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

### LED DISPLAY

<table>
<thead>
<tr>
<th>Description</th>
<th>LD2</th>
<th>LD4</th>
<th>LPAX</th>
<th>EPAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 and 6 Digit, 2.25&quot; (57 mm) Red LED</td>
<td>4 and 6 Digit, 4&quot; (101 mm) Red LED</td>
<td>ANALOG INPUTS 5 Digit, 1.5&quot; (38 mm) Red LED</td>
<td>ANALOG INPUTS 5 Digit, 4&quot; (101 mm) Red LED</td>
<td></td>
</tr>
<tr>
<td>Dimensions (Height)x(Width)</td>
<td>101 mm (H) x 303 mm (W) 6 DIGIT 101 mm (H) x 404 mm (W)</td>
<td>4 DIGIT 199 mm (H) x 505 mm (W) 6 DIGIT 199 mm (H) x 657 mm (W)</td>
<td>121 mm (H) x 254 mm (W)</td>
<td>183 mm (H) x 630 mm (W)</td>
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<tr>
<td>Input</td>
<td>Basic Count Input</td>
<td>Basic Count Input</td>
<td>Via a Plug-in Personality Module</td>
<td>Via a Plug-in Personality Module</td>
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<tr>
<td></td>
<td>DIGITAL INPUTS Count, Count/Rate, Timer, and Serial Slave</td>
<td>DIGITAL INPUTS Count, Count/Rate, Timer, and Serial Slave</td>
<td>DIGITAL INPUTS Count, Rate, Count/Rate, Timer, and Real Time Clock</td>
<td>DIGITAL INPUTS Count, Rate, Count/Rate, Timer, and Real Time Clock</td>
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<tr>
<td>Setpoint Capability</td>
<td>N/A</td>
<td>4 Digit Model Available</td>
<td>Dual Form C</td>
<td>Dual Form C</td>
</tr>
<tr>
<td>Communications</td>
<td>N/A</td>
<td>N/A</td>
<td>RS232</td>
<td>RS232</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RS485</td>
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<td>Modbus DeviceNet</td>
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<td>Profibus</td>
<td>Profibus</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ethernet w/ICM8</td>
<td>Ethernet w/ICM8</td>
</tr>
<tr>
<td>Other Features/ Options</td>
<td>NEMA 4 Version</td>
<td>NEMA 4 Version</td>
<td>NEMA 4 Enclosure, Mounting Brackets, Custom Units Label (5 Digit Only)</td>
<td>NEMA 4 Enclosure, Mounting Brackets</td>
</tr>
<tr>
<td>Power Source</td>
<td>85 to 250 VAC 11 to 16 VDC</td>
<td>85 to 250 VAC 11 to 16 VDC</td>
<td>85 to 250 VAC 18 to 36 VDC 24 VAC</td>
<td>85 to 250 VAC</td>
</tr>
<tr>
<td>Page Number</td>
<td>Page 629</td>
<td>Page 629</td>
<td>Page 682</td>
<td>Page 694</td>
</tr>
</tbody>
</table>
## REPLACEMENT Guide

### WHAT YOU'RE USING NOW

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display: 4 or 6 Digit, 3.3&quot; (84 mm) Red LED</td>
</tr>
<tr>
<td></td>
<td>Power Source: 115/230 VAC</td>
</tr>
<tr>
<td></td>
<td>Input Models: Various Models</td>
</tr>
</tbody>
</table>

### CURRENT PRODUCT

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPAX</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display: 5 or 6 Digit, 4&quot; (101 mm) Red LED</td>
</tr>
<tr>
<td></td>
<td>Power Source: 115/230 VAC</td>
</tr>
<tr>
<td></td>
<td>Input Models: Various Models</td>
</tr>
</tbody>
</table>

**Panel Cut-Out Dimension Differences**

Note: Refer to the current product literature, as some differences may exist.
MODEL LD - LARGE DISPLAY

GENERAL DESCRIPTION
The Large Display is a versatile display that can be configured as a single or dual counter with rate indication, scaling, serial communications and a dual relay output. There are also basic models that have a single counter with direction control only (no scaling or relay output).

The 4 & 6 digit displays are available in either 2.25” or 4” high red LED digits with adjustable display intensities. The 2.25” high models are readable up to 130 feet. The 4” high models are readable up to 180 feet. All versions are constructed of a NEMA 4X enclosure in light weight aluminum.

The 6-digit programmable models have two signal inputs and a choice of eight different count modes. These include bi-directional, quadrature and anti-coincidence counting, as well as a dual counter mode. When programmed as a dual counter, each counter has separate scaling and decimal point selection.

Rate indication is available on the programmable models only. The rate indicator has separate scaling and decimal point selection, along with programmable display update times. The meter display can be toggled either manually or automatically between the count and rate values.

The programmable models also come with a dual Form C relay output and RS232 or RS485 serial communications. The outputs can activate based on either counter or rate setpoint values. An internal batch counter can be used to count setpoint output activations.

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: 2.25” (57 mm) or 4” (101 mm) intensity adjustable Red LED
2. POWER REQUIREMENTS:
   AC POWER: 50 to 250 VAC 50/60 Hz, 26 VA
   DC POWER: 21.6 to 250 VDC, 11 W
   DC Out: +24 VDC @ 100 mA if input voltage is greater than 50 VAC/VDC
   +24 VDC @ 50 mA if input voltage is less than 50 VDC
   Isolation: 2300 VRMS for 1 min. to all inputs and outputs
3. COUNT INPUT(S):
   Counter(s) have DIP switch selectable pull-up (7.8 KΩ) or pull-down resistors (3.9 KΩ) that determine active high or active low input logic. Counters are DIP switch selectable for high or low frequency (Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec min.)
   Input A Trigger levels: VIL = 1.25 V max; VIH = 2.75 V min; VMAX = 28 VDC
   Input B Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
   Overflow Indication: Display "0-0-" alternates with overflowed count value
   LD200400, LD200600, LD400400, & LD400600:
     Count Speed: 25 KHz max. @ 50% duty cycle (no scaling)
   LD2006P0 & LD4006P0:
     Counter A & B Frequency:
     Maximum Count Rates: 50% duty cycle, count mode dependent.
     With setpoints disabled: 25 KHz, all modes except Quadrature x4 (23 KHz).
     With setpoint(s) enabled: 20 KHz, all modes except Dual Counter (14 KHz), Quadrature x2 (13 KHz) and Quadrature x4 (12 KHz).

DIMENSIONS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>X (Length)</th>
<th>Y (Height)</th>
<th>Z (Center)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2004xx</td>
<td>12 (304.8)</td>
<td>4 (101.6)</td>
<td>8 (203.2)</td>
</tr>
<tr>
<td>LD2006xx</td>
<td>16 (406.4)</td>
<td>4 (101.6)</td>
<td>12 (304.3)</td>
</tr>
<tr>
<td>LD4004xx</td>
<td>20 (508)</td>
<td>7.875 (200)</td>
<td>16 (406.4)</td>
</tr>
<tr>
<td>LD4006xx</td>
<td>26 (660.4)</td>
<td>7.875 (200)</td>
<td>22 (558.8)</td>
</tr>
</tbody>
</table>
4. **RATE INPUT:** Models LD2006P0 & LD4006P0 only  
Display Range: 0 to 99999 
Min Freq.: 0.01 Hz  
Max Freq.: See Count Input specification  
Accuracy: ±0.01%  
Rate Overflow Indication: Display "-OL-" 

5. **RESET/USER INPUT:** Function programmable for LD2006P0 & LD4006P0  
Reset/User Input: DIP switch selectable pull-up (7.8 kΩ) or pull-down resistor (3.9 kΩ) that determines active high or active low input logic.  
Trigger levels: $V_{IL} = 1.0$ V max; $V_{IH} = 2.4$ V min; $V_{MAX} = 28$ VDC  
Response Time: 10 msec typ.; 50 msec debounce (activation and release)  

6. **COMMUNICATIONS (LD2006P0 & LD4006P0 only):**  
RS485 SERIAL COMMUNICATIONS  
Type: RS485 multi-point balanced interface (isolated)  
Baud Rate: 300 to 38.4 k  
Data Format: 7/8 bits; odd, even, or no parity  
Bus Address: 0 to 99; max 32 meters per line  
RS232 SERIAL COMMUNICATIONS  
Type: RS232 half duplex (isolated)  
Baud Rate: 300 to 38.4 k  
Data Format: 7/8 bits; odd, even, or no parity  

7. **MEMORY:** Nonvolatile E²PROM retains all programming parameters and count values when power is removed.  

