Innovative operator interface, measurement, monitoring and control solutions
## QUICK Specs

### Digital Panel Meters

<table>
<thead>
<tr>
<th>Description</th>
<th>CUB4V / I</th>
<th>CUB5V / I</th>
<th>PAXLV / I</th>
<th>PAXLA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VOLT/CURRENT</strong></td>
<td>Miniature DC Volt/Current Meter</td>
<td>DC Volt/Current Meter with Output Option Card Capability</td>
<td>1/8 DIN, AC or DC Volt/Current Meter</td>
<td>1/8 DIN, DC Volt/Current/Process Meter with Setpoint Card Capability</td>
</tr>
<tr>
<td><strong>UNIVERSAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions (Height)x(Width)</strong></td>
<td>39mm (H) x 75mm (W)</td>
<td>39mm (H) x 75mm (W)</td>
<td>50mm (H) x 97mm (W)</td>
<td>50mm (H) x 97mm (W)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>3 1/2 Digit, .6” (15mm) Reflective, Green and Red Backlight LCD</td>
<td>5 Digit, .48” (12mm) Reflective, Green and Red Backlight LCD</td>
<td>3 1/2 Digit, .56” (14mm) Red LED</td>
<td>5 Digit, .56” (14mm) Red LED</td>
</tr>
<tr>
<td><strong>Input Ranges</strong></td>
<td>Current (CUB4I) 0 to 199.9 μA DC through 199.9 mA DC Voltage (CUB4V)</td>
<td>Current (CUB5I) 0 to 200 μA DC through 200 mA DC Voltage (CUB5V)</td>
<td>Current (PAXLI) (AC or DC) 0 to 199.9 μA through 1.999 A Voltage (PAXLV) (AC or DC)</td>
<td>Current: 0 to 200 μA through 200 mA DC Voltage: 0 to 200 mV through 200 VDC Process: 4 to 20 mA and 0 to 10 VDC</td>
</tr>
<tr>
<td><strong>Zero/Offset</strong></td>
<td>Zero Based</td>
<td>Zero Based</td>
<td>Zero Based</td>
<td>Non Zero Based</td>
</tr>
<tr>
<td><strong>Setpoint Capability †</strong></td>
<td>No</td>
<td>Single Form C Relay Dual Sinking</td>
<td>No</td>
<td>Dual Form C Relays</td>
</tr>
<tr>
<td><strong>Communication Capability</strong></td>
<td>No</td>
<td>RS232</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Other Features/Options</strong></td>
<td>No</td>
<td>User Input Min/Max Memory Custom Units Indicator</td>
<td>Custom Units Overlay</td>
<td>User Input Excitation Custom Units Overlay Min/Max Memory</td>
</tr>
<tr>
<td><strong>Power Source</strong></td>
<td>9 to 28 VDC</td>
<td>9 to 28 VDC</td>
<td>115/230 VAC</td>
<td>50 to 250 VAC</td>
</tr>
<tr>
<td><strong>Page Number</strong></td>
<td>*</td>
<td>Page 305/317</td>
<td>Page 329</td>
<td>Page 347</td>
</tr>
</tbody>
</table>

*See website for product information.
† Field Installable Option Card
<table>
<thead>
<tr>
<th>Description</th>
<th>PAXLIT</th>
<th>PAXLHV</th>
<th>DP5D</th>
<th>PAXD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 DIN, 5 amp AC Current Meter</td>
<td>1/8 DIN, AC Voltage Monitor</td>
<td>1/8 DIN, Universal DC Meter</td>
<td>1/8 DIN, Universal DC Meter with Output Option Card Capability</td>
<td></td>
</tr>
<tr>
<td>Dimensions (Height) x (Width)</td>
<td>50mm (H) x 97mm (W)</td>
<td>50mm (H) x 97mm (W)</td>
<td>50mm (H) x 97mm (W)</td>
<td>50mm (H) x 97mm (W)</td>
</tr>
<tr>
<td>Display</td>
<td>3 1/2 Digit, .56” (14mm) Red LED</td>
<td>3 1/2 Digit, .56” (14mm) Red LED</td>
<td>4 1/2 Digit, .56” (14mm) Red LED</td>
<td></td>
</tr>
<tr>
<td>Input Ranges</td>
<td>0 to 5 A AC</td>
<td>0 to 600 VAC</td>
<td>Current +/-200 μA DC to +/-2 A DC Voltage +/-200 mV DC to +/-300 VDC Resistance 100 Ohm to 10K Ohm</td>
<td>Current +/-200 μA DC to +/-2 A DC Voltage +/-200 mV DC to +/-300 VDC Resistance 100 Ohm to 10K Ohm</td>
</tr>
<tr>
<td>Zero/Offset</td>
<td>Zero Based</td>
<td>Zero Based</td>
<td>Non Zero Based</td>
<td></td>
</tr>
<tr>
<td>Setpoint Capability</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Form C Relay (Dual) Form A Relay (Quad) Solid State Outputs (Quad)</td>
</tr>
<tr>
<td>Communication Capability</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>RS232 RS485 Modbus DeviceNet Profinet Ethernet w/ICM8</td>
</tr>
<tr>
<td>Other Features/Options</td>
<td>Custom Units Overlay</td>
<td>Custom Units Overlay</td>
<td>Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
<td>Analog Output, Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
</tr>
<tr>
<td>Power Source</td>
<td>115/230 VAC</td>
<td>115/230 VAC</td>
<td>85 to 250 VAC or 11 to 36 VDC</td>
<td>85 to 250 VAC or 11 to 36 VDC</td>
</tr>
<tr>
<td>Page Number</td>
<td>Page 336</td>
<td>Page 342</td>
<td>Page 358</td>
<td>Page 378</td>
</tr>
</tbody>
</table>

*See website for product information.
† Field Installable Option Card
## Digital Panel Meters

<table>
<thead>
<tr>
<th><strong>VOLT/CURRENT</strong></th>
<th><strong>PROCESS</strong></th>
<th><strong>PAXLCL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>1/8 DIN, AC True RMS Voltage and Current Meter with Output Option Card Capability</td>
<td>DC Process meter with Output Option Card Capability</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>50mm (H) x 97mm (W)</td>
<td>39mm (H) x 75mm (W)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>4 1/2 Digit, .56” (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
<td>3 1/2 Digit, .6” (15mm) Reflective, Green and Red Backlight LCD</td>
</tr>
<tr>
<td><strong>Input Ranges</strong></td>
<td>Current +200 μA AC to +5 A AC Voltage +200 mV AC to +300 VAC</td>
<td>Current Loop Dual Range 4 to 20 mA DC or 10 to 50 mA DC</td>
</tr>
<tr>
<td><strong>Zero/Offset</strong></td>
<td>Non Zero Based</td>
<td>Non Zero Based</td>
</tr>
<tr>
<td><strong>Setpoint Capability †</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Communication Capability</strong></td>
<td>RS232 RS485 Modbus DeviceNet Profinbus Ethernet w/ICM8</td>
<td>No</td>
</tr>
<tr>
<td><strong>Other Features/Options</strong></td>
<td>Analog Output †, Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
<td>No</td>
</tr>
<tr>
<td><strong>Power Source</strong></td>
<td>85 to 250 VAC or 11 to 36 VDC</td>
<td>9 to 28 VDC (CUB4CL) Derives Operating Power from Current Loop 3 Volts Max. (CUB4LP)</td>
</tr>
<tr>
<td><strong>Page Number</strong></td>
<td>Page 405</td>
<td>Page 406</td>
</tr>
</tbody>
</table>

*See website for product information.
† Field Installable Option Card
## Digital Panel Meters

<table>
<thead>
<tr>
<th>Description</th>
<th>PAXLPV</th>
<th>DP5P</th>
<th>PAXP</th>
<th>PAXDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>3 1/2 Digit, .56” (14mm) Red LED</td>
<td>4 1/2 Digit, .56” (14mm) Red LED</td>
<td>4 1/2 Digit, .56” (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
<td>4 1/2 Digit, .56” (14mm) Sunlight Readable Red LED, Adjustable Intensity</td>
</tr>
<tr>
<td>Input Ranges</td>
<td>Process Volt 1 to 5 VDC</td>
<td>Process Current/Voltage 0 to 20 mA DC or 0 to 10 VDC</td>
<td>Process Current/Voltage 0 to 20 mA DC or 0 to 10 VDC</td>
<td>Dual Inputs Process Current/Voltage 0 to 20 mA DC/0 to 10 VDC</td>
</tr>
<tr>
<td>Zero/Offset</td>
<td>Non Zero Based</td>
<td>Non Zero Based</td>
<td>Non Zero Based</td>
<td>Non Zero Based</td>
</tr>
<tr>
<td>Setpoint Capability †</td>
<td>No</td>
<td>No</td>
<td>Form C Relay (Dual)</td>
<td>Form C Relay (Dual)</td>
</tr>
<tr>
<td>Communication Capability</td>
<td>No</td>
<td>No</td>
<td>RS232 RS485 Modbus DeviceNet Profibus Ethernet w/ICM8</td>
<td>RS232 RS485 Modbus DeviceNet Profibus Ethernet w/ICM8</td>
</tr>
<tr>
<td>Other Features/Options</td>
<td>Custom Units Overlay, Excitation</td>
<td>Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
<td>Analog Output †, Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
<td>Analog Output †, Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay</td>
</tr>
<tr>
<td>Power Source</td>
<td>85 to 250 VAC</td>
<td>85 to 250 VAC or 11 to 36 VDC</td>
<td>85 to 250 VAC or 11 to 36 VDC</td>
<td>85 to 250 VAC or 18 to 36 VDC</td>
</tr>
</tbody>
</table>

*See website for product information.
† Field Installable Option Card
## Digital Panel Meters

### STRAIN GAGE

<table>
<thead>
<tr>
<th>Description</th>
<th>PAXLSG</th>
<th>PAXS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 DIN, Strain Gage Meter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8 DIN, Strain Gage Meter with Output Option Card Capability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Dimensions (Height)x(Width)  | 50mm (H) x 97mm (W) | 50mm (H) x 97mm (W) |

| Display                      | 3 1/2 Digit, .56" (14mm) Red LED | 4 1/2 Digit, .56" (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity |

| Input Ranges                 | Single-ended or Differential Input 0 to 10 mV through 1.999 A | +/- 24 mV DC or +/- 240 mV DC |

| Zero/Offset                  | Non Zero Based | Non Zero Based |

| Setpoint Capability †        | No             | Form C Relay (Dual) Form A Relay (Quad) Solid State Outputs (Quad) |

| Communication Capability     | No             | RS232 RS485 Modbus DeviceNet Profinet Ethernet w/ICM8 |

| Other Features/Options       | Custom Units Overlay Excitation, Analog Output †, Tare, Min/Max Memory, Integrator/Totalizer, Linearizer, Excitation, Custom Units Overlay |

| Power Source                 | 115/230 VAC    | 85 to 250 VAC or 11 to 36 VDC |

| Page Number                  | Page 473       | Page 481 |

*See website for product information.

† Field Installable Option Card
# REPLACEMENT Guide

## WHAT YOU'RE USING NOW

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| CUBID / CUBVD | Display: 3 1/2 Digit, .35' (9 mm) Reflective LCD  
|              | Power Source: 5 VDC or 7 to 28 VDC  
|              | Measurement: DC Current or Voltage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| CUBSI / CUBSV | Display: 5 Digit, .48' (12 mm) Reflective LCD  
|              | Power Source: 9 to 28 VDC  
|              | Measurement: DC Current or Voltage |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| LPPI | Display: 3 1/2 Digit, .35' (9 mm) Reflective LCD  
|      | Power Source: Loop Powered  
|      | Measurement: Current Loop |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| CUB4LP | Display: 3 1/2 Digit, .35' (9 mm) Reflective LCD  
|        | Power Source: Loop Powered  
|        | Measurement: Current Loop |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| APLI / APLV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|             | Power Source: 115/230 VAC  
|             | Measurement: AC or DC Current and Voltage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXLI / PAXLV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|              | Power Source: 115/230 VAC  
|              | Measurement: AC or DC Current and Voltage |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| APLIT / APLHV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|              | Power Source: 115/230 VAC  
|              | Measurement: 5 Amp AC Current and Voltage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXLIT / PAXLHV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|                  | Power Source: 115/230 VAC  
|                  | Measurement: 5 Amp AC/600 VAC  
|                  | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| APLCL / APLPV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|             | Power Source: 115/230 VAC  
|             | Measurement: Current Loop/Process Volt |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXLCL / PAXLPV | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|                  | Power Source: 115/230 VAC  
|                  | Measurement: Current Loop/Process Volt  
|                  | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| APLSG | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|       | Power Source: 115/230 VAC  
|       | Measurement: Strain Gage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXLSG | Display: 3 1/2 Digit, .56' (14 mm) Red LED  
|        | Power Source: 115/230 VAC  
|        | Measurement: Strain Gage  
|        | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| IMP | Display: 4 1/2 Digit, .56' (14 mm) Red LED  
|     | Power Source: 115/230 VAC  
|     | Measurement: Process Signals |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXP | Display: 6 Digit, .56' (14 mm) Red LED  
|      | Power Source: 85 to 250 VAC, 11 to 36 VDC, 24 VAC  
|      | Measurement: Process Signals  
|      | Requires Appropriate Option Card  
|      | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| IMD | Display: 4 1/2 Digit, .56' (14 mm) Red LED  
|     | Power Source: 115/230 VAC  
|     | Measurement: DC Current and Voltage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXD | Display: 6 Digit, .56' (14 mm) Red LED  
|      | Power Source: 85 to 250 VAC, 11 to 36 VDC, 24 VAC  
|      | Measurement: DC Current and Voltage  
|      | Requires Appropriate Option Card  
|      | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| IMH | Display: 4 1/2 Digit, .56' (14 mm) Red LED  
|     | Power Source: 115/230 VAC  
|     | Measurement: 5 Amp AC |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXH | Display: 6 Digit, .56' (14 mm) Red LED  
|      | Power Source: 85 to 250 VAC, 11 to 36 VDC, 24 VAC  
|      | Measurement: AC Current and Voltage  
|      | Requires Appropriate Option Card  
|      | Panel Cut-Out Dimension Differences |

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| IMS | Display: 4 1/2 Digit, .56' (14 mm) Red LED  
|     | Power Source: 115/230 VAC  
|     | Measurement: Strain Gage |

<table>
<thead>
<tr>
<th>CURRENT PRODUCT</th>
<th>FEATURES</th>
</tr>
</thead>
</table>
| PAXS | Display: 6 Digit, .56' (14 mm) Red LED  
|      | Power Source: 85 to 250 VAC, 11 to 36 VDC, 24 VAC  
|      | Measurement: Strain Gage  
|      | Requires Appropriate Option Card  
|      | Panel Cut-Out Dimension Differences |

---

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

---

1-717-767-6511

---

This document provided by Barr-Thorp Electric Co., Inc.  800-473-9123    www.barr-thorp.com
MODEL CUB5V - MINIATURE ELECTRONIC 5-DIGIT DC VOLTmeter

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 CUB5V accepts a DC Voltage input signal and provides a display in the desired unit of measure. The meter also features minimum and maximum display capture, display offset, units indicator, and programmable user input. The display can be toggled either manually or automatically between the selected displays.

The CUB5 display has 0.48" (12.2 mm) high digits. The LCD is available in two versions, reflective and red/green backlight. The backlight version is user selectable for the desired color and also has variable display intensity.

The capability of the CUB5 can be easily expanded with the addition of option modules. Setpoint capability is field installable with the addition of the setpoint output modules. Serial communications capability for RS232 or RS485 is added with a serial option module.

The CUB5 can be powered from an optional Red Lion Micro-Line/Sensor Power Supply (MLPS1000), which attaches directly to the back of a CUB5. The MLPS1 is powered from 85 to 250 V AC and provides up to 400 mA to drive the unit and sensors.

VOLTAGE

The CUB5V is the DC Volt meter. It features 4 voltage input ranges, that are selected by the user via a programming jumper and software input range selection. The ranges consist of following: 0 to 200 mV, 2 V, 20 V, 200 V. Users should select the appropriate voltage range that covers their display input.

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.

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**: 5 digit LCD 0.48” (12.2 mm) high digits
   - **CUB5VR00**: Reflective LCD with full viewing angle
   - **CUB5VB00**: 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.

3. **INPUT RANGES**
   - **D.C. Voltages**: 200 mV, 2 V, 20 V, 200 V

4. **SIGNAL INPUTS**
   - **Input Impedance**: @ 9 V DC, 500 mΩ max.
   - **Input Signal**: 2 V, 20 V, 200 V
   - **Accuracy**: ±0.1% of span
   - **Resolution**: 10 μV
   - **Temp. Coefficient**: 70 ppm / °C

5. **OVERRANGE RATINGS, PROTECTION & INDICATION**
   - 9 to 28 VDC power circuit is not isolated from the signal circuit.
   - **Input Overrange Indication**: “ULUL”.
   - **Input Underrange Indication**: “OLOL”.
   - **Display Overrange/Underrange Indication**: “.....”/“.....”

6. **AD CONVERTER**: 16 bit resolution

7. **DISPLAY RESPONSE TIME**: 500 msec min.

8. **NORMAL MODE REJECTION**: 60 dB 50/60 Hz

9. **USER INPUT (USR)**: Programmable input. Connect terminal to common (USR COMM) to activate function. Internal 10kΩ pull-up resistor to +9 to 28 VDC.

   - **Threshold Levels**: V<sub>TH</sub> = 1.0 V max; V<sub>RL</sub> = 2.4 V min; V<sub>MAX</sub> = 28 VDC
   - **Response Time**: 5 msec typ.; 50 msec debounce (activation and release)

10. **CONNECTIONS**: Wire clamping screw terminals
    - **Wire Gage**: 30-14 AWG copper wire
    - **Torque**: 5 inch-lbs (0.565 N-m) max.

11. **MEMORY**: Nonvolatile EPROM memory retains all programming parameters and max/min values when power is removed.

12. **ENVIRONMENTAL CONDITIONS**
    - **Operating Temperature Range** for **CUB5VR00**: -35 to 75°C
    - **Operating Temperature Range** for **CUB5VB00** depends on display color and intensity level as per below:

<table>
<thead>
<tr>
<th>INTENSITY LEVEL</th>
<th>TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Display</td>
<td></td>
</tr>
<tr>
<td>1 &amp; 2</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>3</td>
<td>-35 to 70°C</td>
</tr>
<tr>
<td>4</td>
<td>-35 to 60°C</td>
</tr>
<tr>
<td>5</td>
<td>-35 to 50°C</td>
</tr>
<tr>
<td>Green Display</td>
<td></td>
</tr>
<tr>
<td>1 &amp; 2</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>3</td>
<td>-35 to 65°C</td>
</tr>
<tr>
<td>4</td>
<td>-35 to 55°C</td>
</tr>
<tr>
<td>5</td>
<td>-35 to 35°C</td>
</tr>
</tbody>
</table>

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

13. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 requirements for indoor use. Installation Category 1, Pollution Degree 2. High impact plastic case with clear viewing window. Panel gasket and mounting clip included.

14. **CERTIFICATIONS AND COMPLIANCES**:
    - **SAFETY**
      - UL Listed, File # E137808, UL 508, CSA C22.2 No. 14-M095
      - **LISTED** by Underwriters Laboratories 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**
      - 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
        - 3 V/m
        - Fast transients (burst): EN 61000-4-4, Criterion A
        - 2 kV power
        - 1 kV signal
        - Surge: EN 61000-4-5, Criterion A
        - 1 kV L-L
        - 2 kV L&N-E power
        - RF conducted interference: EN 61000-4-6, Criterion A
        - 3 V/m
        - Power frequency magnetic fields: EN 61000-4-8, Criterion A
        - 30 A/m

    - **Emissions**:
      - Emissions: EN 55011, Class A

    - **Notes**:

15. **WEIGHT**: 3.2 oz (100 g)
**OPTIONAL PLUG-IN CARDS**

**ADDING OPTION CARDS**

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

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

*Note:* Measurement errors may occur if signal input common is shared with another circuit common (ie, serial common, Dual Sinking Output option card, or Power Supply common) on multiple units.

**SINGLE RELAY CARD**

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

**DUAL SINKING OUTPUT CARD**

**Type:** Non-isolated switched DC, N Channel open drain MOSFET  
**Current Rating:** 100 mA max.  
**V<sub>DS ON</sub>:** 0.7 V @ 100 mA  
**V<sub>DS MAX</sub>:** 30 VDC  
**Offstate Leakage Current:** 0.5 mA max.

**RS485 SERIAL COMMUNICATIONS CARD**

**Type:** RS485 multi-point balanced interface (non-isolated)  
**Baud Rate:** 300 to 38.4k  
**Data Format:** 7/8 bits; odd, even, or no parity  
**Bus Address:** 0 to 99; max 32 meters per line  
**Transmit Delay:** Selectable (refer to CUB5COM bulletin)

**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

---

**1.0 INSTALLING THE METER**

**INSTALLATION**

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

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

**INSTALLATION ENVIRONMENT**

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

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

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

---

**2.0 SETTING THE JUMPERS**

**INPUT RANGE JUMPER**

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum input to avoid overloads. To access the jumper, remove the rear cover of the meter.

⚠️ **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.
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.

4.0 Wiring the Meter

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

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

EMC Installation Guidelines
Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various applications. 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. 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 at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   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 common of the meter and leave the other end of the shield connected to protective earth.

EMC Installation Guidelines

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. 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 at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   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 common of the meter and leave the other end of the shield connected 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 ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   a. Ferrite Suppression Cores for signal and control cables:
      - Fair-Rite # 0443167251 (RLC# FCOR0000)
      - TDK # ZCAT305-1330A
      - Steward # 28B2029-0A0
   b. Line Filters for input power cables:
      - Schaffner # FN610-1/07 (RLC# LFIL0000)
      - Schaffner # FN670-1.8/07
      - Corcom # 1 VR3

Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC# SNUB0000.

4.1 Power Wiring

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

CAUTION: 9 to 28 VDC power circuit is not isolated from the signal circuit.

4.2 User Input Wiring

Sinking Logic

Connect external switching device between the USR Input terminal and User 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 (<0.7 V).
4.3 INPUT WIRING

**CAUTION:** Power input common is NOT isolated from user and input commons. In order to preserve the safety of the meter application, the power 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 signal or user inputs and input common terminals. Appropriate considerations must then be given to the potential of the user and input commons with respect to earth ground; and the common of the plug-in cards with respect to input common.

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

4.4 SETPOINT (OUTPUT) WIRING

**SINGLE SETPOINT RELAY PLUG-IN CARD**

**ELECTRICAL CONNECTIONS**

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**

Voltage Signal

(self powered)

<table>
<thead>
<tr>
<th>JUMPER POSITION</th>
<th>MAX INPUT VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mV / 2 VDC</td>
<td>75 VDC</td>
</tr>
<tr>
<td>20V / 200 VDC</td>
<td>250 VDC</td>
</tr>
</tbody>
</table>

ELECTRICAL CONNECTIONS
5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

It is recommended that all programming changes be made offline, 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 button. If it is not accessible then it is locked by either a security code, or a hardware lock.

MODULE ENTRY (SEL & RST BUTTONS)

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 button is used to select the desired module. The displayed module is entered by pressing the SEL button.

MODULE MENU (SEL BUTTON)

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

SELECTION / VALUE ENTRY

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

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

PROGRAMMING MODE EXIT (SEL BUTTON)

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

PROGRAMMING TIPS

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

FACTORY SETTINGS

Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems.

ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.
## 6.1 MODULE 1 - SIGNAL INPUT PARAMETERS (i- INP)

### PARAMETER MENU

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANGE</strong></td>
<td>Input Range</td>
</tr>
<tr>
<td><strong>dECPL</strong></td>
<td>Display Decimal Point</td>
</tr>
<tr>
<td><strong>OFSEL</strong></td>
<td>Display Offset Value</td>
</tr>
<tr>
<td><strong>FILTER</strong></td>
<td>Filter Setting</td>
</tr>
<tr>
<td><strong>bAND</strong></td>
<td>Filter Band</td>
</tr>
<tr>
<td><strong>STYLE</strong></td>
<td>Scaling Style</td>
</tr>
<tr>
<td><strong>MP 1</strong></td>
<td>Input Value for Scaling Point 1</td>
</tr>
<tr>
<td><strong>dSP 1</strong></td>
<td>Display Value For Scaling Point 1</td>
</tr>
<tr>
<td><strong>MP 2</strong></td>
<td>Input Value for Scaling Point 2</td>
</tr>
<tr>
<td><strong>dSP 2</strong></td>
<td>Display Value For Scaling Point 2</td>
</tr>
<tr>
<td><strong>USr fn</strong></td>
<td>User Input Function</td>
</tr>
<tr>
<td><strong>USr Rn</strong></td>
<td>User Input Assignment</td>
</tr>
</tbody>
</table>

### CUB5V INPUT RANGE

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>RANGE RESOLUTION</th>
<th>SELECTION</th>
<th>RANGE RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 μV</td>
<td>200.00 mV</td>
<td>0 μV</td>
<td>20.000 V</td>
</tr>
<tr>
<td>0 μV</td>
<td>200.00 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

### DISPLAY DECIMAL POINT

<table>
<thead>
<tr>
<th>dECPL</th>
<th>0</th>
</tr>
</thead>
</table>

Select the decimal point location for the Input, MIN and MAX displays. This selection also affects the *dSP 1* and *dSP 2* parameters and setpoint values.

### DISPLAY OFFSET VALUE

<table>
<thead>
<tr>
<th>OFSEL</th>
<th>0.000</th>
</tr>
</thead>
</table>

The display can be corrected with an offset value. This can be used to compensate for signal variations or sensor errors. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the effects of offset.

### FILTER SETTING

<table>
<thead>
<tr>
<th>FILTER</th>
<th>1</th>
</tr>
</thead>
</table>

If the displayed value is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display. Software filtering effectively combines a fraction of the current input reading with a fraction of the previous displayed reading to generate the new display.

### FILTER BAND

<table>
<thead>
<tr>
<th>bAND</th>
<th>0 to 199 display units</th>
</tr>
</thead>
</table>

The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the filter permanently engaged at the filter level selected above.

### SCALING STYLE

If Input Values and corresponding Display Values are known, the Key-in (*E6*) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (*E3*) scaling style must be used.

#### INPUT VALUE FOR SCALING POINT 1

For Key-in (*E6*) style, enter the first Input Value using the front panel buttons. (The Input Range selection sets the decimal location for the Input Value).

For Apply (*E3*) style, the meter shows the previously stored Input Value. To retain this value, press the **SEL** button to advance to the next parameter. To change the Input Value, press the **RST** button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the **SEL** button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 1

Enter the first Display Value by using the front panel buttons. This is the same for *E3* and *APLY* scaling styles. The decimal point follows the *dECPL* selection.

#### INPUT VALUE FOR SCALING POINT 2

For Key-in (*E6*) style, enter the known second Input Value using the front panel buttons.

For Apply (*E3*) style, the meter shows the previously stored Input Value for Scaling Point 2. To retain this value, press the **SEL** button to advance to the next parameter. To change the Input Value, press the **RST** button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the **SEL** button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 2

Enter the second Display Value by using the front panel buttons. This is the same for *E3* and *APLY* scaling styles.

### General Notes on Scaling

1. When using the Apply (*E3*) scaling style, input values for scaling points must be confined to the signal input limits of the selected range.
2. The same Input Value should not correspond to more than one Display Value. (Example: 10 V can not equal 0 and 10.)
3. For input levels beyond the programmed Input Values, the meter extends the Display Value by calculating the slope from the two coordinate pairs (*MP 1 / dSP 1 & MP 2 / dSP 2*).
**USER INPUT FUNCTION**

<table>
<thead>
<tr>
<th>DISPLAY MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Function</td>
<td>User Input disabled.</td>
</tr>
<tr>
<td>P-Lac</td>
<td>Program Mode Lock-out</td>
</tr>
<tr>
<td>Zer Input</td>
<td>Zero Input (Edge triggered)</td>
</tr>
<tr>
<td>rSEL</td>
<td>Reset (Edge triggered)</td>
</tr>
<tr>
<td>d-Hld</td>
<td>Display Hold</td>
</tr>
<tr>
<td>d-SEL</td>
<td>Display Select (Edge triggered)</td>
</tr>
<tr>
<td>d-LED</td>
<td>Display Intensity Level (Edge triggered)</td>
</tr>
<tr>
<td>COLOr</td>
<td>Backlight Color (Edge triggered)</td>
</tr>
</tbody>
</table>

**DISPLAY MODE**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Select Print Request</td>
</tr>
<tr>
<td>P-SEL Print and Reset</td>
</tr>
<tr>
<td>rSEL Setpoint 1 Reset</td>
</tr>
<tr>
<td>rSEL Setpoint 2 Reset</td>
</tr>
<tr>
<td>rSEL Setpoint 1 and 2 Reset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial transmit of the active parameters selected in the Print Options menu (Module 5).</td>
</tr>
<tr>
<td>Same as Print Request followed by a momentary reset of the assigned value(s).</td>
</tr>
<tr>
<td>Resets setpoint 1 output.</td>
</tr>
<tr>
<td>Resets setpoint 2 output.</td>
</tr>
</tbody>
</table>

**USER INPUT ASSIGNMENT**

Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset, display hold, or print and reset is selected in the User Input Function menu.

### 6.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)

<table>
<thead>
<tr>
<th>Parameter Menu</th>
<th>Max Display Enable</th>
<th>Max Capture Delay Time</th>
<th>Min Display Enable</th>
<th>Min Capture Delay Time</th>
<th>Factory Service Operations</th>
<th>Access Code for Service Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI-En</td>
<td>No</td>
<td>Yes</td>
<td>HI-t</td>
<td>To 9999 sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LO-En</td>
<td>No</td>
<td>Yes</td>
<td>LO-t</td>
<td>To 9999 sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCS</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAX DISPLAY ENABLE**

Enables the Maximum Display Capture capability.

**MAX CAPTURE DELAY TIME**

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

**MIN DISPLAY ENABLE**

Enables the Minimum Display Capture capability.

**MIN CAPTURE DELAY TIME**

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

**FACTORY SERVICE OPERATIONS**

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

**VIEW VERSION DISPLAY**

Entering Code 55 will display the version (x.x) of the meter. The display then returns to LCD 00. Press the SEL button to exit the module.

**CALIBRATION**

The CUSB5 uses stored voltage calibration values to provide accurate voltage measurements. Over time, the electrical characteristics of the components inside the meter will slowly change, with the result that the stored calibration values no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the CUSB5 involves an input voltage calibration, which should only be performed by individuals experienced in calibrating electronic equipment. Allow a 30 minute warm up before performing any calibration related procedures. The following procedures should be performed at an ambient temperature of 15 to 35°C (59 to 95°F).

**CAUTION:** The accuracy of the calibration equipment will directly affect the accuracy of the CUSB5.

**Voltage Calibration**

1. Connect a precision DC voltage source with an accuracy of 0.01% or better to the INP+ (positive) and COMM (negative) terminals of the CUSB5. Set the output of the voltage source to zero.
2. With the display at LCD 00, press and hold the SEL button for 2 seconds. Unit will display CR 00.
3. Press the RST button to select the range to be calibrated.
5. With the voltage source set to zero (or a dead short applied to the input), press SEL. Display reads CR2 for about 8 seconds.
6. When the display reads the selected range, apply full-scale input signal for the range. (Note: For 200V range, apply 100V as indicated on the display.) Press SEL. Display reads CR3 for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads CR4 press the SEL button to exit calibration.
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 (P-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 values 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 CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CodE prompt appears (see chart).

**DISPLAY UPDATE TIME**

This parameter sets the display update time in seconds.

**FRONT PANEL DISPLAY SELECT ENABLE (SEL)**

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

**FRONT PANEL RESET ENABLE (RST)**

This selection allows the RST button to reset the selected value(s).

**ZERO DISPLAY WITH DISPLAY RESET**

This parameter enables the RST button or user input to zero the input display value, causing the display reading to be offset.

**DISPLAY SCROLL ENABLE**

The YES selection allows the display to automatically scroll through the enabled displays. The scroll rate is every 4 seconds. This parameter only appears when the MAX or MIN displays are enabled.

**UNITS INDICATOR SELECTION**

This parameter activates the Units Indicator on the display. There are two methods of selecting the Indicator. List will present a group of Units preprogrammed into the meter. Segments allows the user to choose which of the segments should light.

**DISPLAY COLOR (BACKLIGHT UNIT ONLY)**

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

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

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**

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 (P-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 values 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 CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CodE prompt appears (see chart).
The Setpoint Output Parameters are only active when an optional output module is installed in the meter.

**SETPOINT SELECT**

Enter the setpoint (output) to be programmed. The \( n \) in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to Setpoint Select. Repeat steps for each setpoint to be programmed. Select NO to exit the module. The number of setpoints available is setpoint output card dependent.

**SETPOINT 2 ENABLE**

Select YES to enable Setpoint 2 and access the setup parameters. If NO is selected, the unit returns to Setpoint Select and setpoint 2 is disabled.

**SETPOINT ACTION**

Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

- \( HI-bL \) = High Acting, with balanced hysteresis
- \( LO-bL \) = Low Acting, with balanced hysteresis
- \( HI-Ub \) = High Acting, with unbalanced hysteresis
- \( LO-Ub \) = Low Acting, with unbalanced hysteresis

**ON TIME DELAY**

Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

**OFF TIME DELAY**

Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

**OUTPUT RESET ACTION**

Enter the reset action of the output. See figure for details.

- Auto = Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel RST button or user input. The output remains off until the trigger point is crossed again.
- Latch = Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input.
button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the corresponding “on” output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

L-dLY = Latch with delay reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the meter delays the event until the corresponding “on” output crosses the trigger off point. (Previously latched outputs are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous L-dLY reset if it is not activated at power up.)

OUTPUT RESET WITH DISPLAY RESET

This parameter enables the RST button or user input to reset the output when the display is reset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the output will not reset.

STANDBY OPERATION

When YES, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset Action.

CHANGE DISPLAY COLOR w/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.

6.5 MODULE 5 - SERIAL SETUP PARAMETERS (5-SEr)

The Serial Setup Parameters are only active when the optional RS232 or RS485 serial communications module is installed in the meter. Refer to the CUB5COM bulletin for complete details on CUB5 serial communications.
Press and hold SEL button to enter Programming Mode.
MODEL CUB5I - MINIATURE ELECTRONIC 5-DIGIT DC CURRENT METER

**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 CUB5I accepts a DC Current input signal and provides a display in the desired unit of measure. The meter also features minimum and maximum display capture, display offset, units indicator, and programmable user input. The display can be toggled either manually or automatically between the selected displays.

The CUB5 display has 0.48” (12.2 mm) high digits. The LCD is available in two versions, reflective and red/green backlight. The backlight version is user selectable for the desired color and also has variable display intensity.

The capability of the CUB5 can be easily expanded with the addition of option modules. Setpoint capability is field installable with the addition of the setpoint output modules. Serial communications capability for RS232 or RS485 is added with a serial option module.

The CUB5 can be powered from an optional Red Lion Micro-Line/Sensor Power Supply (MLPS1000), which attaches directly to the back of a CUB5. The MLPS1 is powered from 85 to 250 V AC and provides up to 400 mA to drive the unit and sensors.

**CURRENT**

The CUB5I is the DC Current meter. It features 4 current input ranges, that are selected by the user via a programming jumper and software input range selection. The ranges consist of following: 200 μA, 2 mA, 20 mA, or 200 mA. Users should select the appropriate current range that covers their maximum signal input.

**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.

**DIMENSIONS** In inches (mm)

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

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB5</td>
<td>CUB5I</td>
<td>DC Current Meter with reflective display</td>
<td>CUB5IR00</td>
</tr>
<tr>
<td></td>
<td>CUB5RLY</td>
<td>Single Relay Output Card</td>
<td>CUB5RLY0</td>
</tr>
<tr>
<td></td>
<td>CUB5SNK</td>
<td>Dual Sinking Open Collector Output Card</td>
<td>CUB5SNK0</td>
</tr>
<tr>
<td></td>
<td>CUB5COM</td>
<td>RS485 Serial Communications Card</td>
<td>CUB5COM1</td>
</tr>
<tr>
<td></td>
<td>RS232</td>
<td>RS232 Serial Communications Card</td>
<td>CUB5COM2</td>
</tr>
<tr>
<td></td>
<td>CUB5USB</td>
<td>USB Programming Card for CUB5 Products</td>
<td>CUB5USB0</td>
</tr>
<tr>
<td></td>
<td>MLP51</td>
<td>Micro-Line Power Supply, 85 to 250 VAC</td>
<td>MLP51000</td>
</tr>
<tr>
<td></td>
<td>CUBLPROG</td>
<td>RS232 Programming Cable (DB9-RJ11)</td>
<td>CBPLPROG00</td>
</tr>
<tr>
<td></td>
<td>SFCRD</td>
<td>Crimson 2 PC Configuration Software for Windows ME, 2000, XP</td>
<td>SFCRD200</td>
</tr>
<tr>
<td></td>
<td>CBLUSB</td>
<td>USB Programming Cable</td>
<td>CBLUSB00</td>
</tr>
</tbody>
</table>

1. The USB Programming Card is not UL Approved.
2. Crimson 2 software is a free download from http://www.redlion.net/

### GENERAL METER SPECIFICATIONS

1. **DISPLAY**: 5 digit LCD 0.48” (12.2 mm) high digits

2. **CUB5IR00**: Reflective LCD with full viewing angle

3. **CUB5IB00**: 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 MLS5 or a Class 2 or SELV rated power supply.

3. **INPUT RANGES**: Jumper Selectable

   - D.C. Currents: 200 μA, 2 mA, 20 mA, or 200 mA

   - A, 2 mA, 20 mA, or 200 mA μA

4. **SIGNAL INPUTS**:

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DISPLAY COLOR</th>
<th>INPUT CURRENT @ 9 VDC WITHOUT CUB5RLY0</th>
<th>INPUT CURRENT @ 9 VDC WITH CUB5RLY0</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB5IR00</td>
<td>Red (max intensity)</td>
<td>10 mA</td>
<td>40 mA</td>
</tr>
<tr>
<td>CUB5IB00</td>
<td>Green (max intensity)</td>
<td>85 mA</td>
<td>115 mA</td>
</tr>
<tr>
<td>CUB5IB00</td>
<td>Red (max intensity)</td>
<td>95 mA</td>
<td>125 mA</td>
</tr>
</tbody>
</table>

5. **OVERRANGE RATINGS, PROTECTION & INDICATION**: 9 to 28 VDC power circuit is not isolated from the signal circuit.

   - Input Overrange Indication: “OL”.

   - Input Underrange Indication: “...”/“...”

   - Display Overrange/Underrange Indication: “...”/“...”

6. **DISPLAY RESPONSE TIME**: 500 msec min.

7. **NORMAL MODE REJECTION**: 60 dB 50/60 Hz

8. **USER INPUT (USR)**: Programmable input. Connect terminal to common (USR COMM) to activate function. Internal 10KΩ pull-up resistor to +9 to +28 VDC.

   - Threshold Levels: \( V_{	ext{IN}} = 1.0 \text{ V max;} \ V_{	ext{H}} = 2.4 \text{ V min;} \ V_{	ext{MAX}} = 28 \text{ VDC} \)

   - Response Time: 5 msec typ.; 50 msec debounce (activation and release)

9. **MEMORY**: Nonvolatile EPROM memory retains all programming parameters and max/min values when power is removed.

10. **ENVIRONMENTAL CONDITIONS**:

    - Operating Temperature Range for CUB5IR00: -35 to 75°C

    - Operating Temperature Range for CUB5IB00 depends on display color and intensity level as per below:

<table>
<thead>
<tr>
<th>INTENSITY LEVEL</th>
<th>TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Display</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>1 &amp; 2</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>3</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>4</td>
<td>-35 to 65°C</td>
</tr>
<tr>
<td>5</td>
<td>-35 to 50°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Green Display</th>
<th>-35 to 75°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>-35 to 75°C</td>
</tr>
<tr>
<td>3</td>
<td>-35 to 65°C</td>
</tr>
<tr>
<td>4</td>
<td>-35 to 50°C</td>
</tr>
<tr>
<td>5</td>
<td>-35 to 35°C</td>
</tr>
</tbody>
</table>

- **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 68-2-27**: Operational 30 g, 11 msec in 3 directions.

- **Altitude**: Up to 2000 meters

11. **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.

12. **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.

13. **CERTIFICATIONS AND COMPLIANCES**:

    - **SAFETY**
      - UL Recognized Component, File #E179259, UL61010A-1, CSA 22.2 No. 61010-1
      - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

      - UL Listed, File # E173808, 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/EN 60529: IP65; Protection degree for dust tightness and waterproofness.

      - Criterion A: Normal operation within specified limits.

      - Criterion B: Operation with specified parts and accessories when subjected to specified limits.

      - Criterion C: Operation with parts and accessories not specified.

      - Criterion D: Operation with parts and accessories not specified.

      - Criterion E: Operation with parts and accessories not specified.

      - Criterion F: Operation with parts and accessories not specified.

      - Criterion G: Operation with parts and accessories not specified.

      - Criterion H: Operation with parts and accessories not specified.

      - Criterion I: Operation with parts and accessories not specified.

      - Criterion J: Operation with parts and accessories not specified.

      - Criterion K: Operation with parts and accessories not specified.

      - Criterion L: Operation with parts and accessories not specified.

      - Criterion M: Operation with parts and accessories not specified.

      - Criterion N: Operation with parts and accessories not specified.

      - Criterion O: Operation with parts and accessories not specified.

      - Criterion P: Operation with parts and accessories not specified.

      - Criterion Q: Operation with parts and accessories not specified.

      - Criterion R: Operation with parts and accessories not specified.

      - Criterion S: Operation with parts and accessories not specified.

      - Criterion T: Operation with parts and accessories not specified.

      - Criterion U: Operation with parts and accessories not specified.

      - Criterion V: Operation with parts and accessories not specified.

      - Criterion W: Operation with parts and accessories not specified.

      - Criterion X: Operation with parts and accessories not specified.

      - Criterion Y: Operation with parts and accessories not specified.

      - Criterion Z: Operation with parts and accessories not specified.

    - **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 A
      - 1 kV L-N, 2 kV L-N-E power

      - RF conducted interference EN 61000-4-6: Criterion A
      - 3 V/m

      - Power frequency magnetic fields EN 61000-4-8: Criterion A
      - 30 A/m

    - **EMISSIONS**
      - Emissions EN 55011 Class A
      - 3 V/m

    - **ELECTROMAGNETIC COMPATIBILITY**
      - EN 61000-4-2: Criterion A
      - 4 kV contact discharge
      - 8 kV air discharge

    - **Certification and Compliance**
      - UL Listed, File # E179259-V01-S02
      - CB Scheme Test Report #E179259-V01-S02
      - CB Scheme Test Certificate #US/9257C/UL

    - **Wire Strip Length**: 0.3” (7.5 mm)

    - **Wire Gage**: 30-14 AWG copper wire

    - **Torque**: 5 inch-lbs (0.565 N-m) max.

14. **WEIGHT**: 3.2 oz (100 g)
ADDITIONAL OPTION CARDS

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

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

**Note:** Measurement errors may occur if signal input common is shared with another circuit common (i.e., serial common, Dual Sinking Output option card, or Power Supply common) on multiple units.

**SINGLE RELAY CARD**

**Type:** Single FORM-C relay

**Isolation To Sensor & User Input Commons:** 1400 Vrms for 1 min.

**Working Voltage:** 150 Vrms

**Contact Rating:** 1 amp @ 30 VDC resistive; 0.3 amp @ 125 VAC resistive

**Life Expectancy:** 100,000 minimum operations

**Response Time:**
- **Turn On Time:** 4 msec max.
- **Turn Off Time:** 4 msec max.

**DUAL SINKING OUTPUT CARD**

**Type:** Non-isolated switched DC, N Channel open drain MOSFET

**Current Rating:** 100 mA max.

**V DS ON:** 0.7 V @ 100 mA

**V DS MAX:** 30 VDC

**Offstate Leakage Current:** 0.5 mA max.

**RS485 SERIAL COMMUNICATIONS CARD**

**Type:** RS485 multi-point balanced interface (non-isolated)

**Baud Rate:** 300 to 38.4k

**Data Format:** 7/8 bits; odd, even, or no parity

**Bus Address:** 0 to 99; max 32 meters per line

**Transmit Delay:** Selectable (refer to CUBS.COM bulletin)

**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

1.0 INSTALLING THE METER

**INSTALLATION**

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

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

**INSTALLATION ENVIRONMENT**

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

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

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

2.0 SETTING THE JUMPERS

**INPUT RANGE JUMPER**

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum signal input to avoid overloads. To access the jumper, remove the rear cover of the meter.

**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.
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.

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.

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 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. Long cable runs are more susceptible to EMI pickup than short cable runs.

3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them 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 #ZCAT3055-1330A
     - Steward #28B3029-0A0

   - Line Filters for input power cables:
     - Schaffner #FN610-1/07 (RLC# LFIL0000)
     - Schaffner #FN670-1.8/07
     - Corcom #1VR3

   Note: Refer to manufacturer’s instructions when installing a line filter.

4.1 Power Wiring

DC Power

+9 to +28 VDC: +VDC

Power Common: -VDC

CAUTION: 9 to 28 VDC power circuit is not isolated from the signal circuit.

4.2 User Input Wiring

Sinking Logic

USR COMM Connect external switching device between the USR

User Input terminal and User Input Common.

The user input of the meter is internally pulled up to +9 to +28 V with 10 KΩ resistance. The input is active when it is pulled low (<0.7 V).

REMINDING 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.

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.
4.3 INPUT WIRING

**CAUTION:** Power input common is NOT isolated from user and input commons. In order to preserve the safety of the meter application, the power 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 signal or user inputs and input common terminals. Appropriate considerations must then be given to the potential of the user and input commons with respect to earth ground; and the common of the plug-in cards with respect to input common.

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

**Input Signal (self powered)**

<table>
<thead>
<tr>
<th>JUMPER POSITION</th>
<th>MAX INPUT CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 μA</td>
<td>15 mA</td>
</tr>
<tr>
<td>2 mA</td>
<td>50 mA</td>
</tr>
<tr>
<td>20 mA</td>
<td>150 mA</td>
</tr>
<tr>
<td>200 mA</td>
<td>500 mA</td>
</tr>
</tbody>
</table>

**Series Loop (must use separate supply for sensor power and each CUB5)**

4.4 SETPOINT (OUTPUT) WIRING

**SINGLE SETPOINT RELAY PLUG-IN CARD**

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

**ELECTRICAL CONNECTIONS**

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

### BUTTONS AND DISPLAY MODE OPERATION

<table>
<thead>
<tr>
<th>BUTTON</th>
<th>DISPLAY MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEL</td>
<td>Index display through enabled values</td>
</tr>
<tr>
<td>RST</td>
<td>Resets values (MIN/MAX) or outputs</td>
</tr>
</tbody>
</table>

### ENTERING PROGRAM MODE

- **PROGRAMMING MODE ENTRY (SEL 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 and holding the SEL button. If it is not accessible then it is locked by either a security code, or a hardware lock.

- **MODULE ENTRY (SEL & RST BUTTONS)**
  - 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 button is used to select the desired module. The displayed module is entered by pressing the SEL button.

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

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

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

### PROGRAMMING MODE EXIT (SEL BUTTON)

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

### PROGRAMMING TIPS

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

### FACTORY SETTINGS

- Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems.

### ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following 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

- **PROGRAMMING MODE ENTRY (SEL BUTTON)**
- **MODULE ENTRY (SEL & RST BUTTONS)**
- **MODULE MENU (SEL BUTTON)**
- **SELECTION / VALUE ENTRY**
- **PROGRAMMING MODE EXIT (SEL BUTTON)**
- **PROGRAMMING TIPS**
- **FACTORY SETTINGS**
- **ALTERNATING SELECTION DISPLAY**
Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

**Display Decimal Point**

Select the decimal point location for the Input, MIN and MAX displays. This selection also affects the dSP1 and dSP2 parameters and setpoint values.

**Display Offset Value**

The display can be corrected with an offset value. This can be used to compensate for signal variations or sensor errors. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the effects of offset.

**Filter Setting**

If the displayed value is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display. Software filtering effectively combines a fraction of the current input reading with a fraction of the previous displayed reading to generate the new display. Filter values represent no filtering (0), up to heavy filtering (3). A value of 1 for the filter uses 1/4 of the new input and 3/4 of the previous display to generate the new display. A filter value of 2 uses 1/8 new and 7/8 previous. A filter value of 3 uses 1/16 new and 15/16 previous.

**Filter Band**

The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of '0' keeps the filter permanently engaged at the filter level selected above.

**General Notes on Scaling**

1. When using the Apply (APPLY) scaling style, input values for scaling points must be confined to the range limits shown.
2. The same Input Value should not correspond to more than one Display Value.
3. Scaling Points 1 and 2 must be confined to the range limits shown.

**Input Value for Scaling Point 1**

For Key-in (KEY) style, enter the first Input Value using the front panel buttons. (The Input Range selection sets the decimal location for the Input Value).

For Apply (APPLY) style, the meter shows the previously stored Input Value. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

**Input Value for Scaling Point 2**

For Key-in (KEY) style, enter the known second Input Value using the front panel buttons.

For Apply (APPLY) style, the meter shows the previously stored Input Value for Scaling Point 2. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

**Display Value for Scaling Point 1**

Enter the first Display Value by using the front panel buttons. This is the same for KEY and APPLY scaling styles. The decimal point follows the dECP selection.

