User Input and Function Key Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>USr-1</td>
<td>USER INPUT 1</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>USr-2</td>
<td>USER INPUT 2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>USr-3</td>
<td>USER INPUT 3</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>FUNCTION KEY 1</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>FUNCTION KEY 2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>r St</td>
<td>RESET KEY</td>
<td>dSP-St</td>
<td></td>
</tr>
<tr>
<td>5c-F1</td>
<td>2nd FUNCTION KEY 1</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>5c-F2</td>
<td>2nd FUNCTION KEY 2</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.

### Counter A & B Input Parameters - PAXC & I only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cnt</td>
<td>COUNTER A OPERATING MODE</td>
<td>cnb</td>
<td></td>
</tr>
<tr>
<td>r EEE</td>
<td>COUNTER A RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>dECPk</td>
<td>COUNTER A DECIMAL POSITION</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r SCFAC</td>
<td>COUNTER A SCALE FACTOR (A)</td>
<td>1000000</td>
<td></td>
</tr>
<tr>
<td>r SCALr</td>
<td>COUNTER A SCALE MULTIPLIER</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>r ACMLd</td>
<td>COUNTER A COUNT LOAD VALUE (A)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>r ACMLd</td>
<td>COUNTER A COUNT LOAD VALUE (B)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>p-Up</td>
<td>COUNTER A RESET POWER-UP</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Pr Sel</td>
<td>PRESCALER OUTPUT ENABLE</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>p VRl</td>
<td>PRESCALER SCALE VALUE</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>b Cnt</td>
<td>COUNTER B OPERATING MODE</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>r EEE</td>
<td>COUNTER B RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>dECPk</td>
<td>COUNTER B DECIMAL POSITION</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>b SCFAC</td>
<td>COUNTER B SCALE FACTOR (A)</td>
<td>1000000</td>
<td></td>
</tr>
<tr>
<td>b SCALr</td>
<td>COUNTER B SCALE MULTIPLIER</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b ACMLd</td>
<td>COUNTER B COUNT LOAD VALUE (A)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>b ACMLd</td>
<td>COUNTER B COUNT LOAD VALUE (B)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>b p-Up</td>
<td>COUNTER B RESET POWER-UP</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.

### Counter C Input Parameters - PAXC & I only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cnt</td>
<td>COUNTER C OPERATING MODE</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>r EEE</td>
<td>COUNTER C RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>dECPk</td>
<td>COUNTER C DECIMAL POSITION</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r SCFAC</td>
<td>COUNTER C SCALE FACTOR (A)</td>
<td>1000000</td>
<td></td>
</tr>
<tr>
<td>r SCALr</td>
<td>COUNTER C SCALE MULTIPLIER</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>r ACMLd</td>
<td>COUNTER C COUNT LOAD VALUE (A)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>r ACMLd</td>
<td>COUNTER C COUNT LOAD VALUE (B)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>r p-Up</td>
<td>COUNTER C RESET POWER-UP</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.

### Rate Input Parameters - PAXI & R only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>r EEE</td>
<td>RATE ASSIGNMENT</td>
<td>r EEE - A</td>
<td></td>
</tr>
<tr>
<td>Lo-Ud</td>
<td>LOW UPDATE TIME</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Hi-Ud</td>
<td>HIGH UPDATE TIME</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>r E P</td>
<td>RATE DECIMAL POINT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r SEBS</td>
<td>LINEARIZER SEGMENTS</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r dSP 0</td>
<td>SCALING PT. 1 - DISPLAY VALUE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r dSP 1</td>
<td>SCALING PT. 1 - INPUT VALUE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>r dSP 2</td>
<td>SCALING PT. 2 - DISPLAY VALUE</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>r dSP 3</td>
<td>SCALING PT. 2 - INPUT VALUE</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>r dSP 4</td>
<td>SCALING PT. 3 - DISPLAY VALUE</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>r dSP 5</td>
<td>SCALING PT. 3 - INPUT VALUE</td>
<td>20000</td>
<td></td>
</tr>
<tr>
<td>r dSP 6</td>
<td>SCALING PT. 4 - DISPLAY VALUE</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>r dSP 7</td>
<td>SCALING PT. 4 - INPUT VALUE</td>
<td>30000</td>
<td></td>
</tr>
<tr>
<td>r dSP 8</td>
<td>SCALING PT. 5 - DISPLAY VALUE</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>r dSP 9</td>
<td>SCALING PT. 5 - INPUT VALUE</td>
<td>40000</td>
<td></td>
</tr>
<tr>
<td>r dSP 10</td>
<td>SCALING PT. 6 - DISPLAY VALUE</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>r dSP 11</td>
<td>SCALING PT. 6 - INPUT VALUE</td>
<td>50000</td>
<td></td>
</tr>
<tr>
<td>r dSP 12</td>
<td>SCALING PT. 7 - DISPLAY VALUE</td>
<td>6000</td>
<td></td>
</tr>
<tr>
<td>r dSP 13</td>
<td>SCALING PT. 7 - INPUT VALUE</td>
<td>60000</td>
<td></td>
</tr>
<tr>
<td>r dSP 14</td>
<td>SCALING PT. 8 - DISPLAY VALUE</td>
<td>7000</td>
<td></td>
</tr>
<tr>
<td>r dSP 15</td>
<td>SCALING PT. 8 - INPUT VALUE</td>
<td>70000</td>
<td></td>
</tr>
<tr>
<td>r dSP 16</td>
<td>SCALING PT. 9 - DISPLAY VALUE</td>
<td>8000</td>
<td></td>
</tr>
<tr>
<td>r dSP 17</td>
<td>SCALING PT. 9 - INPUT VALUE</td>
<td>80000</td>
<td></td>
</tr>
<tr>
<td>r dSP 18</td>
<td>SCALING PT. 10 - DISPLAY VALUE</td>
<td>9000</td>
<td></td>
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<tr>
<td>r dSP 19</td>
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<td>90000</td>
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<tr>
<td>r ouNd</td>
<td>RATE DISPLAY Rounding</td>
<td>1</td>
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<tr>
<td>Locut</td>
<td>MINIMUM LOW CUT OUT</td>
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<tr>
<td>Hi-E</td>
<td>MAX CAPTURE DELAY TIME</td>
<td>20</td>
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<tr>
<td>Lo-E</td>
<td>MIN CAPTURE DELAY TIME</td>
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</table>