8. **OUTPUT (LD2006P0 & LD4006P0 only):**  
Relays: Form C contacts rated at 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 V AC (inductive load)  
Reset: Maintained during power down.  
Trigger levels: $V_{IL} = 1.0$ V max; $V_{IH} = 2.4$ V min; $V_{MAX} = 28$ VDC  
Response Time: 10 msec typ.; 50 msec debounce (activation and release)  

9. **ENVIRONMENTAL CONDITIONS:**  
Operating temperature: -30 to 65 ºC  
Storage temperature: -40 to 70 ºC  
Operating and storage humidity: 0 to 85% max. RH (non-condensing)  
Operating and storage altitude: Up to 2,000 meters  

10. **CONNECTIONS:**  
Internal removable terminal blocks are used for power and signal wiring.  
Remove end plates with ¼” nut driver. For LD4 versions, all wiring is on right side of unit. For LD2 versions, power and signal wiring connections are on the right side and the relays and serial options are on the left side.  
Wire Gage: 24-12 AWG copper wire  
Wire Strip Length: 0.4” (10 mm)  
Torque: 5.3 inch-lbs (0.6 N-m) max.  

11. **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  

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 LD200400  
Criterion B LD2006P0  
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-L  
2 kV L-N-E power  

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

Voltage dip/interruptions EN 61000-4-11  
Criterion A  

Notes:  
2. Criterion B: Temporary loss of performance from which the unit self-recover.  

12. **CONSTRUCTION:** Aluminum enclosure, and steel side panels with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications. Installation Category II, Pollution Degree 2.  

13. **WEIGHT:**  
LD2004XX - 3.5 lbs (1.59 kg)  
LD2006XX - 4.5 lbs (2.04 kg)  
LD4004XX - 8 lbs (3.63 kg)  
LD4006XX - 10.5 lbs (4.76 kg)  

---  

**ORDERING INFORMATION**  

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic (No front panel keys)</td>
<td>LD2.25&quot; High 4-Digit Red LED Counter</td>
<td>LD200400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LD2.25&quot; High 6-Digit Red LED Counter</td>
<td>LD200600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4&quot; High 4-Digit Red LED Counter</td>
<td>LD400400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4&quot; High 6-Digit Red LED Counter</td>
<td>LD400600</td>
<td></td>
</tr>
<tr>
<td>Programmable (With front panel keys)</td>
<td>LD2.25&quot; High 6-Digit Red LED Counter w/ dual Relay Output</td>
<td>LD200600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LD4004XX - 2.25&quot; High 6-Digit Red LED Counter w/ dual Relay Output &amp; RS232/RS485 Serial Communications</td>
<td>LD400600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LD4006P0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**1.0 INSTALLING THE METER**  

**INSTALLATION**  
The meter meets NEMA 4X/IP65 requirements when properly installed.  

**INSTALLATION ENVIRONMENT**  
The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided. The unit 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 front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.  

**MOUNTING INSTRUCTIONS**  
This display is designed to be wall mounted or suspended from a ceiling truss or other suitable structure capable of supporting the LD. Caution should be exercised when hanging the display to provide for the safety of personnel. If hanging the LD, run the suspension cables (or chains) through the mounting bracket holes. For wall mounting use #10-32 size bolts.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

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

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection.

Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

- Ferrite Suppression Cores for signal and control cables:
  - Fair-Rite # 0443167251 (RLC# FCOR0000)
  - TDK # ZCAT3035-1330A
  - Steward # 28B2029-0A
  - Corcom # 1 VR3

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

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 pluggable terminal blocks located inside 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 on the label on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.4” (10 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).

WIRING CONNECTIONS

Internal removable terminal blocks are used for power and signal wiring. Access to terminal blocks is through conduit fittings. Remove end plates with ¼” nut driver. For LD4 versions, all wiring is on right side of unit. For LD2 versions, power and input wiring connections are on the right side and the relay and serial options are on the left side.

Connect drain wire from shielded cable(s) to screw on side plate for proper grounding.

Only programmable models have terminals TBC and TBD.

3.1 POWER WIRING

The power wiring is made via the 3 position terminal block (TBA) located inside the unit (right side). The DC out power is located on TBB (right side).

Power
Terminal 1: VAC/DC +
Terminal 2: VAC/DC -
Terminal 3: Protective Conductor

DC Out Power
Terminal 4: + 24 VDC OUT
Terminal 6: User Common

3.2 RESET/USER INPUT WIRING

The Reset/User Input is located on the right side.

Terminal 5: Reset/User
Terminal 6: User Comm

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relays use a six position terminal block (TBC) located inside the unit: LD4 (right side) and LD2 (left side).

Terminal 1: NC 1
Terminal 2: NO 1
Terminal 3: Relay 1 Common
Terminal 4: NC 2
Terminal 5: NO 2
Terminal 6: Relay 2 Common

LD4

LD2 Left Side

LD2 Right Side

3.1 POWER WIRING

Power
Terminal 1: VAC/DC +
Terminal 2: VAC/DC -
Terminal 3: Protective Conductor

DC Out Power
Terminal 4: + 24 VDC OUT
Terminal 6: User Common

3.2 RESET/USER INPUT WIRING

The Reset/User Input is located on the right side.

Terminal 5: Reset/User
Terminal 6: User Comm

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relays use a six position terminal block (TBC) located inside the unit: LD4 (right side) and LD2 (left side).

Terminal 1: NC 1
Terminal 2: NO 1
Terminal 3: Relay 1 Common
Terminal 4: NC 2
Terminal 5: NO 2
Terminal 6: Relay 2 Common
3.4 INPUT WIRING

The Large Display has two signal inputs, A and B. These inputs are wired to terminal block TBB located inside the unit on the right side.

Terminal 1: Input A
Terminal 3: Input B
Terminal 2: Input Common

Programmable models LD2006P0 and LD4006P0 provide a choice of eight different Count Modes. The Count Mode selected determines the action of Inputs A and B. Section 5.1, Input Setup Parameters, provides details on count mode selection and input action.

CAUTION: User common is NOT isolated from input common. In order to preserve the safety of the meter application, the DC 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.

3.5 SERIAL WIRING

The serial connections are made via terminal block TBD located inside the unit on the left side for the LD2 and on the right side for the LD4.

TXD 232
RXD
TBD COMM
A 485
B
4.0 REVIEWING THE FRONT PANEL KEYS AND DISPLAY

**KEY**
- **PAR** - Access Programming Mode
- **SEL** - Index display through selected displays
- **RST** - Resets count display(s) and/or outputs

**OPERATING MODE DISPLAY DESIGNATORS**
- "r" - To the left of the display is the rate value.
- "c" - To the left of the display is the Counter B value (dual count or batch).
- "b" - To the left of the display is the Counter B value (dual count or batch).