**Display Value for Scaling Point 2**

Enter the second Display Value by using the front panel buttons. This is the same for KEY and APPLY scaling styles.
### USER INPUT FUNCTION

**DISPLAY MODE**
- **NO**: No Function
- **P-Loc**: Program Mode Lock-out
- **E**: Enter (Edge triggered)
- **d-SEL**: Display Select (Edge Triggered)
- **d-LEU**: Display Intensity Level (Edge Triggered)
- **COLOr**: Backlight Color (Edge Triggered)
- **IN**: Input

### DESCRIPTION
- **User Input disabled.**
- **See Programming Mode Access chart (Module 3).**
- **Zero Input (Edge triggered)**
- **Reset (Edge triggered)**
- **HI-LO**: Display Hold
- **HI-En**: Display Select
- **LO-En**: Display Intensity Level
- **LO-d**: Backlight Color
- **d-SEL**: Reset (Edge triggered)

### MAX DISPLAY ENABLE
- **NO**: No
- **YES**: Yes

Enables the Maximum Display Capture capability.

### MAX CAPTURE DELAY TIME
- **00** to **9999** sec.

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

### MIN DISPLAY ENABLE
- **NO**: No
- **YES**: Yes

Enables the Minimum Display Capture capability.

### MIN CAPTURE DELAY TIME
- **00** to **9999** sec.

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

### FACTORY SERVICE OPERATIONS
- **NO**: No
- **YES**: Yes

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

### DISPLAY MODE
- **P-rSel**: Print Request
- **P-rSel**: Print and Reset
- **rSt-1**: Setpoint 1 Reset
- **rSt-2**: Setpoint 2 Reset
- **rSt-12**: Setpoint 1 and 2 Reset

### DESCRIPTION
- **Serial transmit of the active parameters selected in the Print Options menu (Module 5).**
- **Same as Print Request followed by a momentary reset of the assigned value(s).**
- **Resets setpoint 1 output.**
- **Resets setpoint 2 output.**
- **Reset both setpoint 1 and 2 outputs.**

### USER INPUT ASSIGNMENT

Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset, display hold, or print and reset is selected in the User Input Function menu.

---

**6.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)**

### PARAMETER MENU

- **Max Display Enable**
- **Max Capture Delay Time**
- **Min Display Enable**
- **Min Capture Delay Time**
- **Factory Service Operations**
- **Access Code**

### RESTORE FACTORY DEFAULT SETTINGS

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

### VIEW VERSION DISPLAY

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

### CALIBRATION

The CUB5I uses stored current calibration values to provide accurate current measurements. Over time, the electrical characteristics of the components inside the CUB5I will slowly change with the result that the stored calibration values no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the CUB5I involves a current calibration which should only be performed by individuals experienced in calibrating electronic equipment. Allow 30 minute warm up before performing any calibration related procedure. The following procedures should be performed at an ambient temperature of 15 to 35 °C (59 to 95 °F).

**CAUTION:** The accuracy of the calibration equipment will directly affect the accuracy of the CUB5I.

### Current Calibration

1. Connect the negative lead of a precision DC current source with an accuracy of 0.01% or better to the COMM terminal. Leave the positive lead of the DC current source unconnected.
2. With the display at **CodE** **50**, press and hold the **SEL** button for 2 seconds. Unit will display **CAL** **00**.
3. Press the **RST** button to select the range to be calibrated.
4. Press the **SEL** button. Display reads 0.0A.
5. With the positive lead of the DC current source unconnected, press **SEL**. Display reads 0.0A for about 8 seconds.
6. When the display reads the selected range, connect the positive lead of the DC current source to INP+ and apply full-scale input signal for the range. (Note: For 200 mA range, apply 100 mA as indicated on the display.)
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads **CAL** **00**, press the **SEL** button to exit calibration.
6.3 MODULE 3 - DISPLAY AND FRONT PANEL BUTTON PARAMETERS (3-dSP)

PARAMETER MENU

DISPLAY UPDATE TIME

\[ d_{SP} \cdot t \]

05 1 2 seconds

This parameter sets the display update time in seconds.

FRONT PANEL DISPLAY SELECT ENABLE (SEL)

\[ \text{SEL} \]

YES NO

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

FRONT PANEL RESET ENABLE (RST)

\[ \text{RST} \]

NO LO dSP HI HI-LO

This selection allows the RST button to reset the selected value(s).

ZERO DISPLAY WITH DISPLAY RESET

\[ \text{ZrD} \]

YES NO

This parameter enables the RST button or user input to zero the input display value, causing the display reading to be offset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the display will not zero.

DISPLAY SCROLL ENABLE

\[ \text{Scrl} \]

YES NO

The YES selection allows the display to automatically scroll through the enabled displays. The scroll rate is every 4 seconds. This parameter only appears when the MAX or MIN displays are enabled.

UNITS INDICATOR SELECTION

\[ \text{UN LS} \]

OFF DS dSP 1S

This parameter activates the Units Indicator on the display. There are two methods of selecting the Indicator. List will present a group of Units preprogrammed into the meter. Segments allows the user to choose which of the segments should light.

DISPLAY COLOR (BACKLIGHT UNIT ONLY)

\[ \text{COLOR} \]

rs Ed Grn

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

DISPLAY INTENSITY LEVEL (BACKLIGHT UNIT ONLY)

\[ \text{d} \cdot \text{LEU} \]

1 to 5

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

PROGRAMMING SECURITY CODE

\[ \text{CodE} \]

000 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 (P-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 values 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 CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CodE prompt appears (see chart).

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

PARAMETER MENU

SETPOINT SELECT

SPSEL

NO SP-1 SP-2

Enter the setpoint (output) to be programmed. The n in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to SPSEL. Repeat steps for each setpoint to be programmed. Select NO to exit the module. The number of setpoints available is setpoint output card dependent.

SETPOINT 2 ENABLE

Enb-2 YES NO

Select YES to enable Setpoint 2 and access the setup parameters. If NO is selected, the unit returns to SPSEL and setpoint 2 is disabled.

SETPOINT ACTION

Act-n HI-bL LD-bL HI-bU LD-bU

Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

- HI-bL = High Acting, with balanced hysteresis
- LD-bL = Low Acting, with balanced hysteresis
- HI-bU = High Acting, with unbalanced hysteresis
- LD-bU = Low Acting, with unbalanced hysteresis

SETPOINT VALUE

SPt-n

-19999 to 99999

Enter the desired setpoint value. The decimal point position for the setpoint and hysteresis values follow the selection set in Module 1.

HYSTERESIS VALUE

Hys-n

1 to 59999

Enter desired hysteresis value. See Setpoint Output Figures for visual explanation of how setpoint output actions (balanced and unbalanced) are affected by the hysteresis. When the setpoint is a control output, usually balanced hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints.

Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.

ON TIME DELAY

Ldn-n

0.0 to 5999 Sec

Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OFF TIME DELAY

Ldf-n

0.0 to 5999 Sec

Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OUTPUT RESET ACTION

St-n Auto LRACh L-dLY

Enter the reset action of the output. See figure for details.

Auto = Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel RST button or user input. The output remains off until the trigger point is crossed again.

LRACh = Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button.
button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the corresponding “on” output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

L·dLY = Latch with delay reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the meter delays the event until the corresponding “on” output crosses the trigger off point. (Previously latched outputs are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous L·dLY reset if it is not activated at power up.)

**OUTPUT RESET WITH DISPLAY RESET**

<table>
<thead>
<tr>
<th>En·n</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>

This parameter enables the RST button or user input to reset the output when the display is reset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the output will not reset.

**STANDBY OPERATION**

<table>
<thead>
<tr>
<th>Stb·n</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

When YES, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset Action.

**CHANGE DISPLAY COLOR w/OUTPUT STATE**

<table>
<thead>
<tr>
<th>ChC·n</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

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

---

**6.5 MODULE 5 - SERIAL SETUP PARAMETERS (5·SER)***

The Serial Setup Parameters are only active when the optional RS232 or RS485 serial communications module is installed in the meter. Refer to the CUB5COM bulletin for complete details on CUB5 serial communications.
Press and hold SEL button to enter Programming Mode.
GENERAL DESCRIPTION

PAX Lite Current and Volt Meters are premium quality instruments designed for tough industrial applications. With multi-range capability, built-in provision for scaling, and DIP switch selectable decimal points, these meters offer the ultimate in application flexibility. Four models cover your voltage and current indicator needs. The meter can provide direct readout from pressure, speed or flow transducers, or any other variable that can be translated to voltage or current. The built-in scaling allows the display to be scaled to the desired engineering unit.

The 3 ½-digit bi-polar display (minus sign displayed when current or voltage is negative) features a 0.56” high, 7-segment LEDs for easy reading. The meter is also available with custom units label capability. Using the PAX label kit (PAXLBK30), the selected label is installed behind the panel, keeping it safe from washdown or other environmental conditions. A DIP switch is used to control the backlight for the units label.

The meters have a NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, allowing the meter to provide 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.

DEFINITION OF TERMS

INSTALLATION CATEGORY (overvoltage category) I, (CAT I):
Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II. (See IEC 664 & IEC 61010)

INSTALLATION CATEGORY (overvoltage category) II, (CAT II):
Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III. (See IEC 664 & IEC 61010)

MODEL PAXLI - PAX LITE CURRENT METERS &
MODEL PAXLV - PAX LITE VOLTMETERS

FOUR MULTI-RANGE UNITS COVER:
- 199.9 μA to 1.999 A*, 199.9 mV (AC or DC)
- 1.999 V to 300 V (AC or DC)
- 3 1/2-DIGIT, 0.56” (14.2 mm) HIGH LED DISPLAY W/ POLARITY
- BUILT-IN SCALING PROVISIONS
- SELECTABLE DECIMAL POINT LOCATION
- AUTO ZEROING CIRCUITS
- OVER-RANGE INDICATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- OPTIONAL CUSTOM UNITS OVERLAY W/ BACKLIGHT

* Accessory Shunts Available For Higher Current Ranges.

DIMENSIONS In inches (mm)

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

1.75 (44.5)
1.75 (44.5)
3.60 (91.4)

1.95 (49.5)
4.10 (104.1)
.10 (2.5)
3.80 (96.5)

1.75 (44.5)
3.60 (91.4)
# Table of Contents

Ordering Information ........................................... 2  
General Meter Specifications ................................. 3  
Accessories ....................................................... 3  
Installing the Meter ........................................... 4  
Setting the Jumpers and Switches ................. 4  
Wiring the Meter ............................................... 5  
Scaling the Meter ............................................ 6  
Troubleshooting ................................................ 7  
Calibration ....................................................... 7  

# Ordering Information

**Meter Part Numbers**

<table>
<thead>
<tr>
<th>PAXL</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
</table>

- **I** - Current Input
- **V** - Voltage Input
- **A** - AC Input
- **D** - DC Input

**Accessories Part Numbers**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK30</td>
</tr>
<tr>
<td>Accessories</td>
<td>APSCM</td>
<td>10 Amp DC Current Shunt</td>
<td>APSCM010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 Amp DC Current Shunt</td>
<td>APSCM100</td>
</tr>
</tbody>
</table>
GENERAL METER SPECIFICATIONS

1. DISPLAY: 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.

2. POWER: 115/230 VAC, switch selectable. Allowable power line variation ±10%, 50/60 Hz, 6 VA.
   Isolation: 2300 Vrms for 1 min. between input and supply
   Working Voltage: 300 V max. , CAT II

3. INPUT RANGES/RESOLUTION: (Selectable by jumper connections.):
   AC Voltmeters  DC Voltmeters  DC Current Meters
   0-199.9 V/100 mV  ±0.5% of Reading + 3 digits
   0-19.99 mA/100 μA  ±0.5% of Reading + 1 digit
   0-199.9 mA/100 μA  ±0.1% of Reading + 1 digit

   Display:
   MAX. CURRENTS (FOR CURRENT METERS):
   1 A (±10%): 300 V max, CAT II
   Isolation: 2300 Vrms for 1 min. between input and supply
   MAX. VOLTAGE ON TERMINAL BLOCK: 350 volt peak
   RESPONSE TIME TO STEP CHANGE INPUT: 1 sec. nominal
   READING RATE: 2.5 readings/sec., nominal

4. ACCURACY:
   AC Voltmeters: ±(0.1% of Reading + 3 digits) (45-500 Hz)
   AC Current Meters: ±(0.1% of Reading + 3 digits) (45-500 Hz)
   DC Voltmeters: ±(0.1% of Reading + 1 digit)
   DC Current Meters:
   199.9 μA/199.9 mV, 19.99 mA: ±0.1% of Reading + 1 digit
   199.9 mA: ±0.15% of Reading + 3 digits
   1 A: ±0.5% of Reading + 3 digits

5. OVER-RANGE INDICATION: on all modes is indicated by blanking 3 least significant digits.

6. MAX. VOLTAGE ON LOWEST INPUT RANGE: 75 VAC or DC (Both voltmeters and current meters).

7. MAX. VOLTAGE ON TERMINAL BLOCK: 300 VAC or DC (Both voltmeters and current meters).

8. MAX. CURRENTS (FOR CURRENT METERS):
   199.9 μA through 19.99 mA: 10 times max. range current
   199.9 mA: 1 A
   1999 A: 3 A

   Caution: In circuits where fault currents can exceed the maximum shunt current, a fast-blow fuse should be installed in series with the input signal. Otherwise, a slow blow 10 amp fuse is recommended that will allow for start-up over current situations, while still protecting the instrument.

9. TEMPERATURE COEFFICIENTS:
   DC: ±100 PPM/°C  AC: ±50 PPM/°C
   DC: ±100 PPM/°C  AC: ±50 PPM/°C

10. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: 0° to 60°C
   Storage Temperature: -40° to 80°C
   Operating and Storage Humidity: 85% max. relative humidity (non-condensing)
   Altitude: Up to 2000 meters

11. RESPONSE TIME TO STEP CHANGE INPUT: 1 sec. nominal

12. READING RATE: 2.5 readings/sec., nominal

13. NORMAL MODE REJECTION: 50 dB 50/60 Hz (DC units only)

14. COMMON MODE REJECTION: 110 dB DC or 50/60 Hz (DC units only)

15. COMMON MODE VOLTAGE (COMM. TO EARTH): 350 volt peak

16. CERTIFICATIONS AND COMPLIANCE:
   SAFETY
   UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
   Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File #E157008, UL508, CSA C22.2 No. 14-M95
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IECEE CB Scheme Test Certificate #UL8843A/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

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

   IMMUNITY TO INDUSTRIAL LOCATIONS:
   Electromagnetic RF fields
   EN 61000-4-3
   Fast transients (burst)
   EN 61000-4-4
   Surge
   EN 61000-4-5
   Voltage dip/interruptions
   EN 61000-4-11
   Emissions
   EN 55011 Class B

   NOTES:
   2. Criterion B: Temporary loss of performance from which the unit self-recovers.

17. 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.

18. CONSTRUCTION: This unit is rated for NEMA 4X/IP65 use. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.

19. WEIGHT: 0.65 lbs. (0.24 Kg)

ACCESSORIES

UNIT LABEL KIT (PAXLBK)
Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled by a DIP switch.

EXTERNAL CURRENT SHUNTS (APSCM)
To measure DC current signals greater than 2 ADC, a shunt must be used. The APSCM010 current shunt converts a maximum 10 ADC signal into 100.0 mV. The APSCM100 current shunt converts a maximum 100 ADC signal into 100.0 mV. The continuous current through the shunt is limited to 115% of the rating.
1.0 INSTALLING THE METER

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

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

Installation Environment
The unit should be installed in a location that does not exceed the 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.

2.0 SETTING THE JUMPERS AND SWITCHES

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

Power Selection Switch
Caution: Insure the AC power selection switch is set for the proper voltage before powering the meter. The meter is shipped from the factory in the 230 V AC position.

Input Range Jumper
A jumper is used for selection of the voltage or current input range. Select the proper input range that will be high enough to avoid input signal overload. It is important that only one jumper position is used at a time. Avoid placing a jumper across two different input ranges.

PAXLI Jumper Selection

Set-Up DIP Switches
A DIP switch is located inside the meter. It is used for the selection of decimal points, backlight annunciator, and scaling. Selecting the “ON” position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
<tr>
<td>5</td>
<td>Enables the Scaling Pot</td>
</tr>
</tbody>
</table>

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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 power supplied to the meter (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, its source or the method of coupling into the unit may be different for various installations. 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. 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 # ZCAT3035-130A
     - 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.
6. 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
115/230

3.2 INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

PAXLV

Voltage Signal (self powered)
Terminal 4: + Volts DC/AC
Terminal 3: - Volts DC/AC

PAXLI

Current Signal (self powered)
Terminal 4: + Amps DC/AC
Terminal 3: - Amps DC/AC

4.0 SCALING THE METER

PAXLV

DIRECT VOLTMETER READOUT

When the application requires direct voltmeter readout, the Scale Switch should remain in the “OFF” position. The Input Range Jumper is set to the voltage range being applied. It is possible to select a range higher than being applied to get lower resolution. The Decimal Point switches are set to resolution of the selected Input Range Jumper.

SCALING VOLTMETER READOUT

In many industrial applications, a voltmeter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The signal voltage being measured can be generated by a transducer that senses the variations and delivers a linear output voltage. To provide the desired readout at the specified voltage, the voltmeter must be scaled.

Place the Scale Switch in the “ON” position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. To properly set the Input Range Jumper, the Division Factor must be determined by first using the below formula. After the Division Factor is calculated, use the Division Factor Range Selection Chart to choose the proper jumper setting. Apply the meter power and the voltage signal. Adjust the Scale Potentiometer to the desired value.

This scaling only effects the span. There is no offset scaling. This means that only zero voltage can display a value of zero.

DIVISION FACTOR FORMULA:

\[
D.F. = \frac{V_T \times D.D.P.}{D.R.}
\]

WHERE:

\[
\begin{align*}
V_T & = \text{Maximum Transducer Output} \\
D.D.P. & = \text{Display Decimal Point} \\
D.F. & = \text{Division Factor} \\
D.R. & = \text{Desired Reading}
\end{align*}
\]

D.D.P.
0.000 = 1 The Display Decimal Point
00.00 = 10 (D.D.P.) is determined by
000.0 = 100 the desired decimal point
0000 = 1000 placement in the readout.

After the Division Factor for the application has been calculated, the proper voltage range jumper can be selected. Use the “Division Factor Range Selection Chart” to choose the proper jumper setting.

DIVISION FACTOR RANGE SELECTION CHART

<table>
<thead>
<tr>
<th>D.F.</th>
<th>Use Input Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 to 1.2</td>
<td>Pos 1: 0-1.999 VDC</td>
</tr>
<tr>
<td>1.2 to 10.5</td>
<td>Pos 2: 0-19.99</td>
</tr>
<tr>
<td>10.5 to 100.5</td>
<td>Pos 3: 0-199.9</td>
</tr>
<tr>
<td>100.5 to 1300</td>
<td>Pos 4: 0-300</td>
</tr>
</tbody>
</table>

Note: Only one voltage jumper should be selected. Install the jumper before the voltage signal is applied.

EXAMPLE: A relative humidity transducer delivers a 7.0 VDC voltage at a relative humidity of 75%.

\[
D.F. = \frac{V_T \times D.D.P.}{D.R.} = \frac{7.0 \times 1000}{75} = 93.3
\]

This Division Factor is between 10.5 and 100.5, therefore jumper position 3 (199.9 V) is selected. The Scaling Potentiometer is then adjusted for the desired readout at a known relative humidity.
DIRECT CURRENT METER READOUT

When the application requires direct current meter readout, the Scale Switch should remain in the “OFF” position. The Input Range Jumper is set to the current range being applied. It is possible to select a range higher than being applied to get lower resolution. The Decimal Point switches are set to resolution of the selected Input Range Jumper.

SCALING CURRENT METER READOUT

In many industrial applications, a current meter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The signal voltage being measured can be generated by a transducer that senses the variations and delivers a linear output voltage. To provide the desired readout at the specified current, the current meter must be scaled.

Place the Scale Switch in the “ON” position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. The Input Range Jumper is set to the current range being applied. Apply the meter power and the current signal. Adjust the Scale Potentiometer to the desired value. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished, in most cases, by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

This scaling only affects the span. There is no offset scaling. This means that only zero amps can display a value of zero.

EXAMPLE: The Pax Current Meter has been connected to measure a circuit current to 120.0 mA maximum. However, in this application, the display is to indicate percent of load current with 120.0 mA equivalent to 100.0 percent. The scale potentiometer is adjusted to reduce the normal 120.0 mA signal input display reading of 120.0 to indicate the desired reading of 100.0 on the display. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished in most cases by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

5.0 TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO DISPLAY</td>
<td>CHECK: Power switch and line voltage</td>
</tr>
<tr>
<td>INCORRECT DISPLAY</td>
<td>CHECK: Input jumper position</td>
</tr>
<tr>
<td></td>
<td>CHECK: Scaling adjustment pot DIP switch position</td>
</tr>
<tr>
<td></td>
<td>ADJUST: Scaling pot</td>
</tr>
<tr>
<td></td>
<td>VERIFY: Input Signal</td>
</tr>
<tr>
<td>OVER-RANGE INDICATION</td>
<td>CHECK: Input jumper position</td>
</tr>
<tr>
<td></td>
<td>VERIFY: Input signal</td>
</tr>
</tbody>
</table>

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

6.0 CALIBRATION

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed by enabling the scale pot DIP switch. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment.

Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the Input Range Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter.

Then perform the following procedure:
1. Place jumper in 2 V range (PAXLV) or 2 mA range (PAXLI).
2. Set the DIP switch off to disable the scaling pot.
3. Apply half scale input signal.
4. Adjust calibration potentiometer as necessary for the display to read 1000 (ignore decimal point).
5. Apply zero signal and ensure display reads zero.
6. Apply full scale signal and ensure display reads 1999.

Note: Any individual range may be recalibrated (scaled) to 0.1% accuracy with appropriate calibration equipment.
GENERAL DESCRIPTION

PAXLIT 5 Amp AC Current Meter provides the capability of measuring large AC currents. The internal current shunt in the PAXLIT can measure up to 5 Amps AC current directly. Using an external current transformer, AC currents of up to 1,999 Amps can be measured and displayed.

The PAXLIT can be scaled, using the scaling potentiometer, to display between 200 and 1999 when measuring full scale current. Using the DIP switch selectable decimal points, the display can be customized for direct readout for practically any application.

The 3½-digit bi-polar display (minus sign displayed when current is negative) features a 0.56" high, 7-segment LEDs for easy reading. The meter is also available with custom units label capability. Using the PAX label kit (PAXLBK30), the selected label is installed behind the panel, keeping it safe from washdown or other environmental conditions. A DIP switch is used to control the backlight for the units label.

The meters have a NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, allowing the meter to provide 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.

DEFINITION OF TERMS

INSTALLATION CATEGORY (overvoltage category) I, (CAT I):
Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II. (See IEC 664 & IEC 61010)

INSTALLATION CATEGORY (overvoltage category) II, (CAT II):
Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III. (See IEC 664 & IEC 61010)

DIMENSIONS In inches (mm)

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

Ordering Information .................................................. 2
General Meter Specifications ........................................... 3
Accessories ................................................................. 3
Installing the Meter ......................................................... 4
Setting the Switches ......................................................... 4
Wiring the Meter ............................................................. 5
Scaling the Meter ............................................................ 5
Application ................................................................. 6
Troubleshooting ............................................................. 6
Calibration ................................................................. 6

ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>PAXL</th>
<th>IT</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
</table>

IT - 5 Amp Current Meter

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>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK30</td>
</tr>
<tr>
<td>Accessories</td>
<td>CT</td>
<td>50.5 Amp Current Transformer</td>
<td>CT005050</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200.5 Amp Current Transformer</td>
<td>CT020050</td>
</tr>
</tbody>
</table>

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

1. **DISPLAY**: 3 1/2-digit, 0.56” (14.2 mm) high, 7-segment LED. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection. 
   - Isolation: 2300 Vrms for 1 min. between input and supply
   - Working Voltage: 300 V max., CAT II

2. **POWER**: 115/230 V AC, switch selectable. Allowable power line variation ±10%, 50/60 Hz, 6 VA.
   - Isolation: ±0.5% of reading + 5 digits).

3. **SIGNAL INPUT**:
   - **Range**: 0 to 5 Amps AC @ 45 to 400 Hz
   - **Resolution**: 2.5 mA
   - **Working Voltage**: 300 V max., CAT II

4. **ACCURACY**: ±(0.5% of reading + 5 digits).

5. **OVER-RANGE INDICATION**: is indicated by blanking 3 least significant digits.

6. **MAX SHUNT CURRENT**: 50 Amps for 1 sec.; 8 Amps continuous.
   - Caution: In circuits where fault currents can exceed the maximum shunt current, a fast-blow fuse should be installed in series with the input signal.
   - Otherwise, a slow blow 8 Amp fuse is recommended that will allow for start-up over current situations, while still protecting the instrument.

7. **ENVIRONMENTAL CONDITIONS**:
   - **Operating Temperature**: 0° to 60°C
   - **Storage Temperature**: -40° to 80°C
   - **Operating and Storage Humidity**: 85% max. relative humidity (non-condensing)
   - **Altitude**: Up to 2000 meters

8. **RESPONSE TIME TO STEP CHANGE INPUT**: 1 sec. nominal

9. **READING RATE**: 2.5 readings/sec., nominal

10. **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
    - IEC 61000-4-5
    - IEC 61000-4-3
    - IEC 61000-4-2
    - IEC 61000-4-11

11. **CONNECTIONS**: High compression cage-clamp terminal block
    - Wire Strip Length: 0.3” (7.5 mm)
    - Wire Gage: 30-14 AWG copper wire
    - Torque: 4.5 inch-lbs (0.51 N-m) max.

12. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 use. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.

13. **WEIGHT**: 0.65 lbs. (0.24 Kg)

**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
    - Electromagnetic RF fields EN 61000-4-3
    - Fast transients (burst) EN 61000-4-4
    - **Surge**: EN 61000-4-5
    - RF conducted interference EN 61000-4-6
    - Voltage dip/interruptions EN 61000-4-11

**Notes**:
1. **Criterion A**: Normal operation within specified limits.
2. **Criterion B**: Temporary loss of performance from which the unit self-recoveres.

**Units Label Kit (PAXLBK)**

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled by a DIP switch.

**Accessories**

- **Units Label Kit (PAXLBK)**
**1.0 Installing the Meter**

**Installation**

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

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

**Installation Environment**

The unit should be installed in a location that does not exceed the 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.

**2.0 Setting the Switches**

The meter has switches, which must be checked and/or changed prior to applying power. To access the 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 the meter. The meter is shipped from the factory in the 230 V AC position.

**Set-Up DIP Switches**

A DIP switch is located inside the meter. It is used for the selection of decimal points, backlight annunciator, and scaling. Selecting the “ON” position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
<tr>
<td>5</td>
<td>Enables the Scaling Pot</td>
</tr>
</tbody>
</table>

**Notes:**

- Panel cut-out dimensions:
  - 3.62 ± .05
  - (92 ± .5)
  - 1.77 ± .05
  - (45 ± .5)

- While installing, ensure proper alignment and tightness of the panel latch.

**Panel Mounting Screws**

- 5/32" x 1/2" (4 mm x 13 mm)

**Front Display**

- 5.5 mm x 70.7 mm (0.218" x 2.78")

**Main Circuit Board**

- 2.75 mm x 47.6 mm (0.109" x 1.877")

**Rear Terminals**

- 2.7 mm x 45.7 mm (0.107" x 1.80")

**Enables the Scaling Pot**

- 3.0 mm x 54.0 mm (0.118" x 2.126")
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. Allabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the meter (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, its source or the method of coupling into the unit may be different for various installations. 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. 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.

3.1 POWER WIRING

AC Power
Terminal 1: VAC
Terminal 2: VAC

Terminal 3: - Amps AC
Terminal 4: + Amps AC

115/230

3.2 INPUT SIGNAL WIRING

Current Signal (self powered)
Terminal 3: - Amps AC
Terminal 4: + Amps AC

5A MAX.

4.0 SCALING THE METER

FACTORY SCALING
The meter is calibrated from the factory for 5 Amps AC current input to show 1999. This scaling will be used when the Scale Switch is in the “OFF” position.

SCALING READOUT
Place the Scale Switch in the “ON” position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. Apply the meter power and the current signal. Adjust the Scale Potentiometer to the desired value.

This scaling only effects the span. There is no offset scaling. This means that only zero current can display a value of zero.

At 5 Amps AC current input, the display can be scaled from 1999 down to 200 by using the scaling potentiometer. For display values below 200, turn on the appropriate Decimal Point Switch and then adjust the potentiometer to achieve the desired display value. Example: A customer wants to display 50 Amps because he is using a 50:5 CT. In this case, he must turn DIP switch 1 on for a decimal point and DIP switch 5 on for scaling. Then apply the 5 Amp signal and turn the scaling pot until 50.0 is shown on the display.
5.0 APPLICATION

MOTOR CURRENT MEASUREMENT USING A CURRENT TRANSFORMER

The PAXLIT 5 Amp AC Current Meter is configured by simply connecting the “COMM.” (Terminal 3) and the “5AMP” (Terminal 4) to the external current transformer. The current carrying wire to be sensed is passed through the center of the current transformer. The resolution of the display, in this case, is 0.1 Amp, therefore, “Switch #1” is selected.

The meter is now ready to be scaled. The installer has access to a calibrated portable digital current meter capable of measuring the motor current. Scaling will be accomplished by adjusting the scaling pot on the PAXLIT meter to agree with the portable digital current meter. The operator turns on the AC motor and lifts a large weight to load the motor. The installer then simply adjusts the scaling adjustment, located at the rear of the unit, until the display is equal to the value indicated on the portable current meter. The meter will now indicate the load current of the motor precisely.

CAUTION: It is recommended that the current transformer be internally protected or that a voltage clamping circuit be provided, preventing dangerous high voltage across the CT secondary windings in case of accidental opening of the secondary output leads when the primary is energized.

In order to prevent risk of electric shock ensure CT is installed according to local NEC regulations for installation of current instrument transformers.

6.0 TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO DISPLAY</td>
<td>CHECK: Power switch and line voltage</td>
</tr>
</tbody>
</table>
| INCORRECT DISPLAY             | CHECK: Scaling adjustment pot DIP switch position  
|                               | ADJUST: Scaling pot                   |
| OVER-RANGE INDICATION         | VERIFY: Input signal                  |

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

7.0 CALIBRATION

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed by enabling the scale pot DIP switch. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every two years), it should only be performed by qualified technicians using appropriate equipment.

Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.05% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter.

Then perform the following procedure:
1. Set the DIP switch off to disable the scaling pot.
2. Apply half scale input signal.
3. Adjust calibration potentiometer as necessary for the display to read 1000 (ignore decimal point)
4. Apply zero signal and ensure display reads zero.
5. Apply full scale signal and ensure display reads 1999.
MODEL PAXLHV - PAX LITE AC VOLTAGE MONITOR

GENERAL DESCRIPTION
The Model PAXLHV is designed for AC voltage monitoring. The half-wave rectified input signal is calibrated to indicate the RMS value of a pure sinusoidal wave-form. The front bezel meets NEMA 4X/IP65 requirements when properly installed.

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.

DEFINITION OF TERMS
INSTALLATION CATEGORY (overvoltage category) I:
Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II.

INSTALLATION CATEGORY (overvoltage category) II:
Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III.

DIMENSIONS In inches (mm)
Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.0" (127) W.
TABLE OF CONTENTS

Ordering Information . . . . . . . . . . . . . . . . . . . . . 2  Installing the Meter . . . . . . . . . . . . . . . . . . . . . 4
General Meter Specifications . . . . . . . . . . . . . . . . . . 3  Setting the Switches . . . . . . . . . . . . . . . . . . . . . . 4
Accessories . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3  Wiring the Meter . . . . . . . . . . . . . . . . . . . . . . . . 5

ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>PAXL</th>
<th>HV</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
</table>

HV - AC Voltage Input

Accessories Part Number

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK30</td>
</tr>
</tbody>
</table>
**GENERAL METER SPECIFICATIONS**

1. **DISPLAY**: 3-digit, 0.56” (14.2 mm) high character, 7-segment Red LED
2. **POWER**: 115 or 230 VAC, switch selectable. Allowable power line variation ±10%, 50/60 Hz, 6 VA. Installation Category II, Pollution Degree 2.
   - **Isolation**: 2300 Vrms for 1 min. to input
   - **Working Voltage**: 300 V max., CAT II
3. **ACCURACY**: At 23°C, 85% R.H.; ±(0.1% of Reading + 2 digits)
4. **INPUT IMPEDANCE**: 1 MΩ
5. **INPUT RANGE**: 0 to 600 VAC max. @ 45 to 500 Hz. Installation Category I
6. **RESOLUTION**: 1 VAC
7. **ENVIRONMENTAL CONDITIONS**:
   - **Operating Temperature Range**: 0° to 60°C
   - **Storage Temperature Range**: -40° to 80°C
   - **Operating and Storage Humidity**: 85% max. relative humidity (non-condensing)
   - **Temperature Coefficient**: ±150 PPM/°C
8. **READING RATE**: 400 msec., nominal
9. **RESPONSE TIME**: 1 sec. nominal for a step change input.
10. **CERTIFICATIONS AND COMPLIANCES**:
    - **SAFETY**
      - UL Recognized Component, File #E179259, UL3101-1, 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
      - 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**
    - **ELECTROMAGNETIC COMPATIBILITY**: Emissions and Immunity to EN 61326:
      - **Immunity to Industrial Locations**:
        - Electrostatic discharge EN 61000-4-2
        - Electromagnetic RF fields EN 61000-4-3
        - Fast transients (burst) EN 61000-4-4
        - Surge EN 61000-4-5
        - RF conducted interference EN 61000-4-6
        - Voltage dip/interruptions EN 61000-4-11
      - **Emissions**
        - EN 55011
      - **Notes**
        - 1. **Criterion A**: Normal operation within specified limits.
        - 2. **Criterion B**: Temporary loss of performance from which the unit self-recovers.
    - **CONNECTIONS**
      - **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.
    - **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 use. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel Gasket and mounting clip included.
    - **WEIGHT**: 0.65 lbs. (0.24 Kg)

**ACCESSORIES**

**UNITS LABEL KIT (PAXLBK)**

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled by a DIP switch.

---

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

Installation

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

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

Installation Environment

The unit should be installed in a location that does not exceed the 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.

2.0 SETTING THE SWITCHES

The meter has a switch, which must be checked and/or changed prior to applying power. To access the 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 V AC position.

Set-Up DIP Switches

A DIP switch is located inside the meter. It is used for the selection of decimal points and backlight annunciator. Selecting the “ON” position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
</tbody>
</table>
3.0 Wiring the Meter

Wiring Overview

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. As depicted in the drawing of the Model PAXLHV, all connections are made on the terminal block located at the rear of the unit.

Block Diagram

The PAX Lite AC Voltage Monitor incorporates a built-in precision voltage divider that provides direct measurement from 0 to 600 VAC.

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. 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. The meter should be mounted in a metal enclosure, that 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 meter 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.
6. 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 Cables for signal and control cables:
     - Fair-Rite # 0443167251 (RLC #FCOR0000)
     - TDK # ZCAT2035-1330A
     - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC #LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom #1VB3
     - Corcom #1VR3
   - 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.

3.1 Power Wiring

Primary AC power is connected to terminal 1 and 2 (Marked AC Power, located on the left-hand side of the terminal block). For best results, the AC power should be relatively “Clean” and within the specified ±10% variation limit. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

AC Power
Terminal 1: VAC
Terminal 2: VAC
115/230

3.2 Input Signal Wiring

Input connections are made on terminal 5 and 8. When powering the PAXLHV with the same voltage that is being measured, terminal 5 (COMM.) should be connected to neutral for the most stable reading on the display. If an unstable display results from measuring a voltage that is isolated from the supply voltage, reversing the supply voltage connections may correct this condition.

Voltage Input
Terminal 5: Common
Terminal 8: 600 VAC

600V MAX, AC
GENERAL DESCRIPTION

The PAXLA is a versatile meter available as a DC volt, current, or process meter with scaling and dual Form C relay outputs. The meter is programmed through the front panel buttons and the use of jumpers. The RST Key will also function as a front panel display reset.

Once the front panel programming is complete, the buttons can be disabled by a user input 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 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.

SPECIFICATIONS

1. DISPLAY: 5 digit, 0.56" (14.2 mm) intensity adjustable Red LED (-19999 to 99999)
2. POWER REQUIREMENTS:
   - AC POWER: 50 to 250 V AC 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 V AC/VDC
   +24 VDC @ 50 mA if input voltage is less than 50 VDC
3. INPUT RANGES: Jumper Selectable
   - D.C. Voltages
     - 200 mV : 0.1% of span
     - 2 V : 0.1% of span
     - 20 V : 0.1% of span
     - 200 V : 0.1% of span
     - 10 V : 200 V
   - D.C. Currents
     - 200 μA : 0.1% of span
     - 2 mA : 0.1% of span
     - 20 mA : 0.1% of span
     - 200 mA : 0.1% of span
   - D.C. Process
     - 4 to 20 mA: Use the 20 mA range
     - 1 to 5 VDC: Use the 10 V range
     - 0/1 to 10 VDC
4. OVERRANGE/UNDERRANGE INDICATION:
   - Input Overrange Indication: “OLOL”
   - Input Underrange Indication: “ULUL”
   - Display Overrange/Underrange Indication: “.....”/“-.....”
5. A/D CONVERTER: 16 bit resolution
6. UPDATE RATES:
   - A/D conversion rate: 20 readings/sec.
   - Display update: 500 msec min.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAXLA</td>
<td>Volt/Current/Process Meter with dual Relay Output</td>
<td>PAXLA000</td>
</tr>
<tr>
<td>PAXLBK</td>
<td>Unit Label Kit Accessory</td>
<td>PAXLBK10</td>
</tr>
</tbody>
</table>

DIMENSIONS In inches (mm)

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
7. USER INPUT:
   User Input: Software selectable pull-up (24.7 kΩ) or pull-down resistor (20 kΩ) that determines active high or active low input logic.
   Trigger levels: \( V_{IL} = 1.0 \text{ V max} \); \( V_{IH} = 2.4 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)
   Response Time: 5 msec typ.; 100 msec debounce (activation and release)

8. MEMORY:
   Nonvolatile E\slash PROM retains all programming parameters when power is removed.

9. OUTPUT:
   Type: Single FORM-C relay
   Isolation To Sensor & User Input Commons: 1400 Vrms for 1 min.
   Working Voltage: 150 Vrms
   Contact Rating: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load)
   Life Expectancy: 100,000 minimum operations
   Response Time:
     Turn On Time: 4 msec max.
     Turn Off Time: 4 msec max.

10. 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)
    Altitude: Up to 2,000 meters

11. CONNECTIONS:
    High compression cage-clamp terminal block
    Wire Strip Length: 0.3” (7.5 mm)
    Wire Gage: 30-14 AWG copper wire
    Torque: 4.5 inch-lbs (0.51 N-m) max.

12. CONSTRUCTION:
    This unit is rated for NEMA 4X/IP65 outdoor use. IP20

13. CERTIFICATIONS AND COMPLIANCES:
    SAFETY
    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
    Type 4X Enclosure rating (Face only), UL50

14. WEIGHT:
    10.4 oz. (295 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 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 Jumpers

Input Range Jumper

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum signal input to avoid overloads.

To access the jumpers, 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.

3.0 Wiring the Meter

EMC Installation Guidelines

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

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

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.)
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 USER INPUT WIRING

Terminal 8: User Input
Terminal 9: User Comm

Sinking Logic
+ 8 USER
3 USER COM

Sourcing Logic
+ 8 USER
- 9 USER COMM

3.3 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

3.4 INPUT SIGNAL WIRING

**CAUTION:** Analog common is NOT isolated from user input common. In order to preserve the safety of the meter application, the Analog and DC 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 User Input and Input Common terminals. Appropriate considerations must then be given to the potential of the input common with respect to earth ground. Always connect the analog signal common to terminal 7.

Voltage Signal (self powered)
Terminal 5: +VDC
Terminal 7: -VDC

Current Signal (self powered)
Terminal 6: +ADC
Terminal 7: -ADC

Current Signal (2 wire requiring excitation)
Terminal 3: +EXC
Terminal 6: +ADC

Current Signal (3 wire requiring excitation)
Terminal 5: +VDC (signal)
Terminal 7: -VDC (common)
Terminal 3: +EXC

Voltage Signal (3 wire requiring excitation)
Terminal 5: +VDC (signal)
Terminal 7: -VDC (common)
Terminal 3: +EXC

www.redlion.net
4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

**BUTTON** | **DISPLAY MODE OPERATION** | **PROGRAMMING MODE OPERATION**
--- | --- | ---
PAR | Access Programming Mode | Store selected parameter and index to next parameter
SEL | Index display through selected displays | Advance through selection list/select digit position in parameter value
RST | Resets display | Increment selected digit of parameter value

**OPERATING MODE DISPLAY DESIGNATORS**

- **MAX** - Maximum display capture value
- **MIN** - Minimum display capture value

- "SP1" - Below the display indicates setpoint 1 output activated.
- "SP2" - Below the display indicates setpoint 2 output activated.

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 **Pr** 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 **Pr**. 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 **Pr** 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 2. 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.

---

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
### 5.1 MODULE 1 - SIGNAL INPUT PARAMETERS (i-INP)

#### PARAMETER MENU

<table>
<thead>
<tr>
<th>Input Range</th>
<th>Display Decimal Point</th>
<th>Display Offset Value</th>
<th>Filter Setting</th>
<th>Filter Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESOLUTION</td>
<td>SELECTION</td>
<td>RANGE RESOLUTION</td>
<td>SELECTION</td>
<td>SELECTION</td>
</tr>
<tr>
<td>200µA</td>
<td>2.0000 mA</td>
<td>200.00 mA</td>
<td>20.00 mA</td>
<td>0.0000 µA</td>
</tr>
<tr>
<td>0.002A</td>
<td>20.000 mA</td>
<td>20.00 mA</td>
<td>0.0000 µA</td>
<td>0.0000 µA</td>
</tr>
<tr>
<td>0.02µA</td>
<td>2.000 mA</td>
<td>0.0000 µA</td>
<td>0.0000 µA</td>
<td>0.0000 µA</td>
</tr>
<tr>
<td>2µA</td>
<td>20.00 V</td>
<td>200.00 V</td>
<td>0.0000 µA</td>
<td>0.0000 µA</td>
</tr>
<tr>
<td>100µA</td>
<td>10.00 V</td>
<td>200.00 V</td>
<td>0.0000 µA</td>
<td>0.0000 µA</td>
</tr>
</tbody>
</table>

#### INPUT RANGE

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

#### DISPLAY DECIMAL POINT

Select the decimal point location for the Input, MIN and MAX displays. This selection also affects the dSP1 and dSP2 parameters and setpoint values and offset value.

#### DISPLAY OFFSET VALUE

The display can be corrected with an offset value. This can be used to compensate for signal variations or sensor errors. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the effects of offset. The decimal point follows the dEECP selection.

#### FILTER SETTING

If the displayed value is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display. Software filtering effectively combines a fraction of the current input reading with a fraction of the previous displayed reading to generate the new display.

Filter values represent no filtering (0), up to heavy filtering (3). A value of 1 for the filter uses 1/4 of the new input and 3/4 of the previous display to generate the new display. A filter value of 2 uses 1/8 new and 7/8 previous. A filter value of 3 uses 1/16 new and 15/16 previous.

#### FILTER BAND

The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the filter permanently engaged at the filter level selected above.

#### SCALING STYLE

If Input Values and corresponding Display Values are known, the Key-in (dECP) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (dAPLY) scaling style must be used.

#### INPUT VALUE FOR SCALING POINT 1

For Key-in (dECP) style, enter the first Input Value using the front panel buttons. (The Input Range selection sets the decimal location for the Input Value).

For Apply (dAPLY) style, the meter shows the previously stored Input Value. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 1

Enter the first Display Value by using the front panel buttons. This is the same for dECP and dAPLY scaling styles. The decimal point follows the dEECP selection.

#### INPUT VALUE FOR SCALING POINT 2

For Key-in (dECP) style, enter the known second Input Value using the front panel buttons.

For Apply (dAPLY) style, the meter shows the previously stored Input Value for Scaling Point 2. To retain this value, press the SEL button to advance to the next parameter. To change the Input Value, press the RST button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the SEL button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 2

Enter the second Display Value by using the front panel buttons. This is the same for dECP and dAPLY scaling styles. The decimal point follows the dEECP selection.

### General Notes on Scaling

1. When using the Apply (dAPLY) scaling style, input values for scaling points must be confined to the range limits shown.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA cannot equal 0 and 20.)
3. For input levels beyond the programmed Input Values, the meter extends the Display Value by calculating the slope from the two coordinate pairs (i-INP1 / dSP1 & i-INP2 / dSP2).
**USER INPUT FUNCTION**

<table>
<thead>
<tr>
<th>USER INPUT ASSIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-ASN</td>
</tr>
<tr>
<td>dSP</td>
</tr>
</tbody>
</table>

Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset, or display hold is selected in the User Input Function menu.

**USER INPUT ACTIVE LEVEL**

<table>
<thead>
<tr>
<th>USER INPUT ACTIVE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Ac</td>
</tr>
</tbody>
</table>

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

### DISPLAY MODE
- **No Function**
- **P-Loc** Program Mode Lock-out
- **Zero Input** (Edge triggered)
- **rESet** Reset (Edge triggered)
- **d-HLd** Display Hold
- **d-SEl** Display Select (Edge Triggered)
- **d-LEU** Display Intensity Level (Edge Triggered)
- **rSt-1** Setpoint 1 Reset
- **rSt-2** Setpoint 2 Reset
- **d-SEL** Setpoint 1 and 2 Reset

### DESCRIPTION
- **User Input disabled.**
- **Zero Input** (Edge triggered)
- **Display Hold**
- **Advance once for each activation.**
- **Increase intensity one level for each activation.**
- **Holds the assigned display, but all other meter functions continue as long as activated (maintained action).**

### Sets Display Select
- **d-SEL**
- **d-LEU**

### USER INPUT FUNCTION

- **d-SEL**
- **d-LEU**
- **rSt-1**
- **rSt-2**

### 5.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)

#### MAX DISPLAY ENABLE

- **H1-En**

#### MAX CAPTURE DELAY TIME

- **HI-L**

#### MIN DISPLAY ENABLE

- **LO-En**

#### MIN CAPTURE DELAY TIME

- **LO-L**

### FACTORY SERVICE OPERATIONS

- **FCS**

### RESTORE FACTORY DEFAULT SETTINGS

- **CodE**

### VIEW MODEL AND VERSION DISPLAY

- **CodE**

### CALIBRATION

The PAXLA uses stored calibration values to provide accurate measurements. Over time, the electrical characteristics of the components inside the PAXLA will slowly change with the result that the stored calibration values no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the PAXLA involves a calibration which should only be performed by individuals experienced in calibrating electronic equipment. Allow 30 minute warm up before performing any calibration related procedure. The following procedures should be performed at an ambient temperature of 15 to 35 °C (59 to 95 °F).

**CAUTION:** The accuracy of the calibration equipment will directly affect the accuracy of the PAXLA.
Current Calibration
1. Connect the negative lead of a precision DC current source with an accuracy of 0.01% or better to the COMM terminal. Leave the positive lead of the DC current source unconnected.
2. With the display at Code 48, press the PAR button. Unit will display CLR NO.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads CLR for about 8 seconds.
5. With the positive lead of the DC current source unconnected, press PAR. Display reads CLR for about 8 seconds.
6. When the display reads the selected range, connect the positive lead of the DC current source to the current input and apply full-scale input signal for the range. (Note: For 200 mA range, apply 100 mA as indicated on the display.) Press PAR. Display reads CLR for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads CLR NO, press the PAR button to exit calibration.

Voltage Calibration
1. Connect a precision DC voltage source with an accuracy of 0.01% or better to the volt input and COMM terminals of the PAXLA. Set the output of the voltage source to zero.
2. With the display at Code 48, press the PAR button. Unit will display CLR NO.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads CLR for about 8 seconds.
5. With the voltage source set to zero (or a dead short applied to the input), press PAR. Display reads CLR for about 8 seconds.
6. When the display reads the selected range, apply full-scale input signal for the range. (Note: For 200V range, apply 100V as indicated on the display.) Press PAR. Display reads CLR for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads CLR NO, press the PAR button to exit calibration.

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

<table>
<thead>
<tr>
<th>Parameter Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-dSP</td>
</tr>
<tr>
<td>dSP-t</td>
</tr>
<tr>
<td>rSt</td>
</tr>
<tr>
<td>Scrol</td>
</tr>
<tr>
<td>d-LEU</td>
</tr>
</tbody>
</table>

### Display Update Time

- **dSP-t**
- **Par**
- **Sel**
- **Rst**
- **2ErO**
- **ScroL**
- **b-LLt**
- **d-LEU**
- **CodE**

**Display Update Time**

- **dSP-t**
- **Par**
- **Sel**
- **Rst**
- **2ErO**
- **ScroL**
- **b-LLt**
- **d-LEU**
- **CodE**

**Display Scroll Enable**

- **ScroL**
- **Par**
- **Sel**
- **Rst**
- **2ErO**
- **ScroL**
- **b-LLt**
- **d-LEU**
- **CodE**

**Front Panel Display Select Enable (SEL)**

- **Yes**
- **No**

**Front Panel Reset Enable (RST)**

- **No**
- **Lo**
- **Hi**
- **Hi-Lo**

**Zero Display With Display Reset**

- **No**
- **Yes**
- **No**

**Units Label Backlight**

- **On**
- **Off**

**Display Intensity Level**

- **1**
- **3**

*Enter the desired Display Intensity Level (1-3). The display will actively dim or brighten as levels are changed.*
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 (P-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 values 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 CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CodE prompt appears (see chart).

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

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

PARAMETER MENU

SETPOINT SELECT

SPSEL

NO SP-1 SP-2

SETPOINT ENABLE

Enb-n

YES NO

Select YES to enable Setpoint n and access the setup parameters. If NO is selected, the unit returns to SPSEL and Setpoint n is disabled.

SETPOINT ACTION

Act-n

H1-bL LO-bL H1-uB LO-uB

Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

H1-bL = High Acting, with balanced hysteresis
LO-bL = Low Acting, with balanced hysteresis
H1-uB = High Acting, with unbalanced hysteresis
LO-uB = Low Acting, with unbalanced hysteresis

SETPOINT VALUE

SPl-n

-9999 to 99999

Enter the desired setpoint value. The decimal point position for the setpoint and hysteresis values follow the selection set in Module 1.