Shaded areas are model dependent.

### Counter C Display Parameters - PAXC & I only

<table>
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<th>DISPLAY</th>
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<td>C Cnt</td>
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<td>C r EEE</td>
<td>COUNTER C RESET ACTION</td>
<td>2E-0</td>
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<td>C dECPk</td>
<td>COUNTER C DECIMAL POSITION</td>
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<td>C SCFAC</td>
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<td>C SCALr</td>
<td>COUNTER C SCALE MULTIPLIER</td>
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<tr>
<td>C ACMLd</td>
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<td>COUNTER C COUNT LOAD VALUE (B)</td>
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<td>C p-Up</td>
<td>COUNTER C RESET POWER-UP</td>
<td>N/A</td>
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* See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.
### 6 - 5P Analog Output Parameters - PAXI only

<table>
<thead>
<tr>
<th>DISPLAY</th>
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<th>FACTORY SETTING</th>
<th>USER SETTING</th>
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<th>USER SETTING</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
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<tr>
<td>L1t-n</td>
<td>SETPOINT ANNUNCIATORS</td>
<td>No</td>
<td>No</td>
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<td>No</td>
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<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
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<td>R CAl</td>
<td>R CAl</td>
<td>R CAl</td>
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<td>R CAl</td>
<td>R CAl</td>
<td>R CAl</td>
<td>R CAl</td>
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<td>H1</td>
<td>H1</td>
<td>H1</td>
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<td>KYSL-n</td>
<td>SETPOINT Hysteresis (rate)</td>
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<td>0</td>
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<td>0</td>
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<td>HOFF-n</td>
<td>SETPOINT OFF DELAY</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
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<tr>
<td>rSAE-n</td>
<td>RESET WHEN SPn+1 ACTIVATES</td>
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<td>No</td>
<td>No</td>
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<td>No</td>
<td>No</td>
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<td>rSBE-n</td>
<td>RESET WHEN SPn+1 DEACTIVATES</td>
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* See Module 2, Exchanging Parameter Lists, for details on programming this value.

### 7 - 5rL Serial Communication Parameters - PAXI only

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<th>FACTORY SETTING</th>
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<td>BAUD RATE</td>
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<td>dftR</td>
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<td>b CAl</td>
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<tr>
<td>C CAl</td>
<td>PRINT COUNTER C</td>
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<td>H I Lo</td>
<td>PRINT MAX &amp; MIN</td>
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<td>SCFLAC</td>
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<td>CNTLnD</td>
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<td>SPALE</td>
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### 8 - RnR Analog Output Parameters - PAXI only

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<th>USER SETTING</th>
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<tr>
<td>L4</td>
<td>ANALOG TYPE</td>
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<td>RSiO</td>
<td>ANALOG ASSIGNMENT</td>
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<td>RLn-Ld</td>
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<td>Rhl-HI</td>
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<td>1000</td>
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### 9 - FC5 Factory Service Parameters

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<th>FACTORY SETTING</th>
<th>USER SETTING</th>
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<td>d-LEU</td>
<td>DISPLAY INTENSITY LEVEL</td>
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</table>
Counter parameters apply to the PAXC and PAXI, while the rate parameters apply to the PAXR and PAXI.