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

Sections 4 and 5 apply to Programmable Models Only

5.0 PROGRAMMING THE METER

**OVERVIEW**

**PROGRAMMING MENU**

**PROGRAMMING MODE ENTRY (PAR KEY)**

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

**MODULE ENTRY (SEL & PAR KEYS)**

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

---

**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 LD emulate 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.

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**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 LD is limited to 38.4k 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.

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**Terminal Block Connection Figure**

---

**Module Entry**

The Programming Menu is organized into five modules. These modules group together parameters that are related in function. The display will alternate between `1SP` and the present module. The **SEL** key is used to select the desired module.

The displayed module is entered by pressing the **PAR** key.
5.1 MODULE 1 - INPUT SETUP PARAMETERS ( * - INP )

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

SELECTION / VALUE ENTRY
For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The SEL\u2192 and RST\u2193 keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the entry is displayed with one digit flashing (initially the right most digit). Pressing the RST\u2193 key increments the digit by one or the user can hold the RST\u2193 key and the digit will automatically scroll. The SEL\u2192 key will select the next digit to the left. Pressing the PAR key will enter the value and move to the next parameter.

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

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

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

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

Indicates Program Mode Alternating Display

Parameter Selection/Value

Factory Settings are shown.

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

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

INPUT B ACTION

INPUT A ACTION

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

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

COUNTER A COUNT DIRECTION
Reverse (\u2212) switches the normal Counter A count direction shown in the Count Mode parameter chart.

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

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

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

Indicates Program Mode Alternating Display

Parameter Selection/Value

Factory Settings are shown.

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

INPUT B ACTION

INPUT A ACTION

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

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

COUNTER A COUNT DIRECTION
Reverse (\u2212) switches the normal Counter A count direction shown in the Count Mode parameter chart.

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

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

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

Indicates Program Mode Alternating Display

Parameter Selection/Value

Factory Settings are shown.
COUNTER A COUNT LOAD VALUE

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

COUNTER B BATCH COUNT ENABLE

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

COUNTER B DECIMAL POINT

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

COUNTER B SCALE FACTOR

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

COUNTER RESET AT POWER-UP

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

SCALING FOR COUNT INDICATION

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

The Count Scale Factor Value can range from 0.00001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more important to note that the precision of a counter application cannot be improved. Therefore, it is necessary for the meter to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.).

Scale Factor = Desired Display Units / Number of Pulses

WHERE:
Desired Display Units: Count display units acquired after pulses that occurred.
Number of Pulses: Number of pulses required to achieve the desired display units.

Decimal Point Position:
0 = 1
0.0 = 10
0.00 = 100
0.000 = 1000
0.0000 = 10000

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

Scale Factor = 128 x Decimal Point Position

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

Scale Factor = 1.00 x 128
Scale Factor = 0.007812 x 100
Scale Factor = 0.7812

USER INPUT FUNCTION

DISPLAY MODE DESCRIPTION

NO No Function

Program Mode Lock-out

Inhibit

Maintained Reset

Store

Store and Reset

Reset both setpoint 1 and 2 outputs.

Reset setpoint 2 output.

Reset setpoint 1 output.

Reset setpoint 1 and 2 outputs.

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 selected counter(s).

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

USER INPUT ASSIGNMENT

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

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

Shaded area selections only apply when Counter B is enabled (Dual Count mode or batch counter).
5.2 MODULE 2 - RATE SETUP PARAMETERS (R\textsuperscript{2}R\textsubscript{E})

**PARAMETER MENU**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Enable (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{E}}} \text{Enb})</td>
<td>NO/YES</td>
</tr>
<tr>
<td>Rate Decimal Point (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{Pt})</td>
<td>00 0000 00000</td>
</tr>
<tr>
<td>Rate Input Scaling Style (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{SP})</td>
<td>00 1000</td>
</tr>
<tr>
<td>Rate Display Value (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{DP})</td>
<td>0 to 999999</td>
</tr>
<tr>
<td>Rate Input Value (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{INP})</td>
<td>0.1 to 99999</td>
</tr>
<tr>
<td>Rate Low Update Time (DISPLAY UPDATE) (\textbf{\text{\textit{R}}} \textsuperscript{-} \textbf{\text{\textit{L}}} \text{Udt})</td>
<td>0.1 to 9999 seconds</td>
</tr>
<tr>
<td>Rate High Update Time (DISPLAY ZERO) (\textbf{\text{\textit{R}}} \textsuperscript{-} \textbf{\text{\textit{H}}} \text{Udt})</td>
<td>0.2 to 9999 seconds</td>
</tr>
</tbody>
</table>

**RATE ENABLE**

This parameter enables the rate display. For maximum input frequency, Rate Enable should be set to NO when not in use. When set to NO, the remaining rate parameters are not accessible.

**RATE DECIMAL POINT**

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

**RATE INPUT SCALING STYLE**

If a Rate Input value (in Hz) and the corresponding Rate Display value are known, the Key-in (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{INP}) Scaling Style can be used. This allows rate scaling without the presence of a rate input signal.

If the Rate Input value has to be derived from the actual rate input signal, the Apply (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{SP}) Scaling Style should be used.

**RATE SCALING DISPLAY VALUE**

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

**RATE SCALING INPUT VALUE**

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

Key-in Style:

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

Apply Style:

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

**SCALING FOR RATE INDICATION**

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

**SCALING CALCULATION FOR KEY-IN STYLE**

If a display value versus input signal (in pulses per second) is known, then the values can be entered into Scaling Display (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{DP}) and Scaling Input (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{INP}). No further calculations are needed.

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

- **Rate per**
  - Second = 1
  - Minute = 60
  - Hour = 3600

- **Display (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{DP})**
  - # of pulses per unit

- **Input (\textbf{\text{\textit{r}}} \textsuperscript{-} \textbf{\text{\textit{d}}} \text{INP})**
  - # of pulses per unit

**NOTES:**

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

**EXAMPLE:**

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

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

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

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

FRONT PANEL DISPLAY SELECT ENABLE (SEL▲)

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

FRONT PANEL COUNTER RESET ENABLE (RST▼)

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

DISPLAY SCROLL ENABLE

The YES selection allows the display to automatically scroll through the enabled displays. The scroll rate is about every 4 seconds.

DISPLAY INTENSITY LEVEL

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

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 default settings. The meter will display *E5Et and then return to Code 00. Press the PAR key to exit the module.

VIEW MODEL AND VERSION DISPLAY

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

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

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>COUNTER ASSIGNMENT (A or B)*</th>
<th>RATE ASSIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT-tn</td>
<td>Setpoint Output Time-out Value</td>
<td>TIMED OUT eyt Boundary LATCH</td>
<td>TIMED OUT eyt Boundary LATCH</td>
</tr>
<tr>
<td>SP-tn</td>
<td>Setpoint Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>OUT-tn</td>
<td>Setpoint Output Logic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>L-tn</td>
<td>Setpoint Annunciator</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>P-UP-tn</td>
<td>Setpoint Output Power-up State</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>TYPE-tn</td>
<td>Setpoint Boundary Type</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>STBY-tn</td>
<td>Standby Operation (Low Acting Only)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>AUTO-tn</td>
<td>Counter Auto Reset</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SP1-2</td>
<td>SP1 Output Off at SP2 (SP1 only)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SP1-2</td>
<td>SP2 Output Off at SP1 (SP2 only)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ST-tn</td>
<td>Output Reset with Manual Reset</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

* BOUNDARY Setpoint Action not applicable for Counter B assignment.