HYSTERESIS VALUE

HYS-n

1 to 59999

Enter desired hysteresis value. See Setpoint Output Figures for visual explanation of how setpoint output actions (balanced and unbalanced) are affected by the hysteresis. When the setpoint is a control output, usually balanced hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints.

Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.
ON TIME DELAY

Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OFF TIME DELAY

Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OUTPUT RESET ACTION

Enter the reset action of the output. See figure for details.

- **Auto**: Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel RST button or user input. The output remains off until the trigger point is crossed again.

- **Latch**: Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, or meter power cycle. When the user input or RST button is activated (momentary action), the corresponding “on” output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

- **L-dLY**: Latch with delay reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel RST button or user input manual reset, or meter power cycle. When the user input or RST button is activated (momentary action), the meter delays the event until the corresponding “on” output crosses the trigger off point. (Previously latched outputs are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous L-dLY reset if it is not activated at power up.)

OUTPUT RESET WITH DISPLAY RESET

This parameter enables the RST button or user input to reset the output when the display is reset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the output will not reset.

STANDBY OPERATION

When YES, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset Action.

Setpoint Output Reset Actions
Press PAR key to enter Programming Mode.
MODEL DP5 – 1/8 DIN ANALOG INPUT PANEL METERS

- PROCESS, VOLTAGE, CURRENT, AND TEMPERATURE INPUTS
- 5-DIGIT 0.56" HIGH LED DISPLAY
- PROGRAMMABLE FUNCTION KEYS/USER INPUT
- 9 DIGIT TOTALIZER (INTEGRATOR) WITH BATCHING
- OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION

The DP5 Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. These meters are available in three different models to handle various analog inputs, including DC Voltage/Current, Process, and Temperature Inputs. Refer to pages 4 and 5 for the details on the specific models.

The 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 signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow, calculate service intervals of motors or pumps, etc. The totalizer can also accumulate batch weighing operations.

Once the meters have been initially configured, the parameter list may be locked out from further modification.

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.

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 5.0" (127) W.
# Table of Contents

Ordering Information ........................................... 2  
General Meter Specifications. ................................. 3  
Universal DC Input Panel Meter .............................. 4  
Process Input Panel Meter .................................. 4  
Thermocouple and RTD Input Meter ......................... 5  
Accessories .................................................... 5  
Installing the Meter ........................................... 6  
Setting the Jumpers ........................................... 6  
Wiring the Meter ............................................... 7  
Reviewing the Front Buttons and Display .................. 9  
Programming the Meter ...................................... 10  
Factory Service Operations ................................ 17  
Parameter Value Chart ....................................... 19  
Programming Overview ...................................... 20  

## Ordering Information

### Meter Part Numbers

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP5 0 0</td>
<td></td>
</tr>
</tbody>
</table>

- **D**: DC Volt/Current Input  
- **P**: Process Input  
- **T**: Thermocouple and RTD Input  
- **0**: Red LED Display  
- **0**: 0 - 85 to 250 VAC  
  1 - 11 to 36 VDC, 24 VAC

### Accessories Part Number

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>Description</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory (Not required for DP5T)</td>
<td>PAXLBK10</td>
</tr>
</tbody>
</table>
GENERAL METER SPECIFICATIONS

1. DISPLAY: 5 digit, 0.56" (14.2 mm) red LED, (-19999 to 99999)

2. POWER:
   AC Versions:
   - AC Power: 85 to 250 VAC, 50/60 Hz, 10 VA
   - Isolation: 2300 Vrms for 1 min. to all inputs.
   DC Versions:
   - DC Power: 11 to 36 VDC, 11 W
   - AC Power: 24 VAC, ± 10%, 50/60 Hz, 10 VA
   - Isolation: 500 Vrms for 1 min. to all inputs (50 V working).

3. ANNUNCIATORS:
   - MAX - maximum readout selected
   - MIN - minimum readout selected
   - TOT - totalizer readout selected, flashes when total overflows
   - Units Label - optional units label backlight
   - MIN - minimum readout selected
   - MAX - maximum readout selected

4. KEYPAD: 3 programmable function keys, 5 keys total

5. A/D CONVERTER: 16 bit resolution

6. UPDATE RATES:
   - A/D conversion rate: 10 readings/sec.
   - Step response: 200 msec. max. to within 99% of final readout value
     (digital filter and internal zero correction disabled)
   - 700 msec. max. (digital filter disabled, internal zero correction enabled)
   - Display update rate: 1 to 10 updates/sec.
   - Max./Min. capture delay time: 0 to 3275 sec.

7. DISPLAY MESSAGES:
   - “OLOL” - Appears when measurement exceeds ± signal range.
   - “ULUL” - Appears when measurement exceeds ± signal range
   - DPST: “OPEN” - Appears when open sensor is detected.
   - DPST: “SHORT” - Appears when shorted sensor is detected (RTD only)
   - “...” - Appears when display values exceed ± display range.
   - “...” - Appears when display values exceed ± display range.

8. INPUT CAPABILITIES: See specific product specifications, pages 4-5

9. EXCITATION POWER: See specific product specifications, pages 4-5

10. LOW FREQUENCY NOISE REJECTION:
    - Normal Mode: > 60 dB @ 50 or 60 Hz ±1%, digital filter off
    - Common Mode: >100 dB, DC to 120 Hz

11. USER INPUT: One software defined user input
    - Max. Continuous Input: 30 VDC
    - Isolation/To Sensor Input Common: Not isolated. Do not tie commons together.
    - Response Time: 50 msec. max.
    - Logic State: Jumper selectable for sink/source logic

12. TOTALIZER:
    - Time Base: second, minute, hour, or day
    - Time Accuracy: 0.01% typical
    - Decimal Point: 0 to 0.0000
    - Scale Factor: 0.001 to 65,000
    - Low Signal Cut-out: -19,999 to 99,999
    - Total: 9 digits, display alternates between high order and low order readouts

13. MEMORY: Nonvolatile E/PROM retains all programmable parameters and display values.

14. ENVIRONMENTAL CONDITIONS:
    - Operating Temperature Range: 0 to 50°C
    - Storage Temperature Range: -40 to 60°C
    - Operating and Storage Humidity: 0 to 85% max. RH non-condensing
    - Altitude: Up to 2000 meters

15. CERTIFICATIONS AND COMPLIANCES:
    - SAFETY
      - UL Recognized Component, File #E179259, UL61010-1, CSA C22.2 No. 61010-1
      - DPST Only: File # E156876, UL873, CSA C22.2 No. 24
      - 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
      - IEC601120-20041018
      - Issued by Underwriters Laboratories, Inc.
    - IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part I
    - 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
        - Power mains class A Level 3; 8 Kv air
        - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
          - 200 Hz, 50% duty cycle
        - Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv I/O
        - RF conducted interference EN 61000-4-6 Level 3; 10 V/m
          - 80 MHz - 1 GHz
          - 150 KHz - 80 MHz
          - 900 MHz ±5 MHz
        - Simulation of cordless telephones ENV 50204 Level 3; 900 MHz ±5 MHz
          - 200 Hz, 50% duty cycle
      - Emissions to EN 50081-2
        - RF interference EN 55011 Level 3; 900 MHz ±5 MHz
    
    - Notes:
      - 1. Self-recoverable loss of performance during EMI disturbance at 10 V/m:
          - Measurement input signal may deviate during EMI disturbance.
      - For operation without loss of performance:
        - Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent)
        - I/O and power cables are routed in metal conduit connected to earth ground.
      - Refer to EMC Installation Guidelines section of the bulletin for additional information.

16. CONNECTIONS:
    - High compression cage-crimp 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.

17. CONSTRUCTION:
    - This unit is rated for NEMA 4X/IP65 outdoor use.
    - IP20 Touch safe. Installation Category II, Pollution Degree 2.

18. WEIGHT: 7 oz. (200 g)
**MODEL DP5D - UNIVERSAL DC INPUT**

- **FOUR VOLTAGE RANGES (300 VDC Max)**
- **FIVE CURRENT RANGES (2A DC Max)**
- **24 VDC TRANSMITTER POWER**

DP5D SPECIFICATIONS

INPUT RANGES:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±200 μADC</td>
<td>0.03% of reading +0.03 μA</td>
<td>0.12% of reading +0.04 μA</td>
<td>1.11 Kohm</td>
<td>15 mA</td>
<td>10 nA</td>
</tr>
<tr>
<td>±2 mADC</td>
<td>0.03% of reading +0.3 μA</td>
<td>0.12% of reading +0.4 μA</td>
<td>111 ohm</td>
<td>50 mA</td>
<td>0.1 μA</td>
</tr>
<tr>
<td>±20 mADC</td>
<td>0.03% of reading +3 μA</td>
<td>0.12% of reading +4 μA</td>
<td>11.1 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>±200 mADC</td>
<td>0.05% of reading +30 μA</td>
<td>0.15% of reading +40 μA</td>
<td>1.1 ohm</td>
<td>500 mA</td>
<td>10 μA</td>
</tr>
<tr>
<td>±2 ADC</td>
<td>0.5% of reading +0.3 mA</td>
<td>0.7% of reading +0.4 mA</td>
<td>0.1 ohm</td>
<td>3 A</td>
<td>0.1 mA</td>
</tr>
<tr>
<td>±200 mVDC</td>
<td>0.03% of reading +30 μV</td>
<td>0.12% of reading +40 μV</td>
<td>1.066 Mohm</td>
<td>100 V</td>
<td>10 μV</td>
</tr>
<tr>
<td>±2 VDC</td>
<td>0.03% of reading +0.3 mV</td>
<td>0.12% of reading +0.4 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>0.1 mV</td>
</tr>
<tr>
<td>±20 VDC</td>
<td>0.03% of reading +3 mV</td>
<td>0.12% of reading +4 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
<tr>
<td>±300 VDC</td>
<td>0.05% of reading +30 mV</td>
<td>0.15% of reading +40 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>10 mV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85%RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:
Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.

**MODEL DP5P - PROCESS INPUT**

- **DUAL RANGE INPUT (20 mA or 10 VDC)**
- **24 VDC TRANSMITTER POWER**

DP5P SPECIFICATIONS

SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA (-2 to 26 mA)</td>
<td>0.03% of reading +2 μA</td>
<td>0.12% of reading +3 μA</td>
<td>20 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>10 VDC (-1 to 13 VDC)</td>
<td>0.03% of reading +2 mV</td>
<td>0.12% of reading +3 mV</td>
<td>500 Kohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85%RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:
Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
DP5T SPECIFICATIONS

READOUT:
Resolution: Variable: 0.1, 0.2, 0.5, or 1, 2, or 5 degree
Scale: °F or °C
Offset Range: -19,999 to 99,999 display units

THERMOCOUPLE INPUTS:
Input Impedance: 20 MΩ
Lead Resistance Effect: 0.03 μV/ohm
Max. Continuous Overvoltage: 30 V

RTD INPUTS:
Type: 3 or 4 wire, 2 wire can be compensated for lead wire resistance
Excitation current: 100 ohm range: 165 μA
10 ohm range: 2.6 mA
Lead resistance: 100 ohm range: 10 ohm/lead max.
10 ohm range: 3 ohms/lead max.
Max. continuous overload: 30 V

DIRECT READOUT:
Input range: -10 to 65 mV
0 to 400 ohms, high range
0 to 25 ohms, low range
Display range: -19999 to 99999

TEMPERATURE INTEGRATOR
The time-temperature integrator provides a digital output proportional to the integrated temperature over a specified period.

ACCESSORIES

UNITS LABEL KIT (PAXLBD) - Not required for DP5T
Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled in the programming.
Each DP5T meter is shipped with °F and °C overlay labels which can be installed into the meter’s bezel display assembly.

- THERMOCOUPLE AND RTD INPUTS
- CONFORMS TO ITS-90 STANDARDS
- TIME-TEMPERATURE INTEGRATOR

MODEL DP5T - THERMOCOUPLE AND RTD INPUT

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE (18 to 28°C)</th>
<th>ACCURACY (0 to 50°C)</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ANSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BS 1843</td>
</tr>
<tr>
<td>T</td>
<td>-200 to 400°C</td>
<td>1.2°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>2.1°C **</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>-200 to 871°C</td>
<td>1.0°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>2.4°C **</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>-200 to 760°C</td>
<td>1.1°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3°C **</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>-200 to 1372°C</td>
<td>1.3°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>3.4°C **</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>-50 to 1768°C</td>
<td>1.9°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.0°C **</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>-50 to 1768°C</td>
<td>1.9°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.0°C **</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>100 to 300°C</td>
<td>3.9°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td>300 to 1820°C</td>
<td>5.7°C **</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4°C **</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>-200 to 1300°C</td>
<td>1.3°C **</td>
<td>ITS-90</td>
</tr>
<tr>
<td></td>
<td>-270 to -200°C</td>
<td>3.1°C **</td>
<td></td>
</tr>
<tr>
<td>C (W5/W26)</td>
<td>0 to 2315°C</td>
<td>1.9°C **</td>
<td>ASTM E988-90***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.1°C **</td>
<td>no standard</td>
</tr>
</tbody>
</table>

*After 20 min. warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 15 to 75% RH environment; and Accuracy over a 0 to 50°C and 0 to 85% RH (non condensing) environment. Accuracy specified over the 0 to 50°C operating range includes meter tempco and ice point tracking effects. The specification includes the A/D conversion errors, linearization conformity, and thermocouple ice point compensation. Total system accuracy is the sum of meter and probe errors. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

** The accuracy over the interval -270 to -200°C is a function of temperature, ranging from 1°C at -200°C and degrading to 7°C at -270°C. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

*** These curves have been corrected to ITS-90.
1.0 INSTALLING THE METER

**Installation**

The DP5 meets NEMA 4X/IP65 requirements for indoor use 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 JUMPERS

The meter can have up to two jumpers that must be checked and / or changed prior to applying power. The two jumpers are: Input Range and User Input Logic. The following Jumper Selection Figures show an enlargement of the jumper area.

To access the jumpers, 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.

**User Input Logic Jumper**

This jumper selects the logic state of the user input. If the user input is not used, it is not necessary to check or move this jumper.

**Input Range Jumper**

One jumper is used for voltage or current input ranges. Select the proper input range high enough to avoid input signal overload. Only one jumper is allowed in this area. Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing the jumper across two ranges.

DP5D Jumper Selection

The \( \wedge \) indicates factory setting.
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 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), 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, its source or the method of coupling into the unit may be different for various installations. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit 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 away as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables:
     - Fair-Rite # 0443167251 (RLC #FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC #LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom #1VR3
   - Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC#SNUB0000.
### 3.1 POWER WIRING

**AC Power**
- Terminal 1: VAC
- Terminal 2: VAC

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

### 3.2 INPUT SIGNAL WIRING

#### DP5D INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

**Voltage Signal (self powered)**
- Terminal 3: +VDC
- Terminal 5: -VDC

**Current Signal (self powered)**
- Terminal 4: +ADC
- Terminal 5: -ADC

**Current Signal (2 wire requiring excitation)**
- Terminal 4: -ADC
- Terminal 6: +ADC

**Current Signal (3 wire requiring excitation)**
- Terminal 4: +ADC (signal)
- Terminal 5: -ADC (common)
- Terminal 6: +Volt supply

**Voltage Signal (3 wire requiring excitation)**
- Terminal 3: +VDC (signal)
- Terminal 5: -VDC (common)
- Terminal 6: +Volt supply

**Potentiometer Signal (3 wire requiring excitation)**
- Terminal 3: Wiper
- Terminal 5: Low end of pot.
- Terminal 6: High end of pot.
- Input Range Jumper: 300 Volt
- Module 1 Input Range: 300 Volt

*Note: The Apply signal scaling style should be used because the signal will be in volts.*

#### 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 voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Input and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common.

#### DP5P INPUT SIGNAL WIRING

**Voltage Signal (self powered)**
- Terminal 3: +VDC
- Terminal 5: -VDC

**Current Signal (self powered)**
- Terminal 4: +ADC
- Terminal 5: -ADC

**Current Signal (2 wire requiring excitation)**
- Terminal 4: -ADC
- Terminal 6: +ADC

**Current Signal (3 wire requiring excitation)**
- Terminal 4: +ADC (signal)
- Terminal 5: -ADC (common)
- Terminal 6: +Volt supply

**Voltage Signal (3 wire requiring excitation)**
- Terminal 3: +VDC (signal)
- Terminal 5: -VDC (common)
- Terminal 6: +Volt supply

**Potentiometer Signal (3 wire requiring excitation)**
- Terminal 3: Wiper
- Terminal 5: Low end of pot.
- Terminal 6: High end of pot.
- Input Range Jumper: 300 Volt
- Module 1 Input Range: 300 Volt

*Note: The Apply signal scaling style should be used because the signal will be in volts.*

#### 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 voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Input and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common.
3.3 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using the User Input then skip this section.

Sinking Logic
Terminal 8: Connect external switching device between the User Input terminal and User Comm.
Terminal 7: Internal switching device is not used.

In this logic, the user input of the meter is internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0.9 V).

Sourcing Logic
Terminal 8: + VDC thru external switching device
Terminal 7: -VDC thru external switching device

In this logic, the user input of the meter is internally pulled down to 0 V with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

Display Readout Legends*

Optional Custom Units Overlay

Max 8.8.8.8. V
Min
Tot

KEY
DSP Index display through max/min/total/input readouts
PAR Access parameter list
F1 Function key 1; hold for 3 seconds for Second Function 1**
F2 Function key 2; hold for 3 seconds for Second Function 2**
RST Reset (Function key)**

PROGRAMMING MODE OPERATION
Quit programming and return to display mode
Store selected parameter and index to next parameter
Increment selected parameter value
Decrement selected parameter value
Hold with F1, F2 to scroll value by x1000

* Display Readout Legends may be locked out in Factory Settings.
** Factory setting for the F1, F2, and RST keys is NO mode.
5.0 Programming the Meter

OVERVIEW

PROGRAMMING MENU

DISPLAY MODE
The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown: Max Value (MAX), Min Value (MIN), or Totalizer Value (TOT). Each of these displays can be locked from view through programming. (See Module 3) The Input Display Value is shown with no annunciator.

PROGRAMMING MODE
Two programming modes are available.

Full Programming Mode permits all parameters to be viewed and modified. Upon entering this mode, the front panel keys change to Programming Mode operations. This mode should not be entered while a process is running, since the meter functions and User Input response may not operate properly while in Full Programming Mode.

Quick Programming Mode permits only certain parameters to be viewed and/or modified. When entering this mode, the front panel keys change to Programming Mode operations, and all meter functions continue to operate properly. Quick Programming Mode is configured in Module 3. Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming Mode.

PROGRAMMING TIPS
The Programming Menu is organized into nine modules (See above). These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. If lost or confused while programming, press the DSP key to exit programming mode and start over. When programming is complete, it is recommended to record the meter settings on the Parameter Value Chart and lock-out parameter programming with a User Input or lock-out code. (See Modules 2 and 3 for programming lock-out details.)

FACTORY SETTINGS
Factory Settings may be completely restored in Module 9. This is a good starting point if encountering programming problems. Throughout the module description sections which follow, the factory setting for each parameter is shown below the parameter display. In addition, all factory settings are listed on the Parameter Value Chart following the programming section.

ALTERNATING SELECTION DISPLAY
In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternating between the parameter (top display) and the parameter’s Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.

STEP BY STEP PROGRAMMING INSTRUCTIONS:

PROGRAMMING MODE ENTRY (PAR KEY)
The Programming Mode is entered by pressing the PAR key. If this mode is not accessible, then meter programming is locked by either a security code or a hardware lock. (See Modules 2 and 3 for programming lock-out details.)

MODULE ENTRY (ARROW & PAR KEYS)
Upon entering the Programming Mode, the display alternates between Pr a and the present module (initially Pr 3). The arrow keys (F1 and F2) are used to select the desired module, which is then entered by pressing the PAR key.

PARAMETER (MODULE) MENU (PAR KEY)
Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. 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 Pr a Pr 3. From this point, programming may continue by selecting and entering additional modules. (See Module Entry above.)

PARAMETER SELECTION ENTRY (ARROW & PAR KEYS)
For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1 and F2) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)
For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The RST key can be used in combination with the arrow keys to enter large numerical values, when the RST key is pressed along with an arrow key, the display scrolls by 1000’s. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr a Pr 0)
The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr a Pr 0 displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)
5.1 MODULE 1 - SIGNAL INPUT PARAMETERS (I-1NP)

Refer to the appropriate Input Range for the selected meter. Use only one Input Range, then proceed to Display Decimal Point.

**DP5D INPUT RANGE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>RESOLUTION</th>
<th>SELECTION</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±200.00 μA</td>
<td>±200.00 mV</td>
<td>±2.0000 mA</td>
<td>±2.0000 V</td>
</tr>
<tr>
<td>±20.000 mA</td>
<td>±20.000 V</td>
<td>±20.000 mA</td>
<td>±20.000 V</td>
</tr>
<tr>
<td>±200.00 mA</td>
<td>±300.00 V</td>
<td>±2.0000 A</td>
<td>±2.0000 V</td>
</tr>
</tbody>
</table>

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

**DP5P INPUT RANGE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>RESOLUTION</th>
<th>SELECTION</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±20.000 mA</td>
<td>±10.000 V</td>
<td>±20.000 mA</td>
<td>±10.000 V</td>
</tr>
</tbody>
</table>

Select the input range that corresponds to the external signal.

**DP5T INPUT TYPE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>TYPE</th>
<th>SELECTION</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>t°C</td>
<td>TC</td>
<td>K°C</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>ETC</td>
<td>JTC</td>
<td>PL392</td>
</tr>
<tr>
<td>t°C</td>
<td>JTC</td>
<td>PL392</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>KTC</td>
<td>NL672</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>RTC</td>
<td>CW427</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>STC</td>
<td>ULC</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>BTC</td>
<td>RES-H</td>
<td>TC</td>
</tr>
<tr>
<td>t°C</td>
<td>NTC</td>
<td>RES-L</td>
<td>TC</td>
</tr>
</tbody>
</table>

Select the input type that corresponds to the input sensor. For RTD types, check the RTD Input Jumper for matching selection. For sensor verification and testing, use the direct readout modes.

**TEMPERATURE SCALE**

Select the temperature scale. This selection applies for Input, MAX, MIN, and TOT displays. This does not change the user installed Custom Units Overlay display. If changed, those parameters that relate to the temperature scale should be checked.

**DISPLAY DECIMAL POINT**

These selections are not available for DP5T.

**DISPLAY Rounding**

These bottom selections are not available for DP5T.

Rounding selections other than one, cause the Input Display to ‘round’ to the nearest rounding increment selected (ie. rounding of ‘5’ causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, etc.) are not automatically adjusted to this display rounding selection.

**DP5T: TEMPERATURE DISPLAY OFFSET**

The temperature display can be corrected with an offset value. This can be used to compensate for probe errors, errors due to variances in probe placement or adjusting the readout to a reference thermometer. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the affects of offset.
**FILTER SETTING***

\[ \text{Filter} \]

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of ‘0’ disables filtering.

**FILTER BAND***

\[ \text{Band} \]

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the digital filter permanently engaged.

**SCALING STYLE**

\[ \text{Style} \]

If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (RPLY) scaling style must be used. After using the Apply (RPLY) scaling style, this parameter will default back to KEY but the scaling values will be shown from the previous applied method.

**INPUT VALUE FOR SCALING POINT 1**

\[ \text{INP 1} \]

For Key-in (KEY), enter the known first Input Value by using the arrow keys. For Apply (RPLY), apply the input signal to the meter, adjust the signal source externally until the desired Input Value appears. In either method, press the PAR key to enter the value being displayed. The DSP key can be pressed without changing the previously stored INP 1 value in the RPLY style.

*Note: RPLY style - Pressing the RST key will advance the display to the next scaling display point without storing the input value.*

**DISPLAY VALUE FOR SCALING POINT 1**

\[ \text{DSP 1} \]

Enter the first coordinating Display Value by using the arrow keys. This is the same for KEY and RPLY scaling styles. The decimal point follows the dECPt selection.

**INPUT VALUE FOR SCALING POINT 2**

\[ \text{INP 2} \]

For Key-in (KEY), enter the known second Input Value by using the arrow keys. For Apply (RPLY), adjust the signal source externally until the next desired Input Value appears.

**DISPLAY VALUE FOR SCALING POINT 2**

\[ \text{DSP 2} \]

Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and RPLY scaling styles.

**General Notes on Scaling**

1. Input Values for scaling points should be confined to the limits of the Input Range.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA cannot equal 0 and 10.) This is referred to as read out jumps (vertical scaled segments).
3. The same Display Value can correspond to more than one Input Value. (Example: 0 mA and 20 mA can equal 10.) This is referred to as readout dead zones (horizontal scaled segments).
4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65,535. For example, using +20 mA range the maximum +20 mA can be scaled to is 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for (32,767 x 2 =) 65,535 but with even Input Display values shown.
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs. If \(\text{INP 1} = 4\) mA and \(\text{DSP 1} = 0\), then 0 mA would be some negative Display Value. The calculations stop at the limits of the Input Range.
6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the two sequential coordinate pairs. The calculations stop at the limits of the Input Range.

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

**FILTER SETTING***

\[ \text{Filter} \]

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of ‘0’ disables filtering.

**FILTER BAND***

\[ \text{Band} \]

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the digital filter permanently engaged.

**SCALING STYLE**

\[ \text{Style} \]

If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (RPLY) scaling style must be used. After using the Apply (RPLY) scaling style, this parameter will default back to KEY but the scaling values will be shown from the previous applied method.

**INPUT VALUE FOR SCALING POINT 1**

\[ \text{INP 1} \]

For Key-in (KEY), enter the known first Input Value by using the arrow keys. For Apply (RPLY), apply the input signal to the meter, adjust the signal source externally until the desired Input Value appears. In either method, press the PAR key to enter the value being displayed. The DSP key can be pressed without changing the previously stored INP 1 value in the RPLY style.

*Note: RPLY style - Pressing the RST key will advance the display to the next scaling display point without storing the input value.*

**DISPLAY VALUE FOR SCALING POINT 1**

\[ \text{DSP 1} \]

Enter the first coordinating Display Value by using the arrow keys. This is the same for KEY and RPLY scaling styles. The decimal point follows the dECPt selection.

**INPUT VALUE FOR SCALING POINT 2**

\[ \text{INP 2} \]

For Key-in (KEY), enter the known second Input Value by using the arrow keys. For Apply (RPLY), adjust the signal source externally until the next desired Input Value appears.

**DISPLAY VALUE FOR SCALING POINT 2**

\[ \text{DSP 2} \]

Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and RPLY scaling styles.

**General Notes on Scaling**

1. Input Values for scaling points should be confined to the limits of the Input Range.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA cannot equal 0 and 10.) This is referred to as read out jumps (vertical scaled segments).
3. The same Display Value can correspond to more than one Input Value. (Example: 0 mA and 20 mA can equal 10.) This is referred to as readout dead zones (horizontal scaled segments).
4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65,535. For example, using +20 mA range the maximum +20 mA can be scaled to is 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for (32,767 x 2 =) 65,535 but with even Input Display values shown.
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs. If \(\text{INP 1} = 4\) mA and \(\text{DSP 1} = 0\), then 0 mA would be some negative Display Value. The calculations stop at the limits of the Input Range.
6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the two sequential coordinate pairs. The calculations stop at the limits of the Input Range.

*Factory Setting can be used without affecting basic start-up.*
### 5.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FACT)

The user input is programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state.

The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed the instant the key is pressed. Holding the function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function.

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

**Note:** In the following explanations, not all selections are available for both the user input and front panel function keys. Alternating displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. 

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER INPUT</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td></td>
</tr>
<tr>
<td>rSET</td>
<td></td>
</tr>
<tr>
<td>S2-F1</td>
<td></td>
</tr>
<tr>
<td>S2-F2</td>
<td></td>
</tr>
</tbody>
</table>

**RELATIVE/ABSOLUTE DISPLAY**

This function will switch the Input Display between Relative and Absolute.

**HOLD DISPLAY**

The shown display is held but all other meter functions continue as long activated (maintained action).

**HOLD ALL FUNCTIONS**

The meter disables processing the input and holds all display contents as long as activated (maintained action).

**SYNCHRONIZE METER READING**

The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

**STORE BATCH READING IN TOTALIZER**

The Input Display value is one time added (batched) to the Totalizer at transition to activate (momentary action). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.

**SELECT TOTALIZER DISPLAY**

The Totalizer display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The DSP key overrides the active user input. The Totalizer continues to function independent of being displayed.

---

The Zero (Tare) Display provides a way to zero the Input Display value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), rSET flashes and the Display is set to zero. At the same time, the Display value (that was on the display before the Zero Display) is subtracted from the Display Offset Value and is automatically stored as the new Display Offset Value (OFFSET). If another Zero (tare) Display is performed, the display will again change to zero and the Display reading will shift accordingly.
5.3 MODULE 3 - DISPLAY AND PROGRAM LOCK-OUT

PARAMETERS (3-LOC)

- **RESET TOTALIZER**
  - When activated (momentary action), $ESE$ flashes and the Totalizer resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

- **RESET AND ENABLE TOTALIZER**
  - When activated (momentary action), $ESE$ flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

- **ENABLE TOTALIZER**
  - The Totalizer continues to operate as long as activated (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

- **SELECT MAXIMUM DISPLAY**
  - The Maximum display is selected as long as activated (maintained action). When the user input is released, the Input Display returns. The DSP key overrides the active user input. The Maximum continues to function independent of being displayed.

- **RESET MAXIMUM**
  - When activated (momentary action), $ESE$ flashes and the Maximum resets to the present Input Display value. The Minimum function then continues from that value. This selection functions independent of the selected display.

- **RESET MINIMUM**
  - When activated (momentary action), $ESE$ flashes and the Minimum reading is set to the present Input Display value. The Minimum function then continues from that value. This selection functions independent of the selected display.

- **RESET, SELECT, ENABLE MAXIMUM DISPLAY**
  - When activated (momentary action), the Maximum value is set to the present Input Display value. Maximum continues from that value while active (maintained action). When the user input is released, Maximum detection stops and holds its value. This selection functions independent of the selected display. The DSP key overrides the active user input display but not the Maximum function.

- **SELECT MINIMUM DISPLAY**
  - The Minimum display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The DSP key overrides the active user input. The Minimum continues to function independent of being displayed.

- **RESET, SELECT, ENABLE MINIMUM DISPLAY**
  - When activated (momentary action), the Minimum value is set to the present Input Display value. Minimum continues from that value while active (maintained action). When the user input is released, Minimum detection stops and holds its value. This selection functions independent of the selected display. The DSP key overrides the active user input display but not the Minimum function.

- **RESET MAXIMUM AND MINIMUM**
  - When activated (momentary action), $ESE$ flashes and the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

- **RESET, SELECT, ENABLE TOTALIZER**
  - When activated (momentary action), the Maximum value is set to the present Input Display value. Maximum continues from that value while active (maintained action). When the user input is released, Maximum detection stops and holds its value. This selection functions independent of the selected display. The DSP key overrides the active user input display but not the Maximum function.

- **SELECT MAXIMUM AND MINIMUM**
  - When activated (momentary action), $ESE$ flashes and the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

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

- **PARAMETER MENU**
  - 3-LOC
  - PAR
  - HI
  - LO
  - TOt
  - CadE

- **MAXIMUM DISPLAY LOCK-OUT**
  - HI
  - LOC

- **MINIMUM DISPLAY LOCK-OUT**
  - LO
  - LOC

- **TOTALIZER DISPLAY LOCK-OUT**
  - EDE
  - LOC

These displays can be programmed for LOC or $Ed$. When programmed for LOC, the display will not be shown when the DSP key is pressed regardless of Program Lock-out status. It is suggested to lock-out the display if it is not needed. The associated function will continue to operate even if its display is locked-out.

**PROGRAM MODE SECURITY CODE**

- By entering any non-zero value, the prompt $\text{CadE} \ 0$ will appear when trying to access the Program 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.*

1-717-767-6511
### 5.4 MODULE 4 - SECONDARY FUNCTION PARAMETERS (4-SEC)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. Capture Delay Time</strong></td>
<td>0.1</td>
<td>When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.</td>
</tr>
<tr>
<td><strong>Min. Capture Delay Time</strong></td>
<td>0.1</td>
<td>When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.</td>
</tr>
<tr>
<td><strong>Display Update Rate</strong></td>
<td>2</td>
<td>This parameter determines the rate of display update. When set to 10 updates/second, the internal re-zero compensation is disabled, allowing for the fastest possible output response.</td>
</tr>
<tr>
<td><strong>Units Label Backlight</strong></td>
<td>OFF</td>
<td>The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed in to the meter’s bezel display assembly. The backlight for these custom units is activated by this parameter.</td>
</tr>
<tr>
<td><strong>Display Offset Value</strong></td>
<td>0.00</td>
<td>This parameter does not apply for the DP5T. Unless a Zero Display was performed or an offset from Module 1 scaling is desired, this parameter can be skipped. The Display Offset Value is the difference from the Absolute (gross) Display value to the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyedin to intentionally add or remove display offset. See Relative / Absolute Display and Zero Display explanations in Module 2.</td>
</tr>
<tr>
<td><strong>DP5T: Ice Point Compensation</strong></td>
<td>OFF</td>
<td>This parameter turns the internal ice point compensation on or off. Normally, the ice point compensation is on. If using external compensation, set this parameter to off. In this case, use copper leads from the external compensation point to the meter.</td>
</tr>
</tbody>
</table>

*Factory Setting can be used without affecting basic start-up.
5.5 MODULE 5 - TOTALIZER (INTEGRATOR) PARAMETERS (5-70B)

The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a time-temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide a readout of temperature integration, useful in curing and sterilization applications. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

TOTALIZER DECIMAL POINT*

For most applications, this matches the Input Display Decimal Point (dECPt). If a different location is desired, refer to Totalizer Scale Factor.

TOTALIZER TIME BASE

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

TOTALIZER SCALE FACTOR*

For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities are:
1. Changing decimal point location (example tenths to whole)
2. Changing engineering units (example inches to meters)
3. Changing both decimal point location and engineering units
4. Average over a controlled time frame.
Details on calculating the scale factor are shown later.
If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

TOTALIZER LOW CUT VALUE*

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

TOTALIZER POWER UP RESET*

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

TOTALIZER HIGH ORDER DISPLAY

When the total exceeds 5 digits, the front panel annunciator TOT flashes. In this case, the meter continues to totalize up to a 9 digit value. The high order 4 digits and the low order 5 digits of the total are displayed alternately. The letter “K” denotes the high order display.

TOTALIZER BATCHING

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (bR). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

TOTALIZER USING TIME BASE

Totalizer accumulates as defined by:

\[ \text{Input Display} \times \text{Totalizer Scale Factor} \]

Where:
- Input Display - the present input reading
- Totalizer Scale Factor - 0.001 to 65.000

Example: The input reading is at an average of 10.0°C per hour. The Totalizer is used to verify this average reading in a controlled time frame of 4 hours. Because the Input Display and Totalizer are both in tenths of °C, the Totalizer Scale Factor is 1. However, the Totalizer Time Base is hours (3600) divided by the 4 hours in the controlled time frame to yield a Totalizer Scale Factor of 0.250. By placing these values in the equation, the Totalizer will accumulate every second as follows:

\[ 10.0 \times 0.250 = 0.00096 \text{ accumulates each second} \]

This results in:
- 0.01467 accumulates each minute
- 2.5 accumulates each hour
- 10.0 reached at the end of 4 hours

TOTALIZER SCALE FACTOR CALCULATION EXAMPLES

1. When changing the Totalizer Decimal Point (dECPt) location from the Input Display Decimal Point (dECPt), the required Totalizer Scale Factor is multiplied by a power of ten.
   Example: Input (dECPt) = 0.0
   Input (dECPt) = 0.00

<table>
<thead>
<tr>
<th>Totalizer dECPt</th>
<th>Scale Factor</th>
<th>Totalizer dECPt</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>10</td>
<td>0.000</td>
<td>10</td>
</tr>
<tr>
<td>0.01</td>
<td>1</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>0.041</td>
<td>0.01</td>
<td>0.000</td>
<td>0.01</td>
</tr>
<tr>
<td>x10</td>
<td>.01</td>
<td>x10</td>
<td>.01</td>
</tr>
<tr>
<td>x100</td>
<td>.001</td>
<td>x100</td>
<td>.001</td>
</tr>
</tbody>
</table>

\((x = \text{Totalizer display is round by tens or hundreds})\)

2. When changing the Totalizer engineering units, the Totalizer Scale Factor is the known conversion multiplier from Input Display units to Totalizer units.
   Example: If Input Display is feet and the Totalizer needs to be in yards, the conversion multiplier from feet to yards is 0.333. Enter 0.333 as the Totalizer scale factor.

3. When changing both the Totalizer engineering units and Totalizer Decimal Point the two calculations are multiplied together. Example: Input Display = feet in tenths (0.0) with Totalizer = whole yards (0), the scale factor would be 0.333.
4. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.
   Example: Average temperature per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for reset. The timer will control the start (reset) and the stopping (hold) of the totalizer.

* Factory Setting can be used without affecting basic start-up.
5.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FES)

PARAMETER MENU

RESTORE FACTORY DEFAULTS

Use the arrow keys to display CodE 66 and press PAR. The meter will display rS5E1 and then return to CodE 50. Press DSP key to return to Display Mode. This will overwrite all user settings with the factory settings.

CALIBRATION

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed in Module 1. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored using the Apply (APPLY) Scaling Style.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

DPST - Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better.

Before starting, verify that the precision signal source is connected to the correct terminals and ready. Allow a 30 minute warm-up period before calibrating the meter. na and PAR can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:
1. Use the arrow keys to display CodE 48 and press PAR.
2. Choose the range to be calibrated by using the arrow keys and press PAR.
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage ranges: dead short applied
   - Current ranges: open circuit
4. Press PAR and will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mA
6. Press PAR and will appear on the display for about 10 seconds.
7. When na appears, press PAR twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

10 OHM RTD Range Calibration

Before selecting any of the calibration procedures, the input to the meter must be at 0 mV or 0 ohms. Set the digital filer in Module 1 to 1 second. Allow a 30 minute warm-up period before calibrating the meter. The na and PAR can be chosen to exit calibration mode without any changes taking place.

1. Set the Input Range Jumper to 10 ohm.
2. Use the arrow keys to display CodE 48 and press PAR. Then choose r · 10 and press PAR.
3. At r, apply a direct short to input terminals 3, 4 and 5 using a three wire link. Wait 10 seconds, then press PAR.
4. At r, apply a precision resistance of 15 ohms (with an accuracy of 0.01% or better) using a three wire link, to input terminals 3, 4 and 5. Wait 10 seconds, then press PAR.
5. Connect the RTD, return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat calibration.

100 OHM RTD Range Calibration

1. Set the Input Range Jumper to 100 ohm.
2. Use the arrow keys to display CodE 48 and press PAR. Then choose r · 100 and press PAR.
3. At r, apply a direct short to input terminals 3, 4 and 5 using a three wire link. Wait 10 seconds, then press PAR.
4. At r, apply a precision resistance of 300 ohms (with an accuracy of 0.01% or better) using a three wire link, to terminals 3, 4 and 5. Wait 10 seconds, press PAR.
5. Connect the RTD, return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat calibration.
**TROUBLESHOOTING**

<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 ENTER: Security code requested</td>
</tr>
<tr>
<td>MAX, MIN, TOT LOCKED-OUT</td>
<td>CHECK: Module 3 programming</td>
</tr>
<tr>
<td>INCORRECT INPUT DISPLAY VALUE</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level PERFORM: Module 9 Calibration (If the above does not correct the problem.)</td>
</tr>
<tr>
<td>&quot;OLOL&quot; in DISPLAY (SIGNAL HIGH)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>&quot;ULUL&quot; in DISPLAY (SIGNAL LOW)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>JITTERY DISPLAY</td>
<td>INCREASE: Module 1 filtering, rounding, input range CHECK: Wiring is per EMC installation guidelines</td>
</tr>
<tr>
<td>ERROR CODE (Err 1-4)</td>
<td>PRESS: Reset KEY (If cannot clear contact factory.)</td>
</tr>
</tbody>
</table>

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

**THERMOCOUPLE Range Calibration**

1. Use the arrow keys to display $PE& and press PAR. Then choose $E and press PAR.
2. At $D$, apply a dead short or set calibrator to zero to input terminals 4 and 5. Wait 10 seconds, then press PAR.
3. At $D$, apply 50.000 mV input signal (with an accuracy of 0.01% or better) to input terminals 4 and 5. Wait 10 seconds, then press PAR.
4. Return to the Display Mode.
5. Continue with Ice Point Calibration.

**ICE POINT Calibration**

1. The ambient temperature must be within 20°C to 30°C.
2. Connect a thermocouple (types T, E, J, K, or N only) with an accuracy of 1°C or better to the meter.
3. Verify the readout Display Offset is 0, Temperature Scale is °C, Display Resolution is 0.0, and the Input Range is set for the connected thermocouple.
4. Place the thermocouple in close thermal contact to a reference thermometer probe. (Use a reference thermometer with an accuracy of 0.25°C or better.)
   The two probes should be shielded from air movement and allowed sufficient time to equalize in temperature. (A calibration bath could be used in place of the thermometer.)
5. In the Normal Display mode, compare the readouts.
6. If a difference exists then continue with the calibration.
7. Enter Module 9, use the arrow keys to display $PE& and press PAR. Then choose $E and press PAR.
8. Calculate a new Ice Point value using: existing Ice Point value + (reference temperature - Display Mode reading). All values are based on °C.
9. Enter the new Ice Point value.
10. Return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat steps 8 through 10.
### Parameter Value Chart

**Programmer**: ________________  **Date**: ________  
**Meter#**: _____________  **Security Code**: ____________

#### 1-inp Signal Input Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>rANGE</td>
<td>INPUT RANGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tYPE</td>
<td>DP5: INPUT TYPE</td>
<td>k C - J</td>
<td></td>
</tr>
<tr>
<td>sCALE</td>
<td>DP5: TEMPERATURE SCALE</td>
<td>°F</td>
<td></td>
</tr>
<tr>
<td>dECpt</td>
<td>DISPLAY RESOLUTION</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>round</td>
<td>DISPLAY ROUNING INCREMENT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>OFFSt</td>
<td>DP5: DISPLAY OFFSET</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### 4-sec Secondary Function Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>h l-t</td>
<td>MAX CAPTURE DELAY TIME</td>
<td>0,1</td>
<td></td>
</tr>
<tr>
<td>lO-t</td>
<td>MIN CAPTURE DELAY TIME</td>
<td>0,1</td>
<td></td>
</tr>
<tr>
<td>dSP-t</td>
<td>DISPLAY UPDATE TIME</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>b-l lk</td>
<td>UNITS LABEL BACKLIGHT - DP5T</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFFSt</td>
<td>DISPLAY OFFSET - NOT DP5T</td>
<td>0,00</td>
<td></td>
</tr>
<tr>
<td>ICE</td>
<td>DP5T. ICE POINT COMPENSATION</td>
<td>ON</td>
<td></td>
</tr>
</tbody>
</table>

#### 5-tot Totalizer (Integrator) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>dECpt</td>
<td>TOTALIZER DECIMAL POINT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>bBASE</td>
<td>TOTALIZER TIME BASE</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>scFAC</td>
<td>TOTALIZER SCALE FACTOR</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Locut</td>
<td>TOTALIZER LOW CUT VALUE</td>
<td>-19999</td>
<td></td>
</tr>
<tr>
<td>P-up</td>
<td>TOTALIZER POWER-UP RESET</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

#### 2-fac 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>U5r - 1</td>
<td>USER INPUT 1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>F 1</td>
<td>FUNCTION KEY 1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>F 2</td>
<td>FUNCTION KEY 2</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>r 5t</td>
<td>RESET KEY</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SC - F 1</td>
<td>2nd FUNCTION KEY 1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SC - F 2</td>
<td>2nd FUNCTION KEY 2</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

#### 3-loc 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>M H</td>
<td>MAX DISPLAY LOCKOUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>M L0</td>
<td>MIN DISPLAY LOCKOUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>M L0b</td>
<td>TOTAL DISPLAY LOCKOUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>M codE</td>
<td>SECURITY CODE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

* Decimal point location is model dependent.
MODEL PAX – 1/8 DIN ANALOG INPUT PANEL METERS

MODELS: VOLT/CURRENT (PAXD)  PROCESS (PAXP)  AC TRUE RMS VOLT AND CURRENT (PAXH)  STRAIN GAGE (PAXS)  THERMOCOUPLE/RTD (PAXT)

- PROCESS, VOLTAGE, CURRENT, TEMPERATURE, AND STRAIN GAGE INPUTS
- 5-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- 16 POINT SCALING FOR NON-LINEAR PROCESSES
- PROGRAMMABLE FUNCTION KEYS/USER INPUTS
- 9 DIGIT TOTALIZER (INTEGRATOR) WITH BATCHING
- OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)
- CRIMSON PROGRAMMING SOFTWARE
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION

The PAX® Analog Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. Available in five different models to handle various analog inputs, including DC Voltage/Current, AC Voltage/Current, Process, Temperature, and Strain Gage Inputs. Refer to pages 4 through 6 for the details on the specific models. 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 unit is available with a red sunlight readable or a standard green LED. The intensity of display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The 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 signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow, calculate service intervals of motors or pumps, etc. The totalizer can also accumulate batch weighing operations.

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. 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 a Windows® based program. 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. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings.

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 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.

A linear DC output signal is available as an optional Plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings.

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

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

CAUTION: Risk of electric shock.
# Table of Contents

- Ordering Information ............................................... 2
- General Meter Specifications ................................. 3
- Universal DC Input Panel Meter ............................ 4
- Process Input Panel Meter ................................ 4
- AC True RMS Voltage and Current Meter ............ 5
- Strain Gage Input Panel Meter ............................. 5
- Thermocouple and RTD Input Meter .................... 6
- Optional Plug-In Cards ....................................... 7

- Installing the Meter ............................................ 8
- Setting the Jumpers ............................................ 8
- Wiring the Meter .............................................. 10
- Reviewing the Front Buttons and Display .......... 13
- Programming the Meter ...................................... 14
- Factory Service Operations ................................. 23
- Parameter Value Chart ....................................... 25
- Programming Overview ....................................... 27

## Ordering Information

**Meter Part Numbers**

<table>
<thead>
<tr>
<th>PAX</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
</table>

**TYPE**

- D - DC Volt/Current Input
- P - Process Input
- H - AC True RMS Volt/Current Input *
- S - Strain Gage/Bridge Input
- T - Thermocouple and RTD Input

**Description**

- 0 - Red, Sunlight Readable Display
- 1 - Green Display

- 0 - 85 to 250 VAC
- 1 - 11 to 36 VDC, 24 VAC

*PAXH is only available with 85-250 VAC power supply.

## 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>PAXCDC</td>
<td></td>
<td><strong>Optional Plug-In Cards</strong></td>
<td></td>
</tr>
<tr>
<td>PAXCDCS</td>
<td></td>
<td>- Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
</tr>
<tr>
<td></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 Sourcng Open Collector Output Card</td>
<td>PAXCDS40</td>
</tr>
<tr>
<td>PAXCD</td>
<td></td>
<td>- RS485 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Extended RS485 Serial Communications Output Card with Dual RJ11 Connector</td>
<td>PAXCDC1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- RS232 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Extended RS232 Serial Communications Output 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>PAXCDL</td>
<td></td>
<td>- Analog Output Card</td>
<td>PAXCDL10</td>
</tr>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory (Not required for PAXT)</td>
<td>PAXLBK10</td>
</tr>
<tr>
<td></td>
<td>SFCRD*</td>
<td>Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP</td>
<td>SFCRD200</td>
</tr>
</tbody>
</table>

*Crimson software is available for download from [http://www.redlion.net/](http://www.redlion.net/)*
GENERAL METER SPECIFICATIONS

1. DISPLAY: 5 digit, 0.56" (14.2 mm) red sunlight readable or standard green LEDs, (-19999 to 99999)

2. POWER:
   AC Versions:
   AC Power: 85 to 250 VAC, 50/60 Hz, 15 VA
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs.
   DC Versions (Not available on PAXH):
   DC Power: 11 to 36 VDC, 11 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. ANNUNCIATORS:
   MAX - maximum readout selected
   MIN - minimum readout selected
   TOT - totalizer readout selected, flashes when total overflows
   SP1 - setpoint alarm 1 is active
   SP2 - setpoint alarm 2 is active
   SP3 - setpoint alarm 3 is active
   SP4 - setpoint alarm 4 is active
   Units Label - optional units label backlight
   SP4 - setpoint alarm 4 is active
   SP3 - setpoint alarm 3 is active
   SP2 - setpoint alarm 2 is active
   SP1 - setpoint alarm 1 is active
   MIN - minimum readout selected
   MAX - maximum readout selected
   Display range: -19,999 to 99,999
   Units: Optional units label backlight

4. KEYPAD: 3 programmable function keys, 5 keys total

5. A/D CONVERTER: 16 bit resolution

6. UPDATE RATES:
   A/D conversion rate: 20 readings/sec.
   Step response: 200 msec. max. to within 99% of final readout value
   (digital filter and internal zero correction disabled)
   700 msec. max. (digital filter disabled, internal zero correction enabled)
   PAXT Only: 1 sec max. to within 99% of final readout value (digital filter disabled)
   Display update rate: 1 to 20 updates/sec.
   Setpoint output on/off delay time: 0 to 3275 sec.
   Analog output update rate: 0 to 10 sec
   Max./Min. capture delay time: 0 to 3275 sec.