<table>
<thead>
<tr>
<th>Counter B</th>
<th>Counter A</th>
<th>Counter C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Mode</td>
<td>Reset Action</td>
<td>Decimal Position</td>
</tr>
<tr>
<td>Rate</td>
<td>Display Lock-out</td>
<td>Display Lock-out</td>
</tr>
<tr>
<td>Max</td>
<td>Min</td>
<td>Setpoint 1-4 Access</td>
</tr>
<tr>
<td>Capture Delay Time</td>
<td>Capture Delay Time</td>
<td></td>
</tr>
<tr>
<td>Time-out Value</td>
<td>On Time Delay</td>
<td></td>
</tr>
<tr>
<td>Time-out Value</td>
<td>Off Time Delay</td>
<td></td>
</tr>
<tr>
<td>Reset with SPn+1 Activates</td>
<td>Reset with SPn+1 Deactivates</td>
<td></td>
</tr>
<tr>
<td>Print Counter A</td>
<td>Print Counter B</td>
<td>Print Counter C</td>
</tr>
<tr>
<td>Print Rate</td>
<td>Print Max/Mn</td>
<td>Print Scale Factors</td>
</tr>
<tr>
<td>Print Scale Load Values</td>
<td>Print Setpoint Values</td>
<td></td>
</tr>
</tbody>
</table>

**Counter Parameters:**
- Counter x Operating Mode
- Counter x Reset Action
- Counter x Decimal Position
- Counter x Scale Factor
- Counter x Scale Multiplier
- Counter x Count Load Value
- Counter x Reset at Power-up
- Prescaler Output Enable
- Prescaler Scale Value

**Rate Parameters:**
- Rate Assignment
- Low Update Time
- High Update Time
- Rate Decimal Position
- Linearizer Segments
- Rate Scaling Display
- Rate Scaling Input
- Rate Display Rounding
- Min. Low Cut-out
- Max. Capture Delay Time
- Min. Capture Delay Time

**Setpoint Parameters:**
- Setpoint Select
- Output Logic
- Power-up State
- Setpoint Action
- Setpoint Assignment
- Setpoint Value
- Setpoint Tracking
- Boundary Type

**Print Options:**
- Print Counter A
- Print Counter B
- Print Counter C
- Print Rate
- Print Max/Mn
- Print Scale Factors
- Print Scale Load Values
- Print Setpoint Values

**Factory Service Code:**
- Factory Service Code

**Abbreviated Printing:**
- Abbreviated Printing

**Data Bit:**
- Baud Rate
- Data Bit
- Parity Bit

**Address:**
- Meter Address

**Display:**
- Display Intensity Level

**Code:**
- Factory Service Code
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 137.

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.

<table>
<thead>
<tr>
<th>FUNCTION QUESTIONS</th>
<th>Single: Counter A or B (with/without rate) or Rate only</th>
<th>Dual: Counter A &amp; B or Rate not assigned to active single counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are any setpoints used?</td>
<td>N N N N</td>
<td>Y Y Y Y</td>
</tr>
<tr>
<td>Is Prescaler Output used?</td>
<td>N N Y Y</td>
<td>N N Y Y</td>
</tr>
<tr>
<td>Is Counter C used?</td>
<td>N Y N Y</td>
<td>N Y N Y</td>
</tr>
<tr>
<td>COUNTER MODE</td>
<td>(Values are in KHz)</td>
<td>(Values are in KHz)</td>
</tr>
<tr>
<td>Count x1</td>
<td>34 25 21 17</td>
<td>Count x2</td>
</tr>
<tr>
<td>Count x2</td>
<td>7 13 16 12</td>
<td>Count x2</td>
</tr>
<tr>
<td>Quadrature x1</td>
<td>22 19 20 17</td>
<td>Quadrature x2</td>
</tr>
<tr>
<td>Quadrature x2</td>
<td>17 13 16 12</td>
<td>Quadrature x4</td>
</tr>
<tr>
<td>Quadrature x4</td>
<td>8 6 8 6</td>
<td>Rate Only</td>
</tr>
<tr>
<td>Rate Only</td>
<td>34 N/A 21 N/A</td>
<td></td>
</tr>
</tbody>
</table>

ANNUNCIATORS:

- A - Counter A
- B - Counter B
- C - Counter C
- r - Rate
- H - Maximum (High) Rate
- L - Minimum (Low) Rate
- DF - 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” DL DL

COUNTER DISPLAYS:

- Maximum display: 8 digits: ±999999999 (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 VIL = 1.5 V max.; VIH = 3.75 V min.
- Current sinking: Internal 7.8 KΩ pull-down, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.
- Current sourcing: Internal 3.9 KΩ pull-up-to +12 VDC, IMAX = 1 mA.
- 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 Junper placement.

PREScalER OUTPUT:

- NPN Open Collector: IsNK = 100 mA max. @ VIL = 1 VDC max. V IH = 30 VDC max. With duty cycle of 25% min. and 50% max.