SETPOINT SELECT

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

SETPOINT ENABLE

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

\[
\begin{array}{ccc}
\text{ASN-a} & \leftrightarrow & \text{Cnt A} \\
\text{Cnt b} & \leftrightarrow & \text{rate} \\
\end{array}
\]

Select the display the Setpoint is to be assigned.

SETPOINT OUTPUT ACTION

\[
\begin{array}{ccc}
\text{ACT-n} & \leftrightarrow & \text{Latched Output Mode} \\
\text{t-Out} & \leftrightarrow & \text{Timed Output Mode} \\
\text{bound} & \leftrightarrow & \text{Boundary Mode} \\
\end{array}
\]

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

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

SETPOINT OUTPUT TIME-OUT

\[
\begin{array}{ccc}
\text{Out-n} & \leftrightarrow & 0.01 \text{ to } 59999 \text{ seconds} \\
\end{array}
\]

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

SETPOINT VALUE

\[
\begin{array}{ccc}
\text{Spk-n} & \leftrightarrow & \text{Count A: } 99999 \text{ to } 999999 \\
\text{Count B: } 0 \text{ to } 99999 \\
\text{Rate: } 0 \text{ to } 99999 \\
\end{array}
\]

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

SETPOINT OUTPUT LOGIC

\[
\begin{array}{ccc}
\text{Out-n} & \leftrightarrow & \text{Normal (nOr) } r\text{EU} \\
\end{array}
\]

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

SETPOINT ANNUNCIATOR

\[
\begin{array}{ccc}
\text{Lk-n} & \leftrightarrow & \text{Normal (nOr) } r\text{EU} \\
\end{array}
\]

Normal (nOr) displays the setpoint annunciator when the corresponding output is “on”. Reverse (rEU) displays the setpoint annunciator when the output is “off”.

SETPOINT OUTPUT POWER-UP STATE

\[
\begin{array}{ccc}
\text{P-Up-n} & \leftrightarrow & \text{OFF ON SAIRU} \\
\end{array}
\]

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

SETPOINT BOUNDARY TYPE

<table>
<thead>
<tr>
<th>TYPE-n</th>
<th>HI-Act</th>
<th>LO-Act</th>
</tr>
</thead>
</table>

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

SETPOINT STANDBY OPERATION

\[
\begin{array}{ccc}
\text{Stby-n} & \leftrightarrow & \text{NO YES} \\
\end{array}
\]

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

COUNTER AUTO RESET

\[
\begin{array}{ccc}
\text{Auto-n} & \leftrightarrow & \text{NO 2Er. Sk Cld. Sk 2Er. En Cld. En} \\
\end{array}
\]

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

<table>
<thead>
<tr>
<th>SELECTION ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO No Auto Reset</td>
</tr>
<tr>
<td>2Er. Sk Reset to Zero at the Start of output activation</td>
</tr>
<tr>
<td>Cld. Sk Reset to Count Load value at the Start of output activation</td>
</tr>
<tr>
<td>2Er. En Reset to Zero at the End of output activation (timed out only)</td>
</tr>
<tr>
<td>Cld. En Reset to Count Load at the End of output activation (timed out only)</td>
</tr>
</tbody>
</table>

SETPOINT 1 OUTPUT OFF AT SETPOINT 2 (SP1 Only)

\[
\begin{array}{ccc}
\text{Off2-1} & \leftrightarrow & \text{NO 02-5Kr 02-End} \\
\end{array}
\]

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

SETPOINT 2 OUTPUT OFF AT SETPOINT 1 (SP2 Only)

\[
\begin{array}{ccc}
\text{Off1-2} & \leftrightarrow & \text{NO 01-5Kr 01-End} \\
\end{array}
\]

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

SETPOINT OUTPUT RESET WITH MANUAL RESET

\[
\begin{array}{ccc}
\text{rSt-n} & \leftrightarrow & \text{NO YES} \\
\end{array}
\]

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

This output reset will not occur when the Assigned Counter is reset by a Setpoint generated Counter Auto Reset.
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the meter with those of the host computer or other serial device.

### BAUD RATE

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

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>1200</td>
</tr>
<tr>
<td>4800</td>
<td>9600</td>
</tr>
<tr>
<td>600</td>
<td>2400</td>
</tr>
<tr>
<td>9600</td>
<td>38400</td>
</tr>
</tbody>
</table>

### DATA BIT

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

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

### PARITY BIT

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to no, an additional stop bit is used to force the frame size to 10 bits.

<table>
<thead>
<tr>
<th>Parity Bit</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>even</td>
<td>odd</td>
</tr>
</tbody>
</table>

### METER ADDRESS

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

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

### ABBREVIATED PRINTING

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select no for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select yes for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

<table>
<thead>
<tr>
<th>Abbreviated</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

### PRINT OPTIONS

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

Selecting yes displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as yes in the sublist will be transmitted during a block print. Parameters entered as no will not be sent.

The “Print All” (Pr-All) option selects all meter values for transmitting (yes), without having to individually select each parameter in the sublist.

Note: Inactive parameters will not be sent regardless of the print option setting. For example, Counter B or Scale Factor B will only be sent if Counter B is enabled (Dual Counter mode or batch count). Likewise, the Rate value will not be sent unless the Rate Display is enabled.

### AUTOMATIC DATA TRANSMIT

Selecting yes causes the meter to automatically transmit serial data per the Print Options selection list. This occurs without using the User Input terminal Print Request function (Module 1), and without requiring any serial data request commands. This makes the User Input available to perform other functions, while still allowing the meter to output serial data.

The selected data is transmitted repeatedly every 1.5 seconds during normal operating mode, and pauses during programming mode.

### COPY PROGRAM SETTINGS

This parameter is used to copy all the program settings from one LD meter directly to another LD meter(s), through the serial terminal block connections (RS232 or RS485). No PC connection or additional software is required. Copying program settings eliminates or greatly reduces programming time when multiple meters use identical, or very similar, settings for an application.

**Copy Requirements:**

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

1. Each meter must have the same software version. The version is displayed during the meter power-up sequence, or by entering Code 50 in the Factory Service Operations. (See Module 3 for details)
2. Each meter receiving the program settings (receiver) must have the baud rate set to 9600 baud. This is the factory default setting, so a new meter should arrive ready for copying. The meter sending the program settings (master) should be set to the desired baud rate for the application (if different than 9600). This baud rate setting will then be copied to the receiver(s).

Copy Connections:
To connect the LD meters for copying, refer to section 3.5 Serial Wiring for details. The meter shown in the figures as LD METER will be the master.
1. RS232 - Allows copying from the master meter to a single receiver only.
2. RS485 - Allows copying from the master meter to one or more receivers simultaneously. Up to 31 receiving meters can be connected during copying.

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

Command Chart

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

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

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

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

Full Field Transmission

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

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

Copy Procedure:
1. Connect the master and receiver(s) using RS232 or RS485 terminals.
2. Apply power to the meters. The receiving meter(s) must be operating in the normal display mode (not programming mode).
3. On the master meter, proceed to the Copy Program Settings parameter and select Y5S to begin copying.
4. During the copy process (~ 2 sec.), the master meter displays an upload message (UP-Ld) while the receiver(s) displays a download message (dn+Ld). This indicates successful communication between the master and receiver(s).
5. When copying is completed, all receivers display the power-up sequence and return to normal operating mode, programmed with all the same settings as the master meter. The master remains at the <EOP> prompt, ready for another receiver(s) to be connected for copying.