7. DISPLAY MESSAGES:
   “OLOL” - Appears when measurement exceeds + signal range.
   “ULUL” - Appears when measurement exceeds - signal range
   PAXT: “SHRT” - Appears when shorted sensor is detected. (RTD only)
   “. . . . .” - Appears when no sensor is detected.
   “. . . . .” - Appears when display range exceeds + display range.
   “. . . . .” - Appears when display range exceeds - display range.
   “E . . . .” - Appears when totalizer exceeds 9 digits.
   “h . . . .” - Denotes the high order display of the Totalizer.

8. INPUT CAPABILITIES:
   See specific product specifications, pages 4-6

9. EXCITATION POWER:
   See specific product specifications, pages 4-6

10. LOW FREQUENCY NOISE REJECTION: (Does not apply to PAXH)
    Normal Mode: > 60 dB @ 50 or 60 Hz ±1%, digital filter off
    Common Mode: > 100 dB, DC to 120 Hz

11. USER INPUTS:
    Three programmable user inputs
    Max. Continuous Input: 30 VDC
    Isolation To Sensor Input Common: Not isolated. (Not PAXH)
    PAXH: Isolation to Sensor Input Common: 1400 Vrms for 1 min.
        Working Voltage: 125 V
        Response Time: 50 msec max.
        Logic State: Jumper selectable for sink/source logic input

12. TOTALIZER:
    Function:
    Time Base: second, minute, hour, or day
    Batch: Can accumulate (gate) input display from a user input
    Time Accuracy: 0.01% typical
    Decimal Point: 0 to 0.0000
    Scale Factor: 0.001 to 65,000
    Low Signal Cut-out: -19,999 to 99,999
    Total: 9 digits, display alternates between high order and low order readouts

13. CUSTOM LINEARIZATION:
    Data Point Pairs: Selectable from 2 to 16
    Display Range: -19,999 to 99,999
    Decimal Point: 0 to 0.0000
    PAXT: Ice Point Compensation: user value (0.00 to 650.00 μV/°C)

14. MEMORY: Nonvolatile E2PROM retains all programmable parameters and display values.

15. ENVIRONMENTAL CONDITIONS:
    Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in cards installed)
    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 25 g (10g relay), 11 msec in 3 directions.
    Storage Temperature Range: -40 to 60°C
    Operating and Storage Humidity: 0 to 85% max. RH non-condensing
    Altitude: Up to 2000 meters

16. CERTIFICATIONS AND COMPLIANCES:
    SAFETY
    UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
    PAXT Only: File #E156876, UL873, CSA C22.2 No. 24
    Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    Type 4X Enclosure rating (Face only), UL50
    IEC/UL CB Scheme Test Certificate #US8843A/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 I
    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
    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/m
    150 KHz - 80 MHz
    Simulation of cordless telephones ENV 50204
    Level 3; 10 V/m
    900 MHz ±25 MHz
    200 Hz, 50% duty cycle

    Emissions to EN 50081-2
    RF interference EN 55011
    Enclosure class A
    Power mains class A

    Notes:
    1. Self-recoverable loss of performance during EMI disturbance at 10 V/m:
       Measurement input and/or analog output signal may deviate during EMI disturbance.
    2. For operation without loss of performance:
       Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent)
       I/O and power cables are routed in metal conduit connected to earth ground.
       Refer to EMC Installation Guidelines section of the bulletin for additional information.

    17. 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 Nm) max.

    18. CONSTRUCTION:
        This unit is rated for NEMA 4X/IP65 outdoor use.

    WEIGHT: 10.4 oz. (295 g)
**MODEL PAXD - UNIVERSAL DC INPUT**

- **FOUR VOLTAGE RANGES** (300 VDC Max)
- **FIVE CURRENT RANGES** (2A DC Max)
- **THREE RESISTANCE RANGES** (10K Ohm Max)
- **SELECTABLE 24 V, 2 V, 1.75 mA EXCITATION**

**PAXD SPECIFICATIONS**

**INPUT RANGES:**

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±200 μADC</td>
<td>0.03% of reading +0.03 μA</td>
<td>0.12% of reading +0.04 μA</td>
<td>1.11 Kohm</td>
<td>15 mA</td>
<td>10 nA</td>
</tr>
<tr>
<td>±2 mAADC</td>
<td>0.03% of reading +0.3 μA</td>
<td>0.12% of reading +0.4 μA</td>
<td>111 ohm</td>
<td>50 mA</td>
<td>0.1 μA</td>
</tr>
<tr>
<td>±20 mAADC</td>
<td>0.03% of reading +3 μA</td>
<td>0.12% of reading +4 μA</td>
<td>11.1 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>±200 mAADC</td>
<td>0.05% of reading +30 μA</td>
<td>0.15% of reading +40 μA</td>
<td>1.1 ohm</td>
<td>500 mA</td>
<td>10 μA</td>
</tr>
<tr>
<td>±2 ADC</td>
<td>0.5% of reading +0.3 mA</td>
<td>0.7% of reading +0.4 mA</td>
<td>0.1 ohm</td>
<td>3 A</td>
<td>0.1 mA</td>
</tr>
<tr>
<td>±200 mVDC</td>
<td>0.03% of reading +30 μV</td>
<td>0.12% of reading +40 μV</td>
<td>1.066 Mohm</td>
<td>100 V</td>
<td>10 μV</td>
</tr>
<tr>
<td>±2 VDC</td>
<td>0.03% of reading +0.3 mV</td>
<td>0.12% of reading +0.4 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
<tr>
<td>±20 VDC</td>
<td>0.03% of reading +3 mV</td>
<td>0.12% of reading +4 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
<tr>
<td>±300 VDC</td>
<td>0.05% of reading +30 mV</td>
<td>0.15% of reading +40 mV</td>
<td>1.066 Mohm</td>
<td>300 V</td>
<td>10 mV</td>
</tr>
<tr>
<td>100 ohm</td>
<td>0.05% of reading +30 Mohm</td>
<td>0.2% of reading +40 Mohm</td>
<td>0.175 V</td>
<td>30 V</td>
<td>0.01 ohm</td>
</tr>
<tr>
<td>1000 ohm</td>
<td>0.05% of reading +0.3 ohm</td>
<td>0.2% of reading +0.4 ohm</td>
<td>1.75 V</td>
<td>30 V</td>
<td>0.1 ohm</td>
</tr>
<tr>
<td>10 kOhm</td>
<td>0.05% of reading +1 ohm</td>
<td>0.2% of reading +1.5 ohm</td>
<td>17.5 V</td>
<td>30 V</td>
<td>1 ohm</td>
</tr>
</tbody>
</table>

*After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

**EXCITATION POWER:**

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
Reference Voltage: 2 VDC, ±2%
Compliance: 1 kohm load min. (2 mA max.)
Temperature coefficient: 40 ppm/°C max.
Reference Current: 1.75 mAADC, ±2%
Compliance: 10 kohm load max.
Temperature coefficient: 40 ppm/°C max.

---

**MODEL PAXP - PROCESS INPUT**

- **DUAL RANGE INPUT** (20 mA or 10 VDC)
- **24 VDC TRANSMITTER POWER**

**PAXP SPECIFICATIONS**

**SENSOR INPUTS:**

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA (-2 to 26 mA)</td>
<td>0.03% of reading +2 μA</td>
<td>0.12% of reading +3 μA</td>
<td>20 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>10 VDC (-1 to 13 VDC)</td>
<td>0.03% of reading +2 mV</td>
<td>0.12% of reading +3 mV</td>
<td>500 Kohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

**EXCITATION POWER:**

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
MODEL PAXH - AC TRUE RMS VOLT AND CURRENT

• FOUR VOLTAGE RANGES (300 VAC Max)
• FIVE CURRENT RANGES (5 A Max)
• ACCEPTS AC OR DC COUPLED INPUTS
• THREE WAY ISOLATION: POWER, INPUT AND OUTPUTS

PAXH SPECIFICATIONS

INPUT RANGES:

Isolation To Option Card Commons and User Input Commons: 125 Vrms
Isolation To AC Power Terminals: 250 Vrms

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY*</th>
<th>IMPEDANCE (60 Hz)</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>MAX DC BLOCKING</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mV</td>
<td>±0.1% of reading +0.4 mV</td>
<td>686 Kohm</td>
<td>30 V</td>
<td>±10 V</td>
<td>0.01 mV</td>
</tr>
<tr>
<td>2 V</td>
<td>±0.1% of reading +2 mV</td>
<td>686 Kohm</td>
<td>30 V</td>
<td>±50 V</td>
<td>0.1 mV</td>
</tr>
<tr>
<td>20 V</td>
<td>±0.1% of reading +20 mV</td>
<td>686 Kohm</td>
<td>300 V</td>
<td>±300 V</td>
<td>1 mV</td>
</tr>
<tr>
<td>300 V</td>
<td>±0.2% of reading +0.3 V</td>
<td>686 Kohm</td>
<td>300 V</td>
<td>±300 V***</td>
<td>0.1 V</td>
</tr>
<tr>
<td>200 µA</td>
<td>±0.1% of reading +0.4 µA</td>
<td>1.11 Kohm</td>
<td>15 mA</td>
<td>±15 mA</td>
<td>0.01 µA</td>
</tr>
<tr>
<td>2 mA</td>
<td>±0.1% of reading +2 µA</td>
<td>111 ohm</td>
<td>50 mA</td>
<td>±50 mA</td>
<td>0.1 µA</td>
</tr>
<tr>
<td>20 mA</td>
<td>±0.1% of reading +20 µA</td>
<td>11.1 ohm</td>
<td>150 mA</td>
<td>±150 mA</td>
<td>1 µA</td>
</tr>
<tr>
<td>200 mA</td>
<td>±0.1% of reading +0.2 mA</td>
<td>1.1 ohm</td>
<td>500 mA</td>
<td>±500 mA</td>
<td>10 µA</td>
</tr>
<tr>
<td>5 A</td>
<td>±0.5% of reading +5 mA</td>
<td>0.02 ohm</td>
<td>7 A**</td>
<td>±7 A***</td>
<td>1 mA</td>
</tr>
</tbody>
</table>

*Conditions for accuracy specification:
- 20 minutes warmup
- 18-28°C temperature range, 10-75% RH non-condensing
- 50 Hz - 400 Hz sine wave input
- 1% to 100% of range
- Add 0.1% reading + 20 counts error over 0-50°C range
- Add 0.2% reading + 10 counts error for crest factors up to 3, add 1% reading up to 5
- Add 0.5% reading + 10 counts of DC component
- Add 1% reading + 20 counts error over 20 Hz to 10 KHz range

**Non-repetitive surge rating: 15 A for 5 seconds
***Inputs are direct coupled to the input divider and shunts. Input signals with high DC component levels may reduce the usable range.

MAX CREST FACTOR (Vp/Vrms): 5 @ Full Scale Input
INPUT COUPLING: AC or AC and DC
INPUT CAPACITANCE: 10 pF
COMMON MODE VOLTAGE: 125 VAC working
COMMON MODE REJECTION: (DC to 60 Hz) 100 dB

MODEL PAXS - STRAIN GAGE INPUT

• LOAD CELL, PRESSURE AND TORQUE BRIDGE INPUTS
• DUAL RANGE INPUT: ±24 mV OR ±240 mV
• SELECTABLE 5 VDC OR 10 VDC BRIDGE EXCITATION
• PROGRAMMABLE AUTO-ZERO TRACKING

PAXS SPECIFICATIONS

SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±24 mVDC</td>
<td>0.02% of reading +3 µV</td>
<td>0.07% of reading +4 µV</td>
<td>100 Mohm</td>
<td>30 V</td>
<td>1 µV</td>
</tr>
<tr>
<td>±240 mVDC</td>
<td>0.02% of reading +30 µV</td>
<td>0.07% of reading +40 µV</td>
<td>100 Mohm</td>
<td>30 V</td>
<td>10 µV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.
**MODEL PAXT - THERMOCOUPLE AND RTD INPUT**

**PAXT SPECIFICATIONS**

**READOUT:**
Resolution: Variable: 0.1, 0.2, 0.5, or 1, 2, or 5 degrees
Scale: F or C
Offset Range: -19,999 to 99,999 display units

**THERMOCOUPLE INPUTS:**
Input Impedance: 20 MΩ
Lead Resistance Effect: 0.03 μV/ohm
Max. Continuous Overvoltage: 30 V

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE</th>
<th>ACCURACY** (18 to 28°C)</th>
<th>ACCURACY** (0 to 50°C)</th>
<th>STANDARD</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>-200 to 400°C</td>
<td>1.2°C</td>
<td>2.1°C</td>
<td>ANSI</td>
<td>(+) white (-) red (+) white (-) blue</td>
</tr>
<tr>
<td>E</td>
<td>-200 to 671°C</td>
<td>1.0°C</td>
<td>2.4°C</td>
<td>ANSI</td>
<td>(+) purple (-) red (+) brown (-) blue</td>
</tr>
<tr>
<td>J</td>
<td>-200 to 760°C</td>
<td>1.1°C</td>
<td>2.3°C</td>
<td>ANSI</td>
<td>(+) white (-) red (+) yellow (-) blue</td>
</tr>
<tr>
<td>K</td>
<td>-200 to 1372°C</td>
<td>1.3°C</td>
<td>3.4°C</td>
<td>ANSI</td>
<td>(+) yellow (-) red (+) brown (-) blue</td>
</tr>
<tr>
<td>R</td>
<td>-50 to 1768°C</td>
<td>1.9°C</td>
<td>4.0°C</td>
<td>ANSI</td>
<td>no standard (+) white (-) blue</td>
</tr>
<tr>
<td>S</td>
<td>-50 to 1768°C</td>
<td>1.9°C</td>
<td>4.0°C</td>
<td>ANSI</td>
<td>no standard (+) white (-) blue</td>
</tr>
<tr>
<td>B</td>
<td>100 to 300°C</td>
<td>3.9°C</td>
<td>5.7°C</td>
<td>ANSI</td>
<td>no standard (+) white (-) blue</td>
</tr>
<tr>
<td>N</td>
<td>100 to 1300°C</td>
<td>1.3°C</td>
<td>3.1°C</td>
<td>ANSI</td>
<td>(+) orange (-) red (+) orange (-) blue</td>
</tr>
<tr>
<td>C</td>
<td>0 to 2315°C</td>
<td>1.9°C</td>
<td>6.1°C</td>
<td>ASTM</td>
<td>no standard no standard</td>
</tr>
</tbody>
</table>

*After 20 min. warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 15 to 75% RH environment; and Accuracy over a 0 to 50°C and 0 to 85% RH (non condensing) environment. Accuracy specified over the 0 to 50°C operating range includes meter tempco and ice point tracking effects. The specification includes the A/D conversion errors, linearization conformity, and thermocouple ice point compensation. Total system accuracy is the sum of meter tempco and ice point tracking effects. The accuracy over the interval -270 to -200°C is a function of temperature, ranging from 1°C at -200°C and degrading to 7°C at -270°C. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

**RTD INPUTS:**
Type: 3 or 4 wire, 2 wire can be compensated for lead wire resistance
Excitation current: 100 ohm range: 165 μA
10 ohm range: 2.6 mA
Lead resistance: 100 ohm range: 10 ohm/lead max.
10 ohm range: 3 ohms/lead max.
Max. continuous overload: 30 V

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE</th>
<th>ACCURACY** (18 to 28°C)</th>
<th>ACCURACY** (0 to 50°C)</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ohm Pt alpha = .00385</td>
<td>-200 to 850°C</td>
<td>0.4°C</td>
<td>1.6°C</td>
<td>IEC 751</td>
</tr>
<tr>
<td>100 ohm Pt alpha = .003919</td>
<td>-200 to 850°C</td>
<td>0.4°C</td>
<td>1.6°C</td>
<td>no official standard</td>
</tr>
<tr>
<td>120 ohm Nickel alpha = .00872</td>
<td>-80 to 260°C</td>
<td>0.2°C</td>
<td>0.5°C</td>
<td>no official standard</td>
</tr>
<tr>
<td>10 ohm Copper alpha = .00427</td>
<td>-100 to 260°C</td>
<td>0.4°C</td>
<td>0.9°C</td>
<td>no official standard</td>
</tr>
</tbody>
</table>

**CUSTOM RANGE:** Up to 16 data point pairs
Input range: -10 to 65 mV
0 to 400 ohms, high range
0 to 25 ohms, low range
Display range: -19999 to 99999

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>RANGE</th>
<th>ACCURACY** (18 to 28°C)</th>
<th>ACCURACY** (0 to 50°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom mV range</td>
<td>-10 to 65mV (1 μV res.)</td>
<td>0.02% of reading + 4μV</td>
<td>0.12% of reading + 5μV</td>
</tr>
<tr>
<td>Custom 100 ohm range</td>
<td>0 to 400 μA (10 μA res.)</td>
<td>0.02% of reading + 0.04 μA</td>
<td>0.12% of reading + 0.05 μA</td>
</tr>
<tr>
<td>Custom 10 ohm range</td>
<td>0 to 25 μA (1 μA res.)</td>
<td>0.04% of reading + 0.005 μA</td>
<td>0.26% of reading + 0.007 μA</td>
</tr>
</tbody>
</table>

**CUSTOM SCALING FOR NON-STANDARD PROBES**
**THERMOCOUPLE AND RTD INPUT**
**CONFORMS TO ITS-90 STANDARDS**
**CUSTOM LABELS**
**TEMPERATURE INTEGRATOR**

**ACCESSORIES**

UNIT LABEL KIT (PAXLBK) - Not required for PAXT
Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled in the programming.
Each PAXT meter is shipped with °F and °C overlay labels which can be installed into the meter’s bezel display assembly.

EXTERNAL CURRENT SHUNTS (APSCM)
To measure DC current signals greater than 2 ADC, a shunt must be used. The APSCM010 current shunt converts a maximum 10 ADC signal into 100.0 mV. The APSCM100 current shunt converts a maximum 100 ADC signal into 100.0 mV. The continuous current through the shunt is limited to 115% of the rating.
Optional Plug-in Output Cards

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

Adding Option Cards

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

PAXH Isolation Specifications For All Option Cards

<table>
<thead>
<tr>
<th>Isolation To Sensor Commons</th>
<th>1400 VRms for 1 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Voltage</td>
<td>125 V</td>
</tr>
<tr>
<td>Isolation to User Input Commons</td>
<td>500 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V</td>
</tr>
</tbody>
</table>

Communications 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 RLCPro, a Windows® based program, the RS232 or RS485 Cards must be used.

- PAXCDC10 - RS485 Serial
- PAXCDC20 - RS232 Serial
- PAXCDC30 - DeviceNet

Serial Communications Card

<table>
<thead>
<tr>
<th>Type</th>
<th>RS485 or RS232</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>500 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V. Not isolated from all other commons.</td>
</tr>
<tr>
<td>Data</td>
<td>7/8 bits</td>
</tr>
<tr>
<td>Baud</td>
<td>300 to 19,200</td>
</tr>
<tr>
<td>Parity</td>
<td>No, odd or even</td>
</tr>
<tr>
<td>Bus Address</td>
<td>Selectable 0 to 99, Max. 32 meters per line (RS485)</td>
</tr>
<tr>
<td>Transmit Delay</td>
<td>Selectable from 2 to 50 msec or 50 to 100 msec (RS485)</td>
</tr>
</tbody>
</table>

DeviceNet™ Card

| Compatibility | Group 2 Server only, not UCMC capable |
| Baud Rates | 125 Kbd, 250 Kbd, and 500 Kbd |
| Bus Interface | Phillips 82C230 or equivalent MIBS 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

<table>
<thead>
<tr>
<th>Type</th>
<th>RS485, RTU and ASCII MODBUS modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>500 VRms for 1 minute.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V. Not isolated from all other commons.</td>
</tr>
<tr>
<td>Baud Rates</td>
<td>300 to 38400</td>
</tr>
<tr>
<td>Data</td>
<td>7/8 bits</td>
</tr>
<tr>
<td>Parity</td>
<td>No, Odd, or Even</td>
</tr>
<tr>
<td>Addresses</td>
<td>1 to 247</td>
</tr>
<tr>
<td>Transmit Delay</td>
<td>Programmable; See Transmit Delay explanation.</td>
</tr>
</tbody>
</table>

Profibus-DP Card

| Fieldbus Type | Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASCII |
| 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 input common. Not isolated from all other commons. |

Programming Software

The Crimson® software is a Windows® based program that allows configuration of the PAX® meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter’s program can then be saved in a PC file for future use. A PAX® serial plug-in card 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 sinking NPN open collector
- PAXCDS40 - Isolated sinking sourcing PNP open collector

Dual Relay Card

<table>
<thead>
<tr>
<th>Type</th>
<th>Two FORM-C relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>2000 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>240 VRms</td>
</tr>
<tr>
<td>Contact Rating</td>
<td>One Relay Energized: 5 amps @ 120/240 VAC or 30 VDC (resistive load), 1/8 HP @ 120 VAC, inductive load</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads</td>
</tr>
</tbody>
</table>

Quad Relay Card

<table>
<thead>
<tr>
<th>Type</th>
<th>Four FORM-A relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>2300 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>250 VRms</td>
</tr>
<tr>
<td>Contact Rating</td>
<td>One Relay Energized: 3 amps @ 240 VAC or 30 VDC (resistive load), 1/10 HP @ 120 VAC, inductive load</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads</td>
</tr>
</tbody>
</table>

Quad Sinking Open Collector Card

<table>
<thead>
<tr>
<th>Type</th>
<th>Four isolated sinking NPN transistors.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>500 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V. Not isolated from all other commons.</td>
</tr>
<tr>
<td>Rating</td>
<td>100 mA max @ VSA = 0.7 V max, VMAX = 30 V</td>
</tr>
</tbody>
</table>

Quad Sourcing Open Collector Card

<table>
<thead>
<tr>
<th>Type</th>
<th>Four isolated sourcing PNP transistors.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>500 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V. Not isolated from all other commons.</td>
</tr>
<tr>
<td>Rating</td>
<td>Internal supply: 24 VDC ± 10%, 30 mA max. total</td>
</tr>
<tr>
<td>External supply: 30 VDC max., 100 mA max. each output</td>
<td></td>
</tr>
</tbody>
</table>

All Four Setpoint Cards

<table>
<thead>
<tr>
<th>Response Time</th>
<th>200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>700 msec. max. (digital filter disabled, internal zero correction enabled)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Types</th>
<th>0 to 20 mA, 4 to 20 mA or 0 to 10 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation To Sensor &amp; User Input Commons</td>
<td>500 VRms for 1 min.</td>
</tr>
<tr>
<td>Working Voltage</td>
<td>50 V. Not isolated from all other commons.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.17% of FS (18 to 28°C); 0.4% of FS (0 to 50°C)</td>
</tr>
<tr>
<td>Resolution</td>
<td>1/3500</td>
</tr>
<tr>
<td>Compliance</td>
<td>10 VDC: 10 KΩ load min., 20 mA; 500 Ω load max.</td>
</tr>
<tr>
<td>Powered</td>
<td>Self-powered</td>
</tr>
<tr>
<td>Update time</td>
<td>200 msec. max. to within 99% of final output value (digital filter and internal zero correction disabled)</td>
</tr>
<tr>
<td>700 msec. max. (digital filter disabled, internal zero correction enabled)</td>
<td></td>
</tr>
</tbody>
</table>
1.0 Installing the Meter

Installation

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

Insert the unit into the panel cutout.

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

Installation Environment

The unit should be installed in a location that does not exceed the 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 Jumpers

The meter can have up to four jumpers that must be checked and / or changed prior to applying power. The following Jumper Selection Figures show an enlargement of the jumper area.

To access the jumpers, 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.

Input Range Jumper

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum input to avoid overloads. The selection is different for each meter. See the Jumper Selection Figure for appropriate meter.

Excitation Output Jumper

If your meter has excitation, this jumper is used to select the excitation range for the application. If excitation is not being used, it is not necessary to check or move this jumper.

User Input Logic Jumper

This jumper selects the logic state of all the user inputs. If the user inputs are not used, it is not necessary to check or move this jumper.

PAXH: Signal Jumper

This jumper is used to select the signal type. For current signals, the jumper is installed. For voltage signals, remove the jumper from the board. (For 2 V inputs, this removed jumper can be used in the “2 V only” location.)

Couple Jumper

This jumper is used for AC / DC couple. If AC couple, then the jumper is removed from the board. If DC couple is used, then the jumper is installed.

PAXD Jumper Selection

Input Range Jumper

One jumper is used for voltage/ohms or current input ranges. Select the proper input range high enough to avoid input signal overload. Only one jumper is allowed in this area. Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing the jumper across two ranges.
PAXP Jumper Selection

**JUMPER SELECTIONS**
The □ indicates factory setting.

**USER INPUT Logic JUMPER**

- □ SINK
- □ SOURCE

**Main Circuit Board**

**JUMPER SELECTIONS**
The □ indicates factory setting.

**PAXH Jumper Selection**

**CAUTION:** To maintain the electrical safety of the meter, remove unneeded jumpers completely from the meter. Do not move the jumpers to positions other than those specified.

**Signal Jumper**
One jumper is used for the input signal type. For current signals, the jumper is installed. For voltage signals, remove the jumper from the board. (For 2 V inputs, this removed jumper can be used in the “2 V only” location.)

**Couple Jumper**
One jumper is used for AC/DC couple. If AC couple is used, then the jumper is removed from the board. If DC couple is used, then the jumper is installed.

**Input Range Jumper**
For most inputs, one jumper is used to select the input range. However, for the following ranges, set the jumpers as stated:
- **5 A:** Remove all jumpers from the input range.
- **2 V:** Install one jumper in “2/2V” position and one jumper in “2 V only”.
- **All Other Ranges:** One jumper in the selected range only.

Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing a jumper across two ranges.

**PAXS Jumper Selection**

**Bridge Excitation**
One jumper is used to select bridge excitation to allow use of the higher sensitivity 24 mV input range. Use the 5 V excitation with high output (3 mV/V) bridges. The 5 V excitation also reduces bridge power compared to 10 V excitation.

A maximum of four 350 ohm load cells can be driven by the internal bridge excitation voltage.

**JUMPER SELECTIONS**
The □ indicates factory setting.

---

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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 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 mm²), two #18 AWG (1.02 mm²), or four #20 AWG (0.61 mm²).

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, its source or the method of coupling into the unit may be different for various installations. 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. With use of the lower input ranges or signal sources with high source impedance, the use of shielded cable may be necessary. This helps to guard against stray AC pick-up. Attach the shield to the input common of the meter. Line voltage monitoring and 5A CT applications do not usually require shielding.
3. To minimize potential noise problems, power the meter from the same power branch, or at least the same phase voltage as that of the signal source.
4. 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.
5. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
6. 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 #1443167251 (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.
7. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
8. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubber: RLC#SNUB0000.

3.1 Power Wiring

<table>
<thead>
<tr>
<th>AC Power</th>
<th>DC Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 1: VAC</td>
<td>Terminal 1: +VDC</td>
</tr>
<tr>
<td>Terminal 2: VAC</td>
<td>Terminal 2: -VDC</td>
</tr>
</tbody>
</table>

RTD Input Jumper

One jumper is used for RTD input ranges. Select the proper range to match the RTD probe being used. It is not necessary to remove this jumper when not using RTD probes.

Jumper Selections

The /\ indicates factory setting.
3.2 INPUT SIGNAL WIRING

PAXD INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper and Excitation Jumper should be verified for proper position.

Voltage Signal (self powered)
Terminal 3: +VDC
Terminal 5: -VDC

Current Signal (self powered)
Terminal 4: +ADC
Terminal 5: -ADC

Current Signal (2 wire requiring excitation)
Terminal 4: -ADC
Terminal 6: +ADC
Excitation Jumper: 24 V

Current Signal (3 wire requiring excitation)
Terminal 4: +ADC (signal)
Terminal 5: -ADC (common)
Terminal 6: +Volt supply
Excitation Jumper: 24 V

Voltage Signal (3 wire requiring excitation)
Terminal 3: +VDC (signal)
Terminal 5: -VDC (common)
Terminal 6: +Volt supply
Excitation Jumper: 24 V

Resistance Signal (3 wire requiring excitation)
Terminal 3: Resistance
Terminal 5: Resistance
Terminal 6: Jumper to terminal 3
Excitation Jumper: 1.75 mA REF.

Potentiometer Signal (3 wire requiring excitation)
Terminal 3: Wiper
Terminal 5: Low end of pot.
Terminal 6: High end of pot.
Excitation Jumper: 2 V REF.
Input Range Jumper: 2 Volt
Module 1 Input Range: 2 Volt
Note: The Apply signal scaling style should be used because the signal will be in volts.

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 voltages; or input common must be at protective earth ground potential. If not, hazardous live 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 common; and the common of the isolated plug-in cards with respect to input common.

PAXP INPUT SIGNAL WIRING

Voltage Signal (self powered)
Terminal 3: +VDC
Terminal 5: -VDC

Current Signal (self powered)
Terminal 4: +ADC
Terminal 5: -ADC

Current Signal (2 wire requiring excitation)
Terminal 4: -ADC
Terminal 6: +ADC

Current Signal (3 wire requiring excitation)
Terminal 4: +ADC (signal)
Terminal 5: -ADC (common)
Terminal 6: +Volt supply

Voltage Signal (3 wire requiring excitation)
Terminal 3: +VDC (signal)
Terminal 5: -VDC (common)
Terminal 6: +Volt supply

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 voltages; or input common must be at protective earth ground potential. If not, hazardous live 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 common; and the common of the isolated plug-in cards with respect to input common.
DEADLOAD COMPENSATION

In some cases, the combined deadload and liveload output may exceed the range of the 24 mV input. To use this range, the output of the bridge can be offset a small amount by applying a fixed resistor across one arm of the bridge. This shifts the electrical output of the bridge downward to within the operating range of the meter. A 100 K ohm fixed resistor shifts the bridge output approximately -10 mV (350 ohm bridge, 10 V excitation).

Connect the resistor between +SIG and -SIG. Use a metal film resistor with a low temperature coefficient of resistance.

BRIDGE COMPLETION RESISTORS

For single strain gage applications, bridge completion resistors must be employed externally to the meter. Only use metal film resistors with a low temperature coefficient of resistance.

Load cells and pressure transducers are normally implemented as full resistance bridges and do not require bridge completion resistors.

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

CAUTION: Connect only one input signal range to the meter. Hazardous signal levels may be present on unused inputs.

CAUTION: The isolation rating of the input common of the meter with respect to the option card commons and the user input common Terminal 8 (If used) is 125 Vrms; and 250 Vrms with respect to AC Power (meter Terminals 1 & 2). To be certain that the ratings are not exceeded, these voltages should be verified by a high-voltage meter before wiring the meter.

CAUTION:

1. Where possible, connect the neutral side of the signal (including current shunts) to the input common of the meter. If the input signal is sourced from an active circuit, connect the lower impedance (usually circuit common) to the input signal common of the meter.

2. For phase-to-phase line monitoring where a neutral does not exist, or for any other signal input in which the isolation voltage rating is exceeded, an isolating potential transformer must be used to isolate the input voltage from earth. With the transformer, the input common of the meter can then be earth referenced for safety.

3. When measuring line currents, the use of a current transformer is recommended. If using external current shunts, insert the shunt in the neutral return line. If the isolation voltage rating is exceeded, the use of an isolating current transformer is necessary.

PAXS INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

PAXH INPUT SIGNAL WIRING

Before connecting signal wires, the Signal, Input Range and Couple Jumpers should be verified for proper position.
3.3 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using User Inputs, then skip this section. Only the appropriate User Input terminal has to be wired.

**Sinking Logic**

Terminal 8-10: Connect external switching device between appropriate User Input terminal and User Comm.

Terminal 7:  

In this logic, the user inputs of the meter are internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0.9 V).

---

**Sourcing Logic**

Terminal 8-10: + VDC thru external switching device

Terminal 7: -VDC thru external switching device

In this logic, the user inputs of the meter are internally pulled down to 0 V with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

---

PAXH ONLY

**Sinking Logic**

Terminals 9-11: Connect external switching device between appropriate User Input terminal and User Comm.

Terminal 8:  

In this logic, the user inputs of the meter are internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0.9 V).

---

**Sourcing Logic**

Terminals 9-11:

+ VDC through external switching device

Terminal 8:

-VDC through external switching device

In this logic, the user inputs of the meter are internally pulled down with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

---

3.4 SETPOINT (ALARMS) WIRING  
3.5 SERIAL COMMUNICATION WIRING  
3.6 ANALOG OUTPUT WIRING

See appropriate plug-in card bulletin for details.

---

4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

Display Readout Legends*  

Optional Custom Units Overlay  

Setpoint Alarm Annunciators

**KEY**  

**DISPLAY MODE OPERATION**

- **D**SP: Index display through max/min/total/input readouts  
- **P**AR: Access parameter list  
- **F**1: Function key 1; hold for 3 seconds for Second Function 1**  
- **F**2: Function key 2; hold for 3 seconds for Second Function 2**  
- **R**ST: Reset (Function key)**

**PROGRAMMING MODE OPERATION**

- Quit programming and return to display mode  
- Store selected parameter and index to next parameter  
- Increment selected parameter value  
- Decrement selected parameter value  
- Hold with F1, F2 to scroll value by x1000

* Display Readout Legends may be locked out in Factory Settings.

** Factory setting for the F1, F2, and RST keys is NO mode.
5.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

DISPLAY MODE
The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown; Max Value (MAX), Min Value (MIN), or Totalizer Value (TOT). Each of these displays can be locked from view through programming. (See Module 3.) The Input Display Value is shown with no annunciator.

PROGRAMMING MODE
Two programming modes are available.

Full Programming Mode permits all parameters to be viewed and modified. Upon entering this mode, the front panel keys change to Programming Mode operations. This mode should not be entered while a process is running, since the meter functions and User Input response may not operate properly while in Full Programming Mode.

Quick Programming Mode permits only certain parameters to be viewed and/or modified. When entering this mode, the front panel keys change to Programming Mode operations, and all meter functions continue to operate properly. Quick Programming Mode is configured in Module 3. The Display Intensity Level “ª-³ª” parameter is available in the Quick Programming Mode only when the security code is non-zero. For a description, see Module 9—Factory Service Operations. Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming Mode.

PROGRAMMING TIPS
The Programming Menu is organized into nine modules (See above). These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. Note that Modules 6 through 8 are only accessible when the present module (initially Pr) and the present module (initially Pr) are used to select the desired module, which is then entered by pressing the PAR key.

PROGRAMMING MODE ENTRY (PAR KEY)
Upon entering the Programming Mode, the display alternates between Pr and the present module (initially Pr). The arrow keys (F1 and F2) are used to sequence through the list of selections, the arrow keys (F1 and F2) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

MODULE ENTRY (ARROW & PAR KEYS)
Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. 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 Pr Pr. From this point, programming may continue by selecting and entering additional modules. (See MODULE ENTRY above.)

PARAMETER SELECTION ENTRY (ARROW & PAR KEYS)
For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1 and F2) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

STEP BY STEP PROGRAMMING INSTRUCTIONS:

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)
For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The RST key can be used in combination with the arrow keys to enter large numerical values. When the RST key is pressed along with an arrow key, the display scrolls by 1000’s. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr Pr)
The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr Pr displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

FACTORY SETTINGS
Factory Settings may be completely restored in Module 9. This is a good starting point if encountering programming problems. Throughout the module description sections which follow, the factory setting for each parameter is shown below the parameter display. In addition, all factory settings are listed on the Parameter Value Chart following the programming section.

ALTERNATING SELECTION DISPLAY
In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternating between the parameter (top display) and the parameter's Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.

PROGRAMMING MENU

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)
For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The RST key can be used in combination with the arrow keys to enter large numerical values. When the RST key is pressed along with an arrow key, the display scrolls by 1000’s. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr Pr)
The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr Pr displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)
5.1 MODULE 1 - SIGNAL INPUT PARAMETERS (I-1 MP)

PAXH INPUT RANGE

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

PAXS INPUT RANGE

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

PAX INPUT TYPE

Select the input type that corresponds to the input sensor. For RTD types, check the RTD Input Jumper for matching selection. For custom types, the Temperature Scale parameter is not available, the Display Decimal Point is expanded, and Custom Sensor Scaling must be completed.

PAX TEMPERATURE SCALE

Select the temperature scale. This selection applies for Input, MAX, MIN, and TOT displays. This does not change the user installed Custom Units Overlay display. If changed, those parameters that relate to the temperature scale should be checked. This selection is not available for custom sensor types.

DISPLAY DECIMAL POINT

Select the decimal point location for the Input, MAX and MIN displays. (The TOT display decimal point is a separate parameter.) This selection also affects round, DSP1 and DSP2 parameters and setpoint values.

The input signal can be either AC coupled (rejecting the DC components of the signal) or DC coupled (measures both the AC and DC components of the signal). The coupling jumper and the setting of this parameter must match.
DISPLAY ROUNDEDING*

Rounding selections other than one, cause the Input Display to 'round' to the nearest rounding increment selected (ie. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection.

PAXT: TEMPERATURE DISPLAY OFFSET*

The temperature display can be corrected with an offset value. This can be used to compensate for probe errors, errors due to variances in probe placement or adjusting the readout to a reference thermometer. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the affects of offset.

FILTER SETTING*

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of '0' disables filtering.

FILTER BAND*

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units. A band setting of '0' keeps the digital filter permanently engaged.

For the PAXT, the following parameters only apply to Custom Sensor Scaling.

PAXT: ICE POINT SLOPE

This parameter sets the slope value for ice point compensation for the Custom TC range (the) only. The fixed thermocouple ranges are automatically compensated by the meter and do not require this setting. To calculate this slope, use \( \mu V \) data obtained from thermocouple manufacturers' tables for two points between 0°C and 50°C. Place this corresponding \( \mu V \) and °C information into the equation:

\[
\text{slope} = \left( \frac{\mu V_2 - \mu V_1}{\text{°C}_2 - \text{°C}_1} \right)
\]

Due to the nonlinear output of thermocouples, the compensation may show a small offset error at room temperatures. This can be compensated by the offset parameter. A value of 0 disables internal compensation when the thermocouple is externally compensated.

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

SCALING POINTS*

Linear - Scaling Points (2)

For linear processes, only 2 scaling points are necessary. It is recommended that the 2 scaling points be at opposite ends of the input signal being applied. The points do not have to be the signal limits. Display scaling will be linear between and continue past the entered points up to the limits of the Input Signal Jumper position. Each scaling point has a coordinate-pair of Input Value (Input) and an associated desired Display Value (Display). Data from tables or equations, or empirical data could be used to derive the required number of segments and data values for the coordinate pairs. In the SF Pax software, several linearization equations are available.

SCALING STYLE

This parameter does not apply for the PAXT. Scaling values for the PAXT must be keyed-in.

INPUT VALUE FOR SCALING POINT 1

For Key-in (Key-in), enter the known first Input Value by using the arrow keys. The Input Range selection sets up the decimal location for the Input Value. With 0.02a Input Range, 4mA would be entered as 4.000. For Apply (Apply), apply the input signal to the meter, adjust the signal source externally until the next scaling point is reached.

Note: Apply style - Pressing the RST key will advance the display to the next scaling display point without storing the input value.

DISPLAY VALUE FOR SCALING POINT 1

Enter the first coordinating Display Value by using the arrow keys. This is the same for Key-in and Apply scaling styles. The decimal point follows the selection.

INPUT VALUE FOR SCALING POINT 2

For Key-in (Key-in), enter the known second Input Value by using the arrow keys. For Apply (Apply), adjust the signal source externally until the next desired Input Value appears. (Follow the same procedure if using more than 2 scaling points.)
DISPLAY VALUE FOR SCALING POINT 2

-19999 to 99999

Enter the second coordinating Display Value by using the arrow keys. This is the same for ³EY and ³PLY scaling styles. (Follow the same procedure if using more than 2 scaling points.)

General Notes on Scaling
1. Input Values for scaling points should be confined to the limits of the Input Range Jumper position.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA can not equal 0 and 10.) This is referred to as read out jumps (vertical scaled segments).
3. The same Display Value can correspond to more than one Input Value. (Example: 0 mA and 20 mA can equal 10.) This is referred to as readout dead zones (horizontal scaled segments).

5.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FKC)

The three user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state.

The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed the instant the key is pressed. Holding the function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function.

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 will be performed every time any of those user inputs or function keys transition to the active state.

Note: In the following explanations, not all selections are available for both user inputs and front panel function keys. Alternating displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. USr - 1 will represent all three user inputs. F 1 will represent all five function keys.

4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65,535. For example using +20 mA range the maximum +20 mA can be scaled to is 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for 65,535 (32,767 x 2) but with even Input Display values shown.

5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs (INP 1 / dSP 1 & INP 2 / dSP 2). If INP 1 = 4 mA and dSP 1 = 0, then 0 mA would be some negative Display Value. This could be prevented by making INP 1 = 0 mA / dSP 1 = 0, dSP 2 = 4 mA / dSP 2 = 0, with INP 2 = 20 mA / dSP 3 = the desired high Display Value. The calculations stop at the limits of the Input Range Jumper position.

6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the last two sequential coordinate pairs. If three coordinate pair scaling points were entered, then the Display Value calculation would be between INP 2 / dSP 2 & INP 3 / dSP 3. The calculations stop at the limits of the Input Range Jumper position.

NO FUNCTION

No function is performed if activated. This is the factory setting for all user inputs and function keys. No function can be selected without affecting basic start-up.

PROGRAMMING MODE LOCK-OUT

Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.

ZERO (TARE) DISPLAY

The Zero (Tare) Display provides a way to zero the Input Display value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), ³ESTK flashes and the Display is set to zero. At the same time, the Display value (that was on the display before the Zero Display) is subtracted from the Display Offset Value and is automatically stored as the new Display Offset Value (⁶FF⁵). If another Zero (tare) Display is performed, the display will again change to zero and the Display reading will shift accordingly.

RELATIVE/ABSOLUTE DISPLAY

This function will switch the Input Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input Display will normally show the Absolute unless switched by this function. Regardless of the display selected, all meter functions continue to operate based on relative values. The Absolute is a gross value (based on Module 1 DSP and INP entries) without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input display switches back to Relative display. ³ES (absolute) or ³EL (relative) is momentarily displayed at transition to indicate which display is active.
**HOLD DISPLAY**
The shown display is held but all other meter functions continue as long as activated (maintained action).

**HOLD ALL FUNCTIONS**
The meter disables processing the input, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

**SYNCHRONIZE METER READING**
The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

**STORE BATCH READING IN TOTALIZER**
The Input Display value is one time added (batched) to the Totalizer at transition to activate (momentary action). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.

**SELECT TOTALIZER DISPLAY**
The Totalizer display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The DSP key overrides the active user input display but not the Maximum function.

**RESET TOTALIZER**
When activated (momentary action), the Maximum and Minimum resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

**RESET AND ENABLE TOTALIZER**
When activated (momentary action), the Totalizer stops and holds its value. This selection functions independent of the selected display.

**ENABLE TOTALIZER**
The Totalizer continues to operate as long as activated (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

**SELECT MAXIMUM DISPLAY**
The Maximum display is selected as long as activated (maintained action). When the user input is released, the Input Display returns. The DSP key overrides the active user input. The Maximum continues to function independent of being displayed.

**SELECT MINIMUM DISPLAY**
The Minimum display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The DSP key overrides the active user input. The Minimum continues to function independent of being displayed.

**RESET MINIMUM**
When activated (momentary action), the Minimum value is set to the present Input Display value. The Maximum function then continues from that value. This selection functions independent of the selected display.

**RESET MAXIMUM AND MINIMUM**
When activated (momentary action), the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

**RESET, SELECT, ENABLE MAXIMUM DISPLAY**
When activated (momentary action), the Maximum value is set to the present Input Display value. Maximum continues from that value while active (maintained action). When the user input is released, Maximum detection stops and holds its value. This selection functions independent of the selected display. The DSP key overrides the active user input display but not the Maximum function.

**RESET, SELECT, ENABLE MINIMUM DISPLAY**
When activated (momentary action), the Minimum value is set to the present Input Display value. Minimum continues from that value while active (maintained action). When the user input is released, Minimum detection stops and holds its value. This selection functions independent of the selected display. The DSP key overrides the active user input display but not the Minimum function.

**CHANGE DISPLAY INTENSITY LEVEL**
When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEU) settings of 0, 3, 8, and 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.
SETPOINT SELECTIONS

The following selections are accessible only with the Setpoint plug-in card installed. Refer to the Setpoint Card Bulletin shipped with the Setpoint plug-in card for an explanation of their operation.

- **LSE** - Select main or alternate setpoints
- **r 1** - Reset Setpoint 1 (Alarm 1)
- **r 2** - Reset Setpoint 2 (Alarm 2)
- **r 3** - Reset Setpoint 3 (Alarm 3)
- **r 4** - Reset Setpoint 4 (Alarm 4)
- **r 34** - Reset Setpoint 3 & 4 (Alarm 3 & 4)
- **r 234** - Reset Setpoint 2, 3 & 4 (Alarm 2, 3 & 4)
- **r ALL** - Reset Setpoint All (Alarm All)

The following selections are accessible only with the Setpoint plug-in card installed. Refer to the Setpoint Card Bulletin shipped with the Setpoint plug-in card for an explanation of their operation.

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

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.

### PARAMETER MENU

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>

### SELECTIONS

- **r Ed** - Visible in Display Mode
- **En** - Visible and changeable in Quick Programming Mode
- **Loc** - Not visible in Quick Programming Mode

“Full” Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the **PAR** key is pressed, the meter enters a Quick Programming Mode. In this mode, the setpoint values can still be read and/or changed per the selections below. The Display Intensity Level (**dEd**) parameter also appears whenever Quick Programming Mode is enabled and the security code is greater than zero.

### SECURITY CODE

- **COD**
- **D**

### PROGRAMMING MODE ACCESS

<table>
<thead>
<tr>
<th>Security Code</th>
<th>User Input Configured</th>
<th>User Input State</th>
<th>When PAR Key is Pressed</th>
<th>“FULL” Programming Mode Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>not LDC</td>
<td>—</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>not LDC</td>
<td>—</td>
<td>Quick Programming w/Display Intensity</td>
<td>After Quick Programming with correct code # at Code prompt.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>LDC</td>
<td>Active</td>
<td>Quick Programming w/Display Intensity</td>
<td>After Quick Programming with correct code # at Code prompt.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>LDC</td>
<td>Not Active</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
<tr>
<td>0</td>
<td>LDC</td>
<td>Active</td>
<td>Quick Programming</td>
<td>No access</td>
</tr>
<tr>
<td>0</td>
<td>LDC</td>
<td>Not Active</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
</tbody>
</table>

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

PRINT REQUEST

The meter issues a block print through the serial port when activated. The data transmitted during a print request is programmed in Module 7. If the user input is still active after the transmission is complete (about 100 msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.

PROGRAM MODE SECURITY CODE

By entering any non-zero value, the prompt **CodE 0** will appear when trying to access the Program 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.
5.4 MODULE 4 - SECONDARY FUNCTION PARAMETERS (4-SEC)

**MAX CAPTURE DELAY TIME**

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

**MIN CAPTURE DELAY TIME**

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

**DISPLAY UPDATE RATE**

This parameter determines the rate of display update. When set to 20 updates/second, the internal re-zero compensation is disabled, allowing for the fastest possible output response.

**PAXS: AUTO-ZERO TRACKING**

The meter can be programmed to automatically compensate for zero drift. Drift may be caused by changes in the transducers or electronics, or accumulation of material on weight systems.

Auto-zero tracking operates when the readout remains within the tracking band for a period of time equal to the tracking delay time. When these conditions are met, the meter re-zeroes the readout. After the re-zero operation, the meter resets and continues to auto-zero track.

The auto-zero tracking band should be set large enough to track normal zero drift, but small enough to not interfere with small process inputs.

For filling operations, the fill rate must exceed the auto-zero tracking rate. This avoids false tracking at the start of the filling operation.

Auto-zero tracking is disabled by setting the auto-zero tracking parameter = 0.

**PAXS: AUTO-ZERO BAND**

This parameter determines the range of the auto-zero tracking band. It is expressed in increments of 0.02.

**UNIT LABEL BACKLIGHT**

The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed into the meter’s bezel display assembly. The backlight for these custom units is activated by this parameter.

**DISPLAY OFFSET VALUE**

This parameter does not apply for the PAXT.

**PAXT: ICE POINT COMPENSATION**

This parameter turns the internal ice point compensation on or off. Normally, the ice point compensation is on. If using external compensation, set this parameter to off. In this case, use copper leads from the external compensation point to the meter. If using Custom TC range, the ice point compensation can be adjusted by a value in Module 1 when this is yes.

* Factory Setting can be used without affecting basic start-up.
The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide a readout of temperature integration, useful in curing and sterilization applications. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

**TOTALIZER DECIMAL POINT**

For most applications, this matches the Input Display Decimal Point \(\text{dECPl}\). If a different location is desired, refer to Totalizer Scale Factor.

**TOTALIZER TIME BASE**

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

**TOTALIZER SCALE FACTOR**

For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities are:

1. Changing decimal point location (example tenths to whole)
2. Average over a controlled time frame.

Details on calculating the scale factor are shown later.

If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

**TOTALIZER LOW CUT VALUE**

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

**TOTALIZER POWER UP RESET**

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

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

**TOTALIZER HIGH ORDER DISPLAY**

When the total exceeds 5 digits, the front panel annunciator TOT flashes. In this case, the meter continues to totalize up to a 9 digit value. The high order 4 digits and the low order 5 digits of the total are displayed alternately. The letter "K" denotes the high order display. When the total exceeds a 9 digit value, the Totalizer will show "E..." and will stop.