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>MNEMONIC</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Counter A</td>
<td>CTA</td>
<td>T, V, R</td>
<td>6 digit positive/5 digit negative (with minus sign)</td>
</tr>
<tr>
<td>B</td>
<td>Counter B</td>
<td>CTB</td>
<td>T, V, R</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>C</td>
<td>Rate</td>
<td>RTE</td>
<td>T</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>D</td>
<td>Scale Factor A</td>
<td>SFA</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>E</td>
<td>Scale Factor B</td>
<td>SFB</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, V, R</td>
<td>per setpoint Assignment, same as Counter or Rate</td>
</tr>
<tr>
<td>G</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>T, V, R</td>
<td>per setpoint Assignment, same as Counter or Rate</td>
</tr>
<tr>
<td>H</td>
<td>Counter A Load Value</td>
<td>CLD</td>
<td>T, V, R</td>
<td>6 digit positive/5 digit negative (with minus sign)</td>
</tr>
</tbody>
</table>

Command String Examples:
1. Node address = 17, Write 350 to the Setpoint 1 value
   String: N17VF350*
2. Node address = 5, Read Counter A, response time of 50 msec min
   String: NSTA*
3. Node address = 0, Reset Setpoint 1 output
   String: RF*
4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31PS

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

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

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

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a requested counter or rate value exceeds the meter’s display limits, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

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

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

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

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

Command Response Time

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

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

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

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

If the meter is to reply with data, the time interval $t_3$ is controlled by the use of the command terminating character. The '*' terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with 'S' results in a response time ($t_3$) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

Communication Format

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

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

* Voltage levels at the Receiver

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

Start Bit and Data Bits

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

Parity Bit

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

Stop Bit

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

Timing Diagram Figure

<table>
<thead>
<tr>
<th>NO REPLY FROM METER</th>
<th>Command String Transmission</th>
<th>Meter Response Time</th>
<th>Meter</th>
<th>Ready</th>
<th>t1</th>
<th>t2</th>
<th>Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>t1</td>
<td>t2</td>
<td>Meter</td>
<td>Ready</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Timing Diagram Figure

Start Bit and Data Bits

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

- **NO**
- **End**
- **Sel**
- **Par**
- **Inp**
- **R-Dpt**
- **R-Scf**
- **R-St**
- **R-Dr**
- **Cnt Ld**
- **b-bRt**
- **Dual Count or Batch Only**
- **b-Dpt**
- **b-Scf**
- **r-P-Up**
- **Usr INP**
- **Usr-Rst**
- **Rate Enable**
- **Rate Decimal Point**
- **Rate Input Scaling Style**
- **Rate Input Scaling Value**
- **Rate Scaling Input Value**
- **Rate Low Update Time**
- **Rate High Update Time**
- **Sel-En**
- **r-St-En**
- **Scrll**
- **d-Levu**
- **CodE**
- **Fcs**
- **Setpoint Select**
- **Setpoint Enable**
- **Setpoint Assignment**
- **Setpoint Output Action**
- **Setpoint Output Time-out**
- **Setpoint Output Value**
- **Setpoint Output Logic**
- **Setpoint Annunciator**
- **Baud Rate**
- **Data Bit**
- **Parity Bit**
- **Meter Address**
- **Abbreviated Printing**
- **Print Options**
- **Automatic Data Transmit**
- **Copy Program Settings**
GENERAL DESCRIPTION

The Large Display Timer and Cycle Counter is a versatile display that functions as an Elapsed Timer or Preset Timer, with full-featured user programmability. The meter includes a built-in Cycle Counter, relay output and serial communications capability. The 6 digit displays are available in either 2.25” or 4” high red LED digits with adjustable display intensity. The 2.25” high models are readable up to 130 feet. The 4” high models are readable up to 180 feet. Both versions are constructed of a NEMA 4 enclosure in light weight aluminum.

The Timer has two signal inputs and eight input operating modes. These modes provide level active or edge triggered start/stop operation. The Timer features 18 selectable timer ranges to cover a wide variety of timing applications. The built-in Cycle Counter can be linked to timer operation to count timing cycles, or function as a totally independent counter, accepting count speeds up to 500 Hz. The display can be toggled either manually or automatically between the Timer and Counter values.

In addition to the Timer/Counter inputs, a programmable User Input is provided to perform a variety of meter functions. DIP switches are used to configure the inputs for current sinking (active low) or current sourcing (active high) operation.

The Setpoint Output can be assigned to the Timer or Counter value, and configured to suit a variety of control and alarm requirements. The meter also includes RS232 or RS485 serial communications.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

1. DISPLAY: 2.25” (57 mm) or 4” (101 mm) intensity adjustable Red LED
2. POWER REQUIREMENTS:
   AC POWER: 50 to 250 VAC 50/60 Hz, 26 VA
   DC POWER: 21.6 to 250 VDC, 11 W
   DC Out: +24 VDC @ 100 mA if input voltage is greater than 50 VAC/VDC
   +24 VDC @ 50 mA if input voltage is less than 50 VDC
   Isolation: 2300 VRMS for 1 min. to all inputs and outputs
3. TIMER DISPLAY: 6-digits
   Display Range: 0 to 999999
   Overflow/Underflow Indication: Display flashes “U07&S”
   Maximum Single Digit Resolution: 1 Hr.
   Timing Accuracy: ±0.01%
4. CYCLE COUNTER DISPLAY: 5-digits, may be disabled if not used
   Display Designator: “$” to the left side of the display
   Display Range: 0 to 99999
   Overflow/Underflow Indication: Display flashes “$07&S”

DIMENSIONS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>X (Length)</th>
<th>Y (Height)</th>
<th>Z (Center)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2T6P0</td>
<td>16 (406.4)</td>
<td>4 (101.6)</td>
<td>12 (304.8)</td>
</tr>
<tr>
<td>LD4T6P0</td>
<td>26 (660.4)</td>
<td>7.875 (200)</td>
<td>22 (558.8)</td>
</tr>
</tbody>
</table>

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

CAUTION: Risk of electric shock.

AIR PRESSURE STABILIZATION VENT


5. **TIMER SIGNAL INPUTS**

   DIP switch selectable pull-up (7.8 kΩ) or pull-down (3.9 kΩ) resistors determine active high or active low input logic.

   **Input A:**
   - Trigger levels: \( V_{IL} = 1.25 \text{ V max} \); \( V_{IH} = 2.75 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)
   - Response Time: \( 10 \text{ msec typ.} \); \( 50 \text{ msec debounce (activation and release)} \)

   **Input B:**
   - Trigger levels: \( V_{IL} = 1.0 \text{ V max} \); \( V_{IH} = 2.4 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)
   - Response Time: \( 10 \text{ msec typ.} \); \( 50 \text{ msec debounce (activation and release)} \)

6. **RESET/USER INPUT**

   Programmable Function Input:
   - DIP switch selectable pull-up (7.8 kΩ) or pull-down (3.9 kΩ) resistor 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: \( 10 \text{ msec typ.} \); \( 50 \text{ msec debounce (activation and release)} \)

7. **COMMUNICATIONS:**

   **RS485 SERIAL COMMUNICATIONS**
   - Type: RS485 multi-point balanced interface (isolated)
   - Baud Rate: 300 to 38400
   - Data Format: 7/8 bits; odd, even, or no parity
   - Bus Address: 0 to 99; max 32 meters per line
   - RS232 SERIAL COMMUNICATIONS
     - Type: RS232 half duplex (isolated)
     - Baud Rate: 300 to 38400
     - Data Format: 7/8 bits; odd, even, or no parity

8. **MEMORY:**

   Nonvolatile E²PROM retains all programming parameters and timer/count values when power is removed.

9. **OUTPUT:**

   Relay: Form C contacts rated at 5amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load)

10. **CONNECTIONS:**

    Internal removable terminal blocks are used for power and signal wiring. Remove end plates with ¼” nut driver. For LD4 versions, all wiring is on the right side of unit. For LD2 versions, power and signal wiring connections are on the right side and the relay and serial output options are on left side.

    - Wire Strip Length: \( 0.4” \) (10 mm)
    - Wire Gage: 24-12 AWG copper wire
    - Torque: 5-3 inch-lbs (0.6 N·m) max

11. **ENVIRONMENTAL CONDITIONS:**

    - Operating temperature: 0 to 50 °C
    - Storage temperature: -40 to 70 °C

---

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>2.25” High 6-Digit Red LED Timer/Cycle Counter w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td>4” High 6-Digit Red LED Timer/Cycle Counter w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**1.0 INSTALLING THE METER**

**INSTALLATION**

The meter meets NEMA 4X/IP65 requirements when properly installed.

**INSTALLATION ENVIRONMENT**

The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided. The unit 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 front overlay. Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>LD</td>
<td>2.25” High 6-Digit Red LED Timer/Cycle Counter w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td>4” High 6-Digit Red LED Timer/Cycle Counter w/ Relay Output &amp; RS232/RS485 Serial Communications</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MOUNTING INSTRUCTIONS**

This display is designed to be wall mounted or suspended from a ceiling truss or other suitable structure capable of supporting the LDA. Caution should be exercised when hanging the display to provide for the safety of personnel. If hanging the LDA, run the suspension cables (or chains) through the mounting bracket holes. For wall mounting use #10-32 size bolts.
2.0 Setting the DIP Switches

To access the switches, remove the right side plate of the meter. A bank of eight switches is located inside the unit. *Note: Some switches are not used and should remain in the factory set position.*

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

**SWITCH 1 (Unused)**
This switch is not used and should remain in the factory set position.

**SWITCH 2 (Input A) [See Note 1]**
- **SNK:** Adds internal 7.8 KΩ pull-up resistor to +12 VDC, *I*\(_{\text{MAX}}\) = 2.1 mA.
- **SRC:** Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

**SWITCH 3 (Input A)**
**FILTER ON:** Provides hardware debounce for Input A to allow relay or switch contacts to be used as a signal source. Software debounce for Inputs A and B is provided in the programming menu (Module 1).

**SWITCH 4 (Input B) [See Note 1]**
- **SNK:** Adds internal 7.8 KΩ pull-up resistor to +12 VDC, *I*\(_{\text{MAX}}\) = 2.1 mA.
- **SRC:** Adds internal 3.9 KΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

**SWITCH 5 (Input B)**
**FILTER ON:** Provides hardware debounce for Input B to allow relay or switch contacts to be used as a signal source. Software debounce for Inputs A and B is provided in the programming menu (Module 1).

---

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 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 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
   - Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Schaffner # FN670-1.8/07
   - Corcom # 1 VR3

   Line Filters for input power cables:
   - Fair-Rite # 0443167251 (RLC# FCOR0000)
   - Schaffner # FN610-1/07 (RLC# LFIL0000)
   - Schaffner # FN670-1.8/07
   - Corcom # 1 VR3

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

The power wiring is made via the 3 position terminal block (TBA) located inside the unit (right side). The DC out power is located on TBB (right side).

**Power**
- Terminal 1: VAC/DC +
- Terminal 2: VAC/DC -
- Terminal 3: Protective Conductor

**DC Out Power**
- Terminal 4: + 24 VDC OUT
- Terminal 6: User Common

3.2 RESET/USER INPUT WIRING

The Reset/User Input is located on the right side.

**Sinking Logic**
- Terminal 5: Reset/User
- Terminal 6: Comm

**Sourcing Logic**
- Terminal 5: Reset/User
- Terminal 6: Comm

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relay uses a three position terminal block (TBC) located on the left side of the LD2 model, and on the right side for the LD4 model.

**Terminal 1**: NC
**Terminal 2**: NO
**Terminal 3**: Relay Common
3.4 INPUT WIRING

The Large Display Timer is equipped with two signal inputs, A and B. These inputs are wired using the six position terminal block (TBB) located inside the unit on the right side.

Terminal 1: Input A
Terminal 3: Input B
Terminal 2: Input Common

CAUTION: DC common is NOT isolated from input common. In order to preserve the safety of the meter application, the DC 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.

Two Wire Proximity, Current Source

Interfacing With TTL

Switch or Isolated Transistor; Current Sink

Switch or Isolated Transistor; Current Source

3.5 SERIAL WIRING

The serial connections are made via terminal block TBD located inside the unit on the left side for the LD2 and on the right side for the LD4.

RS232 Communications

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 LD is limited to 38.4k 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 PANEL KEYS AND DISPLAY

**KEY** | **DISPLAY MODE OPERATION** | **PROGRAMMING MODE OPERATION**
--- | --- | ---
PAR | Access Programming Mode | Store selected parameter and index to next parameter
SEL | Select display (Timer or Cycle Counter) | Advance through selection list/select digit position in parameter value
RST | Reset value(s) per front panel reset setting | Increment selected digit position of parameter value

**OPERATING MODE DISPLAY DESIGNATORS**
- "P" - To the left of the display is the Cycle Counter value.
- "I" - Between digits 5 and 6 indicates the setpoint status.
- * - Decimal point to the far right of the display can be programmed to flash when the timer is running, to provide a "Timer Run" indicator.

If display scroll is enabled, the display will toggle automatically every four seconds between the Timer and Cycle Counter values.

5.0 PROGRAMMING THE METER

**OVERVIEW**

**PROGRAMMING MENU**

**PROGRAMMING MODE ENTRY (PAR KEY)**

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock (See Module 3).

**MODULE ENTRY (SEL & PAR KEYS)**

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

**MODULE MENU (PAR KEY)**

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

**SELECTION / VALUE ENTRY**

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

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

**PROGRAMMING MODE EXIT (PAR KEY)**

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

**PROGRAMMING TIPS**

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

**FACTORY SETTINGS**

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

**ALTERNATING SELECTION DISPLAY**

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

PARAMETER MENU

This parameter determines how the Timer Input Signals affect the Run/Stop status of the Timer. Timing diagrams are shown below for level active and edge triggered (1-input or 2-input) operation. For single input modes (Input A only), Input B provides a level active Timer Inhibit function. In the Display Hold mode, the timer display value remains held and only updates when a Timer Start (Input A) or Timer Stop (Input B) edge occurs.

The timer reset (S4U) operating modes are identical to the other modes in the diagrams, except the timer display value is reset at the Time Start edges.

For Reset Modes (S4U), the timer is reset at Time Start edge.

Please refer to the diagrams for a visual representation of the timing sequences.

For Reset Modes (S5k), the timer is reset at Time Start edge.

This parameter determines how the Timer Input Signals affect the Run/Stop status of the Timer. Timing diagrams are shown below for level active and edge triggered (1-input or 2-input) operation. For single input modes (Input A only), Input B provides a level active Timer Inhibit function. In the Display Hold mode, the timer display value remains held and only updates when a Timer Start (Input A) or Timer Stop (Input B) edge occurs.

The timer reset (S5k) operating modes are identical to the other modes in the diagrams, except the timer display value is reset at the Time Start edges.

The Timer can also be stopped at a Timer Stop Value or at Setpoint output activation or deactivation. This type of Stop condition is cleared when a Timer Reset occurs, or another start edge is applied on the timer input.

For Reset Modes (S5k), the timer is reset at Time Start edge.

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5.2 MODULE 2 - CYCLE COUNTER PARAMETERS (Z-Cnt)

PARAMETER MENU

**CYCLE COUNTER ENABLE**

- **Cnt-En**
  - **YES**
  - **NO**
  - **YES**

When set to **NO**, the remaining Cycle Counter parameters are not accessible.