**TOTALIZER BATCHING**

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (dEPK). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

**TOTALIZER USING TIME BASE**

Totalizer accumulates as defined by:

\[
\text{Input Display} \times \text{Totalizer Scale Factor} = \text{Totalizer Time Base}
\]

Where:

- \(\text{Input Display}\) - the present input reading
- \(\text{Totalizer Scale Factor}\) - 0.001 to 65,000
- \(\text{Totalizer Time Base}\) - (the division factor of \(\text{tBASE}\))

Example: The input reading is at a constant rate of 10.0 gallons per minute. The Totalizer is used to determine how many gallons in tenths has flowed. Because the Input Display and Totalizer are both in tenths of gallons, the Totalizer Scale Factor is 1. With gallons per minute, the Totalizer Time Base is minutes (60). By placing these values in the equation, the Totalizer will accumulate every second as follows:

\[
10.0 \times 1.000 = 0.1667 \text{ gallon accumulates each second}
\]

This results in:

- 10.0 gallons accumulates each minute
- 600.0 gallons accumulates each hour

**TOTALIZER SCALE FACTOR CALCULATION EXAMPLES**

1. When changing the Totalizer Decimal Point \(\text{dECPl}\) location from the Input Display Decimal Point \(\text{dECPl}\), the required Totalizer Scale Factor is multiplied by a power of ten.

Example:

<table>
<thead>
<tr>
<th>(\text{Input} \ (\text{dECPl}) = 0)</th>
<th>(\text{Input} \ (\text{dECPl}) = 0.0)</th>
<th>(\text{Input} \ (\text{dECPl}) = 0.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{dECPl})</td>
<td>(\text{Scale Factor})</td>
<td>(\text{dECPl})</td>
</tr>
<tr>
<td>0.0</td>
<td>10</td>
<td>0.00</td>
</tr>
<tr>
<td>x10</td>
<td>0.1</td>
<td>x10</td>
</tr>
<tr>
<td>x100</td>
<td>0.001</td>
<td>x100</td>
</tr>
</tbody>
</table>

\(x = \text{Totalizer display is round by tens or hundreds}\)

2. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.

Example: Average temperature per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for \(\text{latK}\). The timer will control the start (reset) and the stopping (hold) of the totalizer.
5.6 MODULE 6 - SETPOINT (ALARM) PARAMETERS (G-5Pt)

<table>
<thead>
<tr>
<th>Parameter Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPSEL</strong> - SELECT SETPOINT</td>
</tr>
<tr>
<td><strong>ACM-n</strong> - SETPOINT ACTION</td>
</tr>
<tr>
<td><strong>SP-1</strong> - SETPOINT VALUE</td>
</tr>
<tr>
<td><strong>HYS-n</strong> - SETPOINT Hysteresis</td>
</tr>
</tbody>
</table>

**On Time Delay** | 00 to 32750 sec |
**Off Time Delay** | 00 to 32750 sec |
**Output Logic** | nor | rEv |
**Reset Action** | RUt | LAeC |
**Standby Operation** | NO | YES |
**Setpoint Annunciators** | OFF | rEv |
**Probe Burn-out Action** | on | OFF |

Repeat programming for each setpoint.

5.7 MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS (7-Srl)

<table>
<thead>
<tr>
<th>Parameter Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRd</strong> - BAUD RATE</td>
</tr>
<tr>
<td><strong>dRtR</strong> - DATA BITS</td>
</tr>
<tr>
<td><strong>PAr</strong> - PARITY BIT</td>
</tr>
</tbody>
</table>

**Addr** - METER ADDRESS | 0 to 99 |
**AbRu** - ABBREVIATED PRINTING | NO | YES |
**Opt** - PRINT OPTIONS | YES | Gross | tArE |

These two options are for the PAXS ONLY.

5.8 MODULE 8 - ANALOG OUTPUT PARAMETERS (8-Out)

<table>
<thead>
<tr>
<th>Parameter Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong> - ANALOG TYPE</td>
</tr>
<tr>
<td><strong>RS In</strong> - ANALOG ASSIGNMENT</td>
</tr>
<tr>
<td><strong>SN-LD</strong> - ANALOG LOW SCALE VALUE</td>
</tr>
<tr>
<td><strong>RN-HI</strong> - ANALOG HIGH SCALE VALUE</td>
</tr>
<tr>
<td><strong>udT</strong> - ANALOG UPDATE TIME</td>
</tr>
<tr>
<td><strong>burn</strong> - PROBE BURN-OUT ACTION</td>
</tr>
</tbody>
</table>
5.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FC5)

PAXH - Input Calibration

**WARNING:** Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the precision signal source is connected to the correct terminals and ready. Allow a 30 minute warm-up period before calibrating the meter. \( \text{na} \) and PAR can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:
1. Use the arrow keys to display \( \text{CdE} \) \( \text{48} \) and press PAR.
2. Choose the range to be calibrated by using the arrow keys and press PAR. (\( \text{na} \) and PAR can be chosen to exit the calibration mode without any changes taking place.)
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage range: dead short applied
   - Current range: open circuit
4. Press PAR and \( \ldots \ldots \) will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mA
6. Press PAR and \( \ldots \ldots \ldots \) will appear on the display for about 10 seconds.
7. When \( \text{na} \) appears, press PAR twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

PAXP - Input Calibration

**WARNING:** Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the precision signal source is connected to the correct terminals and ready. Allow a 30 minute warm-up period before calibrating the meter. \( \text{na} \) and PAR can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:
1. Use the arrow keys to display \( \text{CdE} \) \( \text{48} \) and press PAR.
2. Choose the range to be calibrated by using the arrow keys and press PAR. (\( \text{na} \) and PAR can be chosen to exit the calibration mode without any changes taking place.)
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage range: dead short applied
   - Current range: open circuit
4. Press PAR and \( \ldots \ldots \) will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mA
6. Press PAR and \( \ldots \ldots \ldots \) will appear on the display for about 10 seconds.
7. When \( \text{na} \) appears, press PAR twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

PAXD - Input Calibration

**WARNING:** Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better. Resistance inputs require a resistance substitution device with an accuracy of 0.01% or better.

Before starting, verify that the Input Range Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter. \( \text{na} \) and PAR can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:
1. Use the arrow keys to display \( \text{CdE} \) \( \text{48} \) and press PAR.
2. Choose the range to be calibrated by using the arrow keys and press PAR.
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage ranges: dead short applied
   - Current ranges: open circuit
   - Resistance ranges: dead short with current source connected
4. Press PAR and \( \ldots \ldots \ldots \) will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage ranges: top range value applied (The 300 V range is the exception. It is calibrated with a 100 V signal.)
   - Current ranges: top range value
   - Resistance ranges: top range value (The ohms calibration requires connection of the internal current source through a resistance substitution device and the proper voltage range selection.)
6. Press PAR and \( \ldots \ldots \ldots \) will appear on the display for about 10 seconds.
7. When \( \text{na} \) appears, press PAR twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.
1. Set the Input Range Jumper to 10 ohm.
2. Use the arrow keys to display $\text{CdE} \ 48$ and press \text{PAR}. Then choose $\cdot \ 100$ and press \text{PAR}.
3. At $\cdot \ R$, apply a dead short or set calibrator to zero to input terminals 4 and 5. Wait 10 seconds, then press \text{PAR}.
4. At $\cdot \ R$, apply a precision resistance of 300 ohms (with an accuracy of 0.1% or better) using a three wire link, to input terminals 3, 4 and 5. Wait 10 seconds, then press \text{PAR}.
5. Connect the RTD, return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat calibration.

**THERMOCOUPLE Range Calibration**

1. Use the arrow keys to display $\text{CdE} \ 48$ and press \text{PAR}. Then choose $\cdot \ E$ and press \text{PAR}.
2. At $\cdot \ W$, apply a dead short or set calibrator to zero to input terminals 4 and 5. Wait 10 seconds, then press \text{PAR}.
3. At $\cdot \ D$, apply a precision resistance of 300 ohms (with an accuracy of 0.1% or better) using a three wire link, to input terminals 3, 4 and 5. Wait 10 seconds, then press \text{PAR}.
4. Return to the Display Mode.
5. Continue with Ice Point Calibration.

**ICE POINT Calibration**

1. Remove all option cards or invalid results will occur.
2. The ambient temperature must be within $20^\circ \text{C}$ to $30^\circ \text{C}$.
3. Connect a thermocouple (type T, E, J, K, or N only) with an accuracy of 0.25 $^\circ \text{C}$ or better.
4. Verify the readout Display Offset is 0, Temperature Scale is $^\circ \text{C}$, Display Resolution is 0.0, and the Input Range is set for the connected thermocouple.
5. Place the thermocouple in close thermal contact to a reference thermometer probe. (Use a reference thermometer with an accuracy of 0.25 $^\circ \text{C}$ or better.) The two probes should be shielded from air movement and allowed sufficient time to equalize in temperature. (A calibration bath could be used in place of the thermometer.)
6. In the Normal Display mode, compare the readouts.
7. If a difference exists then continue with the calibration.
8. Enter Module 9, use the arrow keys to display $\text{CdE} \ 48$ and press \text{PAR}. Then choose $\cdot \ E$ and press \text{PAR}.
9. Calculate a new Ice Point value using: existing Ice Point value + (reference temperature - Display Mode reading). All values are based on $^\circ \text{C}$.
10. Enter the new Ice Point value.
11. Return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat steps 8 through 10.

**ANALOG OUTPUT CARD CALIBRATION**

Before starting, verify that the precision voltmeter (voltage output) or current meter (current output) is connected and ready. Perform the following procedure:

1. Use the arrow keys to display $\text{CdE} \ 48$ and press \text{PAR}.
2. Use the arrow keys to choose $\cdot \ U$ and press \text{PAR}.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAX arrow keys to adjust the external meter display to match the selection being calibrated. When the external reading matches, or if this range is not being calibrated, press \text{PAR}.

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>EXTERNAL METER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\cdot \ A$</td>
<td>0.00</td>
<td>Adjust if necessary, press \text{PAR}</td>
</tr>
<tr>
<td>$\cdot \ B$</td>
<td>4.00</td>
<td>Adjust if necessary, press \text{PAR}</td>
</tr>
<tr>
<td>$\cdot \ C$</td>
<td>20.00</td>
<td>Adjust if necessary, press \text{PAR}</td>
</tr>
<tr>
<td>$\cdot \ D$</td>
<td>0.00</td>
<td>Adjust if necessary, press \text{PAR}</td>
</tr>
<tr>
<td>$\cdot \ E$</td>
<td>10.00</td>
<td>Adjust if necessary, press \text{PAR}</td>
</tr>
</tbody>
</table>

4. When $\cdot \ A$ appears remove the external meters and press \text{PAR} twice.
TROUBLESHOOTING

<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&lt;br&gt;ENTER: Security code requested</td>
</tr>
<tr>
<td>MAX, MIN, TOT LOCKED-OUT</td>
<td>CHECK: Module 3 programming</td>
</tr>
<tr>
<td>INCORRECT INPUT DISPLAY VALUE</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level&lt;br&gt;PERFORM: Module 9 Calibration (if the above does not correct the problem.)</td>
</tr>
<tr>
<td>“OLOL” in DISPLAY (SIGNAL HIGH)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>“ULUL” in DISPLAY (SIGNAL LOW)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>JITTERY DISPLAY</td>
<td>INCREASE: Module 1 filtering, rounding, input range&lt;br&gt;CHECK: Wiring is per EMC installation guidelines</td>
</tr>
<tr>
<td>MODULES or PARAMETERS NOT ACCESSIBLE</td>
<td>CHECK: Corresponding plug-in card installation</td>
</tr>
<tr>
<td>ERROR CODE (Err 1-4)</td>
<td>PRESS: Reset KEY (if cannot clear contact factory.)</td>
</tr>
<tr>
<td>DISPLAY ZERO’S AT LEVELS BELOW 1% OF RANGE</td>
<td>PROGRAM: Module 4 as Hi-t: 0.0 LO-t: 3271.1 (to disable zero chop feature)</td>
</tr>
</tbody>
</table>

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

PARAMETER VALUE CHART
PAX MODEL NUMBER ___________

Programmer ________________   Date ____________
Meter# _____________   Security Code ________

<table>
<thead>
<tr>
<th>i-1nP Signal Input Parameters</th>
<th></th>
<th>FACTORY</th>
<th>SETTING</th>
<th>FACTORY</th>
<th>SETTING</th>
<th>USER SETTING</th>
<th>FACTORY</th>
<th>SETTING</th>
<th>USER SETTING</th>
<th>FACTORY</th>
<th>SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPLAY</td>
<td>i-1nP</td>
<td>PARAMETER</td>
<td></td>
<td>DISPLAY</td>
<td>PARAMETER</td>
<td></td>
<td>DISPLAY</td>
<td>PARAMETER</td>
<td></td>
<td>DISPLAY</td>
<td>PARAMETER</td>
<td></td>
</tr>
<tr>
<td>SCALE</td>
<td>1</td>
<td>MODE DEPENDENT</td>
<td></td>
<td>1</td>
<td>INPUT VALUE 1</td>
<td></td>
<td>1</td>
<td>INPUT VALUE 1</td>
<td></td>
<td>1</td>
<td>INPUT VALUE 1</td>
<td></td>
</tr>
<tr>
<td>COUPL</td>
<td>2</td>
<td>FILTER ENABLE BAND - PAXH 05</td>
<td></td>
<td>2</td>
<td>DISPLAY VALUE 1</td>
<td></td>
<td>2</td>
<td>DISPLAY VALUE 1</td>
<td></td>
<td>2</td>
<td>DISPLAY VALUE 1</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>3</td>
<td>PAX: TEMPERATURE SCALE</td>
<td></td>
<td>3</td>
<td>INPUT VALUE 2</td>
<td></td>
<td>3</td>
<td>INPUT VALUE 2</td>
<td></td>
<td>3</td>
<td>INPUT VALUE 2</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>4</td>
<td>PAX: INPUT COUPLE</td>
<td></td>
<td>4</td>
<td>DISPLAY VALUE 2</td>
<td></td>
<td>4</td>
<td>DISPLAY VALUE 2</td>
<td></td>
<td>4</td>
<td>DISPLAY VALUE 2</td>
<td></td>
</tr>
<tr>
<td>iNP</td>
<td>5</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>5</td>
<td>INPUT VALUE 3</td>
<td></td>
<td>5</td>
<td>INPUT VALUE 3</td>
<td></td>
<td>5</td>
<td>INPUT VALUE 3</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>6</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>6</td>
<td>INPUT VALUE 4</td>
<td></td>
<td>6</td>
<td>INPUT VALUE 4</td>
<td></td>
<td>6</td>
<td>INPUT VALUE 4</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>7</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>7</td>
<td>INPUT VALUE 5</td>
<td></td>
<td>7</td>
<td>INPUT VALUE 5</td>
<td></td>
<td>7</td>
<td>INPUT VALUE 5</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>8</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>8</td>
<td>INPUT VALUE 6</td>
<td></td>
<td>8</td>
<td>INPUT VALUE 6</td>
<td></td>
<td>8</td>
<td>INPUT VALUE 6</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>9</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>9</td>
<td>INPUT VALUE 7</td>
<td></td>
<td>9</td>
<td>INPUT VALUE 7</td>
<td></td>
<td>9</td>
<td>INPUT VALUE 7</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>10</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>10</td>
<td>INPUT VALUE 8</td>
<td></td>
<td>10</td>
<td>INPUT VALUE 8</td>
<td></td>
<td>10</td>
<td>INPUT VALUE 8</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>11</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>11</td>
<td>INPUT VALUE 9</td>
<td></td>
<td>11</td>
<td>INPUT VALUE 9</td>
<td></td>
<td>11</td>
<td>INPUT VALUE 9</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>12</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>12</td>
<td>INPUT VALUE 10</td>
<td></td>
<td>12</td>
<td>INPUT VALUE 10</td>
<td></td>
<td>12</td>
<td>INPUT VALUE 10</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>13</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>13</td>
<td>INPUT VALUE 11</td>
<td></td>
<td>13</td>
<td>INPUT VALUE 11</td>
<td></td>
<td>13</td>
<td>INPUT VALUE 11</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>14</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>14</td>
<td>DISPLAY VALUE 1</td>
<td></td>
<td>14</td>
<td>DISPLAY VALUE 1</td>
<td></td>
<td>14</td>
<td>DISPLAY VALUE 1</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>15</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>15</td>
<td>DISPLAY VALUE 2</td>
<td></td>
<td>15</td>
<td>DISPLAY VALUE 2</td>
<td></td>
<td>15</td>
<td>DISPLAY VALUE 2</td>
<td></td>
</tr>
<tr>
<td>dSP</td>
<td>16</td>
<td>PAX: DISPLAY OFFSET</td>
<td></td>
<td>16</td>
<td>DISPLAY VALUE 3</td>
<td></td>
<td>16</td>
<td>DISPLAY VALUE 3</td>
<td></td>
<td>16</td>
<td>DISPLAY VALUE 3</td>
<td></td>
</tr>
</tbody>
</table>

* Decimal point location is model and programming dependent.
### 1. 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></td>
<td></td>
</tr>
<tr>
<td>USr-2</td>
<td>USER INPUT 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USr-3</td>
<td>USER INPUT 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 1</td>
<td>FUNCTION KEY 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 2</td>
<td>FUNCTION KEY 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rStk</td>
<td>RESET KEY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sc-F 1</td>
<td>2nd FUNCTION KEY 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sc-F 2</td>
<td>2nd FUNCTION KEY 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2. 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>H 1</td>
<td>MAX DISPLAY LOCKOUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD</td>
<td>MIN DISPLAY LOCKOUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L 0t</td>
<td>TOTAL DISPLAY LOCKOUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP-1</td>
<td>SETPOINT 1 ACCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP-2</td>
<td>SETPOINT 2 ACCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP-3</td>
<td>SETPOINT 3 ACCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP-4</td>
<td>SETPOINT 4 ACCESS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CadE</td>
<td>SECURITY CODE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3. Secondary Function Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>H 1-b</td>
<td>MAX CAPTURE DELAY TIME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD-b</td>
<td>MIN CAPTURE DELAY TIME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dSP-b</td>
<td>DISPLAY UPDATE TIME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ra-b</td>
<td>PAXS: AUTO-ZERO DELAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ra-b</td>
<td>PAXS: AUTO-ZERO BAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b-L 1b</td>
<td>UNITS LABEL BACKLIGHT - PAXT</td>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td>OFF 5b</td>
<td>DISPLAY OFFSET - NOT PAXT</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>ICE</td>
<td>PAXT: ICE POINT COMPENSATION</td>
<td></td>
<td>ON</td>
</tr>
</tbody>
</table>

### 4. Serial Communication Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>bR Ud</td>
<td>BAUD RATE</td>
<td></td>
<td>9600</td>
</tr>
<tr>
<td>dR Lt</td>
<td>DATA BIT</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>PAr</td>
<td>PARITY BIT</td>
<td></td>
<td>Odd</td>
</tr>
<tr>
<td>Addr</td>
<td>METER ADDRESS</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>AbRu</td>
<td>ABBREVIATED PRINTING</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>DPr</td>
<td>ENTER PRINT OPTIONS</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Br aS</td>
<td>PAXS: PRINT GROSS OFFSET</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>LAr e</td>
<td>PAXS: PRINT TARE OFFSET</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Inp</td>
<td>PRINT INPUT VALUE</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>tot</td>
<td>PRINT TOTAL VALUE</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>H 1 Lo</td>
<td>PRINT MAX &amp; MIN VALUES</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>Sp n t</td>
<td>PRINT SETPOINT VALUES</td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

### 5. Setpoint (Alarm) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rct-n</td>
<td>SETPOINT ACTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sp-n</td>
<td>SETPOINT VALUE (main)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Sp-n</td>
<td>SETPOINT VALUE (alternate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hys-n</td>
<td>SETPOINT HYSTERESIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LdOn</td>
<td>ON TIME DELAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LdOf</td>
<td>OFF TIME DELAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>aut-n</td>
<td>OUTPUT LOGIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rSt-n</td>
<td>RESET ACTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stb-n</td>
<td>STANDBY OPERATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lt-n</td>
<td>SETPOINT ANNUNCIATORS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bPr-n</td>
<td>PAXT: PROBE BURN-OUT ACTION</td>
<td></td>
<td>OFF</td>
</tr>
</tbody>
</table>

### 6. Totalizer (Integrator) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>dECPl</td>
<td>TOTALIZER DECIMAL POINT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBA 5E</td>
<td>TOTALIZER TIME BASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FScFaC</td>
<td>TOTALIZER SCALE FACTOR</td>
<td></td>
<td>1000</td>
</tr>
<tr>
<td>Locu b</td>
<td>TOTALIZER LOW CUT VALUE</td>
<td></td>
<td>19999</td>
</tr>
<tr>
<td>P-UP</td>
<td>TOTALIZER POWER-UP RESET</td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

### 7. Analog Output Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>kType</td>
<td>ANALOG TYPE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As In</td>
<td>ANALOG ASSIGNMENT</td>
<td></td>
<td>4-20</td>
</tr>
<tr>
<td>An-Ld</td>
<td>ANALOG LOW SCALE VALUE</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>An-H I</td>
<td>ANALOG HIGH SCALE VALUE</td>
<td></td>
<td>1000</td>
</tr>
<tr>
<td>UdT</td>
<td>ANALOG UPDATE TIME</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>burn</td>
<td>PAXT: PROBE BURN-OUT ACTION</td>
<td></td>
<td>LO</td>
</tr>
</tbody>
</table>

### 8. Security Code

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPXR</td>
<td>PAXT: ICE PROBE BURN-OUT ACTION</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9. Factory Setting Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>dL E-u</td>
<td>DISPLAY INTENSITY LEVEL</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

† Select alternate list to program these values.

* Decimal point location is model and programming dependent.
MODEL PAXH - AC TRUE RMS VOLT AND CURRENT

This is a brief overview of the PAXH. For complete specifications and programming information, see the PAX Analog Input Panel Meters Bulletin starting on page 378.

- 5-DIGIT 0.56" RED SUNLIGHT READABLE OR STANDARD GREEN DISPLAY
- FOUR VOLTAGE RANGES (300 VAC Max)
- FIVE CURRENT RANGES (5 A Max)
- ACCEPTS AC OR DC COUPLED INPUTS
- THREE WAY ISOLATION: POWER, INPUT AND OUTPUTS
- FOUR SETPOINT ALARM OUTPUTS (w/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (w/OPTION CARD

PAXH SPECIFICATIONS

INPUT RANGES:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY*</th>
<th>IMPEDANCE (60 Hz)</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>MAX DC BLOCKING</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mV</td>
<td>0.1% of reading +0.4 mV</td>
<td>686 Kohm</td>
<td>30 V</td>
<td>±10 V</td>
<td>0.01 mV</td>
</tr>
<tr>
<td>2 V</td>
<td>0.1% of reading +2 mV</td>
<td>686 Kohm</td>
<td>30 V</td>
<td>±50 V</td>
<td>0.1 mV</td>
</tr>
<tr>
<td>20 V</td>
<td>0.1% of reading +20 mV</td>
<td>686 Kohm</td>
<td>300 V</td>
<td>±300 V</td>
<td>1 mV</td>
</tr>
<tr>
<td>300 V</td>
<td>0.2% of reading +0.3 V</td>
<td>686 Kohm</td>
<td>300 V</td>
<td>±300 V***</td>
<td>0.1 V</td>
</tr>
<tr>
<td>200 μA</td>
<td>0.1% of reading +0.4 μA</td>
<td>11.1 Kohm</td>
<td>15 mA</td>
<td>±15 mA</td>
<td>0.01 μA</td>
</tr>
<tr>
<td>2 mA</td>
<td>0.1% of reading +2 μA</td>
<td>111 ohm</td>
<td>50 mA</td>
<td>±50 mA</td>
<td>0.1 μA</td>
</tr>
<tr>
<td>20 mA</td>
<td>0.1% of reading +20 μA</td>
<td>11.1 ohm</td>
<td>150 mA</td>
<td>±150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>200 mA</td>
<td>0.1% of reading +0.2 mA</td>
<td>1.1 ohm</td>
<td>500 mA</td>
<td>±500 mA</td>
<td>10 μA</td>
</tr>
<tr>
<td>5 A</td>
<td>0.5% of reading +5 mA</td>
<td>0.02 ohm</td>
<td>7 A**</td>
<td>±7 A***</td>
<td>1 mA</td>
</tr>
</tbody>
</table>

*Conditions for accuracy specification:
- 20 minutes warmup
- 18-28°C temperature range, 10-75% RH non-condensing
- 50 Hz - 400 Hz sine wave input
- 1% to 100% of range
- Add 0.1% reading + 20 counts error over 0-50°C range
- Add 0.2% reading + 10 counts error for crest factors up to 3, add 1% reading up to 5
- Add 0.5% reading + 10 counts of DC component
- Add 1% reading + 20 counts error over 20 Hz to 10 KHz range
** Non-repetitive surge rating: 15 A for 5 seconds
*** Inputs are direct coupled to the input divider and shunts. Input signals with high DC component levels may reduce the usable range.

MAX CREST FACTOR (Vp/Vrms): 5 @ Full Scale Input
INPUT COUPLING: AC or AC and DC
INPUT CAPACITANCE: 10 pF
COMMON MODE VOLTAGE: 125 VAC working
COMMON MODE REJECTION: (DC to 60 Hz) 100 dB

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123  www.barr-thorp.com
MODEL CUB4LP - LOOP POWERED PROCESS INDICATOR
MODEL CUB4CL - CURRENT LOOP INDICATOR

### DESCRIPTION

The CUB4LP and CUB4CL are additions to the CUB4 product line. The CUB4LP uses a 4 to 20 mA or a 10 to 50 mA input signal as operating power. The input signal is also used to power the backlighting on the CUB4LP40 unit. The CUB4CL uses a 4 to 20 mA or a 10 to 50 mA input signal to power the unit. An external power supply is used to power the CUB4CL backlighting to provide a brighter, more consistent display and a lower compliance voltage.

The units have a 3½-digit LCD display with 0.6" (15.2 mm) high digits and a DIP switch selectable decimal point. The CUB4LP display is available in positive image reflective (dark digits, reflective background) or positive image transflective (dark digits, illuminated background) with red backlighting. The CUB4CL display is available in positive image transflective (dark digits, illuminated background) with red or yellow/green backlighting or negative image transmissive (illuminated digits, dark background) with red or yellow/green backlighting.

The ability to scale the display allows indication in any desired unit of measurement such as temperature, pressure, humidity, fluid flow, etc. The unit is calibrated at the factory with 0.0 displayed @ 4 mA input and 100.0 displayed @ 20 mA input.

The units are contained in a lightweight, high impact plastic case with a clear viewing window. When properly installed, the sealed front panel meets NEMA 4X/IP65 specifications for wash-down and dusty environments.

### 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.

**WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2 / CLASS II, DIVISION 2 / CLASS III, DIVISION 2**

### SPECIFICATIONS

1. **DISPLAY**: 3½-digit (-1999 to 1999), 0.6" (15.2 mm) high digits. The CUB4LP is available with a positive image reflective LCD or a red backlight positive image transflective LCD. The intensity of the backlighting will vary with the input signal. The CUB4CL is available with a positive image transflective LCD with red or yellow/green backlighting or a negative image transmissive with red or yellow/green backlight. A minus sign is displayed when the indicator is adjusted for a negative offset. **Overrange**: Overrange is indicated by a “1” in the most significant digit and the blanking of the three least significant digits.

2. **EXTERNAL BACKLIGHT POWER**: (CUB4CL only)
   9 - 28 VDC, @ 35 mA typ., 50 mA max. Power Supplies must be Class 2 (NEC) or SELV rated. Above 26 VDC, derate the operating temperature to 50°C.

3. **DECIMAL POINTS**: Three DIP switch selectable, decimal point positions allow the display to be read in tenths, hundredths or thousandths.

### 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.

---

FOR USE IN HAZARDOUS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 2

UL LISTED C CONTROLLED EQUIPMENT

FOR USE IN HAZARDOUS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 2

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

---

www.redlion.net
SPECIFICATIONS (Cont’d)

5. EQUIVALENT RESISTANCE:
   CUB4LP00: 800 Ω max. @ 4 mA; 160 Ω max. @ 20 mA
   320 Ω max. @ 10 mA; 65 Ω max. @ 50 mA
   CUB4LP40: 1000 Ω max. @ 4 mA; 200 Ω max. @ 20 mA
   400 Ω max. @ 10 mA; 80 Ω max. @ 50 mA
   CUB4CL (all models): 800 Ω max. @ 4 mA; 160 Ω max. @ 20 mA
   320 Ω max. @ 10 mA; 65 Ω max. @ 50 mA

6. MAXIMUM ALLOWABLE INPUT CURRENT: 100 mA

7. SCALING RANGE:
   Span: Two potentiometers provide a coarse and fine span adjustment. Span range = 0 to 2000.
   Offset: Two potentiometers provide a coarse and fine zero offset adjustment. Offset range = -1999 to 1999.

8. LINEARITY: (@ 23°C. Less than 85% RH) ±0.1% + 1 digit).

9. READING RATE: 2.5 per second, nominal.

10. RESPONSE TIME: 1.5 seconds to settle for a step change.

11. NORMAL MODE REJECTION: 60 dB 50/60 Hz

12. TEMPERATURE EFFECTS:
   Span Temperature Coefficient: 100 PPM/°C
   Offset Temperature Coefficient: 0.2 digits/°C

13. CONSTRUCTION: High impact plastic case with clear viewing window.

14. CERTIFICATIONS AND COMPLIANCES:

   SAFETY
   UL Listed, File #E184589, UL1604, CSA 22.2 No. 213-M1987
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Indoor Enclosure rating (Face only), UL50
   IEC 601010-1, EN 601010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529

   INSTALLATION

   When properly installed, the CUB4LP/LCL meets NEMA 4X/IP65 requirements for indoor use. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket, mounting clip, two screws, and nut fasteners are provided to install and seal the unit in the panel cutout.

   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.

   The following procedure assures proper installation:
   1. Cut the panel opening to the specified dimensions. Remove burrs and clean the panel opening.
   2. Slide nut fastener into slot on mounting clip and then insert mounting screw through nut on both sides of mounting clip. The tip of mounting screw should not project through hole on clip.
   3. Slide the panel gasket over the rear of the unit to the back of the bezel. Install CUB4LP/LCL unit through panel cutout.
   4. Slide mounting clip over rear of unit until the clip is against back of panel. The mounting clip and CUB4LP/LCL housing have a latching feature to hold the unit in place until tightened.

   Note: Hold the CUB4LP/LCL front bezel in place when sliding the mounting clip into position.

   5. Alternately tighten each mounting screw to ensure uniform gasket pressure. Visually inspect the gasket for proper seal. The gasket should be compressed to approximately 75 to 80% of its original thickness.

   (Recommended torque is 28 to 36 in-oz.)

   6. If the gasket is not adequately compressed and the mounting screws cannot be tightened any further, loosen the mounting screws and insure that the clip is latched as closely as possible to the panel.

   7. Repeat Step #6 for tightening the mounting screws.

   ELECTROMAGNETIC COMPATIBILITY

   Immunity to EN 50082-2
   Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
   Level 3; 8 Kv air
   Level 3; 10 V/m1
   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/m2
   150 KHz - 80 MHz
   Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m

   Emissions to EN 50081-1
   RF interference EN 55011
   Enclosure class B
   Power mains class B

   Notes:
   1. Self-recoverable loss of performance during EMI disturbance at 10 V/m;
      Process Signal may deviate during EMI disturbance.
      For operation without loss of performance:
      Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent) connected to earth ground.

   2. Self-recoverable loss of performance during EMI disturbance at 10 V/m;
      Process signal may deviate during EMI disturbance.
      For operation without loss of performance:
      Install 1 ferrite core, RLC FCOR0000 or equivalent, to signal cable at the unit.
      Refer to the EMC Installation Guidelines of this bulletin for additional information.

   15. ENVIRONMENTAL CONDITIONS:

   Operating Temperature: 0° to 60°C
   (Derate backlit voltage to 26 VDC above 50°C.)

   Storage Temperature: -40° to 80°C

   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 60°C.

   Vibration According to IEC 68-2-6:
   Operational 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

   16. WEIGHT: 3.3 oz. (93.5 g)
**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. 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 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**

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.

The electrical connections are made via 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. Strip the wire, leaving approximately ¼" of bare wire (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

**CUB4LP/CL SIGNAL INPUT**

The current range is selected by setting DIP switch S1 to the OFF position for a 4 to 20 mA input or ON for a 10 to 50 mA input. Attach the signal wires to terminals 3 (SIG-) and 4 (SIG+) observing the correct polarity. The (SIG-) signal input circuit is not reverse polarity protected.

**Backlight Power (CUB4CL only)**

Attach a 9 to 28 VDC supply to terminals 1 (COM) and 2 (V+) to power the backlight. Terminals 3 (SIG-) and 1 (COM) are AC coupled with a capacitor. This limits the isolation between these terminals to 50 VDC maximum.

**OFFSET ADJUSTMENTS**

The minimum currents are not zero based with 4 to 20 mA and 10 to 50 mA signals. To obtain a zero minimum display reading, the display must be offset. The display on the CUB4LP/CL can be offset by adjusting the Coarse and Fine Offset pots.

**SPAN ADJUSTMENTS**

Span is defined as the numerical range that the display traverses, disregarding the decimal point, when the input signal is varied from minimum to maximum (4 to 20 mA or 10 to 50 mA). For example; if a unit is to display 250 @ 4 mA and 1000 @ 20 mA, the span is 750 (the difference between 250 and 1000). Had the minimum display been -250, the span would be 1250 (1000 - (-250) = 1250). The CUB4LP/CL can be set to operate over a wide span range by adjusting the Coarse and Fine Span adjustment pots. The Coarse Span pot is used to get the display to within a couple of counts of the desired reading, and the Fine Span pot is used to adjust for the exact reading.

---

**WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.**

**THIS EQUIPMENT IS SUITABLE FOR USE IN:**

- Class I, Division 2, Groups A, B, C, and D
- Class II, Division 2, Groups F and G
- Class III, Division 2 or Non Hazardous locations.
**DECIMAL POINT POSITION SELECTION**

The decimal point position is DIP switch selectable for one of three locations. The CUB4LP/CL can be set up to read in 10ths, 100ths, or 1000ths. If all the DIP switches are set to the “OFF” position, no decimal point will appear on the display. The DIP switches are located at the rear of the unit.

---

**APPLICATION EXAMPLE**

Operation of a refinery process required a local display of the position of a remote pipeline valve. The display would indicate 0 (zero) when the valve was fully closed with an input signal of 4 mA. When the valve was fully open the display would indicate 100 with an input signal of 20 mA.

Both the CUB4LP and the CUB4CL meet the necessary requirements.

---

**CALIBRATING THE DISPLAY**

Calibrating the CUB4LP/CL requires either an accurate adjustable constant current supply or the CUB4LP/CL can be installed and scaled with the process sensor connected to the CUB4LP/CL. To calibrate the unit, proceed as follows.

1. Set DIP switching for the desired current range.
2. Select the desired decimal point position.
3. Apply the minimum input signal to the CUB4LP/CL and adjust the COARSE OFFSET to display the approximate desired minimum value.
4. Apply the maximum input signal to the CUB4LP/CL and adjust the COARSE SPAN to display the approximate desired maximum value.
5. Repeat steps 3 and 4 until the minimum and maximum values are within the desired values.
6. Apply the minimum input signal to the CUB4LP/CL and adjust the FINE OFFSET to display the exact desired minimum value.
7. Apply the maximum input signal to the CUB4LP/CL and adjust the FINE SPAN to display the exact desired maximum value.
8. Apply the minimum input signal and verify that the display indicates correctly.
9. Apply the maximum input signal and verify that the display indicates correctly.
10. Repeat Steps 6 through 9 until display reads exact.

*Note: The CUB4LP/CL display is factory calibrated to indicate 0.0 to 100.0 with an input of 4 to 20 mA at approximately 25°C.*

---

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB4LP</td>
<td>Reflective LCD Loop Powered Process Indicator</td>
<td>CUB4LP00</td>
</tr>
<tr>
<td></td>
<td>Red Backlit LCD Loop Powered Process Indicator Positive Image Transflective LCD</td>
<td>*CUB4LP40</td>
</tr>
<tr>
<td></td>
<td>Yel/Grn Backlit LCD External Powered Process Indicator Negative Image Transmissive LCD</td>
<td>CUB4CL10</td>
</tr>
<tr>
<td>CUB4CL</td>
<td>Red Backlit LCD External Powered Process Indicator Negative Image Transmissive LCD</td>
<td>CUB4CL20</td>
</tr>
<tr>
<td></td>
<td>Yel/Grn Backlit LCD External Powered Process Indicator Positive Image Transflective LCD</td>
<td>CUB4CL30</td>
</tr>
<tr>
<td></td>
<td>Red Backlit LCD External Powered Process Indicator Positive Image Transflective LCD</td>
<td>CUB4CL40</td>
</tr>
<tr>
<td>MLPS</td>
<td>Micro Line/Sensor Power Supply (Non-hazardous use only)</td>
<td>MLPS1000</td>
</tr>
</tbody>
</table>

*Backlight intensity will vary depending on signal level.*

---

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
GENERAL DESCRIPTION
The CUB5 Series provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The CUB5 accepts a DC voltage or current input signal and provides a display in the desired unit of measure. The meter also features minimum and maximum display capture, display offset, units indicator, and programmable user input. The display can be toggled either manually or automatically between the selected displays.
The CUB5 display has 0.48" (12.2 mm) high digits. The LCD is available in two versions, reflective or red/green backlight. The backlight version is user selectable for the desired color and also has variable display intensity.

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.

INPUT
The CUB5P is a DC Process meter. It features voltage and current input ranges, that are selected by the user via a programming jumper and software input range selection. The ranges consist of the following: 0 to 10 V, 0(4) to 20 mA, or 0 to 50 mA. Users should select the appropriate voltage range that covers their maximum input.

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**: 5 digit LCD 0.48” (12.2 mm) high digits
   - CUB5PR00: Reflective LCD with full viewing angle
   - CUB5PB00: 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.
   - MODEL NO.: 
     - CUB5PR00
     - CUB5PB00
   - DISPLAY COLOR: 
     - Red (max intensity)
     - Green (max intensity)
   - INPUT RANGES: 
     - 5 mA
     - 0.1% of span
   - TEMPERATURE: 
     - -35 to 35°C
     - -35 to 75°C
   - RED DISPLAY: 125 mA
   - GREEN DISPLAY: 150 mA
   - 0.1% of span
   - TEMP.: 70 ppm / °C
   - CONNECTIONS: 30 V
   - Sensor Inputs: 
     - Input Voltage Range is +9 to +28 VDC with short circuit and input
   - Power: 
     - Operating and 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 68-2-27: Operational 30 g, 11 m/sec in 3 directions.
   - Altitude: Up to 2000 meters

3. **INPUT RANGES**: Jumper Selectable 0 to 10 V, (0/4) to 20 mA, 0 to 50 mA

4. **SENSOR INPUTS**:
   - SIGNAL: 
     - Max Input: 10 V, 0(4) to 20 mA, 0 to 50 mA
   - IMPEDANCE: 50 Ω
   - COEFFICIENT: 
     - 20 / 50 mA
     - 0.1% of span
     - 0 to 2000 meters
   - RESPONSE TIME: 0.1% of span
   - Operational 5 to 500 Hz, in X, Y, Z
   - TEMPERATURE: -35 to 75°C
   - MAX INPUT CURRENT: 
     - 10 mA
     - 40 mA
     - 85 mA
     - 115 mA
     - 95 mA
     - 125 mA
   - MEMORY: 
     - Nonvolatile E’PROM memory retains all programming parameters and max/min values when power is removed.
   - 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.
   - ENVIRONMENTAL CONDITIONS: 
     - Operating Temperature Range for CUB5PR00: -35 to 75°C
     - Operating Temperature Range for CUB5PB00: -35 to 65°C
     - Red Display: 
       - 1 & 2: -35 to 75°C
       - 3: -35 to 70°C
       - 4: -35 to 60°C
       - 5: -35 to 50°C
     - Green Display: 
       - 1 & 2: -35 to 75°C
       - 3: -35 to 65°C
       - 4: -35 to 50°C
       - 5: -35 to 50°C
   - Electrostatic discharge: 30 A/m
   - Electromagnetic RF fields: 
     - EN 61000-4-3
     - Criterion A
     - 3 V/rms
     - 1 kV L-L
     - Fast transients (burst): 
     - EN 61000-4-4
     - Criterion A
     - 2 kV power
     - 1 kV signal
     - Surge: 
     - EN 61000-4-5
     - Criterion A
     - 1 kV L-L
     - 2 kV L-N-E power
     - RF conducted interference: 
     - EN 61000-4-6
     - Criterion A
     - 3 V/MS
     - Power frequency magnetic fields: 
     - EN 61000-4-8
     - Criterion A
     - 30 A/m

### Ordering Information

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cub5</td>
<td>CUB5PR00</td>
<td>Process Meter with reflective display</td>
<td>CUB5PR00</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUB5PB00</td>
<td>Process Meter with backlight display</td>
<td>CUB5PB00</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUB5RLY0</td>
<td>Single Relay Output Card</td>
<td>CUB5RLY0</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUBSNK0</td>
<td>Dual Sinking Open Collector Output card</td>
<td>CUBSNK0</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUB5COM1</td>
<td>RS485 Serial Communications Card</td>
<td>CUB5COM1</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUB5COM2</td>
<td>RS232 Serial Communications Card</td>
<td>CUB5COM2</td>
</tr>
<tr>
<td>Cub5</td>
<td>CUB5USB0</td>
<td>USB Programming Card for CUB5 Products</td>
<td>CUB5USB0</td>
</tr>
<tr>
<td>Accessories</td>
<td>MLPS1</td>
<td>Micro-Line Power Supply, 85 to 250 VAC</td>
<td>MLPS1000</td>
</tr>
<tr>
<td>Accessories</td>
<td>CBLPROG</td>
<td>RS232 Programming Cable (DB9-RJ11)</td>
<td>CBLPROG0</td>
</tr>
<tr>
<td>Accessories</td>
<td>CBPRO007</td>
<td>RS485 Programming Cable (DB9-RJ11)</td>
<td>CBPRO007</td>
</tr>
<tr>
<td>Accessories</td>
<td>SFCRD200</td>
<td>Crimson 2 PC Configuration Software for Windows 98, ME, 2000, XP</td>
<td>SFCRD200</td>
</tr>
<tr>
<td>Accessories</td>
<td>CBLUSB0</td>
<td>USB Programming Cable</td>
<td>CBLUSB0</td>
</tr>
</tbody>
</table>

*1 Crimson 2 software is a free download from http://www.redlion.net/*

**Notes:**

**Weight:** 3.2 oz (100 g)
**OPTIONAL PLUG-IN CARDS**

**ADDING OPTION CARDS**

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

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

*Note:* Measurement errors may occur if signal input common is shared with another circuit common (ie, serial common, Dual Sinking Output option card, or Power Supply common) on multiple units.

**SINGLE RELAY CARD**

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

**DUAL SINKING OUTPUT CARD**

*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  
*Offstate Leakage Current:* 0.5 mA max.

**RS485 SERIAL COMMUNICATIONS CARD**

*Type:* RS485 multi-point balanced interface (non-isolated)  
*Baud Rate:* 300 to 38.4k  
*Data Format:* 7/8 bits; odd, even, or no parity  
*Bus Address:* 0 to 99; max 32 meters per line  
*Transmit Delay:* Selectable (refer to CUB5COM bulletin)

**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

---

**1.0 INSTALLING THE METER**

**INSTALLATION**

The meter meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout. While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approx. 28 to 36 in-oz [0.202 to 0.26 N-m]). Do not overtighten 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 JUMPERS**

**INPUT RANGE JUMPER**

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum input signal to avoid overloads. To access the jumper, remove the rear cover of the meter.

**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.
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.

4.0 Wiring the Meter

4.1 Power Wiring

**DC Power**

-9 to +28 VDC: +VDC

Power Common: -VDC

**CAUTION:**

| Power Circuit is not isolated from the signal circuit. |

**Setpoint Card**

**Range Jumpers**

**Comms Card**

---

4.2 User Input Wiring

**Sinking Logic**

USR COMM  Connect external switching device between the USR (User Input Terminal) and User Input Common.

The user input of the meter is internally pulled up to +9 to +28 VDC with 10 K resistance. The input is active when it is pulled low (<0.7 V).

---

**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 (protective earth).
   b. 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:
   a. Ferrite Suppression Cores for signal and control cables:
      - Fair-Rite # 0443167251 (RLC# FCOR0000)
      - TDK # ZCAT3035-130A
      - Steward # 28B2029-BA0
   b. 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.

---

**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.
4.3 INPUT WIRING

**CAUTION**: Power input common is NOT isolated from user and input commons. In order to preserve the safety of the meter application, the power 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 signal or user inputs and input common terminals. Appropriate considerations must then be given to the potential of the user and input commons with respect to earth ground; and the common of the plug-in cards with respect to input common.

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

**Input Signal (self powered)**

<table>
<thead>
<tr>
<th>JUMPER POSITION</th>
<th>MAX SIGNAL INPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 VDC</td>
<td>30 VDC</td>
</tr>
<tr>
<td>20/60 mA DC</td>
<td>150 mA</td>
</tr>
</tbody>
</table>

**Series Loop (must use separate supply for sensor power and each CUB5)**

### 4.4 SETPOINT (OUTPUT) WIRING

**SINGLE SETPOINT RELAY PLUG-IN CARD**

**ELECTRICAL CONNECTIONS**

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

**ELECTRICAL CONNECTIONS**

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

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

OPERATING MODE DISPLAY DESIGNATORS
- MAX - Maximum display capture value
- MIN - Minimum display capture value
- “1” - To the right of the display indicates setpoint 1 output activated.
- “2” - To the right of the display indicates setpoint 2 output activated.

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.

6.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

PROGRAMMING MODE ENTRY (SEL 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 and holding the SEL button. If it is not accessible then it is locked by either a security code, or a hardware lock.

MODULE ENTRY (SEL & RST BUTTONS)
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 button is used to select the desired module. The displayed module is entered by pressing the SEL button.

MODULE MENU (SEL BUTTON)
Each module has a separate module menu (which is shown at the start of each module discussion). The SEL button is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro NO.

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

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

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

FACTORY SETTINGS
Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems.

ALTERNATING SELECTION DISPLAY
In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter’s Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.
6.1 MODULE 1 - SIGNAL INPUT PARAMETERS

**PARAMETER MENU**

### CUB5P INPUT RANGE

**SELECTION**

- **RANGE**
  - 10 u
  - 10.000 V
  - 50.000 mA

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

### DISPLAY DECIMAL POINT

**OFFSEt**

- 0.000

Select the decimal point location for the Input, MIN and MAX displays. This selection also affects the *dSP*1 and *dSP*2 parameters and setpoint values.

### DISPLAY OFFSET VALUE

**FILT**

- 0.000

The display can be corrected with an offset value. This can be used to compensate for signal variations or sensor errors. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the effects of offset.

### FILTER SETTING

**FILT**

- 0 1 2 3

If the displayed value is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display. Software filtering effectively combines a fraction of the current input reading with a fraction of the previous displayed reading to generate the new display.

Filter values represent no filtering (0), up to heavy filtering (3). A value of 1 for the filter uses 1/4 of the new input and 3/4 of the previous display to generate the new display. A filter value of 2 uses 1/8 new and 7/8 previous. A filter value of 3 uses 1/16 new and 15/16 previous.

### FILTER BAND

**FILT**

- 0 to 99 display units

The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the filter permanently engaged at the filter level selected above.

### SCALING STYLE

**STYLE**

- dSP2

If Input Values and corresponding Display Values are known, the Key-in (dSP) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (dSP) scaling style must be used.

#### INPUT VALUE FOR SCALING POINT 1

**dSP 1**

- 0 to 59999

For Key-in (dSP) style, enter the known first Input Value using the front panel buttons. (The Input Range selection sets the decimal location for the Input Value).

For Apply (dSP) style, the meter shows the previously stored Input Value. To retain this value, press the **SEL** button to advance to the next parameter. To change the Input Value, press the **RST** button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the **SEL** button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 1

**dSP 1**

- 0 to 59999

Enter the first Display Value using the front panel buttons. This is the same for dSP and dSP scaling styles. The decimal point follows the dSP selection.

#### INPUT VALUE FOR SCALING POINT 2

**dSP 2**

- 0 to 59999

For Key-in (dSP) style, enter the known second Input Value using the front panel buttons.

For Apply (dSP) style, the meter shows the previously stored Input Value for Scaling Point 2. To retain this value, press the **SEL** button to advance to the next parameter. To change the Input Value, press the **RST** button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the **SEL** button to enter the value being displayed.

#### DISPLAY VALUE FOR SCALING POINT 2

**dSP 2**

- 0 to 59999

Enter the second Display Value using the front panel buttons. This is the same for dSP and dSP scaling styles.

**General Notes on Scaling**

1. When using the Apply (dSP) scaling style, input values for scaling points must be confined to signal limits of the selected range.
2. The same Input Value should not correspond to more than one Display Value. (Example: 10 V can not equal 0 and 10.)
3. For input levels beyond the programmed Input Values, the meter extends the Display Value by calculating the slope from the two coordinate pairs (*dSP*1, *dSP*2).
**USER INPUT FUNCTION**

**DISPLAY MODE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Function</td>
<td>NO</td>
</tr>
<tr>
<td>Program Mode Lock-out</td>
<td>P-Loc</td>
</tr>
<tr>
<td>Zero Input (Edge triggered)</td>
<td>ZE-O</td>
</tr>
<tr>
<td>Reset (Edge triggered)</td>
<td>rESel</td>
</tr>
<tr>
<td>Display Hold</td>
<td>d-HLd</td>
</tr>
<tr>
<td>Display Select (Edge Triggered)</td>
<td>d-SEL</td>
</tr>
<tr>
<td>Display Intensity Level (Edge Triggered)</td>
<td>d-LEU</td>
</tr>
<tr>
<td>Backlight Color (Edge Triggered)</td>
<td>COLOr</td>
</tr>
</tbody>
</table>

**DESCRIPTION**

- **No Function**: User Input disabled.
- **Program Mode Lock-out**: See Programming Mode Access chart (Module 3).
- **Zero Input (Edge triggered)**: Zero the Input Display value causing Display Reading to be Offset.
- **Reset (Edge triggered)**: Resets the assigned value(s) to the current input value.
- **Display Hold**: Holds the assigned display, but all other meter functions continue as long as activated (maintained action).
- **Display Select (Edge Triggered)**: Advance once for each activation.
- **Display Intensity Level (Edge Triggered)**: Increase intensity one level for each activation (backlight version only).
- **Backlight Color (Edge Triggered)**: Change backlight color with each activation (backlight version only).

**FACTORY SERVICE OPERATIONS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>Yes</td>
<td>YES</td>
</tr>
</tbody>
</table>

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

**DISPLAY MODE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Request</td>
<td>Pr v</td>
</tr>
<tr>
<td>Print and Reset</td>
<td>Pr-St</td>
</tr>
<tr>
<td>Setpoint 1 Reset</td>
<td>rSt-1</td>
</tr>
<tr>
<td>Setpoint 2 Reset</td>
<td>rSt-2</td>
</tr>
<tr>
<td>Setpoint 1 and 2 Reset</td>
<td>rSt-12</td>
</tr>
</tbody>
</table>

**DESCRIPTION**

- **Print Request**: Serial transmit of the active parameters selected in the Print Options menu (Module 5).
- **Print and Reset**: Same as Print Request followed by a momentary reset of the assigned value(s).
- **Setpoint 1 Reset**: Resets setpoint 1 output.
- **Setpoint 2 Reset**: Resets setpoint 2 output.
- **Setpoint 1 and 2 Reset**: Reset both setpoint 1 and 2 outputs.

**USER INPUT ASSIGNMENT**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-ASn</td>
<td>HI</td>
</tr>
<tr>
<td>dSP</td>
<td>LO</td>
</tr>
</tbody>
</table>

Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset, display hold, or print and reset is selected in the User Input Function menu.

### 6.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)

**MAX DISPLAY ENABLE**

- **Enable**: HI-En
- **Disable**: LO-En

Enables the Maximum Display Capture capability.

**MAX CAPTURE DELAY TIME**

- **Enable**: HI-t
- **Disable**: LO-t

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

**MIN DISPLAY ENABLE**

- **Enable**: HI-En
- **Disable**: LO-En

Enables the Minimum Display Capture capability.

**MIN CAPTURE DELAY TIME**

- **Enable**: HI-t
- **Disable**: LO-t

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

**FACTORY SERVICE OPERATIONS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>Yes</td>
<td>YES</td>
</tr>
</tbody>
</table>

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

**RESTORE FACTORY DEFAULT SETTINGS**

Entering Code 66 will overwrite all user settings with the factory settings. The meter will display rSt12 and then return to CodE 00. Press the SEL button to exit the module.

**VIEW VERSION DISPLAY**

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

**CALIBRATION**

The CUB5P uses stored calibration values to provide accurate voltage and current measurements. Over time, the electrical characteristics of the components inside the meter could slowly change, therefore the stored calibration values may no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the CUB5P involves a voltage or current calibration, which should only be performed by individuals experienced in calibrating electronic equipment. Allow a 30 minute warm up for equipment and unit before performing any calibration related procedures. The following procedures should be performed at an ambient temperature of 15 to 35°C (59 to 95°F).

**CAUTION**: The accuracy of the calibration equipment will directly affect the accuracy of the CUB5P.

**Calibration**

1. Connect the negative lead of a precision DC source with an accuracy of 0.01% or better to the COMM. Leave the positive lead of the DC source unconnected.
2. With the display at CalC 88, press and hold the SEL button for 2 seconds. Unit will display 0.0 V (0.0 mA for voltage).
3. Press the RST button to select the range to be calibrated.
4. Press the SEL button. Display reads 000 (00 0 if for voltage).
5. Apply 0 signal:
   - **Current**: leave the positive lead of the DC source unconnected.
   - **Voltage**: apply a short to the input or connect the positive lead of the DC source to INP+ and set the source to 0.
6. Press SEL. Display reads 0.0V for about 8 seconds.
7. When the display reads the selected range (10 V, 20 mA, or 50 mA), connect the positive lead of the DC source to INP+ and apply the full scale input signal for the range. Press SEL. Display reads 0.0V for about 8 seconds.
8. Repeat steps 3 through 6 for each input range to be calibrated. When display reads 0.0, press the SEL button to exit calibration.

**FACTORY SERVICE OPERATIONS**

- **Print Request**: Serial transmit of the active parameters selected in the Print Options menu (Module 5).
- **Setpoint 1 Reset**: Resets setpoint 1 output.
- **Setpoint 2 Reset**: Resets setpoint 2 output.
- **Setpoint 1 and 2 Reset**: Reset both setpoint 1 and 2 outputs.
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 (P-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 values 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 CodE prompt in order to access Full Programming mode. Depending on the code value, Quick Programming may be accessible before the CodE prompt appears (see chart).

---

**PROGRAMMING SECURITY CODE**

<table>
<thead>
<tr>
<th>Security Code</th>
<th>Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-999</td>
<td>Full Programming (Immediate Access)</td>
</tr>
<tr>
<td>100-999</td>
<td>With correct code entry at CodE prompt *</td>
</tr>
</tbody>
</table>

* Entering Code 222 allows access regardless of security code.

---

**USER INPUT FUNCTION**

<table>
<thead>
<tr>
<th>User Input State</th>
<th>Security Code</th>
<th>Mode When &quot;Sel&quot; Button Is Pressed</th>
<th>Full Programming Mode Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>not P-Loc</td>
<td>0</td>
<td>Full Programming</td>
<td>After Quick Programming</td>
</tr>
<tr>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>with correct code entry</td>
</tr>
<tr>
<td></td>
<td>100-999</td>
<td>CodE prompt</td>
<td>With correct code entry</td>
</tr>
<tr>
<td>P-Loc Active</td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td>100-999</td>
<td>CodE prompt</td>
<td>With correct code entry</td>
</tr>
<tr>
<td>Not Active</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.

---

**FRONT PANEL DISPLAY SELECT ENABLE (SEL)**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

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

---

**FRONT PANEL RESET ENABLE (RST)**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

This selection allows the RST button to reset the selected value(s).

---

**ZERO DISPLAY WITH DISPLAY RESET**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

This parameter enables the RST button or user input to zero the input display value, causing the display reading to be offset. Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the display will not zero.

---

**DISPLAY COLOR (BACKLIGHT UNIT ONLY)**

<table>
<thead>
<tr>
<th>Color</th>
<th>rEd</th>
<th>gbn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

---

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

<table>
<thead>
<tr>
<th>Intensity Level</th>
<th>1 to 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

---

**DISPLAY SCROLL ENABLE**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

The YES selection allows the display to automatically scroll through the enabled displays. The scroll rate is every 4 seconds. This parameter only appears when the MAX or MIN displays are enabled.

---

**DISPLAY UPDATE TIME**

<table>
<thead>
<tr>
<th>Update Time</th>
<th>1 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 seconds</td>
</tr>
</tbody>
</table>

This parameter sets the display update time in seconds.

---

**UNITS INDICATOR SELECTION**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>L ISL</td>
</tr>
<tr>
<td></td>
<td>SEIS</td>
</tr>
</tbody>
</table>

This parameter activates the Units Indicator on the display. There are two methods of selecting the Indicator. List will present a group of Units preprogrammed into the meter. Segments allows the user to choose which of the segments should light.
The Setpoint Output Parameters are only active when an optional output module is installed in the meter.

**SETPOINT SELECT**

Enter the setpoint (output) to be programmed. The \( n \) in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to \( 4\text{-SPL} \). Repeat steps for each setpoint to be programmed. Select \( \text{NO} \) to exit the module. The number of setpoints available is setpoint output card dependent.

**SETPOINT 2 ENABLE**

Select \( \text{YES} \) to enable Setpoint 2 and access the setup parameters. If \( \text{NO} \) is selected, the unit returns to \( 4\text{-SPL} \) and setpoint 2 is disabled.

**SETPOINT ACTION**

Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

- \( \text{HI-bL} \) = High Acting, with balanced hysteresis
- \( \text{LO-bL} \) = Low Acting, with balanced hysteresis
- \( \text{HI-Ub} \) = High Acting, with unbalanced hysteresis
- \( \text{LO-Ub} \) = Low Acting, with unbalanced hysteresis

**SETPOINT VALUE**

Enter the desired setpoint value. The decimal point position for the setpoint and hysteresis values follow the selection set in Module 1.

**HYSTERESIS VALUE**

Enter desired hysteresis value. See Setpoint Output Figures for visual explanation of how setpoint output actions (balanced and unbalanced) are affected by the hysteresis. When the setpoint is a control output, usually balanced hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints.

**ON TIME DELAY**

Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

**OFF TIME DELAY**

Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

**OUTPUT RESET ACTION**

Enter the reset action of the output. See figure for details.

- \( \text{Auto} \) = Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel \( \text{RST} \) button or user input. The output remains off until the trigger point is crossed again.
- \( \text{L-dLY} \) = Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel \( \text{RST} \) button.
The Serial Setup Parameters are only active when the optional RS232 or RS485 serial communications module is installed in the meter. Refer to the CUBSCOM bulletin for complete details on CUB5 serial communications.

**OUTPUT RESET WITH DISPLAY RESET**

This parameter enables the RST button or user input to reset the output when the display is reset.

Note: For this parameter to operate, the RST button or User Input being used must be set to dSP and the Input value must be displayed. If these conditions are not met, the output will not reset.

**STANDBY OPERATION**

When YES, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset action.

**CHANGE DISPLAY COLOR w/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.
Press and hold SEL button to enter Programming Mode.
MODEL PAXLCL - PAX LITE CURRENT LOOP METER

- DUAL RANGE, 4 to 20 mA or 10 to 50 mA *
- 3 1/2-DIGIT, 0.56" (14.2 mm) HIGH LED READOUT
- 24 VDC EXCITATION SUPPLY
- WIDE SPAN & OFFSET SCALING RANGE
- OVER-RANGE INDICATION
- SELECTABLE DECIMAL POINTS
- NEMA 4X/IP65 SEALED FRONT BEZEL
- OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT

* Also adapts to 0 to 50, 0 to 20, 0 to 10, 1 to 5 mA ranges as well as bi-polar inputs.

GENERAL DESCRIPTION
The premium features of the PAX Lite Series can now be applied to measurement of process variables. With its high sensitivity and programmability, the PAX Lite Current Loop Meter can be set up for a wide variety of applications. In most plants the PAXLCL can be used for 90 to 95% of current loop meter needs for readout of pressure, flow, temperature, level and other variables. The meter has 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. This allows the PAXLCL to be used in dirty, hostile environments and in wash-down areas. The 3 1/2-digit bi-polar display (minus sign displayed when current or voltage is negative) features 0.56" (14.2 mm) high, 7-segment LEDs for easy reading.

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.

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

CAUTION: Read complete instructions prior to installation and operation of the unit.
CAUTION: Risk of electric shock.
TABLE OF CONTENTS

Ordering Information .................................. 2
General Meter Specifications. ......................... 3
Accessories ............................................. 3
Installing the Meter .................................... 4
Setting the Switches ................................... 4
Wiring the Meter ........................................ 4
Scaling the Meter ....................................... 6
Calibrating the Meter .................................. 7
Applications ............................................ 8

ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td>PAXL</td>
<td>0 0 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL - Current Loop Meter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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>Accessory</td>
<td>PAXLBK30</td>
<td>Units Label Kit Accessory</td>
<td></td>
</tr>
</tbody>
</table>
GENERAL METER SPECIFICATIONS

1. DISPLAY: 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.

2. OVER-RANGE INDICATION: Indicated by blanking 3 least significant digits.

3. POWER:
   - AC Power: 85 to 250 VAC, 50/60 Hz, 6 VA
   - Isolation: 2300 Vrms for 1 min. between input and supply (300 V working voltage).

4. INPUT SENSITIVITY: (Numerical Readout Change/mA)
   - 260 units/mA @ 4 to 20 mA input
   - 105 units/mA @ 10 to 50 mA input (max. allowable input current, 170 mA)

5. COMPLIANCE: Voltage drop across input at max. signal current, less than 600 mV for both 4 to 20 mA ranges.

6. INPUT RESISTANCE:
   - 4 to 20 mA: 29.2 Ω
   - 10 to 50 mA: 11.8 Ω

7. SCALING RANGE:
   - SPAN: 32 coarse steps (binary progression with 5 DIP switches) Each step providing approx. 8.125 numerical units/mA/step sensitivity for 4 to 20 mA input and 3.25 units/mA/step for 10 to 50 mA input.
   - OFFSET: 16 coarse steps (binary progression with 4 DIP switches) with ± switch to add or subtract offset. Each step adds or subtracts approximately 175 from the numerical display for a total offset range of ±2700.

8. LINEARITY: ±(0.05% ±1 digit)

9. READING RATE: 2.5 updated readings/second, nominal.

10. RESPONSE TIME: 1 second to settle for step change.

11. LOW FREQUENCY NOISE REJECTION:
    - Normal Mode Rejection: 63 dB @ 50/60 Hz
    - Common Mode Rejection: 100 dB, DC to 50/60 Hz

12. ENVIRONMENTAL CONDITIONS:
    - Operating Temperature: 0° to 60°C
    - Storage Temperature: -40° to 80°C
    - Operating and Storage Humidity: 85% max. relative humidity (non-condensing)
    - Span Temperature Coeff.: 100 PPM/°C
    - Offset Temperature Coeff.: 100 PPM/°C
    - Altitude: Up to 2000 meters

13. CERTIFICATIONS AND COMPLIANCES:
    - SAFETY
      - UL Recognized Component, File # EI79259, UL3101-1, 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 # EI37808, 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
      - IEEE CB Scheme Test Certificate # UL/7470A/UL
      - CB Scheme Test Report # 03ME09282-08292003 Issued by Underwriters Laboratories, Inc.
      - 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
      - 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:**
  - 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
  - 2 kV power
  - 2 kV signal
  - Fast transients (burst): EN 61000-4-4 (Criterion A)
  - 1 kV L-L
  - 2 kV L & N-E power
  - Surge: EN 61000-4-5 (Criterion A)
    - 1 kV L-L
    - 2 kV L & N-E power

- **Emissions:**
  - Emissions: EN 55011 Class B

**Notes:**
2. Criterion B: Temporary loss of performance from which the unit self-recover.

14. EXCITATION SUPPLY: 24 VDC @ 50 mA max. Regulated and isolated.

15. 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.

16. CONSTRUCTION:
    - This unit is rated for NEMA 4X/IP65 use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.

17. WEIGHT: 0.65 lbs (0.24 kg)

ACCESSORIES

UNITS LABEL KIT (PAXLBK)

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit (PAXLBK30). The backlight is controlled by a DIP switch.
1.0 Installing the Meter

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

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

Installation Environment
The unit should be installed in a location that does not exceed the 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.

2.0 Setting the Switches

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

Set-Up DIP Switches
Two banks of DIP switches are located inside the meter. The 10 position bank of switches are used for calibrating the meter. The values of these switches are discussed in section 5.0 Calibrating the Meter.
The bank of 4 switches located near the front display are used for the selection of decimal points and backlight annunciator. Selecting “ON” position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
</tbody>
</table>

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 power supplied to the meter (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, its source or the method of coupling into the unit may be different for various installations. 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. 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.

3.1 POWER WIRING

AC Power
Terminal 1: VAC
Terminal 2: VAC
115/230

3.2 INPUT SIGNAL WIRING

2-WIRE, EXTERNAL EXCITATION  
2-WIRE, WITH EXCITATION (Series Conn.)  
2-WIRE, WITH EXCITATION (Parallel Conn.)

NOTES
1. When shielded wire leads are used, connect the shield to earth ground at the meter and insulate the other end to avoid contact with machine ground.
2. Never run signal leads in conduit, bundles, or race ways with power conductors. Avoid runs close to contactors, relays, solenoids, transformers, and other potential sources of electrical noise.

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 #2BD2029-040
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.
6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
Snubber: RLC#SNUB0000.
4.0 SCALING THE METER

DESCRIPTION OF OPERATION

The PAX Lite Current Loop Meter consists of a digital volt meter combined with an analog scaling circuit (shown above). The unit was designed primarily for use with 4-20 mA and 10-50 mA current loop signal circuits. However, it can also be adapted to other current ranges, such as 0-50 mA, 0-20 mA, 0-10 mA, and in a great many applications it can be used even with 0-5 mA and 1-5 mA current loops. In addition, input current can be reversed in polarity resulting in negative numerical readout with a minus (-) sign displayed. Input terminals 3 and 4 are connected in series with 10-50 mA current loops, and Terminal 3 and 5 are series connected with 4-20 mA loops. In either case, the voltage drop generated across the shunt resistor(s) ranges from approximately 0.12 V min. (@ 4 or 10 mA) to 0.59 V max. (@ 20 or 50 mA). The buffer amplifier (K1) conditions and filters the input signal voltage and applies it to the input of the scaling circuit. The procedure for scaling PAX Lite Current Loop Meters is simplified by dividing the scaling process into two separate components, span adjustments and offset adjustments which are defined in the following discussion.

SPAN ADJUSTMENTS

Span is defined as the numerical range that the display traverses, disregarding decimal points, when the input signal current is varied from minimum (4 or 10 mA) to maximum (20 or 50 mA). For example, if a unit is to display 25.0 @ 4 mA and 100.0 @ 20 mA, the span is 750 (the difference between 250 and 1000). Had the minimum display been -25.0 @ 4 mA and +100.0 @ 20 mA, the span would be 1250 (1000 - (-250) = 1250). (Note: the terms “GAIN”, “SCALE”, and “SENSITIVITY” are also frequently used interchangeably with the term “SPAN.”) The PAX Lite Current Loop Meter can be set up over a very wide span range by means of the coarse DIP switches S6-S10, and the fine screwdriver adjustment pot, located at the back cover. The coarse span switches add parallel input resistors to the summing amplifier (K2), thereby increasing its gain, or sensitivity, as more summing resistors are added. Effectively, adding more parallel input resistors, increases the slope of the transfer curve (at right) and increases the numerical readout for a given input signal current change. The input summing resistor values are weighted in a binary progression, so they can be switched in combinations to give 32 discrete steps of span. The fine adjust control brackets these coarse steps and can be adjusted to the exact span needed.

OFFSET ADJUSTMENTS

In the foregoing discussion of span, the transfer curves were shown as “ZERO-BASED”, i.e., the numerical readout displays “0” when the signal current goes to zero. With current loop ranges such as 0-5 or 0-10, or 0-20 mA, and with Bi-Polar (+/-) signals, this is often the desired condition. However, with 4-20 and 10-50 mA current loops, the minimum current level of 4 or 10 mA usually represents the zero level of the parameter being displayed. There are also many applications where the minimum (or zero level) represents some value that does not fall on a zero based transfer curve. To accommodate non-zero based applications, the PAX Lite Current Loop Meter has provisions for offsetting the transfer curve over a wide range. Essentially, offset moves the transfer curve up or down to change its intercept with the numerical readout axis, but it does not change the slope (SPAN) of the transfer curve. In the PAX Lite Current Loop Meter, offset is accomplished by adding (or subtracting) a constant at the input of the summing amplifier (K2). This offset constant is summed in with a switched binary resistor network and a fine adjust offset control in a similar manner to that used for span adjustment. Switches S2-S5 can be turned on in combinations to give 16 different coarse offset levels. Each switch is labeled to show the approximate amount of offset contributed when it is turned “ON”. Switch 1 selects the polarity of the switched-in offset value and allows offsetting the transfer curve “UP” (adding the offset constant) or “DOWN” (subtracting). The fine offset control has a numerical readout range of ±100 and brackets all the coarse switched ranges.
5.0 CALIBRATING THE METER

Direct calibration in the signal loop is usually not practical due to the difficulty in varying the measured parameter and the confusing interaction that occurs between span and offset adjustments. However, the PAXLCL can be quickly and easily bench calibrated using a commercially available current calibrator or the calibration set-up shown below.

CALIBRATION PROCEDURE

The procedure outlined below minimizes span/offset interaction and simplifies calibration. In Steps 1 to 4 the unit is “nulled” to zero readout with zero input signal current. In Steps 5 and 6, the span adjustments are made to establish the required slope of the transfer curve. Then in Step 7, the transfer curve is shifted up or down as required by setting the offset adjustments. In Step 8, the final “tweaking” adjustments are made at minimum and maximum signal current. Setting the decimal points in Step 9 completes the calibration.

Before calibrating, the READOUT SPAN (Rs) and SWING CURRENT (Is) must be determined.

WHERE:

Rs = (Max. Numerical Display) - (Min. Numerical Display)  (Disregard Decimal Points)
Is = (Current @ Max. Display) - (Current @ Min. Display)

Example:

Readout is to be 0.00 @ 4 mA and 10.00 @ 20 mA.
READOUT SPAN (Rs) = 1000 - 0 = 1000
SWING CURRENT (Is) = 20 mA - 4 mA = 16

CALIBRATION STEPS

1. Power down the meter and remove it from its case. Turn off all offset and span adjustment switches (S2-S10 down). S1 has no effect when zeroing and can be in either position.
2. Turn the span control pot fully counter-clockwise (20 turns max.).
3. Turn on a combination of span adjust switches (6-10) to obtain a total value closest to (but not greater than) the READOUT SPAN (Rs) desired (1000 in this example). The following chart gives an approximate span adjustment value for each switch:

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>SPAN VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2100</td>
</tr>
<tr>
<td>7</td>
<td>1050</td>
</tr>
<tr>
<td>8</td>
<td>525</td>
</tr>
<tr>
<td>9</td>
<td>260</td>
</tr>
<tr>
<td>10</td>
<td>130</td>
</tr>
</tbody>
</table>

4. Place unit in its case and apply power. Apply zero current. Adjust the indicator to read zero using the offset adjustment pot.
5. Apply the SWING CURRENT (Is) (16 mA in the example) to the input. Set the exact READOUT SPAN value (1000) with span adj.pot.
6. Apply zero current to see if the zero value has shifted. If it has, re-zero with the offset pot, then repeat Step 5.
7. After the span has been adjusted, set the signal current to the minimum level (4 mA in the example). Record the meter reading (in this example the reading will be 250). Subtract the desired reading at minimum current value (0 in the example) from the recorded reading (0-250 = -250). Power down the meter and remove it from its case. Set the offset add/subtract switch S1 (subtract = on), and the offset switches (S2-S5) to obtain a total value closest to (but no more than) the difference between the desired reading at minimum current value and the observed reading. The following chart gives an approximate offset adjustment value for each switch:

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>OFFSET VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1400</td>
</tr>
<tr>
<td>3</td>
<td>700</td>
</tr>
<tr>
<td>4</td>
<td>350</td>
</tr>
<tr>
<td>5</td>
<td>175</td>
</tr>
</tbody>
</table>

Place the meter in its case and apply power. Using the offset adjust pot, adjust the readout to equal the desired reading at the minimum current value (0 in the example). 
8. Adjust the input signal current to its maximum value to see if the proper readout is obtained (1000 @ 20 mA in the example). If the readout is slightly off, adjust the span pot to obtain the true reading. Then, recheck the reading at the minimum input current (4 mA) and readjust the offset pot if necessary. Repeat the maximum and minimum readout adjustments until the unit displays the proper readout at both extremes.
9. Set decimal points as desired using the three decimal point switches. The unit can now be installed.

TROUBLESHOOTING

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

Example 1:
A PAXLCL is to be calibrated to match a flow transducer whose output is 10 mA @ 0 GPM and 50 mA @ 1375 GPM.

READOUT SPAN (Rs) = 1375 – 0 = 1375
SWING CURRENT (Is) = 50 mA – 10 mA = 40 mA

ADJUSTMENTS (Refer to the transfer curve below)
A Null the unit to zero readout @ 0 current per Steps 1 to 4 of the calibration steps.
B Set the coarse and fine span adjustments to get a readout of 1375 @ 40 mA per Steps 5 and 6. Note: With the full standard swing of 40 mA, the coarse span switch reference markings can be used to determine settings as follows:
S7 ON (1050) + S9 ON (260) = 1310
Span set with switches.
375 (needed) - 1310 (with SW's) = 65 w. fine span adj.
C Set offset to readout 0 @ 10 mA per Step 7. Note: The read out observed when the 10 mA min. current is first applied can be used to determine the offset switch settings.) In this example the readout will be (+) 344 when the 10 mA min. current is first applied. Applying -344 offset then reduces the readout to zero @ 10 mA.
D Check readout at max. (50 mA) and min. (10 mA) and fine tune (tweak) as required per Step 8.

Example 2 (Negative Slope):
A level measuring device puts out 6 mA when a storage tank is full and 15 mA when the tank is empty. The PAXLCL is to readout 90.0 tons at full tank and zero when empty.

READOUT SPAN (Rs) = 900 – 0 = 900 (Disregard Decimal Points)
SWING CURRENT (Is) = 6 mA (@ max rdg) - 15 mA (@ min rdg) = -9 mA

In this case, the signal current is reverse [Term 3 (-) with respect to Term 5 (+)] causing the readout to go “down” (increasingly negative) as the negative current increases.

ADJUSTMENTS
A Null the unit per Steps 1 to 4.
B Set slope of transfer curve with span adjustments per Steps 5 and 6, to get a readout of +1500 @ 8 mA.
C Apply (-) offset per Step 7 until readout is +900 @ -6 mA.
D Check min. and max. extremes and tweak if required to get desired readout @ 4 and 20 mA per Step 8.

Example 3 (± Display):
A differential pressure transducer has a range of ±1500 PSI with a 4 to 20 mA output (-1500 @ 4 mA, +1500 @ 20 mA).

READOUT SPAN (Rs) = +1500 – (-1500) = 3000
SWING CURRENT (Is) = 20 mA(max) - 4 mA(min) = 16 mA

Note: Since the display readout is limited to 1999 numerical indication, the full READOUT SPAN of 3000 cannot be obtained during zero based span adjustment. However, dividing both the READOUT SPAN and SWING CURRENT by two, i.e. 1500 readout @ 8 mA, allows the span adjustment to be made for the proper transfer curve slope.

ADJUSTMENTS
A Null the unit per Steps 1 to 4.
B Set transfer curve slope with span adjustments per Steps 5 and 6, to get a readout of +1500 @ 8 mA.
C Apply (-) offset per Step 7 to get a reading of -1500 @ 4 mA.
D Check min. and max. extremes and tweak if required to get desired readout @ 4 and 20 mA per Step 8.

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
MODEL PAXLPV - PAX LITE PROCESS VOLT METER

WIDE SPAN & OFFSET SCALING RANGE
3 1/2-DIGIT, 0.56” (14.2 mm) HIGH LED READOUT
24 VDC EXCITATION SUPPLY
OVER-RANGE INDICATION
SELECTABLE DECIMAL POINTS
NEMA 4X/IP65 SEALED FRONT BEZEL
OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT
±25 VOLT DC MAXIMUM INPUT

GENERAL DESCRIPTION
The premium features of the PAX Lite Series can now be applied to measurement of process variables. With its high sensitivity and programmability, the PAX Lite Process Volt Meter can be set up for a wide variety of applications. In most plants the PAXLPV can be used for 90 to 95% of Process Volt meter needs for readout of pressure, flow, temperature, level and other variables. The meter has 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. This allows the PAXLPV to be used in dirty, hostile environments and in wash-down areas. The 3½-digit bi-polar display (minus sign displayed when voltage is negative) features 0.56” (14.2 mm) high, 7-segment LEDs for easy reading.

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 5.0” (127) W.
Table of Contents

Ordering Information ........................................... 2
General Meter Specifications. ........................... 3
Accessories .................................................. 3
Installing the Meter ......................................... 4
Setting the Switches ....................................... 4
Wiring the Meter .............................................. 5
Scaling the Meter ............................................ 6
Calibrating the Meter ....................................... 7
Applications .................................................. 8

Ordering Information

Meter Part Numbers

PAXLPV00

PV - Process Volt Meter

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>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK30</td>
</tr>
</tbody>
</table>

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

1. DISPLAY: 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.

2. OVER-RANGE INDICATION: Indicated by blanking 3 least significant digits.

3. POWER:
   - AC Power: 85 to 250 VAC, 50/60 HZ, 6 VA
   - Isolation: 2300 Vrms for 1 min. to all inputs.

4. INPUT SENSITIVITY: (Numerical Readout Change/Volt) Adjustable from 40 units/volt to 1000 units/volt. Max. allowable input voltage, ±25 volts DC.

5. INPUT RESISTANCE: 1 MΩ

6. SCALING RANGE:
   - SPAN: 32 coarse steps (binary progression with 5 DIP switches) Each step providing approx. 40 numerical units/volt/step sensitivity. Fine adjust brackets the coarse step increments.
   - OFFSET: 16 coarse steps (binary progression with 4 DIP switches) with ± switch to add or subtract offset. Each step adds or subtracts approximately 175 from the numerical display for a total offset range of ±2700. Fine control brackets the steps.

7. LINEARITY: ±(0.05% ±1 digit)

8. READING RATE: 2.5 updated readings / second, nominal.

9. RESPONSE TIME: 1 second to settle for step change.

10. LOW FREQUENCY NOISE REJECTION:
    Normal Mode Rejection: 63 dB @ 50/60 Hz
    Common Mode Rejection: 100 dB, DC to 50/60 Hz

11. ENVIRONMENTAL CONDITIONS:
    - Operating Temperature: 0° to 60°C
    - Storage Temperature: -40° to 80°C
    - Operating and Storage Humidity: 85% max. relative humidity (non-condensing)
    - Span Temperature Coeff.: 100 PPM/°C
    - Offset Temperature Coeff.: 100 PPM/°C
    - Altitude: Up to 2000 meters

12. 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
    IECEE CB Scheme Test Certificate # US/8843A/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

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 B
- 10 V/m
- Fast transients (burst) EN 61000-4-4: Criterion A
- 2 kV power
- 2 kV signal
- Surge EN 61000-4-5: Criterion A
- 1 kV L-L
- 2 kV L & N-E power
- RF conducted interference EN 61000-4-6: Criterion A
- 3 V/μs
- 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: EN 55011 Class B

Notes:
- 2. Criterion B: Temporary loss of performance from which the unit self-recoveres.

13. EXCITATION SUPPLY: 24 VDC @ 50 mA max. Regulated and isolated.

14. 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.

15. CONSTRUCTION: This unit is rated for NEMA 4X/IP65 indoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel Gasket and mounting clip included.

16. WEIGHT: 0.65 lbs (0.24 kg)

ACCESORIES

UNITS LABEL KIT (PAXLBK)
Each meter has a units indicator with backlighting that can be customized using the Units Label Kit (PAXLBK30). The backlight is controlled by a DIP switch.
1.0 Installing the Meter

Installation

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

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

Installation Environment

The unit should be installed in a location that does not exceed the 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.

2.0 Setting the Switches

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

Set-Up DIP Switches

Two banks of DIP switches are located inside the meter. The 10 position bank of switches are used for calibrating the meter. The values of these switches are discussed in section 5.0 Calibrating the Meter.

The bank of 4 switches located near the front display are used for the selection of decimal points and backlight annunciator. Selecting “ON” position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
</tbody>
</table>
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 power supplied to the meter (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, its source or the method of coupling into the unit may be different for various installations. 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. 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-A0A
   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.
6. 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

Voltage Signal (2 wire)
Terminal 3: COMM
Terminal 4: INPUT

Voltage Signal (4 wire)
Terminal 3: COMM
Terminal 4: INPUT
Terminal 5: EXCITATION -
Terminal 6: EXCITATION +

3.1 Input Wiring

Voltage Signal (2 wire)
Terminal 3: COMM
Terminal 4: INPUT

Voltage Signal (4 wire)
Terminal 3: COMM
Terminal 4: INPUT
Terminal 5: EXCITATION -
Terminal 6: EXCITATION +
4.0 SCALING THE METER

DESCRIPTION OF OPERATION

The PAX Lite Process Volt Meter consists of a digital volt meter combined with an analog scaling circuit (shown above). Input voltage can be reversed in polarity resulting in negative numerical readout with a minus (-) sign displayed. Input terminals 3 and 4 are connected to the signal voltage. The buffer amplifier (K1) conditions and filters the input signal voltage and applies it to the input of the scaling circuit. The procedure for scaling PAX Lite Process Volt Meters is simplified by dividing the scaling process into two separate components, span adjustments and offset adjustments which are defined in the following discussion.

SPAN ADJUSTMENTS

Span is defined as the numerical range that the display traverses, disregarding decimal points, when the input signal is varied from minimum to maximum. For example, if a unit is to display 25.0 @ 1 V and 100.0 @ 5 V, the span is 750 (the difference between 250 and 1000). Had the minimum display been -25.0 @ 1 V and +100.0 @ 5 V, the span would be 1250 (1000 + (-250) = 1250). (Note: the terms “GAIN,” “SCALE,” and “SENSITIVITY” are also frequently used interchangeably with the term “SPAN.”) The PAX Lite Process Volt Meter can be set up over a very wide span range by means of the coarse DIP switches S6-S10, and the fine screwdriver adjustment pot, located at the back cover. The coarse span switches add parallel input resistors to the summing amplifier (K2), thereby increasing its gain, or sensitivity, as more summing resistors are added. Effectively, adding more parallel input resistors increases the slope of the transfer curve (at right) and increases the numerical readout for a given input signal change. The input summing resistor values are weighted in a binary progression, so they can be switched in combinations to give 32 discrete steps of span. The fine adjust control brackets these coarse steps and can be adjusted to the exact span needed.

The approximate span contributed by each switch is shown on the rear label. The values shown are “units per volt.” For example, if S6 only is turned “ON,” the numerical readout will change approximately 550 units for a signal voltage change of 1 volt. If S7 were also turned “ON,” the numerical readout would change approximately 825 units for a signal voltage change of 1 volt. The span adjust pot has a continuous span range of approximately 0-45.

OFFSET ADJUSTMENTS

Effectively, adding more parallel input resistors increases the slope of the transfer curve (at right) and increases the numerical readout for a given input signal change. In the foregoing discussion of span, the transfer curves were shown as “ZERO-BASED,” i.e., the numerical readout displays “0” when the signal goes to zero. With voltage ranges such as 0-5 V or 0-10 V, and with Bi-Polar (+/-) signals this is often the desired condition. However, with voltage ranges such as 1-5 V or 1-10 V, the minimum voltage level usually represents the zero level of the parameter being displayed. There are also many applications where the minimum (or zero level) represents some value that does not fall on a zero based transfer curve. To accommodate non-zero based applications, the PAX Lite Process Volt Meter has provisions for offsetting the transfer curve over a wide range. Essentially, offset moves the transfer curve up or down to change its intercept with the numerical readout axis, but it does not change the slope (SPAN) of the transfer curve. In the PAX Lite Process Volt Meter, offset is accomplished by adding (or subtracting) a constant at the input of the summing amplifier (K2). This offset constant is summed in with a switched binary resistor network and a fine adjust offset control in a similar manner to that used for span adjust. Switches S2-S5 can be turned on in combinations to give 16 different coarse offset levels. Each switch is labeled to show the approximate amount of offset contributed when it is turned “ON.” Switch 1 selects the polarity of the switched-in offset value and allows offsetting the transfer curve “UP” (adding the offset constant) or “DOWN” (subtracting). The offset adjust pot has a numerical readout range of +/-100 and brackets all the coarse switched ranges.
5.0 CALIBRATING THE METER

Direct calibration in the signal loop is usually not practical due to the difficulty in varying the measured parameter and the confusing interaction that occurs between span and offset adjustments. However, the PAXLPV can be quickly and easily bench calibrated using a commercially available calibrator.

CALIBRATION PROCEDURE

The procedure outlined in the calibration steps below, minimizes span/offset interaction and simplifies calibration. In Steps 1 to 4 the unit is “nulled” to zero readout with zero input signal voltage. In Steps 5 and 6, the span adjustments are made to establish the required slope of the transfer curve. Then in Step 7, the transfer curve is shifted up or down as required by setting the offset adjustments. In Step 8, the final “tweaking” adjustments are made at minimum and maximum signal voltage. Setting the decimal points in Step 9 completes the calibration. Before calibrating, the READOUT SPAN (Rs), SWING VOLTAGE (Vs), and SPAN PER VOLT (Rs/Vs) must be determined.

CALIBRATION STEPS

1. Power down the meter and remove it from its case. Turn off all offset and span adjustment switches (S2-S10 down). S1 has no effect when zeroing and can be in either position.
2. Turn the span control pot. fully counter-clockwise (20 turns max.).
3. Turn on a combination of span adjust switches (6-10) to obtain a total value closest to (but not greater than) the SPAN PER VOLT desired (250 in this example). The following chart gives an approximate span adjustment value for each switch:

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>SPAN VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>550</td>
</tr>
<tr>
<td>7</td>
<td>275</td>
</tr>
<tr>
<td>8</td>
<td>140</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
</tr>
<tr>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

4. Place unit in its case and apply power. Apply zero volts. Adjust the indicator to read zero using the offset adjustment pot.
5. Apply the SWING VOLTAGE (Vs) (4 V in this example) to the input. Set the exact READOUT SPAN value (1000) with span adj. pot.
6. Apply zero volts to see if the zero value has shifted. If it has, re-zero with the offset pot, then repeat Step 5.
7. After the span has been adjusted, set the signal voltage to the minimum level (1 V in the example). Record the meter reading (in this example the reading will be 250). Subtract the desired reading at minimum voltage value (0 in the example) from the recorded reading (0-250 = -250). Power down the meter and remove it from its case. Set the offset add/subtract switch S1 (subtract = on), and the offset switches (S2-S5) to obtain a total value closest to (but no more than) the difference between the desired reading at minimum voltage value and the observed reading. The following chart gives an approximate offset adjustment value for each switch:

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>OFFSET VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1400</td>
</tr>
<tr>
<td>3</td>
<td>700</td>
</tr>
<tr>
<td>4</td>
<td>350</td>
</tr>
<tr>
<td>5</td>
<td>175</td>
</tr>
</tbody>
</table>

Place the meter in its case and apply power. Using the offset adjust pot, adjust the readout to equal the minimum voltage value (0 in the example).
8. Adjust the input signal voltage to its maximum value to see if the proper readout is obtained (1000 @ 5 V in the example). If the readout is slightly off, adjust the span pot to obtain the true reading. Then, recheck the reading at the minimum input voltage (1 V) and readjust the offset pot if necessary. Repeat the maximum and minimum readout adjustments until the unit displays the proper readout at both extremes.
9. Set decimal points as desired using the three decimal point switches. The unit can now be installed.

TROUBLESHOOTING

For further assistance, contact technical support at the appropriate company numbers listed.
Example 1 (± Display):
A differential pressure transducer has a range of ±15 PSI with a 1-6 V output (-15 @ 1 V, +15 @ 6 V)
READOUT SPAN (Rs) = +1500 - (-1500) = 3000
SWING VOLTAGE (Vs) = 6 V (max) - 1 V (min) = 5 V
SPAN PER VOLT (Rs/Vs) = 3000 / 5 V = 600
Note: Since the display readout is limited to 1999 numerical indication, the full READOUT SPAN of 3000 cannot be obtained during zero based span adjustment. However, dividing both the READOUT SPAN and SWING VOLTAGE by two, i.e. 1500 readout @ 2.5 V, allows the span adjustment to be made for the proper transfer curve slope.

ADJUSTMENTS
A Null the unit to zero readout @ 0 V per Steps 1 to 4 of the calibration steps.
B Set transfer curve slope with span adjustments per Steps 5 and 6 to get a readout of +1500 @ 2.5 V (SPAN PER VOLT = 600).
C Apply (-) offset per Step 7 to get a reading of -1500 @ 1 V.
D Check min. and max. extremes and tweak if required to get desired readout @ 1 V and 6 V per step 8. Set D.P. switch S2 and replace unit in case.

Example 2 (Positive Offset):
PAkLPV is to be calibrated to match a flow transducer whose output is 0 V @ 40 GPM and 5 V @ 650 GPM.
READOUT SPAN (Rs) = 650 - 40 = 610
SWING VOLTAGE (Vs) = 5 V (max) - 0 V (min) = 5 V
SPAN PER VOLT (Rs/Vs) = 610 / 5 V = 122

ADJUSTMENTS
A Null the unit per Steps 1 to 4 of the calibration steps.
B Set the coarse and fine span adjustments to get a readout of 610 @ 5 V (SPAN PER VOLT = 122) per Steps 5 and 6.
C Set offset to readout 40 @ 0 V per Step 7.
D Check the readout @ max. (5 V) and min. (0 V) and fine tune (tweak) as required per Step 8.

Example 3 (Negative Slope):
A liquid level sensor puts out 1 V when a storage tank is full and 11 V when the tank is empty. The PAkLPV is to read out 100.0 when the tank is full and zero when the tank is empty.
READOUT SPAN (Rs) = 1000 - 0 = 1000
SWING VOLTAGE (Vs) = 1 V (max) - 11 V (min) = -10 V
SPAN PER VOLT (Rs/Vs) = 1000 / -10 V = -100
In this case, the signal voltage is reversed [Term. 3 (+) with respect to Term. 4 (-)] causing the readout to go “down” (increasingly negative) as the negative voltage increases (hence, the negative (-) SPAN PER VOLT).

ADJUSTMENTS
A Null the unit per Steps 1 to 4 of the calibration steps.
B Set the slope of the transfer curve with the span adjustments to get a readout of -1000 @ -10V (SPAN PER VOLT = -100) per Steps 5 and 6.
C Move the transfer curve up by applying (+) offset per Step 7 until readout is +1000 @ -1 V.
D Check extreme readings per Step 8 0 readout @ -11 V and +1000 @ -1 V. Set D.P. switch S1 ON and replace unit in case.
MODEL DP5P - PROCESS INPUT

This is a brief overview of the DP5P. For complete specifications and programming information, see the DP5 Analog Input Panel Meters Bulletin starting on page 358.

- DUAL RANGE INPUT (20 mA or 10 VDC)
- 5-DIGIT 0.56" HIGH RED LED DISPLAY
- PROGRAMMABLE FUNCTION KEYS/USER INPUT
- 24 VDC TRANSMITTER POWER
- NEMA 4X/IP65 SEALED FRONT BEZEL

DP5P SPECIFICATIONS

SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT (RANGE)</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA (-2 to 26 mA)</td>
<td>0.03% of reading +2 μA</td>
<td>0.12% of reading +3 μA</td>
<td>20 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>10 VDC (-1 to 13 VDC)</td>
<td>0.03% of reading +2 mV</td>
<td>0.12% of reading +3 mV</td>
<td>500 Kohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
MODEL PAXP - PROCESS INPUT

This is a brief overview of the DPSP. For complete specifications and programming information, see the PAX Analog Input Panel Meters Bulletin starting on page 378.

- 5-DIGIT 0.56" RED SUNLIGHT READABLE OR STANDARD GREEN DISPLAY
- DUAL RANGE INPUT (20 mA or 10 VDC)
- 24 VDC TRANSMITTER POWER
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- CRIMSON PROGRAMMING SOFTWARE

PAXP SPECIFICATIONS

SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT (RANGE)</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA (-2 to 26 mA)</td>
<td>0.03% of reading +2 μA</td>
<td>0.12% of reading +3 μA</td>
<td>20 ohm</td>
<td>150 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>10 VDC (-1 to 13 VDC)</td>
<td>0.03% of reading +2 mV</td>
<td>0.12% of reading +3 mV</td>
<td>500 Kohm</td>
<td>300 V</td>
<td>1 mV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
MODEL PAXDP – 1/8 DIN DUAL PROCESS INPUT METER

- ACCEPTS TWO 4 - 20 mA OR 0 - 10 VDC INPUT SIGNALS
- PROGRAMMABLE A/D CONVERSION RATE, 5 TO 105 READINGS PER SECOND
- 5-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- LINEARIZATION/SQUARE ROOT EXTRACTION INPUT RANGE
- PROGRAMMABLE FUNCTION KEYS/USER INPUTS
- 9 DIGIT TOTALIZER (INTEGRATOR) WITH BATCHING
- OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)
- NEMA 4X/IP65 SEALED FRONT BEZEL
- PC SOFTWARE AVAILABLE FOR METER CONFIGURATION

GENERAL DESCRIPTION
The PAXDP Dual Process Input Meter offers many features and performance capabilities to suit a wide range of industrial applications. Available in two models, AC or DC power, the meter has the capability to accept two, 4 to 20 mA or 0 to 10 VDC input signals. Each input signal can be independently scaled and displayed. In addition, a math function can be performed on the two signals, C + A + B, C - A - B, C + A - B, AB / C, CA / B, or C (A / B - 1). Any of the three meter values can have Alarms, Comms, and/or a Retransmitted Analog Output capability by simply adding optional cards. The optional plug-in output cards allow the opportunity to configure the meter for current applications, while providing easy upgrades for future needs.

The update rate of the meter is user selectable. This will help in those applications where a quick response from the meter is of the utmost importance. The rate can be adjusted from eight selections with a minimum of 5 updates/second to a maximum of 105 updates/second.

The meters employ a bright 0.56" (14.2 mm) red sunlight readable LED display. The intensity of display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The 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 signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow, calculate service intervals of motors or pumps, etc. The totalizer can also accumulate batch operations.

The meter has 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. The standard output is in Modbus Protocol. Any of the following option cards, RS232, RS485, DeviceNet, or Profibus can be used with the meter. 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.

A linear DC output signal is available as an optional Plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max/min readings, or math calculation value.

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 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.

DIMENSIONS
In inches (mm)

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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering Information</td>
<td>2</td>
</tr>
<tr>
<td>General Meter Specifications</td>
<td>3</td>
</tr>
<tr>
<td>Accessories</td>
<td>4</td>
</tr>
<tr>
<td>Optional Plug-In Cards</td>
<td>5</td>
</tr>
<tr>
<td>Installing the Meter</td>
<td>6</td>
</tr>
<tr>
<td>Setting the Jumpers</td>
<td>6</td>
</tr>
<tr>
<td>Wiring the Meter</td>
<td>7</td>
</tr>
<tr>
<td>Reviewing the Front Buttons and Display</td>
<td>9</td>
</tr>
<tr>
<td>Programming the Meter</td>
<td>10</td>
</tr>
<tr>
<td>Factory Service Operations</td>
<td>30</td>
</tr>
<tr>
<td>Parameter Value Chart</td>
<td>32</td>
</tr>
<tr>
<td>Programming Overview</td>
<td>34</td>
</tr>
</tbody>
</table>

## Ordering Information

### Meter Part Numbers

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAX</td>
<td>DP - Dual Process Input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - Red, Sunlight Readable Display</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 85 to 250 VAC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 - 18 to 36 VDC, 24 VAC</td>
<td></td>
</tr>
</tbody>
</table>

### 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 Plug-In Cards</td>
<td>PAXCDS</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
</tr>
<tr>
<td></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>PAXCDS</td>
<td></td>
<td>RS485 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS485 Serial Communications Output Card with Dual RJ11 Connector</td>
<td>PAXCDC1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS232 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS232 Serial Communications Output 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>Profibus-DP Communications Card</td>
<td>PAXCDC50</td>
</tr>
<tr>
<td>PAXCDL</td>
<td></td>
<td>Analog Output Card</td>
<td>PAXCDL10</td>
</tr>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK10</td>
</tr>
<tr>
<td></td>
<td>SFCRD</td>
<td>Crimson® 2 PC Configuration Software for Windows 98, ME, 2000, XP ²</td>
<td>SFCRD200</td>
</tr>
</tbody>
</table>

Notes:
1. For Modbus communications use RS485 Communications Output Card and configure communication (39F/39F) parameter for Modbus.
2. Crimson® 2 software is available as a free download at http://www.redlion.net/
GENERAL METER SPECIFICATIONS

1. DISPLAY: 5 digit, 0.56" (14.2 mm) variable intensity red sunlight readable (-19999 to 99999)

2. POWER:
   AC Versions:
   - Power: 85 to 250 VAC, 50/60 Hz, 21 VA
   DC Versions: (Derate operating temperature to 40°C if three plug-in option cards or PXACDC50 are installed.)
   - Power: 18 to 36 VDC, 13 W
   AC Power: 24 VAC, ± 10%, 50/60 Hz, 16 VA
   Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).
   Must use a Class 2 or SELV rated power supply

3. ANNUNCIATORS:
   A - Programmable Display
   B - Programmable Display
   C - Programmable Display
   SP1 - Setpoint alarm 1 is active
   SP2 - Setpoint alarm 2 is active
   SP3 - Setpoint alarm 3 is active
   SP4 - Setpoint alarm 4 is active
   Units Label - Optional units label backlight

4. KEYPAD: 3 programmable function keys, 5 keys total

5. A/D CONVERTER: 16 bit resolution

6. UPDATE RATES:
   A/D conversion rate: Adjustable 5.3 to 105 readings/sec.
   Step response: (to within 99% of final readout value with digital filter disabled)

<table>
<thead>
<tr>
<th>INPUT UPDATE RATE</th>
<th>MAX. TIME (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3</td>
<td>770</td>
</tr>
<tr>
<td>7.5</td>
<td>560</td>
</tr>
<tr>
<td>16.7</td>
<td>260</td>
</tr>
<tr>
<td>19.8</td>
<td>220</td>
</tr>
<tr>
<td>20</td>
<td>220</td>
</tr>
<tr>
<td>30</td>
<td>150</td>
</tr>
<tr>
<td>105</td>
<td>60</td>
</tr>
</tbody>
</table>

7. DISPLAY MESSAGES:
   "OLUL" - Appears when measurement exceeds + signal range.
   "ULUL" - Appears when measurement is active - signal range
   "..." - Appears when display values exceed + display range.
   "..." - Appears when display values exceed - display range.

8. SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT (RANGE)</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE/COMPLIANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±20 mA (-26 to 26 mA)</td>
<td>0.03% of reading +2 μA</td>
<td>0.12% of reading +3 μA</td>
<td>24.6 ohm</td>
<td>90 mA</td>
<td>1 μA</td>
</tr>
<tr>
<td>±10 VDC (-13 to 13 VDC)</td>
<td>0.03% of reading +2 mV</td>
<td>0.12% of reading +3 mV</td>
<td>500 Kohm</td>
<td>50 V</td>
<td>1 mV</td>
</tr>
</tbody>
</table>

9. EXCITATION POWER:
   Transmitter Power: 18 VDC, ±20%, unregulated, 70 mA max. per input channel.

10. LOW FREQUENCY NOISE REJECTION:
    Normal Mode: (digital filter off)

<table>
<thead>
<tr>
<th>INPUT UPDATE RATE</th>
<th>50 Hz ±1 Hz</th>
<th>60 Hz ±1 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3</td>
<td>&gt;90 dB</td>
<td>&gt;65 dB</td>
</tr>
<tr>
<td>7.5</td>
<td>&gt;80 dB</td>
<td>&gt;55 dB</td>
</tr>
<tr>
<td>16.7</td>
<td>&gt;100 dB</td>
<td>&gt;50 dB</td>
</tr>
<tr>
<td>19.8*</td>
<td>&gt;60 dB</td>
<td>&gt;95 dB</td>
</tr>
<tr>
<td>20</td>
<td>&gt;65 dB</td>
<td>&gt;100 dB</td>
</tr>
<tr>
<td>30</td>
<td>&gt;20 dB</td>
<td>&gt;20 dB</td>
</tr>
<tr>
<td>105</td>
<td>&gt;20 dB</td>
<td>&gt;13 dB</td>
</tr>
</tbody>
</table>

*Note: 19.8 Hz Input Rate provides best rate performance and simultaneous 50/60 Hz rejection.

Common Mode: > 100 dB @ 50/60 ±1 Hz (19.8 or 20 Input Rate)

11. USER INPUTS: Three programmable user inputs
    Max. Continuous Input: 30 VDC
    Isolation To Sensor Input A Common: 500 Vrms for 1 min.
    Working Voltage: 50 V
    Isolation To Sensor Input B Common: Not isolated.

12. TOTALIZER:
    Function:
    Time Base: second, minute, hour, or day
    Batch: Can accumulate (gate) input display from a user input
    Time Accuracy: 0.01% typical
    Decimal Point: 0 to 0.0000
    Scale Factor: 0.001 to 65.000
    Low Signal Cut-out: -19,999 to 99,999
    Total: 9 digits, display alternates between high order and low order readings

13. CUSTOM LINEARIZATION:
    Data Point Pairs: Selectable from 2 to 16
    Display Range: -19,999 to 99,999
    Decimal Point: 0 to 0.0000

14. MEMORY: Nonvolatile memory retains all programmable parameters and display values.

15. CERTIFICATIONS AND COMPLIANCES:
    SAFETY
    UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
    Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    Type 4X Enclosure rating (Face only), UL50
    IEEE CB Scheme Test Certificate #US/8843A/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
15. **CERTIFICATIONS AND COMPLIANCES (Cont'd):**

**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
- Electromagnetic RF fields: EN 61000-4-3
- Fast transients (burst): EN 61000-4-4
- Surge: EN 61000-4-5
- Voltage dip/interruptions: EN 61000-4-11
- RF conducted interference: EN 61000-4-6

**Emissions:**
- AC powered: EN 55011
- DC powered: EN 55011

**Notes:**
1. **Criterion A:** Normal operation within specified limits. 
2. **Criterion B:** Temporary loss of performance from which the unit self-recoveres.

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

16. **ENVIRONMENTAL CONDITIONS:**

Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in option cards installed)

Storage Temperature Range: -40 to 60°C

Operating and Storage Humidity: 0 to 85% max. RH non-condensing

Altitude: Up to 2000 meters

17. **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.

18. **CONSTRUCTION:**

This unit is rated for NEMA 4X/IP65 outdoor use.


19. **WEIGHT:**

10.4 oz. (295 g)

**ACCESSORIES**

**UNITS LABEL KIT (PAXLBK)**

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled in the programming.

**PROGRAMMING SOFTWARE**

The Crimson® 2 (SFCRM2) software is a Windows® based program for configuring and updating the firmware of the PAXDP meter from a PC. Using the software makes programming the PAXDP meter easier and allows the user to save the PAXDP database in a PC file for future use. The software is available as a free download from Red Lion’s website, or it can be purchased on CD.

The first time Crimson® 2 software is run from the File menu, select “New” to display a dialog and select the PAXDP. The screen will display icons that represent the various programming sections of the PAXDP. Double-click on an icon to configure the programming parameters pertaining to the selection. Tool Tip help is available for each of the program parameters. A PAX® serial plug-in card is required to program the meter using the software.

When communicating with Crimson® 2 software, the PAXDP must be set in default configuration type of:

- Communications Type: MODBUS RTU
- Baud Rate: 38400
- Data Bit: 8
- Parity Bit: no
- Meter Unit Address: 247
### 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. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

- **PAXCDS** - Setpoint Alarm Cards
- **PAXCDC** - Communication Cards
- **PAXCDL** - Analog Output Cards
- **PAXCDR** - Dual Relay Cards
- **PAXCDQ** - Quad Relay Cards

#### 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. Note: For Modbus communications use RS485 Communications Output Card and configure communication (TYPE) parameter for Modbus.

- **PAXCDC10** - RS485 Serial (Terminal Block)
- **PAXCDC1C** - RS485 Serial (Dual RJ11 Connector)
- **PAXCDC20** - RS232 Serial (Terminal Block)
- **PAXCDC2C** - RS232 Serial (9 Pin D Connector)
- **PAXCDC30** - DeviceNet
- **PAXCDC50** - Profibus-DP

#### SERIAL COMMUNICATIONS CARD

**Type:** RS485 or RS232  
**Communication Type:** RLC Protocol (ASCII), Modbus RTU, and Modbus ASCII  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min. Working Voltage: 50 V. Not isolated from all other commons.  
**Baud:** 300 to 38,400  
**Data:** 7/8 bits  
**Parity:** no, odd or even  
**Bus Address:** Selectable 0 to 99 (RLC Protocol), or 1 to 247 (Modbus Protocol), Max. 32 meters per line (RS485)  
**Transmit Delay:** Selectable for 0 to 0.250 sec (+2 msec min)

#### DEVCINETM™ CARD

**Compatibility:** Group 2 Server Only, not UCMM capable  
**Baud Rates:** 125 Kbaud, 250 Kbaud, and 500 Kbaud  
**Bus Interface:** Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.  
**Node Isolation:** Bus powered, isolated node  
**Host Isolation:** 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

#### PROFIBUS-DP CARD

**Fieldbus Type:** Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC  
**Conformance:** PNO Certified Profibus-DP Slave Device  
**Baud Rates:** Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud  
**Station Address:** 0 to 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.

### 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 30 VDC (resistive load), 1/8 HP @ 120 VAC, inductive load  
- Total current with both relays energized not to exceed 5 amps  
**Life Expectancy:** 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

#### Quad Relay Card

**Type:** Four FORM-A relays  
**Isolation To Sensor & User Input Commons:** 2300 Vrms for 1 min. Working Voltage: 250 Vrms  
**Contact Rating:**  
- One Relay Energized: 3 amps @ 240 VAC or 30 VDC (resistive load), 1/10 HP @ 120 VAC, inductive load  
- Total current with all four relays energized not to exceed 4 amps  
**Life Expectancy:** 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

#### Quad Sinking Open Collector Card

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

#### Quad Sourcing Open Collector Card

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

#### All Four Setpoint Cards

**Response Time:** See update rates step response specification; add 6 msec (typical) for relay card

### Linear DC Output (PAXCDL)

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

- **PAXCDL10** - Retransmitted Analog Output Card

### Analog Output Card

**Types:** 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min. Working Voltage: 50 V. Not isolated from all other commons.  
**Accuracy:** 0.17% of FS (18 to 28°C); 0.4% of FS (0 to 50°C)  
**Resolution:** 1/3500  
**Compliance:** 10 VDC: 10 KΩ load min., 20 mA: 500 Ω load max.  
**Powered:** Self-powered  
**Step Response:** See update rates step response specification  
**Update Time:** See ADC Conversion Rate and Update Time parameter
1.0 Installing the Meter

Installation

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

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

Installation Environment

The unit should be installed in a location that does not exceed the 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 Jumpers

The meter has three jumpers that must be checked and/or changed prior to applying power. The following Jumper Selection Figures show an enlargement of the jumper area.

To access the jumpers, 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.

Input Jumpers

These jumpers are used to select the proper input types, Voltage (V) or Current (I). The input type selected in programming must match the jumper setting. See the Jumper Selection Figures for more details.

User Input Logic Jumper

This jumper selects the logic state of all the user inputs. If the user inputs are not used, it is not necessary to check or move this jumper.

PAXDP Jumper Selection

JUMPER SELECTIONS

The \ indicates factory setting.

Note: In the figures above, the text shown in parenthesis is printed on the circuit board to help with proper jumper positioning.
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 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), 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, its source or the method of coupling into the unit may be different for various installations. 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. With use of the lower input ranges or signal sources with high source impedance, the use of shielded cable may be necessary. This helps to guard against stray AC pick-up. Attach the shield to the input common of the meter.
3. To minimize potential noise problems, power the meter from the same power branch, or at least the same phase voltage as that of the signal source.
4. 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.
5. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
6. 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.
7. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
8. 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 1: +VDC
Terminal 2: -VDC

3.2 Input Signal Wiring

Before connecting signal wires, the Input Range Jumper must be verified for proper position.

Input A Signal Wiring

Voltage Signal (self powered)
Terminal 4: -VDC
Terminal 5: +VDC

Current Signal (self powered)
Terminal 4: -ADC
Terminal 5: +ADC

Current Signal (2 wire requiring excitation)
Terminal 3: +ADC
Terminal 5: -ADC

Voltage/Current Signal (3 wire requiring excitation)
Terminal 3: +Volt supply
Terminal 4: -ADC (common)
Terminal 5: +ADC (signal)
3.3 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using User Inputs, then skip this section. Only the appropriate User Input terminal has to be wired.

Sinking Logic
Terminal 9:
Terminal 10-11: 
Connect external switching device between appropriate User Input terminal and User Comm.
In this logic, the user inputs of the meter are internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0.9 V).

Sourcing Logic
Terminal 9: -VDC thru external switching device
Terminal 10-11: +VDC thru external switching device
In this logic, the user inputs of the meter are internally pulled down to 0 V with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

3.4 SETPOINT (ALARMS) WIRING

VOLTAGE SIGNAL WIRING
Voltage Signal (self powered)
Terminal 7: -VDC
Terminal 8: +VDC
Current Signal (self powered)
Terminal 7: -ADC
Terminal 8: +ADC
Current Signal (2 wire requiring excitation)
Terminal 6: +ADC
Terminal 8: -ADC
Voltage/Current Signal (3 wire requiring excitation)
Terminal 6: +Volt supply
Terminal 7: -ADC (common)
Terminal 8: +ADC (signal)

CAUTION: Sensor Input B 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 voltages; or input common must be at protective earth ground potential. If not, hazardous live 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 common; and the common of the isolated plug-in cards with respect to input common.
3.5 ANALOG OUTPUT Wiring

ANALOG OPTION CARD FIELD TERMINALS

16 + 0-10V ANALOG OUTPUT
17 +
18 + 0-20mA ANALOG OUTPUT
19 +

3.6 SERIAL COMMUNICATION Wiring

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.

4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

Display Readout Legends*

Setpoint Alarm Annunciators

Optional Custom Units Overlay

KEY
DSP  DISPLAY MODE OPERATION
PAR  Index display through main displays as programmed in 3-LOC
F1↑  Access parameter list
F2↓  Function key 1; hold for 3 seconds for Second Function 1**
RST  Function key 2; hold for 3 seconds for Second Function 2**

PROGRAMMING MODE OPERATION
Quit programming and return to display mode
Store selected parameter and index to next parameter
Increment selected parameter value
Decrement selected parameter value
Hold with F1↑, F2↓ to scroll value by x1000

* Display Readout Legends may be locked out in Factory Settings.
** Factory setting for the F1, F2, and RST keys is NO mode.
5.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

DISPLAY MODE

The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown; A, B, or C. Each of these displays are programmable and can be locked from view through programming. (See Module 3.)

PROGRAMMING MODE

Two programming modes are available.

Full Programming Mode permits all parameters to be viewed and modified. Upon entering this mode, the front panel keys change to Programming Mode operations. This mode should not be entered while a process is running, since the meter functions and User Input response may not operate properly while in Full Programming Mode.

Quick Programming Mode permits only certain parameters to be viewed and/or modified. When viewing parameters (SPI, etc), the front panel keys change to Programming Mode operations, and all meter functions continue to operate properly. Quick Programming Mode is configured in Module 3. The Display Intensity Level "S" parameter is available in the Quick Programming Mode only when the security code is non-zero. For a description, see Module 9—Factory Service Operations. Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming Mode.

PROGRAMMING TIPS

The Programming Menu is organized into ten modules (see above). These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. Note that Modules 6 through 8 are only accessible when the appropriate plug-in card is installed. If lost or confused while programming, press the DSP key to exit programming mode and start over.

Factories Settings may be completely restored in Module 9. This is a good starting point if encountering programming problems. Throughout the module description sections which follow, the factory setting for each parameter is shown below the parameter display. In addition, all factory settings are listed on the Parameter Value Chart following the programming section.

ALTERNATING SELECTION DISPLAY

In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternating between the parameter (top display) and the parameter’s Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.

FACTORY SETTINGS

For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1 † and F2 †) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)

For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The RST key can be used in combination with the arrow keys to enter large numerical values. When the RST key is pressed along with an arrow key, the display scrolls by 1000’s. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr a #0)

The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr a #0 displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

STEP BY STEP PROGRAMMING INSTRUCTIONS:

PROGRAMMING MODE ENTRY (PAR KEY)

The Programming Mode is entered by pressing the PAR key. If this mode is not accessible, then meter programming is locked by either a security code or a hardware lock. (See Modules 2 and 3 for programming lock-out details.)

MODULE ENTRY (ARROW & PAR KEYS)

Upon entering the Programming Mode, the display alternates between Pr a and the present module (initially Pr 0). The arrow keys (F1 † and F2 †) are used to select the desired module, which is then entered by pressing the PAR key.

PARAMETER (MODULE) MENU (PAR KEY)

Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. 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 Pr a. From this point, programming may continue by selecting and entering additional modules. (See Module Entry above.)

PARAMETER SELECTION ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1 † and F2 †) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)

For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The RST key can be used in combination with the arrow keys to enter large numerical values. When the RST key is pressed along with an arrow key, the display scrolls by 1000’s. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr a #0)

The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr a #0 displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)
### 5.1 MODULE 1 - Signal Input Parameters

#### INPUT A PARAMETER MENU

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANGE</strong></td>
<td>10.000 V</td>
</tr>
<tr>
<td><strong>DR</strong></td>
<td>5.3, 7.5, 16.7, 19.8</td>
</tr>
<tr>
<td><strong>DECPL</strong></td>
<td>0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0</td>
</tr>
<tr>
<td><strong>round</strong></td>
<td>1, 2, 5, 10</td>
</tr>
<tr>
<td><strong>FILTER</strong></td>
<td>0.001 s</td>
</tr>
<tr>
<td><strong>bAND</strong></td>
<td>0.00 to 250 display units</td>
</tr>
<tr>
<td><strong>PES</strong></td>
<td>2 to 16</td>
</tr>
<tr>
<td><strong>STYLE</strong></td>
<td>Key-in data</td>
</tr>
<tr>
<td><strong>INP x DSP</strong></td>
<td></td>
</tr>
</tbody>
</table>

#### INPUT B PARAMETER MENU

Select the input range that corresponds to the external signal. Before applying signal configure input jumper to match setting desired.

### ADC CONVERSION RATE

<table>
<thead>
<tr>
<th><strong>RANGE</strong></th>
<th><strong>SELECTION</strong></th>
<th><strong>RANGE RESOLUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VOLT</strong></td>
<td>10.000 V</td>
<td></td>
</tr>
<tr>
<td><strong>curr</strong></td>
<td>20.000 mA</td>
<td></td>
</tr>
<tr>
<td><strong>U±5%</strong></td>
<td>±10.000 V - Square Root Extraction</td>
<td></td>
</tr>
<tr>
<td><strong>L±5%</strong></td>
<td>±20.000 mA - Square Root Extraction</td>
<td></td>
</tr>
</tbody>
</table>

Select the ADC conversion rate (conversions per second). The selection does not affect the display update rate, however it does affect setpoint and analog output response time. The default factory setting of 19.8 is recommended for most applications. Selecting a fast update rate may cause the display to appear very unstable.

### DISPLAY DECIMAL POINT

Select the decimal point location for the Input display. (The TOT display decimal point is a separate parameter.) This selection also affects round, DSP1 and DSP2 parameters and setpoint values.

### DISPLAY ROUNDDING*

Rounding selections other than one, cause the Input Display to ‘round’ to the nearest rounding increment selected (ie. rounding of ‘5’ causes 121 to round to 120 and 124 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection.

### FILTER SETTING

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of ‘0’ disables filtering.

### FILTER BAND*

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the digital filter permanently engaged.

### SCALING POINTS

#### Linear - Scaling Points (2)

For linear processes, only 2 scaling points are necessary. It is recommended that the 2 scaling points be at opposite ends of the input signal being applied. The points do not have to be the signal limits. Display scaling will be linear between and continue past the entered points up to the limits of the Input Signal Jumper position. Each scaling point has a coordinate-pair of Input Value (INP) and an associated desired Display Value (DSP).

#### Square Root Extraction Input Range - Scaling Points (2)

The PAXDP can apply the square root function directly to the sensor signal by selecting the Square Root Extraction Input Range (U±5% or L±5%). When configured for Square Root Extraction, piecewise multipoint linearization is not required and only the first 2 scaling points are used. For proper operation the Display 1 (DSP) b value must be zero.

#### Nonlinear - Scaling Points (Greater than 2)

For non-linear processes, up to 16 scaling points may be used to provide a piece-wise linear approximation. (The greater the number of scaling points used, the greater the conformity accuracy.) The Input Display will be linear between scaling points that are sequential in program order. Each scaling point has a coordinate-pair of Input Value (INP) and an associated desired Display Value (DSP). Data from tables or equations, or empirical data could be used to derive the required number of segments and data values for the coordinate pairs.

In the Crimson 2 (SFCRM2) software, several linearization equations are available. See the Accessories section for more information.

### SCALING STYLE

If Input Values and corresponding Display Values are known, the Key-in (Key) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (RPLy) scaling style must be used.

* The decimal point position is dependent on the selection made in the “Display Decimal Point” parameter.
5.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (Z-FNC)

The two user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed immediately after the user inputs are activated. The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed immediately after the front panel function keys are activated.

The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed immediately after the front panel function keys are activated. The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed immediately after the front panel function keys are activated. The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed immediately after the front panel function keys are activated.

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 will be performed every time any of those user inputs or function keys transition to the active state.

Note: In the following explanations, not all selections are available for both user inputs and front panel function keys. Alternating displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. USr - 1 will represent both user inputs. F 1 will represent all five function keys.

Display Decimal Point parameter.

Note user inputs or function keys transition to the active state. Momentary (edge trigger) actions will be performed every time any of those while at least one of those user inputs or function keys are activated. The for the same function, the maintained (level trigger) actions will be performed.

For Key-in (PEY), enter the known first Input Value by using the arrow keys. (The Input Range selection sets up the decimal location for the Input Value.) For Apply (RPLY), apply the input signal to the meter, adjust the signal source externally until the desired Input Value appears. In either method, press the PAR key to enter the value being displayed. In the RPLY style, the RST key can be pressed to advance the display past the INP 1 value or other input value without storing it. This is useful for application scaling of the second scaling point (i.e. when the tank is full), or some other point in multipoint applications.

Display Value for Scaling Point 1

Enter the first coordinating Display Value by using the arrow keys. This is the same for PEY and RPLY scaling styles. The decimal point follows the DEC Pt selection. For Square Root Extraction Input Range, the Display 1 value must be zero.

Display Value for Scaling Point 2

Enter the second coordinating Display Value by using the arrow keys. This is the same for PEY and RPLY scaling styles. The Display 1 value must be zero. The decimal point position is dependent on the selection made in the "Display Decimal Point" parameter.

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

General Notes on Scaling

1. Input Values for scaling points should be confined to the limits of the Input Signal, i.e. 4-20 mA or 0-10 VDC.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA cannot equal 0 and 10.)
3. The same Display Value can correspond to more than one Input Value. (Example: 0 mA and 20 mA can equal 10.)
4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65,535. For example using +20 mA range the maximum +20 mA can be scaled to be 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for 65,535 (32,767 x 2) but with even Input Display values shown.
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs (INP 1 / DSP 1 & INP 2 / DSP 2). If INP 1 = 4 mA and DSP 1 = 0, then 0 mA would be some negative Display Value. This could be prevented by making INP 1 = 0 mA / DSP 1 = 0, INP 2 = 4 mA / DSP 2 = 0, with INP 3 = 20 mA / DSP 3 = the desired high Display Value. The calculations stop at the limits of the Input Range Juniper position.
6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the last two sequential coordinate pairs. If three coordinate pair scaling points were entered, then the Display Value calculation would be between INP 2 / DSP 2 & INP 3 / DSP 3. The calculations stop at the limits of the Signal Input.

The maximum scaled Display Value is limited to 65,535. For example, using +20 mA range the maximum +20 mA can be scaled to be 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for 65,535 (32,767 x 2) but with even Input Display values shown.

The calculations stop at the limits of the Input Range Juniper position.

Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.
INPUT A ZERO (TARE) DISPLAY

The Zero (Tare) Display provides a way to zero the Input A value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), \(E\) flashes and the Input A value is set to zero. At the same time, the Input B value (that was on the display before the Zero Display) is subtracted from the Input B Display Offset Value and is automatically stored as the new Display Offset Value \(DF5\). If another Zero (tare) Display is performed, the display will again change to zero and the Input A reading will shift accordingly.

INPUT B ZERO (TARE) DISPLAY

The Zero (Tare) Display provides a way to zero the Input B value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), \(E\) flashes and the Input B value is set to zero. At the same time, the Input A value (that was on the display before the Zero Display) is subtracted from the Input A Display Offset Value and is automatically stored as the new Display Offset Value \(DF5\). If another Zero (tare) Display is performed, the display will again change to zero and the Input B reading will shift accordingly.

INPUT A RELATIVE/ABSOLUTE DISPLAY

This function will switch the Input A Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input A Display will normally show the Relative unless switched by this function. The Absolute is a gross value (based on Module 1 DSP and INP entries) without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the Input A display switches back to Relative display. \(A_E\) (absolute) or \(E_L\) (relative) is momentarily displayed at transition to indicate which display is active.

INPUT B RELATIVE/ABSOLUTE DISPLAY

This function will switch the Input B Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input B Display will normally show the Relative unless switched by this function. The Absolute is a gross value (based on Module 1 DSP and INP entries) without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the Input B display switches back to Relative display. \(A_E\) (absolute) or \(E_L\) (relative) is momentarily displayed at transition to indicate which display is active.

HOLD DISPLAY

The shown display is held but all other meter functions continue as long as activated (maintained action).

HOLD ALL FUNCTIONS

The meter disables processing the input, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

SYNCHRONIZE METER READING

The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D’s with other processes or timing events.

STORE BATCH READING IN TOTALIZER

The assigned value is one time added (batched) to the Totalizer at transition to activate (momentary action). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.

RESET TOTALIZER

When activated (momentary action), \(E\) flashes and the Totalizer resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

RESET AND ENABLE TOTALIZER

When activated (momentary action), \(E\) flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

ENABLE TOTALIZER

The Totalizer continues to operate as long as activated (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

RESET MAXIMUM

When activated (momentary action), \(E\) flashes and the Maximum resets to the present assigned value. The Maximum function then continues from that value. This selection functions independent of the selected display.
RESET MINIMUM

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

RESET MAXIMUM AND MINIMUM

When activated (momentary action), the Maximum and Minimum readings are set to the present assigned values. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

Note: Following display functions are only available on User Input.

ADVANCE DISPLAY

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

SELECT DISPLAY A

When activated (momentary action), the display advances to Display A, if enabled.

SELECT DISPLAY B

When activated (momentary action), the display advances to Display B, if enabled.

SELECT DISPLAY C

When activated (momentary action), the display advances to Display C, if enabled.

SELECT DISPLAY _

When activated (momentary action), the display advances to the Display _ (no annunciator), if enabled.

CHANGE DISPLAY INTENSITY LEVEL

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

SETPOINT SELECTIONS

The following selections are functional only with the Setpoint plug-in card installed. Refer to the Setpoint Card Bulletin shipped with the Setpoint plug-in card for an explanation of their operation.

SELECT SETPOINT LIST

Two lists of values are available for SP·1, SP·2, SP·3, SP·4. The two lists are named L5t·R and L5t·b. If a user input is used to select the list then L5t·R is selected when the user input is not active and L5t·b is selected when the user input is active (maintained action). If a front panel key is used to select the list then the list will toggle for each key press (momentary action). The display will only indicate which list is active when the list is changed.

To program the values for L5t·R and L5t·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. If any other parameters are changed then the other list values must be reprogrammed.

PRINT REQUEST

The meter issues a block print through the serial port when activated, and the serial type is set to r·LC. The data transmitted during a print request and the serial type is programmed in Module 7. If the user input is still active after the transmission is complete (about 100 msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.
Module 3 is the programming for the Display, Display assignments, Display lock-out and “Full” and “Quick” Program lock-out.

When in the main Display Mode, the available displays (A,B,C,_) can be read consecutively by repeatedly pressing the DSP key. An annunciator indicates the display being shown ( _ = No annunciator). A meter display value can be programmed to one of the displays, to the quick programming mode or be locked from being visible. It is recommended that the meter display value be set to LOC when it is not being used in the application.

“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, the setpoint values can still be read and/or changed per the selections below. The display Intensity Level (d·LE) parameter also appears whenever Quick Programming Mode is enabled and the security code greater than zero.

There are six meter values that can be individually programmed for one of the main displays (A,B,C or _), or programmed to be viewable in Quick Programming mode (rEd), or programmed to be locked out from display (LOC) (see the following table). If two or more values are assigned to the same display the last value assigned will be the one that is displayed.

<table>
<thead>
<tr>
<th>LOC</th>
<th>rEd</th>
<th>dSP-</th>
<th>dSP-b</th>
<th>dSP-c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not visible in Display Mode or Quick Programming Mode</td>
<td>Visible in Quick Programming Mode only</td>
<td>Assign to Display A</td>
<td>Assign to Display B</td>
<td>Assign to Display C</td>
</tr>
</tbody>
</table>

PROGRAMMING MODE ACCESS

<table>
<thead>
<tr>
<th>SECURITY CODE</th>
<th>USER INPUT CONFIGURED</th>
<th>USER INPUT STATE</th>
<th>WHEN PAR KEY IS PRESSED</th>
<th>“FULL” PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>not LOC</td>
<td>—</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>not LOC</td>
<td>—</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code # at Code prompt.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>LOC</td>
<td>Active</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code # at Code prompt.</td>
</tr>
<tr>
<td>&gt;0</td>
<td>LOC</td>
<td>Not Active</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
<tr>
<td>0</td>
<td>LOC</td>
<td>Active</td>
<td>Quick Programming</td>
<td>No access</td>
</tr>
<tr>
<td>0</td>
<td>LOC</td>
<td>Not Active</td>
<td>“Full” Programming</td>
<td>Immediate access.</td>
</tr>
</tbody>
</table>

Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming (all meter parameters are accessible).
5.4 MODULE 4 - SECONDARY FUNCTION PARAMETERS (4-SEC)

### Parameter Menu

**INPUT A OFFSET VALUE**

- 0.000

Unless a Zero Display was performed or an offset from Module 1 scaling is desired for Input A, this parameter can be skipped. The Display Offset Value is the difference between the Absolute (gross) Display value and the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyed-in to intentionally add or remove display offset. See Relative / Absolute Display and Zero Display explanations in Module 2.

**MAX CAPTURE ASSIGNMENT**

- R-REL

Select the desired parameter that will be assigned to the Max Capture.

**MAX CAPTURE DELAY TIME**

0.00 to 32750 sec.

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

**MIN CAPTURE ASSIGNMENT**

- R-REL

Select the desired parameter that will be assigned to the Min Capture.

**MIN CAPTURE DELAY TIME**

0.00 to 32750 sec.

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

**DISPLAY UPDATE RATE**

1 2 5 10 20 updates/sec.

This parameter determines the rate of display update.

**INPUT B OFFSET VALUE**

- 0.000

Unless a Zero Display was performed or an offset from Module 1 scaling is desired for Input B, this parameter can be skipped. The Display Offset Value is the difference between the Absolute (gross) Display value and the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyed-in to intentionally add or remove display offset. See Relative / Absolute Display and Zero Display explanations in Module 2.

**UNITS LABEL BACKLIGHT**

ON OFF

The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed in to the meter’s bezel display assembly. The backlight for these custom units is activated by this parameter.

**CALCULATION FUNCTION**

This parameter determines the math calculation that will be performed on Input A and Input B and shown on the calculation display. The above formulas represent the available calculations; \( R \) = Input A relative value, \( B \) = Input B relative value, and \( c \) = Calculation Constant Value (\( \text{CONSt} \)). For the average between A and B inputs, scale the display (Input A & Input B \( \text{DSP} \times \)) values in half and then use \( C \div A \div B \).

Note: \(+\) = add, \(-\) = subtract, \(\mathbf{D} \)= division, \(c(R/b-1)\) is displayed in the PAX as \(R/b-1\) and the function performs with A divided b then 1 is subtracted and the result is multiply by c.

**CALCULATION DECIMAL POINT**

This parameter determines the decimal point location for the Calculation Display. For the \( \text{C4A4b} \), \( \text{C4b} \), and \( \text{C4A4b} \) calculation functions, Input A “Display Decimal Point”, Input B “Display Decimal Point” and “Calculation Decimal Point” must all be in the same position.

* The decimal point position is dependent on the selection made in the “Display Decimal Point” parameter.
CALCULATION CONSTANT VALUE

<table>
<thead>
<tr>
<th>Value</th>
<th>0-9999 to 99999</th>
</tr>
</thead>
</table>

The constant value is used in the Calculation Function formulas to provide offsetting or scaling capabilities. For the 
\( c \cdot \), \( c(A+b) \), and \( c(A \cdot b \cdot b') \) calculation functions, the Constant decimal point matches that Calculation Decimal point position. For these functions, the “Constant Value” must be lowered to a value of 0 for no offset.

For the \( c \cdot \), \( c(A+b) \), and \( c(A \cdot b \cdot b') \) calculation functions, there is no “Constant Value” decimal point shown. However, when Input A “Display Decimal Point”, Input B “Display Decimal Point” and “Calculation Decimal Point” are in the same position, then the “Constant Value” decimal point will be assumed to be at the same location as the “Calculation Decimal Point”. For the Calculation Display to have the same resolution as Inputs A & B, the “Constant Value” must be a value of 1 with trailing 0’s for each assumed decimal point location.

Example: With Input A, Input B and the Calculation decimal points entered as 0.00, then the “Constant Value” would be entered as 100 for no gain.

CALCULATION ROUNDING*

| Value | 0.00 1 2 5 10 20 50 100 |

Rounding selections other than one, cause the Calculation Display to ‘round’ to the nearest rounding increment selected (ie. rounding of ‘0.005’ causes 0.121 to round to 0.120 and 0.124 to round to 0.125). Rounding starts at the least significant digit of the Calculation Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection. The displayed decimal point reflects that programmed in \( dP \).

5.5 MODULE 5 - TOTALIZER (INTEGRATOR) PARAMETERS (S-\( \text{tO} \)k)

The totalizer accumulates (integrates) the relative Input value using one of two modes. The first is using a time base. This can be used to provide an indication of total flow, usage or consumption over time. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used for weighing applications where accumulation is based on a completed event. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

TOTALIZER ASSIGNMENT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS IN</td>
<td>Totalizer Assignment</td>
</tr>
<tr>
<td>REL</td>
<td>Relative</td>
</tr>
<tr>
<td>REL b-REL</td>
<td>Calculated</td>
</tr>
</tbody>
</table>

This parameter determines which value is to be totalized.

TOTALIZER DECIMAL POINT*

| Value | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 |

For most applications, this should match the decimal point position of the meter value selected in the totalizer assignment. If a different location is desired, refer to Totalizer Scale Factor.

CALCULATION FILTER SETTING

| Value | 0.00 to 250 |

The calculation filter setting is a time constant expressed in tenths of a second. The filter sets to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Calculation Display reading. A value of ‘0’ disables filtering.

CALCULATION FILTER BAND*

| Value | 0 to 250 display units |

The digital filter will adapt to variations in the calculation filter. When the variation exceeds the calculation filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of ‘0’ keeps the digital filter permanently engaged.

* The decimal point position is dependent on the selection made in the “Calculation Decimal Point” parameter.

TOTALIZER TIME BASE

| Value | SECONDS (+1) MINUTES (+60) HOURS (+3600) |

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

TOTALIZER SCALE FACTOR*

| Value | 0.001 to 65000 |

For most applications, the Totalizer reflects the same decimal point location and engineering units as the assigned Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities are:

1. Changing decimal point location (example tenths to whole)
2. Average over a controlled time frame.

Details on calculating the scale factor are shown later.

If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.
TOTALIZER LOW CUT VALUE

-19999 to 99999

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

TOTALIZER POWER UP RESET

Do not reset totalizer
Reset totalizer

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

* The decimal point position is dependent on the selection made in the "Totalizer Decimal Point" parameter.

TOTALIZER HIGH ORDER DISPLAY

When the total exceeds 5 digits, the front panel annunciator flashes (if assigned to A, B, or C display). In this case, the meter continues to totalize up to a 9 digit value. The high order 4 digits and the low order 5 digits of the total are displayed alternately. The letter "H" denotes the high order display.

TOTALIZER BATCHING

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (bBASE). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

TOTALIZER USING TIME BASE

Totalizer accumulates as defined by:

\[
\text{Input Display} \times \text{Totalizer Scale Factor} \div \text{Totalizer Time Base}
\]

Where:

- Input Display - the present input reading
- Totalizer Scale Factor - 0.001 to 65.000
- Totalizer Time Base - (the division factor of \( bBASE \))

Example: The input reading is at a constant rate of 10.0 gallons per minute. The Totalizer is used to determine how many gallons in tenths has flowed. Because the Input Display and Totalizer are both in tenths of gallons, the Totalizer Scale Factor is 1. With gallons per minute, the Totalizer Time Base is minutes (60). By placing these values in the equation, the Totalizer will accumulate every second as follows:

\[
10.0 \times 1.000 = 0.1667 \text{ gallons accumulate each second} \\
60
\]

This results in:

- 10.0 gallons accumulate each minute
- 600.0 gallons accumulate each hour

TOTALIZER SCALE FACTOR CALCULATION EXAMPLES

1. When changing the Totalizer Decimal Point (dECPl) location from the Input Display Decimal Point (dECPl), the required Totalizer Scale Factor is multiplied by a power of ten.

Example: Input (dECPl) = 0.0

<table>
<thead>
<tr>
<th>Totalizer Scale Factor</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>10</td>
</tr>
<tr>
<td>0.00</td>
<td>1</td>
</tr>
<tr>
<td>x10</td>
<td>.01</td>
</tr>
<tr>
<td>x100</td>
<td>.001</td>
</tr>
</tbody>
</table>

\( x = \text{Totalizer display is round by tens or hundreds} \)

2. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.

Example: Average flow rate per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for \( bBASE \). The timer will control the start (reset) and the stopping (hold) of the totalizer.
Repeat programming for each setpoint.

**SELECT SETPOINT**

Select a setpoint (alarm output) to open the remaining module menu. (The "n" in the following parameters will reflect the chosen setpoint number.) After the chosen setpoint is programmed, the display will default to **SPSEL NO**. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing **PAR** at **SPSEL NO** will exit Module 6.

The parameters listed below are different from those listed in the Setpoint Card Literature. Use the separate Setpoint Option Card Literature for all other setpoint parameters.

**SETPOINT ASSIGNMENT**

Selects the meter value that is used to trigger the Setpoint Alarm. The **rEL** settings cause the setpoint to trigger off of the relative (net) input value. The relative input value is the absolute input value that includes the Display Offset Value. The **b-REL** settings cause the setpoint to trigger off of the absolute (gross) input value. The absolute input value is based on Module 1 *dSP* and *mIP* entries.

**SETPOINT ACTION**

Enter the action for the selected setpoint (alarm output).

The Setpoint Alarm Figures in the Setpoint Card Bulletin for a visual detail of each action. The Inside Band action is shown here as it only applies to the PAXDP.

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td>No Setpoint Action</td>
</tr>
<tr>
<td><strong>Rb-HI</strong></td>
<td>Absolute high, with balanced hysteresis</td>
</tr>
<tr>
<td><strong>Rb-LO</strong></td>
<td>Absolute low, with balanced hysteresis</td>
</tr>
<tr>
<td><strong>Ru-HI</strong></td>
<td>Absolute high, with unbalanced hysteresis</td>
</tr>
<tr>
<td><strong>Ru-LO</strong></td>
<td>Absolute low, with unbalanced hysteresis</td>
</tr>
<tr>
<td><strong>dE-HI</strong></td>
<td>Deviation high, with unbalanced hysteresis *</td>
</tr>
<tr>
<td><strong>dE-LO</strong></td>
<td>Deviation low, with unbalanced hysteresis *</td>
</tr>
<tr>
<td><strong>bAnd</strong></td>
<td>Outside band, with unbalanced hysteresis *</td>
</tr>
<tr>
<td><strong>bNd In</strong></td>
<td>Inside band, with unbalanced hysteresis *</td>
</tr>
<tr>
<td><strong>tAbLo</strong></td>
<td>Lower Totalizer absolute high, unbalance hysteresis **</td>
</tr>
<tr>
<td><strong>tAbHi</strong></td>
<td>Upper Totalizer absolute high, unbalance hysteresis **</td>
</tr>
</tbody>
</table>

* Setpoint 2 or Setpoint 4 deviation and band action setpoints are relative to the value of setpoint 1 or Setpoint 3 respectively. It is not possible to configure setpoint 1 or 3 as deviation or band actions. It is possible to use setpoint 1 or 3 for an absolute action, while its value is being used for deviation or band.

**HYS-n** - SETPOINT HYSTERESIS

**L0n-n** - ON TIME DELAY

**L0F-n** - OFF TIME DELAY

**out-n** - OUTPUT DELAY

**rSt-n** - RESET ACTION

**Stb-n** - STANDBY OPERATION

**L It-n** - SETPOINT ANNUNCIATORS

With reverse output logic *rEu*, the below 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 PAXDP 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 PAXDP. In order to establish serial communications, the user must have host software that can send and receive ASCII characters or utilizes Modbus protocol. For serial hardware and wiring details, refer to section 3.6 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 PAXDP. Also, this section does NOT apply to the DeviceNet, or Profinet-DP communication cards. For details on the operation of the Fieldbus cards, refer to the bulletin shipped with each card.

### COMUNICATIONS TYPE

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

### 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.

† The Communication Type factory settings must be changed from the Modbus RTU for Crimson 2 communications.

When communicating with Crimson 2 software, the PAXDP must be set in default configuration type of:
- Communications Type: MODBUS RTU
- Baud Rate: 38400
- Data Bit: 8
- Parity Bit: no
- Meter Unit Address: 247
SERIAL MODBUS COMMUNICATIONS

Modbus Communications requires that the Serial Communication Type Parameter (U:1&) be set to "CSU" or "C".

SUPPORTED FUNCTION CODES

FC03: Read Holding Registers
1. Up to 32 registers can be requested at one time.
2. HEX <8000> is returned for non-used registers.

FC04: Read Input Registers
1. Up to 32 registers can be requested at one time.
2. Block starting point can not exceed register boundaries.
3. HEX <8000> is returned in registers beyond the boundaries.
4. Input registers are a mirror of Holding registers.

FC06: Preset Single Register
1. HEX <8001> is echoed back when attempting to write to a read only register.
2. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit. It is also returned in the response.

FC16: Preset Multiple Registers
1. No response is given with an attempt to write to more than 32 registers at one time.
2. Block starting point cannot exceed the read and write boundaries (40001-41280).
3. If a multiple write includes read only registers, then only the write registers will change.
4. If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit.

FC08: Diagnostics
The following is sent upon FC08 request:
Module Address, 08 (FC code), 04 (byte count), “Total Comms” 2 byte count, “Total Good Comms” 2 byte count, checksum of the string.

SUPPORTED EXCEPTION CODES

01: Illegal Function
Issued whenever the requested function is not implemented in the meter.

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

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

07: Negative Acknowledge
Issued when a write to a register is attempted with an invalid string length.
## PAXDP MODBUS REGISTER TABLE

The below limits are shown as Integers or HEX <> values. Read and write functions can be performed in either Integers or Hex as long as the conversion was done correctly. Negative numbers are represented by two’s complement.

Note 1: The PAXDP should not be powered down while parameters are being changed. Doing so may corrupt the non-volatile memory resulting in checksum errors.

### FREQUENTLY USED REGISTERS

<table>
<thead>
<tr>
<th>REGISTER ADDRESS 1</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 2</th>
<th>HIGH LIMIT 2</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>Input A Relative Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process value of present input level. This value is affected by Input Type, Resolution, Scaling &amp; Offset Value (Relative Value = Absolute Input Value + Offset Value)</td>
</tr>
<tr>
<td>40002</td>
<td>Input A Relative Value (Lo word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process value of present input level. This value is affected by Input Type, Resolution, Scaling &amp; Offset Value (Relative Value = Absolute Input Value + Offset Value)</td>
</tr>
<tr>
<td>40003</td>
<td>Input B Relative Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process value of present input level. This value is affected by Input Type, Resolution, Scaling &amp; Offset Value (Relative Value = Absolute Input Value + Offset Value)</td>
</tr>
<tr>
<td>40004</td>
<td>Input B Relative Value (Lo word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process value of present input level. This value is affected by Input Type, Resolution, Scaling &amp; Offset Value (Relative Value = Absolute Input Value + Offset Value)</td>
</tr>
<tr>
<td>40005</td>
<td>Calculation Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Calculation Result of Math Function</td>
</tr>
<tr>
<td>40006</td>
<td>Calculation Value (Lo word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Calculation Result of Math Function</td>
</tr>
<tr>
<td>40007</td>
<td>Maximum Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40008</td>
<td>Maximum Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40009</td>
<td>Minimum Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40010</td>
<td>Minimum Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40011</td>
<td>Total Value (Hi word)</td>
<td>-1999999000</td>
<td>999999000</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40012</td>
<td>Total Value (Lo word)</td>
<td>-1999999000</td>
<td>999999000</td>
<td>N/A</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40013</td>
<td>Setpoint 1 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40014</td>
<td>Setpoint 1 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40015</td>
<td>Setpoint 2 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>200</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40016</td>
<td>Setpoint 2 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>200</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40017</td>
<td>Setpoint 3 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>300</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40018</td>
<td>Setpoint 3 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>300</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40019</td>
<td>Setpoint 4 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40020</td>
<td>Setpoint 4 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40021</td>
<td>Setpoint Output Register (SOR)</td>
<td>0</td>
<td>15</td>
<td>N/A</td>
<td>Read/Write</td>
<td>See Note</td>
</tr>
<tr>
<td>40022</td>
<td>Manual Mode Register (MMR)</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40023</td>
<td>Reset Output Register</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40024</td>
<td>Analog Output Register (AOR)</td>
<td>0</td>
<td>4095</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40025</td>
<td>Input A Absolute Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Gross value of present Input A level. This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value</td>
</tr>
<tr>
<td>40026</td>
<td>Input A Absolute Value (Lo word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Gross value of present Input A level. This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value</td>
</tr>
<tr>
<td>40027</td>
<td>Input B Absolute Value (Hi word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Gross value of present Input B level. This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value</td>
</tr>
<tr>
<td>40028</td>
<td>Input B Absolute Value (Lo word)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Gross value of present Input B level. This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value</td>
</tr>
<tr>
<td>40029</td>
<td>Input A Offset Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value</td>
</tr>
<tr>
<td>40030</td>
<td>Input A Offset Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value</td>
</tr>
<tr>
<td>40031</td>
<td>Input B Offset Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value</td>
</tr>
<tr>
<td>40032</td>
<td>Input B Offset Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value</td>
</tr>
<tr>
<td>40033</td>
<td>Main Setpoint 1 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40034</td>
<td>Main Setpoint 1 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40035</td>
<td>Main Setpoint 2 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>200</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40036</td>
<td>Main Setpoint 2 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>200</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40037</td>
<td>Main Setpoint 3 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>300</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40038</td>
<td>Main Setpoint 3 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>300</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40039</td>
<td>Main Setpoint 4 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40040</td>
<td>Main Setpoint 4 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td>Setpoint List A</td>
</tr>
<tr>
<td>40041</td>
<td>Alternate Setpoint 1 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
<tr>
<td>40042</td>
<td>Alternate Setpoint 1 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>100</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
</tbody>
</table>

1 For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.  
2 An attempt to exceed a limit will set the register to its high or low limit value.
<table>
<thead>
<tr>
<th>REGISTER ADDRESS 1</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 2</th>
<th>HIGH LIMIT 2</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40043</td>
<td>Alternate Setpoint 2 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>200</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
<tr>
<td>40044</td>
<td>Alternate Setpoint 2 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>300</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
<tr>
<td>40045</td>
<td>Alternate Setpoint 3 Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
<tr>
<td>40046</td>
<td>Alternate Setpoint 3 Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>400</td>
<td>Read/Write</td>
<td>Setpoint List B</td>
</tr>
<tr>
<td>40101</td>
<td>Input Range</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Vol, 1=Current, 2=Volt Square Root Extraction, 3=Current Square Root Extraction</td>
</tr>
<tr>
<td>40102</td>
<td>ADC Conversion Rate (samples/sec)</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>Read/Write</td>
<td>0=5.3, 1=7.5, 2=16.7, 3=19.8, 4=20, 5=30, 6=105</td>
</tr>
<tr>
<td>40103</td>
<td>Decimal Point</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>Read/Write</td>
<td>0=0, 1=0.0, 2=0.00, 3=0.000, 4=0.0000</td>
</tr>
<tr>
<td>40104</td>
<td>Rounding Factor</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0=1, 1=2, 2=3, 3=10, 4=20, 5=50, 6=100</td>
</tr>
<tr>
<td>40105</td>
<td>Digital Input Filter</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40106</td>
<td>Filter Band</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1=1 display unit</td>
</tr>
<tr>
<td>40107</td>
<td>Number of Scaling Points</td>
<td>2</td>
<td>16</td>
<td>2</td>
<td>Read/Write</td>
<td>Number of Linearization Scaling Points</td>
</tr>
<tr>
<td>40108</td>
<td>Reserved</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### SCALING POINTS PARAMETERS

<table>
<thead>
<tr>
<th>CH A</th>
<th>CH B</th>
<th>INPUT PARAMETERS</th>
<th>SEE MODULE 1 FOR DESCRIPTION OF PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40109</td>
<td>40209</td>
<td>Input 1 Input Value (Hi word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40110</td>
<td>40201</td>
<td>Input 1 Input Value (Lo word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40111</td>
<td>40211</td>
<td>Display 1 Input Value (Hi word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40112</td>
<td>40212</td>
<td>Display 1 Input Value (Lo word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>th</td>
<td>th</td>
<td>Display Parameters</td>
<td>See User F1 Key Description</td>
</tr>
<tr>
<td>40169</td>
<td>40269</td>
<td>Input 16 Input Value (Hi word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40170</td>
<td>40270</td>
<td>Input 16 Input Value (Lo word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40171</td>
<td>40271</td>
<td>Input 16 Input Value (Hi word)</td>
<td>0=1=0.001</td>
</tr>
<tr>
<td>40172</td>
<td>40272</td>
<td>Input 16 Input Value (Lo word)</td>
<td>0=1=0.001</td>
</tr>
</tbody>
</table>

### USER INPUT/FUNCTION KEYS

<table>
<thead>
<tr>
<th>USER INPUT/FUNCTION KEYS</th>
<th>SEE MODULE 2 FOR DESCRIPTIONS OF PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40301 User Input 1 Action</td>
<td>0=NO 8=SYNC 16=SP 24=r-2</td>
</tr>
<tr>
<td>40302 User Input 2 Action</td>
<td>0=NO 5=bAt 10=dSP-A 25=r-3</td>
</tr>
<tr>
<td>40303 User F1 Key Action</td>
<td>2=A-rEL 3=r-EL 4=A-EL</td>
</tr>
<tr>
<td>40304 User F2 Key Action</td>
<td>5=b-drl 6=r-Lo 7=A-HLd 8=r-HI 9=r-EL</td>
</tr>
<tr>
<td>40305 User Reset Key Action</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40306 User F1 Second Action</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40307 User F2 Second Action</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
</tbody>
</table>

### DISPLAY/QUICK PRO MENU LOCKS

<table>
<thead>
<tr>
<th>DISPLAY/QUICK PRO MENU LOCKS</th>
<th>SEE MODULE 3 FOR DESCRIPTIONS OF PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40311 Input A Display Lock 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40312 Input B Display 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40313 Calculation Display 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40314 Maximum (Hi) Value 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40315 Minimum (Lo) Value 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40316 Total Display 0</td>
<td>0=Loc 1=Red 2=Disp 3=Disp A 4=Disp B 5=Disp C</td>
</tr>
<tr>
<td>40317 SP1 Quick Pro 0</td>
<td>0=Lock 1=Read 2=Enter</td>
</tr>
<tr>
<td>40318 SP2 Quick Pro 0</td>
<td>0=Lock 1=Read 2=Enter</td>
</tr>
<tr>
<td>40319 SP3 Quick Pro 0</td>
<td>0=Lock 1=Read 2=Enter</td>
</tr>
<tr>
<td>40320 SP4 Quick Pro 0</td>
<td>0=Lock 1=Read 2=Enter</td>
</tr>
<tr>
<td>40321 Program Mode Security Code 0</td>
<td>0=Lock 1=Read 2=Enter</td>
</tr>
<tr>
<td>40322 Display Intensity Level 0</td>
<td>0=Min Intensity 15=Max Intensity</td>
</tr>
</tbody>
</table>

1 For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.
2 An attempt to exceed a limit will set the register to its high or low limit value.
**SECONDARY PARAMETERS**

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 1</th>
<th>HIGH LIMIT 1</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40029</td>
<td>Input A Offset Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>*Value shown here for reference</td>
</tr>
<tr>
<td>40030</td>
<td>Input A Offset Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td>*Value shown here for reference</td>
</tr>
<tr>
<td>40031</td>
<td>Input B Offset Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40032</td>
<td>Input B Offset Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40331</td>
<td>Max (Hi) Value Assignment</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40332</td>
<td>Max (Hi) Capture Delay Time</td>
<td>0</td>
<td>32750</td>
<td>10</td>
<td>Read/Write</td>
<td>0=Max Update Rate, 1=0.1 sec</td>
</tr>
<tr>
<td>40333</td>
<td>Min (Lo) Value Assignment</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Min Update Rate, 1=0.1 sec</td>
</tr>
<tr>
<td>40334</td>
<td>Min (Lo) Capture Delay Time</td>
<td>0</td>
<td>32750</td>
<td>10</td>
<td>Read/Write</td>
<td>0=Max Update Rate, 1=0.1 sec</td>
</tr>
<tr>
<td>40335</td>
<td>Display Update Time</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40336</td>
<td>Units Annunciator Backlight</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Off, 1=On</td>
</tr>
<tr>
<td>40337</td>
<td>Calculation Function</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40338</td>
<td>Calculation Display Decimal Point</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>Read/Write</td>
<td>0=0.1 Rdgs/sec, 1=2 Rdgs/sec, 2=5 Rdgs/sec, 3=10 Rdgs/sec, 4=20 Rdgs/sec</td>
</tr>
<tr>
<td>40339</td>
<td>Calculation Constant Value</td>
<td>-19999</td>
<td>99999</td>
<td>1000</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40340</td>
<td>Calculation Constant Value Low</td>
<td>-19999</td>
<td>99999</td>
<td>1000</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40341</td>
<td>Calculation Display Rounding Factor</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0=1, 1=2, 2=5, 3=10, 4=20, 5=50, 6=100</td>
</tr>
<tr>
<td>40342</td>
<td>Calculation Display Filter Value</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40343</td>
<td>Calculation Filter Band</td>
<td>0</td>
<td>250</td>
<td>10</td>
<td>Read/Write</td>
<td>1=1 display unit</td>
</tr>
</tbody>
</table>

**TOTALIZER PARAMETERS**

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 1</th>
<th>HIGH LIMIT 1</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40351</td>
<td>Total Assignment</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0=A-Rel, 1=b-Rel, 2=Calc</td>
</tr>
<tr>
<td>40352</td>
<td>Total Decimal Point</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>Read/Write</td>
<td>0=0, 1=0.0, 2=0.00, 3=0.000, 4=0.0000</td>
</tr>
<tr>
<td>40353</td>
<td>Total Timebase</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0=Second, 1=Minute, 2=Hour, 3=Day</td>
</tr>
<tr>
<td>40354</td>
<td>Total Scale Factor</td>
<td>0</td>
<td>65000</td>
<td>1000</td>
<td>Read/Write</td>
<td>1=0.001</td>
</tr>
<tr>
<td>40355</td>
<td>Total Low Cut Value (Hi word)</td>
<td>-19999</td>
<td>99999</td>
<td>-19999</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40356</td>
<td>Total Low Cut Value (Lo word)</td>
<td>-19999</td>
<td>99999</td>
<td>-19999</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td>40357</td>
<td>Total Reset at Power Up</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0 = No, 1 = Yes</td>
</tr>
</tbody>
</table>

**SETPOINT 1 OUTPUT PARAMETERS**

Note: SP Values are located at Registers 40013-40021

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 1</th>
<th>HIGH LIMIT 1</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40361</td>
<td>Assignment</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1=A-Rel, 2=B-Rel, 3=b-Rel</td>
</tr>
<tr>
<td>40362</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1=Ab-Hi, 2=Ab-Lo, 3=AU-HI, 4=AU-LO, 5=TotLo, 6=TotHI; Do not use 5-8.</td>
</tr>
<tr>
<td>40363</td>
<td>Hysteresis</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1=1 Display Unit</td>
</tr>
<tr>
<td>40364</td>
<td>On Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40365</td>
<td>Off Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40366</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Normal, 1=Reverse</td>
</tr>
<tr>
<td>40367</td>
<td>Reset</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Auto, 1=Latch1, 2=Latch2</td>
</tr>
<tr>
<td>40368</td>
<td>Standby</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1 = Yes</td>
</tr>
<tr>
<td>40369</td>
<td>Lit - Annunciator</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0=Off, 1=Normal, 2=Reverse, 3=Flash</td>
</tr>
</tbody>
</table>

**SETPOINT 2 OUTPUT PARAMETERS**

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT 1</th>
<th>HIGH LIMIT 1</th>
<th>FACTORY SETTING</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40371</td>
<td>Assignment</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1=A-Rel, 2=B-Rel, 3=b-Rel</td>
</tr>
<tr>
<td>40372</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1=Ab-Hi, 2=Ab-Lo, 3=AU-HI, 4=AU-LO, 5=DE-HI, 6=DE-LO, 7=dAnd, 8=dNdIn, 9=totLo, 10=totHI</td>
</tr>
<tr>
<td>40373</td>
<td>Hysteresis</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1=1 Display Unit</td>
</tr>
<tr>
<td>40374</td>
<td>On Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40375</td>
<td>Off Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40376</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Normal, 1=Reverse</td>
</tr>
<tr>
<td>40377</td>
<td>Reset</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Auto, 1=Latch1, 2=Latch2</td>
</tr>
<tr>
<td>40378</td>
<td>Standby</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=No, 1 = Yes</td>
</tr>
<tr>
<td>40379</td>
<td>Lit - Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0=Off, 1=Normal, 2=Reverse, 3=Flash</td>
</tr>
</tbody>
</table>

1 For Input Registers, replace the 4xxxx with a 3xxx in the above register address. The 3xxx are a mirror of the 4xxxx Holding Registers.