**CYCLE COUNTER COUNT SOURCE**

- **C-src**
  - **INP**
  - **0-ON**
  - **OFF**
  - **INP**
  - **0-ON**

This parameter selects the source from which the Cycle Counter derives counts. The Timer Reset (t-rSt) selection generates a count when either a manual or automatic timer reset occurs (See Module 4 for programming Automatic Reset). The Input B (INP b) selection generates a count each time Input B is activated. This selection overrides the timer inhibit function of Input B, when the timer is programmed for Level or Edge-1 operating mode (See Module 1 for Timer Input Operating Modes).

The User Input (USr INP) selection generates a count each time the User Input is activated. When selected as the count source, the User Input can still be set to perform a User Function described in Module 1. In this case, the Cycle Counter will count the number of times the selected User Function occurred.

The Output ON/OFF selections generate a count when the Setpoint output either activates or deactivates.

**CYCLE COUNTER COUNTING DIRECTION**

- **C-dir**
  - **UP**
  - **dn**

Bi-directional counting capability. Select the counting direction desired for the application.

**CYCLE COUNTER START VALUE**

- **C-Strt**
  - **00000 to 99999**

The Cycle Counter returns to this value whenever a Counter Reset occurs. Non-zero values are normally used for “down counting” applications, but can also provide an offset value when counting up.

**CYCLE COUNTER RESET AT POWER-UP**

- **r P-UP**
  - **NO**
  - **YES**

The Cycle Counter can be programmed to Reset at each meter power-up.
5.3 MODULE 3 - DISPLAY AND FRONT PANEL KEY PARAMETERS (3-dSP)

PARAMETER MENU

FRONT PANEL DISPLAY SELECT ENABLE (SEL▲)

The YES selection allows the SEL▲ key to toggle between the timer and cycle counter displays.

FRONT PANEL RESET ENABLE (RST▼)

The YES selection allows the RST▼ key to reset the selected value(s). The shaded selections only appear if the cycle counter is enabled.

DISPLAY SCROLL ENABLE

The YES selection allows the display to automatically scroll between the timer and cycle counter values. The scroll rate is about every 4 seconds.

DISPLAY INTENSITY LEVEL

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

PROGRAMMING SECURITY CODE

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (Prolac) in the User Input 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 and Timer Stop value 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).

LOAD FACTORY DEFAULT SETTINGS

The YES selection will return the meter to the factory default settings. The meter will display rSet and then return to Pr, at which time all settings have been changed.
Module 4 is the programming module for the Setpoint Output parameters. Some parameters will not appear depending on the Setpoint Assignment and Setpoint Output Action selected.

**SETPOINT ASSIGNMENT**

Select the display for Setpoint assignment.

**SETPOINT OUTPUT ACTION**

This parameter selects the action of the Setpoint output as shown below.

<table>
<thead>
<tr>
<th>SPT ACTION</th>
<th>DESCRIPTION</th>
<th>OUTPUT ACTIVATES</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCH</td>
<td>Latched Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>At Manual Reset (if Setr-r = YES)</td>
</tr>
<tr>
<td>OUT</td>
<td>Timed Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>ON-OFF</td>
<td>On-Off Output Mode</td>
<td>When Time or Count = Setpoint On value</td>
<td>When Time or Count = Setpoint Off value</td>
</tr>
</tbody>
</table>

**SETPOINT ON**

This parameter determines when the Setpoint output will activate. The output can activate at a programmed Setpoint Value or can be set to activate when the Timer starts (STOP-r) or stops (STOP-r).

Selecting VALUE displays a sub-menu where the Setpoint Value is entered. If the Setpoint is assigned to the Timer, the value is entered in the same display format as the selected Timer Range.

**SETPOINT OFF**

The Setpoint Off parameter only appears if the Setpoint Action is set to On-Off Output mode (ON-OFF). In this mode, the Setpoint OFF parameter determines when the Setpoint Output will deactivate. The output can be programmed to deactivate at a Setpoint Off Value or can be set to deactivate when the Timer starts (STOP-r) or stops (STOP-r).

Selecting VALUE displays a sub-menu where the Setpoint Off Value is entered. If the Setpoint is assigned to the Timer, the value is entered in the same display format as the selected Timer Range.

**SETPOINT OUTPUT TIME-OUT**

This parameter is only active if the Setpoint Action is set to Timed Output mode (OUT). Enter the time duration the Setpoint Output will remain ON once it is activated. This value is always entered in minutes, seconds, and hundredths of seconds format. The maximum value is 99 minutes 59.99 seconds.

**STOP TIMER**

Stops the Timer when the Setpoint output activates (ON) or deactivates (OFF). Select NO if the output should not affect the Timer Run/Stop status. The Timer Stop condition is cleared when a Timer Reset occurs, or a Time Start edge is applied on the Timer input.

**TIMER/COUNTER AUTO RESET**

Automatically resets the Setpoint Assigned display value when the Setpoint Output activates (ON) or deactivates (OFF). Select NO if the output should not cause a display reset.

**SETPOINT OUTPUT RESET WITH DISPLAY RESET**

Select YES to have the Setpoint Output deactivate (reset) when the Setpoint Assigned display resets. Reset can occur by the RST key or the User Input, if programmed for that function. Select NO if the Setpoint output should not reset when the display resets.

**SETPOINT OUTPUT POWER-UP STATE**

SAVE will restore the output to the same state it was at before the meter was powered down. ON will activate the output at power up. OFF will deactivate the output at power up. This parameter is not active when the Setpoint Action is selected for timed output mode.
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the meter with those of the host computer or other serial device.

### BAUD RATE

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

### DATA BIT

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

### PARITY BIT

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.

### METER ADDRESS

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

### ABBREVIATED PRINTING

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select NO for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

### PRINT OPTIONS

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

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as NO will not be sent.

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

Note: Inactive parameters will not be sent regardless of the print option setting. For example, the Cycle Counter and Cycle Counter Start values will only be sent when the Cycle Counter is enabled. If disabled, these parameters are inactive and will not be transmitted. Likewise, only the Setpoint parameters that apply to the programmed Setpoint Output Action will be transmitted.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY SETTING</th>
<th>MNEMONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-URL</td>
<td>Timer</td>
<td>YES</td>
<td>TMR</td>
</tr>
<tr>
<td>C-URL</td>
<td>Cycle Counter</td>
<td>NO</td>
<td>CNT</td>
</tr>
<tr>
<td>t-Stk</td>
<td>Timer Start</td>
<td>NO</td>
<td>TST</td>
</tr>
<tr>
<td>t-StSp</td>
<td>Timer Stop</td>
<td>NO</td>
<td>TSP</td>
</tr>
<tr>
<td>C-Stk</td>
<td>Counter Start</td>
<td>NO</td>
<td>CST</td>
</tr>
<tr>
<td>SP-ON</td>
<td>Setpoint ON</td>
<td>NO</td>
<td>SPT</td>
</tr>
<tr>
<td>SP-OFF</td>
<td>Setpoint OFF</td>
<td>NO</td>
<td>SOF</td>
</tr>
<tr>
<td>D-TOut</td>
<td>Setpoint Time-out</td>
<td>NO</td>
<td>STO</td>
</tr>
</tbody>
</table>
Sending Serial Commands and Data

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

Command Chart

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

Command String Construction

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

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

Receiving Data From The Meter

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

Full Field Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>2 byte Node Address field [00-99]</td>
</tr>
<tr>
<td>3</td>
<td>&lt;SP&gt; (Space)</td>
</tr>
<tr>
<td>4-6</td>
<td>3 byte Register Mnemonic field</td>
</tr>
<tr>
<td>7-18</td>
<td>12 byte data field; 9 bytes for number and three bytes for decimal points</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>21</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>22</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>23</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

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

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

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a display overflow exists for a requested timer or cycle counter value, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of seven positions for the requested value with decimal points positioned for the selected timer range. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

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

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint On value
   String: N17TV350$T

2. Node address = 5, Read Timer value, response time of 50 msec min
   String: N5TA*

3. Node address = 0, Reset Setpoint output
   String: RF*

4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31PS

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. The meter ignores any decimal point and conforms the number to the appropriate display format. For example: The Timer range is set for tenths of a second and 25 is written to the Timer Start register. The value of the register is now 2.5 seconds. In this case, write a value of 250 to equal 25.0 seconds).