2 An attempt to exceed a limit will set the register to its high or low limit value.
<table>
<thead>
<tr>
<th>Register Address</th>
<th>Register Name</th>
<th>Low Limit 2</th>
<th>High Limit 2</th>
<th>Factory Setting</th>
<th>Access</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>40381</td>
<td>Assignment</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0=None  1=A-Rel 2=A-Abs 3=b-Rel 4=bAbs 5=Calc 6=Tot</td>
</tr>
<tr>
<td>40382</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,No, 1=Ab-HI, 2=Ab-Lo, 3=AU-HI, 4=AU-LO, 5=totLo, 6=totHI Do not use 5-8.</td>
</tr>
<tr>
<td>40383</td>
<td>Hysteresis</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1=1 Display Unit</td>
</tr>
<tr>
<td>40384</td>
<td>On Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40385</td>
<td>Off Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40386</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Normal, 1=Reverse</td>
</tr>
<tr>
<td>40387</td>
<td>Reset</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>Read/Write</td>
<td>0=Auto, 1=Latch1, 2=Latch2</td>
</tr>
<tr>
<td>40388</td>
<td>Standby</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0,No, 1 = Yes</td>
</tr>
<tr>
<td>40389</td>
<td>Lit - Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0=Off, 1=Normal, 2=Reverse, 3=Flash</td>
</tr>
<tr>
<td>40391</td>
<td>Assignment</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Read/Write</td>
<td>0=None  1=A-Rel 2=A-Abs 3=b-Rel 4=bAbs 5=Calc 6=Tot</td>
</tr>
<tr>
<td>40392</td>
<td>Action</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>Read/Write</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,No, 1=Ab-HI, 2=Ab-Lo, 3=AU-HI, 4=AU-LO, 5=DE-HI, 6=DE-LO, 7=band, 8=bndln, 9=totLo, 10=totHI</td>
</tr>
<tr>
<td>40393</td>
<td>Hysteresis</td>
<td>1</td>
<td>65000</td>
<td>2</td>
<td>Read/Write</td>
<td>1=1 Display Unit</td>
</tr>
<tr>
<td>40394</td>
<td>On Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40395</td>
<td>Off Delay</td>
<td>0</td>
<td>32750</td>
<td>0</td>
<td>Read/Write</td>
<td>1=0.1 Second</td>
</tr>
<tr>
<td>40396</td>
<td>Output Logic</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read/Write</td>
<td>0=Normal, 1=Reverse</td>
</tr>
<tr>
<td>40397</td>
<td>Reset</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>Read/Write</td>
<td>0=Auto, 1=Latch1, 2=Latch2</td>
</tr>
<tr>
<td>40398</td>
<td>Standby</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>0,No, 1 = Yes</td>
</tr>
<tr>
<td>40399</td>
<td>Lit - Annunciator</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Read/Write</td>
<td>0=Off, 1=Normal, 2=Reverse, 3=Flash</td>
</tr>
</tbody>
</table>

**SERIAL COMMUNICATIONS PARAMETERS**

<table>
<thead>
<tr>
<th>Address</th>
<th>Type</th>
<th>Baud Rate</th>
<th>Data Bits</th>
<th>Parity</th>
<th>Address</th>
<th>PARSE MESSAGES (APPLIIES ONLY WHEN LINEAR OUTPUT CARD, PAXCDL IS INSTALLED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40401</td>
<td></td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>RLC Protocol, 1=Modbus RTU, 2=Modbus ASCII</td>
</tr>
<tr>
<td>40402</td>
<td></td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0=300, 1=800, 2=1200, 3=2400, 4=4.8k, 5=9.6k, 6=19.2k, 7=38.4k</td>
</tr>
<tr>
<td>40403</td>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0=7 bits, 1=8 bits</td>
</tr>
<tr>
<td>40404</td>
<td></td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0=None, 1=Even, 2=Odd</td>
</tr>
<tr>
<td>40405</td>
<td></td>
<td>0</td>
<td>99</td>
<td>247</td>
<td>0</td>
<td>0=RLC Protocol, 0=99 1=Modbus: 1-247</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0=No, 1=Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not used when communications type is Modbus</td>
</tr>
<tr>
<td>40408</td>
<td></td>
<td>0</td>
<td>63</td>
<td>0</td>
<td>0</td>
<td>0=None, 1=Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not used when communications type is Modbus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 0 - Print Input A Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 1 - Print Input B Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 2 - Print CALC Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 3 - Print Max &amp; Min Values</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 4 - Print Total Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 5 - Print Setpoint Values</td>
</tr>
<tr>
<td>40409</td>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Changing 40401-40406 will not update the PAXDP until this register is written with a 1. After the write, the communicating device must be changed to the new PAXDP settings and the register returns to 0.</td>
</tr>
</tbody>
</table>

**ANALOG OUTPUT PARAMETERS**

<table>
<thead>
<tr>
<th>Address</th>
<th>Type</th>
<th>Assignment</th>
<th>Analog Low Value (Hi word)</th>
<th>Analog Low Value (Lo word)</th>
<th>Analog High Value (Hi word)</th>
<th>Analog High Value (Lo word)</th>
<th>Update Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>40411</td>
<td></td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0=0-20 mA, 1 = 4-20 mA, 2 = 0-10 V</td>
</tr>
<tr>
<td>40412</td>
<td></td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40413</td>
<td></td>
<td>0</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>0</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
</tr>
<tr>
<td>40414</td>
<td></td>
<td>0</td>
<td>-19999</td>
<td>99999</td>
<td>0</td>
<td>0</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
</tr>
<tr>
<td>40415</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>10000</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
</tr>
<tr>
<td>40416</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>10000</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
</tr>
<tr>
<td>40417</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>10000</td>
<td>0=NONE, 1=A-REL, 2=A-Abs, 3=b-REL, 4=b-AbS, 5=CALC, 6=tot, 7=HI, 8=LO</td>
</tr>
</tbody>
</table>

1 For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.

2 An attempt to exceed a limit will set the register to its high or low limit value.
## SERIAL RLC PROTOCOL COMMUNICATIONS

RLC Communications requires the Serial Communications Type Parameter (TYPE) be set to rLE.

### 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 $.

### 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 a one or two digit node address. Not required when address = 0.</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 1 or 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the address specifier, the next character is the command character.
3. The next character is the Register ID. This identifies the register that the command affects. The P command does not require a Register ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $.

### Notes

- For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.
- An attempt to exceed a limit will set the register to its high or low limit value.
Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>VALUE DESCRIPTION</th>
<th>REGISTER NAME 1</th>
<th>COMMAND SUPPORTED 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Input A Relative Value</td>
<td>INA</td>
<td>T, R (reset command zeros or tares input)</td>
</tr>
<tr>
<td>B</td>
<td>Input B Relative Value</td>
<td>INB</td>
<td>T, R (reset command zeros or tares input)</td>
</tr>
<tr>
<td>C</td>
<td>Calculation Value</td>
<td>CLC</td>
<td>T</td>
</tr>
<tr>
<td>D</td>
<td>Total</td>
<td>TOT</td>
<td>T, R (reset command zeros Total)</td>
</tr>
<tr>
<td>E</td>
<td>Min</td>
<td>MIN</td>
<td>T, R (reset command loads current reading)</td>
</tr>
<tr>
<td>F</td>
<td>Max</td>
<td>MAX</td>
<td>T, R (reset command loads current reading)</td>
</tr>
<tr>
<td>G</td>
<td>Input A Absolute (Gross) Value</td>
<td>ABA</td>
<td>T</td>
</tr>
<tr>
<td>H</td>
<td>Input B Absolute (Gross) Value</td>
<td>ABB</td>
<td>T</td>
</tr>
<tr>
<td>I</td>
<td>Input A Offset</td>
<td>OFA</td>
<td>T, V</td>
</tr>
<tr>
<td>J</td>
<td>Input B Offset</td>
<td>OFB</td>
<td>T, V</td>
</tr>
<tr>
<td>M</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, V, R (reset command resets setpoint output)</td>
</tr>
<tr>
<td>O</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>T, V, R (reset command resets setpoint output)</td>
</tr>
<tr>
<td>Q</td>
<td>Setpoint 3</td>
<td>SP3</td>
<td>T, V, R (reset command resets setpoint output)</td>
</tr>
<tr>
<td>S</td>
<td>Setpoint 4</td>
<td>SP4</td>
<td>T, V, R (reset command resets setpoint output)</td>
</tr>
<tr>
<td>U</td>
<td>Auto/Manual Register</td>
<td>MMR</td>
<td>T, V</td>
</tr>
<tr>
<td>W</td>
<td>Analog Output Register</td>
<td>AOR</td>
<td>T, V</td>
</tr>
<tr>
<td>X</td>
<td>Setpoint Register</td>
<td>SOR</td>
<td>T, V</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). 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: N17VM350*
2. Address = 5, Read Input A value
   String: NSTA*
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 2.5. In this case, write a value of 250 to equal 25.0).

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

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. See Abbreviated Printing (\textit{\(\text{Fr}_u\)) parameter.

Full Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>2 byte Node (Meter) Address field [00-99]</td>
</tr>
<tr>
<td>3</td>
<td>(&lt;\text{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 numeric data field: 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>19</td>
<td>(&lt;\text{CR}&gt;) (Carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>(&lt;\text{LF}&gt;) (Line feed)</td>
</tr>
<tr>
<td>21</td>
<td>(&lt;\text{SP}&gt;) (Space) (^3)</td>
</tr>
<tr>
<td>22</td>
<td>(&lt;\text{CR}&gt;) (Carriage return) (^3)</td>
</tr>
<tr>
<td>23</td>
<td>(&lt;\text{LF}&gt;) (Line feed) (^3)</td>
</tr>
</tbody>
</table>

\(^3\) 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. Byte 8 always is 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 \(<\text{CR}>\) (byte 19), and \(<\text{LF}>\) (byte 20). When a block print is finished, an extra \(<\text{SP}>\) (byte 21), \(<\text{CR}>\) (byte 22), and \(<\text{LF}>\) (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;\text{CR}&gt;) (Carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>(&lt;\text{LF}&gt;) (Line feed)</td>
</tr>
<tr>
<td>15</td>
<td>(&lt;\text{SP}&gt;) (Space) (^3)</td>
</tr>
<tr>
<td>16</td>
<td>(&lt;\text{CR}&gt;) (Carriage return) (^3)</td>
</tr>
<tr>
<td>17</td>
<td>(&lt;\text{LF}&gt;) (Line feed) (^3)</td>
</tr>
</tbody>
</table>

\(^3\) 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, Input A = 875
   17 INA 875 \(<\text{CR}>\) \(<\text{LF}>\)
2. Address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5\(<\text{CR}>\)\(<\text{LF}>\)
3. Address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250\(<\text{CR}>\)\(<\text{LF}>\)\(<\text{SP}>\)\(<\text{CR}>\)\(<\text{LF}>\)
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.

<table>
<thead>
<tr>
<th>U abcd</th>
</tr>
</thead>
<tbody>
<tr>
<td>c = Analog Output</td>
</tr>
<tr>
<td>d = SP4</td>
</tr>
<tr>
<td>c = SP3</td>
</tr>
<tr>
<td>b = SP2</td>
</tr>
<tr>
<td>a = SP1</td>
</tr>
</tbody>
</table>

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>0-20 mA</td>
<td>0-20 mA</td>
</tr>
<tr>
<td>4-20 mA</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>0-10V</td>
<td>0-10V</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).

<table>
<thead>
<tr>
<th>Output Signal*</th>
<th>0-20 mA</th>
<th>4-20 mA</th>
<th>0-10V</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1</td>
<td>0.005</td>
<td>0.004</td>
<td>0.0025</td>
</tr>
<tr>
<td>2047</td>
<td>10.000</td>
<td>12.000</td>
<td>5.000</td>
</tr>
<tr>
<td>4094</td>
<td>19.995</td>
<td>19.996</td>
<td>9.9975</td>
</tr>
<tr>
<td>4095</td>
<td>20.000</td>
<td>20.000</td>
<td>10.000</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>X abcd</th>
</tr>
</thead>
<tbody>
<tr>
<td>d = SP4</td>
</tr>
<tr>
<td>c = SP3</td>
</tr>
<tr>
<td>b = SP2</td>
</tr>
<tr>
<td>a = SP1</td>
</tr>
</tbody>
</table>

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

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

COMMAND RESPONSE TIME

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

At the start of the time interval 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 (*) 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 from 2 msec to 15 msec. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t2 is controlled by the use of the command terminating character and the Serial Transmit Delay parameter (\(dEL9\)). The standard command line terminating character is ".". This terminating character results in a response time window of the Serial Transmit Delay time (\(dEL9\)) plus 15msec. maximum. The \(dEL9\) parameter should be programmed to a value that allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with "$" results in a response time window (t2) of 2 msec minimum and 15 msec maximum. The response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

At the beginning of time interval t3, the meter responds with the first character of the reply. As with t1, the time duration of t3 is dependent on the number of characters and baud rate of the channel.

\[ t3 = \frac{10 \times \text{# of characters}}{\text{baud rate}} \]

At the end of t3, the meter is ready to receive the next command. The maximum serial throughput of the meter is limited to the sum of the times t1, t2 and t3.

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.

Timing Diagrams
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 ∞). 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 PAX meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop bit

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

5.8 MODULE 8 - ANALOG OUTPUT PARAMETERS (B-Out)

Module 8 is the programming for the analog output parameter. 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 PAXDP.

ANALOG TYPE

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

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

ANALOG ASSIGNMENT

| AS IN | NONE | A-REL | A-ABS | b-REL | b-ABS | CALC | tot | HI | LD |

Enter the source for the analog output to retransmit:
- rel = Relative (net) Input Value. The Relative Input Value is the Absolute Input Value that includes the Display Offset Value.
- abs = Absolute (gross) Input Value. The Absolute Input Value is based on Module 1 disp and imp entries.
- calc = Calculation Value
- tot = Totalizer Value
- hi = Maximum Display Value
- ld = Minimum Display Value

ANALOG LOW SCALE VALUE

-19999 to 99999

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

ANALOG HIGH SCALE VALUE

-19999 to 99999

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

ANALOG UPDATE TIME

00 to 100

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at the ADC Conversion Rate.
5.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FC5)

DISPLAY INTENSITY LEVEL
Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

RESTORE FACTORY DEFAULTS
Use the arrow keys to display Code 48 and press PAR. The meter will display FE0E and then return to Code 50. Press DSP key to return to Display Mode. This will overwrite all user settings with the factory settings.

CALIBRATION
The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed in Module 1. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored using the Apply (APL) Scaling Style.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

INPUT CALIBRATION
WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the Input Ranger Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter. No and PAR can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:
1. Use the arrow keys to display (Code 48) and press PAR.
2. Choose the input channel/range to be calibrated by using the arrow keys and press PAR. (No and PAR can be chosen to exit the calibration mode without any changes taking place.)
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage range: dead short applied
   - Current range: open circuit
4. Press PAR and the top range limit will appear on the display after approximately 1 second.
5. With the top range limit on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mADC
6. Press PAR and CAL. No will appear on the display after approximately 1 second.
7. When No appears, press PAR twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.
TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO DISPLAY</td>
<td>CHECK: Power level, power connections, Module 3 programming</td>
</tr>
<tr>
<td>PROGRAM LOCKED-OUT</td>
<td>CHECK: Active (lock-out) user input ENTER: Security code requested</td>
</tr>
<tr>
<td>DISPLAY LOCKED-OUT</td>
<td>CHECK: Module 3 programming</td>
</tr>
<tr>
<td>INCORRECT INPUT DISPLAY VALUE</td>
<td>CHECK: Module 1 programming, Input Jumper position, input connections, input signal level, Module 4 Display Offset is zero, press DSP for Input Display PERFORM: Module 9 Calibration (If the above does not correct the problem.)</td>
</tr>
<tr>
<td>“OLOL” in DISPLAY (SIGNAL HIGH)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>“ULUL” in DISPLAY (SIGNAL LOW)</td>
<td>CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level</td>
</tr>
<tr>
<td>JITTERY DISPLAY</td>
<td>INCORCE: Module 1 filtering, rounding, input range</td>
</tr>
<tr>
<td>MODULES or PARAMETERS NOT ACCESSIBLE</td>
<td>CHECK: Corresponding plug-in card installation</td>
</tr>
<tr>
<td>ERROR CODE (Err xxx or EE xxx)</td>
<td>PRESS: Reset KEY (If cannot clear contact factory.)</td>
</tr>
</tbody>
</table>

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

PARAMETER VALUE CHART

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT VALUE 1</td>
<td>0000</td>
</tr>
<tr>
<td>INPUT VALUE 2</td>
<td>0000</td>
</tr>
<tr>
<td>INPUT VALUE 3</td>
<td>0000</td>
</tr>
<tr>
<td>INPUT VALUE 4</td>
<td>0000</td>
</tr>
<tr>
<td>INPUT VALUE 5</td>
<td>0000</td>
</tr>
<tr>
<td>INPUT VALUE 6</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 1</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 2</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 3</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 4</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 5</td>
<td>0000</td>
</tr>
<tr>
<td>DISPLAY VALUE 6</td>
<td>0000</td>
</tr>
<tr>
<td>MODULE NUMBER</td>
<td>METER#</td>
</tr>
<tr>
<td>SECURITY CODE</td>
<td>Date</td>
</tr>
</tbody>
</table>

For further assistance, contact technical support at the appropriate company numbers listed.
### 2 - FAC 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>No</td>
<td></td>
</tr>
<tr>
<td>USR - 2</td>
<td>USER INPUT 2</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>FUNCTION KEY 1</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>FUNCTION KEY 2</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>rSb</td>
<td>RESET KEY</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sc - F1</td>
<td>2nd FUNCTION KEY 1</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sc - F2</td>
<td>2nd FUNCTION KEY 2</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

### 3 - LOC 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>INP A</td>
<td>INPUT A ASSIGNMENT</td>
<td>dSP-A</td>
<td></td>
</tr>
<tr>
<td>INP b</td>
<td>INPUT B ASSIGNMENT</td>
<td>dSP-b</td>
<td></td>
</tr>
<tr>
<td>CACLC</td>
<td>CALCULATION ASSIGNMENT</td>
<td>dSP-c</td>
<td></td>
</tr>
<tr>
<td>H-I</td>
<td>MAX DISPLAY LOCKOUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>LO</td>
<td>MIN DISPLAY LOCKOUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 1</td>
<td>SETPOINT 1 ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 2</td>
<td>SETPOINT 2 ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 3</td>
<td>SETPOINT 3 ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 4</td>
<td>SETPOINT 4 ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>CDAE</td>
<td>SECURITY CODE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### 4 - SEC Secondary Function Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFS - A</td>
<td>INPUT A OFFSET VALUE</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>DFS - b</td>
<td>INPUT B OFFSET VALUE</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>H - AS</td>
<td>MAX CAPTURE ASSIGNMENT</td>
<td>R - E</td>
<td></td>
</tr>
<tr>
<td>H - B</td>
<td>MAX CAPTURE DELAY TIME</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>L0 - AS</td>
<td>MIN CAPTURE ASSIGNMENT</td>
<td>R - E</td>
<td></td>
</tr>
<tr>
<td>L0 - B</td>
<td>MIN CAPTURE DELAY TIME</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>dSPE - b</td>
<td>DISPLAY UPDATE TIME</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b - L b'</td>
<td>UNITS LABEL BACKLIGHT</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>CFUNC</td>
<td>CALCULATION FUNCTION</td>
<td>cR A-b</td>
<td></td>
</tr>
<tr>
<td>c - P</td>
<td>CALCULATION DECIMAL POINT</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>conSt</td>
<td>CALCULATION CONSTANT VALUE</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>c - rnd</td>
<td>CALCULATION Rounding</td>
<td>0.00 i</td>
<td></td>
</tr>
<tr>
<td>c - FLt</td>
<td>CALCULATION FILTER SETTING</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>c - bNd</td>
<td>CALCULATION FILTER BAND</td>
<td>0.0 i</td>
<td></td>
</tr>
</tbody>
</table>

### 5 - LoK Totalizer (Integrator) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>R55</td>
<td>TOTALIZER ASSIGNMENT</td>
<td>R - E</td>
<td></td>
</tr>
<tr>
<td>dECPL</td>
<td>TOTALIZER DECIMAL POINT</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>tBASE</td>
<td>TOTALIZER TIME BASE</td>
<td>P - E</td>
<td></td>
</tr>
<tr>
<td>SFAC</td>
<td>TOTALIZER SCALE FACTOR</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Luct</td>
<td>TOTALIZER LOW CUT VALUE</td>
<td>-15399</td>
<td></td>
</tr>
<tr>
<td>P - uP</td>
<td>TOTALIZER POWER-UP RESET</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

### 7 - SRL Serial Communication Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTYPE</td>
<td>COMMUNICATIONS TYPE</td>
<td>0 - E</td>
<td></td>
</tr>
<tr>
<td>brAd</td>
<td>BAUD RATE</td>
<td>38400</td>
<td></td>
</tr>
<tr>
<td>dRb</td>
<td>DATA BIT</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Pr</td>
<td>PARITY BIT</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Addr</td>
<td>METER ADDRESS</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>dELEY</td>
<td>TRANSMIT DELAY</td>
<td>0.0 i</td>
<td></td>
</tr>
<tr>
<td>Abbr</td>
<td>ABBREVIATED PRINTING</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>OPt</td>
<td>PRINT OPTIONS</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>IMP A</td>
<td>INPUT A VALUE</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>IMP b</td>
<td>INPUT B VALUE</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>CACLC</td>
<td>CALCULATION</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>kT</td>
<td>PRINT TOTAL VALUE</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>H ILO</td>
<td>PRINT MAX &amp; MIN VALUES</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>SPABE</td>
<td>PRINT SETPOINT VALUES</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

### 8 - OUT Analog Output Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYPE</td>
<td>ANALOG TYPE</td>
<td>4 - 20</td>
<td></td>
</tr>
<tr>
<td>R55</td>
<td>ANALOG ASSIGNMENT</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>AN - LO</td>
<td>ANALOG LOW SCALE VALUE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AN - HI</td>
<td>ANALOG HIGH SCALE VALUE</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>ut</td>
<td>ANALOG UPDATE TIME</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

### 9 - FCS Factory Setting Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>d - LEU</td>
<td>DISPLAY INTENSITY LEVEL</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

### 6 - SPl Setpoint (Alarm) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPSNL</td>
<td>SELECT SETPOINT</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>RNPC</td>
<td>SETPOINT ASSIGNMENT</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>RAC</td>
<td>SETPOINT ACTION</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>SP - n</td>
<td>SETPOINT VALUE (main)</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>SPC</td>
<td>SETPOINT VALUE (alternate)</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>HY5 - n</td>
<td>SETPOINT HYSTERESIS</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>tOD - n</td>
<td>ON TIME DELAY</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>tOF - n</td>
<td>OFF TIME DELAY</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>out - n</td>
<td>OUTPUT LOGIC</td>
<td>nor</td>
<td></td>
</tr>
<tr>
<td>rSb - n</td>
<td>RESET ACTION</td>
<td>RUL - a</td>
<td></td>
</tr>
<tr>
<td>Sb - n</td>
<td>STANDBY OPERATION</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>L - b</td>
<td>SETPOINT ANNUNCIATORS</td>
<td>nor</td>
<td></td>
</tr>
</tbody>
</table>

*Select alternate list to program these values.
MODEL PAXLSG - PAX LITE STRAIN GAGE METER / MILLIVOLT METER

- 3 1/2-DIGIT, 0.56" (14.2 mm) HIGH LED READOUT
- HIGH SENSITIVITY, 10 mV FULL SCALE
- WIDE RANGE GAIN AND OFFSET ADJUSTMENTS
- BUILT-IN EXCITATION 5 OR 10 VDC
- APPLICABLE AS REGULAR MILLIVOLT INDICATOR (Single-ended or Differential Input)
- SELECTABLE DECIMAL POINTS
- OVER-RANGE INDICATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- OPTIONAL CUSTOM UNITS OVERLAY WITH BACKLIGHT

GENERAL DESCRIPTION
The Model PAXLSG expands the PAX Lite capabilities into the indication of pressure, load, force, and other parameters measured with strain gages. The unit features broad range scaling and can be used with a wide variety of strain gage resistances and bridge configurations. A built-in excitation source is jumper selectable for 5 or 10 VDC @ 120 mA maximum, and can power up to four full 350 Ω bridges in load averaging applications. Although designed primarily for strain-gage indication, the PAXLSG is also ideal for single-ended or differential millivolt input applications, with full-scale input ranges from 0 to 10 mV thru 0 to 2 VDC. Adjustable scaling and offset allow direct readout in nearly any engineering unit.

The meter has a NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, allowing the meter to provide 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.

DIMENSIONS In inches (mm)

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

Meter Part Numbers

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>PAXLBK</td>
<td>Units Label Kit Accessory</td>
<td>PAXLBK30</td>
</tr>
</tbody>
</table>

SG - Strain Gage Meter
1. **DISPLAY**: 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.

2. **OVER-RANGE INDICATION**: Indicated by blanking 3 least significant digits.

3. **POWER**:
   - AC Power: 85 to 250 VAC, 50/60 Hz, 6 VA
   - Isolation: 2300 Vrms for 1 min. to all inputs.

4. **INPUT SIGNAL**: Single-ended or differential input, ±2.0 V max. Gain (Sensitivity) is adjustable from 200 Units of Numerical Readout/millivolt input (gives full scale readout of 1999 at 10 mV input), to less than 1 Unit of Numerical Readout/mV (gives full scale readout of 1999 at 2.0 V input). Maximum common mode voltage swing with respect to signal ground, 0 to 7 V. Note: Absolute maximum voltage that can be applied between the two input terminals or between input and signal common is 50 VDC.

5. **INPUT IMPEDANCE**: 100 MΩ

6. **LINEARITY**: ±0.05% ±1 digit

7. **LOW FREQUENCY NOISE REJECTION**:
   - Normal Mode Rejection: 84 dB @ 50/60 Hz
   - Common Mode Rejection: 50 dB with respect to excitation common; 110 dB with respect to earth ground.

8. **RESPONSE TIME**: 2.0 seconds to settle from step input.

9. **READING RATE**: 2.5 updated readings/second, nominal.

10. **EXCITATION SUPPLY**:
    - Jumper Selectable: 5 VDC @ 60 mA max., ±2%
    - 10 VDC @ 120 mA max., ±2%
    - Temperature coefficient (ratio metric): 20 ppm/°C max.

11. **ENVIRONMENTAL CONDITIONS**:
    - Operating Temperature: 0° to 60°C
    - Storage Temperature: -40° to 80°C
    - Operating and Storage Humidity: 85% max. relative humidity (non-condensing)
    - Span Temperature Coeff.: 100 PPM/°C
    - Offset Temperature Coeff.: 100 PPM/°C
    - Altitude: Up to 2000 meters

12. **CERTIFICATIONS AND COMPLIANCES**:
    - SAFETY
      - UL Recognized Component, File # E179259, UL61010A-1, CSA C22.2 No. 61010-1
      - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
      - UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
      - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
      - Type 4X Enclosure rating (Face only), UL50
      - IECEx CB Scheme Test Certificate # UL/8843/A/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
      - 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 B
        - 10 V/m
        - Fast transients (burst) EN 61000-4-4 Criterion B
        - 2 kV power
        - 2 kV signal
        - Surge EN 61000-4-5 Criterion A
        - 1 kV L-L
        - 2 kV L-N-E power
        - 1 kV signal
        - RF conducted interference EN 61000-4-6 Criterion A
        - 3 V/rms
        - Power frequency magnetic fields EN 61000-4-8 Criterion A
        - 30 A/m
        - Voltage dip/interruptions EN 61000-4-11 Criterion A
        - 0.5 cycle
      - **Emissions**:
        - Emissions EN 55011 Class B

      - Notes:
        2. Criterion B: Temporary loss of performance from which the unit self-recover.

    - 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)

    - CONSTRUCTION:
      - This unit is rated for NEMA 4X/IP65 outdoor use.

    - **WEIGHT**: 0.65 lbs (0.24 kg)

**ACCESSORIES**

**UNITS LABEL KIT (PAXLBK)**

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled by a DIP switch.


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 into 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.

2.0 Setting the Switches and Jumpers

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

Excitation Range Jumper

A jumper is used for selection of the 5 or 10 volt range. It is important that only one jumper position is used at a time.

Set-Up DIP Switches

Two banks of DIP switches are located inside the meter. The 9 position bank of switches is used for calibrating the meter. The values of these switches is discussed in section 5.0 Calibrating the Meter.

The bank of 4 switches located near the front display are used for the selection of decimal points and backlight annunciator. Selecting "ON" position enables the function.

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal Point 1 (000.0)</td>
</tr>
<tr>
<td>2</td>
<td>Decimal Point 2 (00.00)</td>
</tr>
<tr>
<td>3</td>
<td>Decimal Point 3 (0.000)</td>
</tr>
<tr>
<td>4</td>
<td>Backlight Annunciator for Units Label</td>
</tr>
</tbody>
</table>

PAXLSG Jumper Selection

The indicated factory setting.

FRONT DISPLAY

REAR TERMINALS

MAIN CIRCUIT BOARD
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 power supplied to the meter (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, its source or the method of coupling into the unit may be different for various installations. 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. 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.
6. 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
85–250 VAC

Excitation Power
Terminal 3: Common
Terminal 4: Excitation +

3.2 INPUT SIGNAL WIRING

2-Wire Single Ended Input

4-Wire Bridge Input

6-Wire Bridge Input

DEADLOAD COMPENSATION

In some cases, the combined deadload and liveload output may exceed the range of the input. To use this range, the output of the bridge can be offset a small amount by applying a fixed resistor across one arm of the bridge. This shifts the electrical output of the bridge downward to within the operating range of the meter. A 100 K ohm fixed resistor shifts the bridge output approximately -10 mV (350 ohm bridge, 10 V excitation).

Connect the resistor between +SIG and -SIG. Use a metal film resistor with a low temperature coefficient of resistance.

BRIDGE COMPLETION RESISTORS

For single strain gage applications, bridge completion resistors must be employed externally to the meter. Only use metal film resistors with a low temperature coefficient of resistance.

Load cells and pressure transducers are normally implemented as full resistance bridges and do not require bridge completion resistors.
**DESCRIPTION OF OPERATION**

The Pax Lite Strain Gage Indicator (PAXLSG) consists of a digital voltmeter combined with a high-gain, differential input amplifier that has provision for wide range scaling adjustment (shown above). The unit also incorporates an excitation power supply (5 or 10 VDC) that delivers up to 120 mA. In the simplified schematic above, K1, K2, and K3 form a high-gain, high-stability, differential input preamplifier with a single ended output. The gain of this preamplifier is set up by coarse gain select switches S5 through S9. These switches can be turned on in combination to provide discrete steps of gain-range adjustment. The output of the preamplifier (K3 output) is applied to the summing amplifier (K4) through coarse and fine adjustable potentiometers. These adjustable potentiometers provide final vernier gain adjustment over a range of slightly more than 2:1. An adjustable offset voltage signal is also added in at the input of K4 for zero-balance or for applications where the transfer curve must be offset from zero.

**GAIN ADJUSTMENTS**

Gain is defined as the Units of Numerical change seen on the display per mV (millivolt) of input signal change (disregarding display decimal points). In effect, gain determines the slope of the transfer curve and is expressed in Units/mV.

\[
GAIN = \frac{(\text{Max. Num. Readout}) - (\text{Min. Num. Readout})}{(\text{Max. mV Input Sig.}) - (\text{Min. mV Input Sig.})}
\]

Note: Disregarded Decimal Points in Readout.

For example, if an PAXLSG is to display 50.0 @ 2 mV (min.) and 169.0 @ 19 mV (max.), the required gain will be:

\[
GAIN = \frac{1690 \text{ Units} - 500 \text{ Units}}{19 \text{ mV} - 2 \text{ mV}} = 70 \text{ Units/mV}
\]

Note: Remember, display decimal points are disregarded.

To establish this gain, the settings of the coarse gain select switches must first be determined. These switches establish the maximum end of the 2:1 adjustment range of the coarse and fine vernier gain adjustments.

**COARSE GAIN SELECT SWITCHES**

Each of the coarse gain select switches is marked with the amount of maximum gain it will contribute when turned on. They are turned on singly or in combination (adding up each of their gain contributions), to arrive at a maximum gain value that is just above the desired gain value. To achieve the desired gain of 70 Units/mV in the example just given, the following switches would be turned on:

\[
S6 \text{ (Gain 50)} + S7 \text{ (Gain 16)} + S8 \text{ (Gain 6.6)} = 72.6 \text{ Units/mV}
\]

With these switches ON, the coarse and fine vernier adjustments cover a gain range from about 36 Units/mV (½ of max.) to 72.6 Units/mV. The required gain of 70 Units/mV falls within this adjustable range.

**COARSE AND FINE GAIN ADJUSTMENTS**

Once the gain select switches have been set, the final gain calibration is made with the Coarse and Fine Gain adjustments. Both of these adjustments are 15-Turn, screwdriver adjustable potentiometers that increase gain with clockwise rotation. The Coarse adjustment has a 2:1 range. The Fine adjustment has a range of 5-10% (depending on the setting of the Coarse adjustment). Both pots are located at the rear of the meter.

**OFFSET ADJUSTMENTS**

Offset adjustments move the transfer curve up-and-down along the vertical axis without changing the slope (Gain). They are used to “balance” the output of transducers or to intentionally introduce an offset, such as tare-load compensation. The Fine Offset Adjustment is a 15-turn screwdriver adjustable potentiometer, located at the rear of the meter. It has a range of ±125 Numerical Units of offset which is sufficient for balancing the output of most transducers.

The Coarse Offset Switches (S2, 3, and 4) can be used to add additional steps of offset. Like the coarse gain select switches, the offset switches are marked with the approximate value of offset contributed by each switch, and they can be turned on in combinations with each switch, contributing its value to the total. Switch S1 selects the polarity of the offset signal and can be set to either add or subtract the offset contribution of the switches. The maximum offset that can be obtained with all switches ON and the Fine Offset at its maximum is ±1000, which is one half of the full scale readout.
5.0 CALIBRATING THE METER

There are three different methods that can be used to calibrate the PAXLSG, and the method chosen depends largely on the nature of the application. The three methods are:

VOLTAGE CALIBRATION
In this method, the transducer signal is simply replaced with an accurately measured input voltage that can be varied through the range normally delivered by the transducer (See Voltage Calibration Circuit, below). The PAXLSG is then adjusted to provide the proper readout.

SYSTEM CALIBRATION
In this method, the transducer is connected to the input of the PAXLSG in the final installation, or in a bench set-up simulating the actual installation. Accurately known inputs are then applied to the transducer (i.e. load, pressure, force, etc.) and the PAXLSG adjustments are made to provide the desired indication. This method is usually preferable to the Voltage Calibration method since it calibrates both the transducer and the PAXLSG as a combination, and reduces the inherent risk of inaccuracy or errors accumulated by separate calibration. However, it can only be used in applications where the parameter to be indicated can be easily varied and accurately measured or established. It is also very awkward to use if an offset or transducer unbalance must be dealt with because of Offset/Gain adjustment interaction.

COMBINATION VOLTAGE/SYSTEM CALIBRATION
In applications where tare-load, offset, or substantial transducer unbalance exists and where high accuracy is required in the final indication, it may be desirable to voltage calibrate the unit first to get it very close to its final settings. Then, after final installation, the unit can be “tweaked” to its final settings while using accurately known inputs to the system. These various factors make it impossible to set up one calibration procedure to cover all applications. However, using the following information on Voltage Calibration together with the examples given should provide a good basis for handling virtually any calibration requirement.

CALIBRATION EXAMPLE
“Voltage Calibration” can be easily performed for any application, using the calibration circuit shown below.

VOLTAGE CALIBRATION CIRCUIT
(Using 350 Ohm Dummy Bridge)

This 350 Ohms “Dummy Bridge” circuit delivers calibration voltages in ranges of 0 to ±22 mV, 0 to +44 mV, or 0 to −44 mV, depending on the setting of R2. The range can be increased or decreased by adjusting the value of R3 (shown as 40 KΩ). An accurate reference millivoltmeter is used to set up the calibration voltage, and a “Zero Switch” facilitates balancing without readjusting the calibration voltage. High-stability metalized resistors (1% tol.) should be used. The use of a dummy bridge insures a common-mode voltage during calibration that is very similar to that of the actual transducer.

SET-UP:
Before starting the procedure, the Input Swing Voltage (Vs), the Readout Span (Rs) and the required GAIN must be determined.

WHERE:
Rs = (Max. Numerical Display) - (Min. Numerical Display) Disregard Decimal Points
Vs = (mV in @ Max. Display) - (mV in @ Min. Display)
GAIN = Rs = Units/mV

EXAMPLE: Readout is to be 5.00 Units @ 2 mV minimum, and 15.00 Units @ 18 mV maximum. The transducer is a 350 Ω strain-gage bridge requiring 10 VDC excitation.

Rs = 1500 - 500 = 1000 Units
Vs = 18 mV - 2 mV = 16 mV
GAIN = 1000 = 62.5 Units/mV

Note: While most strain gage readout applications are zero-based (i.e. zero readout @ zero input) this example was intentionally chosen because it included an offset readout at zero input. It will be used in the Calibration Procedure below to illustrate the most convenient way to handle offset situations without excessive interaction of gain and offset adjustments. If a zero-based example had been given, the minimum readout and input voltage would have both been zero. Rs and Vs would then simply be the maximum values of readout and input voltage respectively, gain would just be the ratio of (Max. Readout/Max. Input mV), and Steps 7 and 8 of the procedure below could be eliminated.

CALIBRATION PROCEDURE
1. Set the Coarse Gain Select Switches, S5 through S9 to establish a maximum range just exceeding the required gain. Referring to the example given, the required gain was calculated to be 62.5 Units/mV. Setting switches S6 and S7 ON gives 50 + 16 = 66 Units/mV, which is just above the required amount. The following chart gives an approximate gain adjustment value for each switch:

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>SPAN VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>140</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>6.6</td>
</tr>
<tr>
<td>9</td>
<td>3.3</td>
</tr>
</tbody>
</table>

All offset switches, S2, 3, and 4, should be off.
2. Connect the unit to the Calibration Circuit as shown. Set the excitation voltage range jumper to the 10 V position.
3. Place unit in the case and turn power on to the unit. Allow 10 minutes of warm-up time for stabilization.
4. Close the “Zero Switch” of the calibration circuit to obtain zero input voltage. Adjust the fine offset control to get a zero readout.
5. Open the “Zero Switch” of the calibrating circuit and set the input voltage to the calculated swing voltage, Vs. (Vs is 16 mV in the example given.) Now, adjust the Gain Coarse and Fine Controls to get a readout equal to the Readout Span.
(Rs = 1000 Units in the example given.)
6. Repeat Step 4 and adjust zero if required. If zero readjustment was needed, repeat Step 5, then back to Step 4, etc., until Zero and Rs readings are acceptable.

7. Set the calibration voltage to the minimum input level (2 mV in this example). Record the meter reading (125 in this example). Power the meter down and remove it from the case. Set the Coarse Offset Select Switches to get the corresponding minimum readout (add the switch offset value(s) to the recorded meter reading). In the example given, the minimum readout was 500 units @ 2 mV, therefore setting switches 3 and 4 gives us 125 (meter reading) + 125 (SW4) + 250 (SW3) = 500. The following chart gives an approximate offset adjustment value for each switch.

<table>
<thead>
<tr>
<th>SWITCH NUMBER</th>
<th>OFFSET VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
</tr>
<tr>
<td>4</td>
<td>125</td>
</tr>
</tbody>
</table>

*8. Place unit in the case and turn power on to the unit. Use the fine offset adjustment to fine tune the desired minimum reading (500 in this example). Vary the input from the minimum to maximum levels and check the corresponding readouts. Fine-tune if necessary by readjusting the fine gain adjustment at the maximum end and the fine offset adjustment at the minimum end. (In the example, readout is 500 @ 2 mV min. and 1500 @ 18 mV max.) Alternate between minimum and maximum inputs as required until readout is within desired tolerance at the extremes.
9. Set appropriate decimal point switch (S2 for the example given).

The unit is now ready for installation.

* Steps 7 and 8 are not required in zero-based applications.
6.0 APPLICATIONS

EXAMPLE #1  PRESSURE READOUT & SYSTEM CALIBRATION

This illustration depicts a common application using a PAXLSG with a strain gage pressure transducer for pressure indication. The gain required to display 150 Units @ 20 mV is 150/20, or 7.5 Units/mV. Setting the Coarse Gain Select Switches S8 and S9 ON, gives a gain range of 6.6 + 3.3, or 9.9 Units/mV maximum, which brackets the required gain. The transducer curve is zero-based (i.e. zero readout at zero input), and can be easily System Calibrated. A variable pressure input is applied to the transducer with a "Dead-Weight Tester" and the Fine Offset is adjusted to give a readout of zero with no pressure applied. Then 150 PSI is applied, the Coarse and Fine Gain controls are adjusted for a readout of 150. Pressure is removed, zero is checked and readjusted with the Fine Offset control if needed. Pressure is varied between zero and maximum, with the Fine Gain and Offset adjustments trimmed as needed until the readout is within tolerance.

EXAMPLE #2  THE MODEL PAXLSG AS A MILLIVOLT METER

The PAXLSG can be used as a scaleable millivolt meter and will accept either single-ended or differential inputs when connected as shown. Input signals are referenced to the negative (common) side of the excitation supply (Terminal 3). Maximum common-mode voltage (for differential input) is 0 to +7 VDC.

EXAMPLE #3  MULTIPLE LOAD-CELL INPUT, AVERAGE READING

The 120 mA excitation output capability of the PAXLSG allows it to operate multiple strain gage bridges. In this example, it is used to indicate the quantity of granular material held in a hopper that is supported by three load cells in a tripod mounting arrangement. The tare-weight of the empty hopper is about 30% of the full weight, requiring a significant offset for a zero readout when empty. The PAXLSG is first Voltage-Calibrated (using the known output of the load cells at the empty and full conditions). Then the unit is installed and fine trimmed (System Calibration) using known loads.
MODEL PAXS - STRAIN GAGE INPUT

This is a brief overview of the PAXS. For complete specifications and programming information, see the PAX Analog Input Panel Meters Bulletin starting on page 378.

- 5-DIGIT 0.56" RED SUNLIGHT READABLE OR STANDARD GREEN DISPLAY
- LOAD CELL, PRESSURE AND TORQUE BRIDGE INPUTS
- DUAL RANGE INPUT: ±24 mV OR ±240 mV
- SELECTABLE 5 VDC OR 10 VDC BRIDGE EXCITATION
- PROGRAMMABLE AUTO-ZERO TRACKING
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- CRIMSON PROGRAMMING SOFTWARE

PAXS SPECIFICATIONS

SENSOR INPUTS:

<table>
<thead>
<tr>
<th>INPUT RANGE</th>
<th>ACCURACY* (18 to 28°C)</th>
<th>ACCURACY* (0 to 50°C)</th>
<th>IMPEDANCE</th>
<th>MAX CONTINUOUS OVERLOAD</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>±24 mVDC</td>
<td>0.02% of reading +3 μV</td>
<td>0.07% of reading +4 μV</td>
<td>100 Mohm</td>
<td>30 V</td>
<td>1 μV</td>
</tr>
<tr>
<td>±240 mVDC</td>
<td>0.02% of reading +30 μV</td>
<td>0.07% of reading +40 μV</td>
<td>100 Mohm</td>
<td>30 V</td>
<td>10 μV</td>
</tr>
</tbody>
</table>

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

CONNECTION TYPE: 4-wire bridge (differential)
2-wire (single-ended)

COMMON MODE RANGE (w.r.t. input common): 0 to +5 VDC
Rejection: 80 dB (DC to 120 Hz)

BRIDGE EXCITATION:
Jumper Selectable: 5 VDC @ 65 mA max., ±2%
10 VDC @ 125 mA max., ±2%
Temperature coefficient (ratio metric): 20 ppm/°C max.