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

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>MNEMONIC</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Timer</td>
<td>TMR</td>
<td>T, V, R</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>B</td>
<td>Cycle Counter</td>
<td>CNT</td>
<td>T, V, R</td>
<td>5 digit</td>
</tr>
<tr>
<td>C</td>
<td>Timer Start</td>
<td>TST</td>
<td>T, V</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>D</td>
<td>Timer Stop</td>
<td>TSP</td>
<td>T, V</td>
<td>6 digit, per Timer Range</td>
</tr>
<tr>
<td>E</td>
<td>Counter Start</td>
<td>CST</td>
<td>T, V</td>
<td>5 digit</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint ON (Reset Output)</td>
<td>SPT</td>
<td>T, V, R</td>
<td>per Setpoint Assignment, same as Timer or Counter</td>
</tr>
<tr>
<td>G</td>
<td>Setpoint OFF</td>
<td>SOF</td>
<td>T, V</td>
<td>per Setpoint Assignment, same as Timer or Counter</td>
</tr>
<tr>
<td>H</td>
<td>Setpoint Time-out</td>
<td>STO</td>
<td>T, V</td>
<td>6 digit, mm.ss.ss format</td>
</tr>
</tbody>
</table>

Abbreviated Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 9 bytes for number and three bytes for decimal points</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

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

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

Meter Response Examples:

1. Node address = 17, full field response, Cycle Counter = 875
   17 CNT 875 <CR><LF>

2. Node address = 0, full field response, Setpoint On value = 250.5
   SPT 250.5<CR><LF>

3. Node address = 0, abbreviated response, Setpoint On value= 250, last line of block print
   250<CR><LF><SP><CR><LF>
Command Response Time

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

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

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

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

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

Timing Diagram Figure

Communication Format

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

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

* Voltage levels at the Receiver

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

Start Bit and Data Bits

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

Parity Bit

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

Stop Bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.
Press PAR key to enter Programming Mode.
MODEL LD - LARGE DC VOLT/CURRENT/PROCESS DISPLAY

GENERAL DESCRIPTION
The Large Display is a versatile display available as a DC volt, current, or process meter with scaling, serial communications and dual relay outputs. The 5 digit displays are available in either 2.25” or 4” high red LED digits with adjustable display intensities. The 2.25” high models are readable up to 130 feet. The 4” high models are readable up to 180 feet. Both versions are constructed of a NEMA 4X enclosure in light weight aluminum.

All models also come with dual Form C relay outputs and RS232 / RS485 serial communications.

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.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2A</td>
<td>2.25&quot; High 5 Digit Red LED Volt/Current Meter w/ Relay Output and RS232/RS485 Serial Comms</td>
<td>LD2A05P0</td>
</tr>
<tr>
<td>LD4A</td>
<td>4&quot; High 5 Digit Red LED Volt/Current Meter w/ Relay Output and RS232/RS485 Serial Comms</td>
<td>LD4A05P0</td>
</tr>
</tbody>
</table>

DIMENSIONS In inches (mm)

SPECIFICATIONS

1. DISPLAY: 5 digit, 2.25" (57 mm) or 4" (101 mm) intensity adjustable Red LED (-99999 to 99999)

2. POWER REQUIREMENTS:
   - AC POWER: 50 to 250 V AC 50/60 Hz, 26 V A
   - DC POWER: 21.6 to 250 VDC, 11 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
   - Isolation: 2300 Vrms for 1 min. to all inputs and outputs

3. INPUT RANGES: Jumper Selectable
   - D.C. Voltages: 200 mV, 2 V, 20 V, 200 V, 10 V
   - D.C. Currents: 200 μA, 2 mA, 20 mA, 200 mA
   - D.C. Process: 4 to 20 mA, 1 to 5 VDC, 0/1 to 10 VDC

4. OVERRANGE/UNDERRANGE INDICATION:
   - Input Overrange Indication: "-OL-".
   - Input Underrange Indication: "-UL-".
   - Display Overrange/Underrange Indication: "-----"/"-----"

5. A/D CONVERTER: 16 bit resolution
   - A/D Conversion Rate: 6 readings/sec.
6. **DISPLAY RESPONSE TIME:** 500 msec min.
7. **USER INPUT:**
   Software selectable pull-up (8.6 KΩ) or pull-down resistor
   (3.9 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.; 50 msec debounce (activation and release)
8. **COMMUNICATIONS:**
   **Type:** RS485 or RS232
   **Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min.
   **Working Voltage:** 50 V. Not Isolated from all other commons.
   **Data:** 7/8 bits
   **Parity:** no, odd or even
   **Baud Rate:** 300 to 38.4 K
   **Bus Address:** Selectable 0 to 99. Max. 32 meters per line (RS485)
9. **MEMORY:** Nonvolatile \( \text{EEPROM} \) retains all programming parameters and max/min values when power is removed.
10. **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.
11. **ENVIRONMENTAL CONDITIONS:**
    **Operating temperature:** 0 to 50 °C
    **Storage temperature:** -40 to 70 °C
    **Operating and storage humidity:** 0 to 85% max. RH (non-condensing)
    **Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g’s (1 g relay).**
    **Shock According to IEC 68-2-27: Operational 30 g’s (10 g relay), 11 msec in 3 directions.**
    **Altitude:** Up to 2,000 meters
12. **CONNECTIONS:**
    Internal removable terminal blocks
    - **Wire Strip Length:** 0.4” (10 mm)
    - **Wire Gage:** 24-12 AWG copper wire
    - **Torque:** 5.3 inch-lbs (0.6 N-m) max.
    - **Cable Diameter:** Outside diameter must be 0.181” (4.6 mm) to 0.312” (7.9 mm) to maintain NEMA 4 rating of cord grips.
13. **CONSTRUCTION:** Aluminum enclosure, and steel side panels with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications. Installation Category II, Pollution Degree 2.
14. **CERTIFICATIONS AND COMPLIANCES:**
   **SAFETY**
   - UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
   - File # E179259, UL61010A-1, CSA C22.2 No. 61010-1
   - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   - Type 4X Enclosure rating, UL50
   - IEC6EE CB Scheme Test Certificate #US/8843B/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, 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 B
     - **Electromagnetic RF fields**
       - EN 61000-4-3: Criterion B
       - 10 V/m
     - **Fast transients (burst)**
       - EN 61000-4-4: Criterion B
       - 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 B
       - 3 V/m
     - **Voltage dip/interruptions**
       - EN 61000-4-11: Criterion A
       - 0.5 cycle
   - **Emissions:**
     - EN 55011 Class A
   - **Notes:**
     1. **Criterion A:** Normal operation within specified limits.
     2. **Criterion B:** Temporary loss of performance from which the unit self-recover.
15. **WEIGHT:**
   - LD2A05XX - 4.5 lbs (2.04 kg)
   - LD4A05XX - 10.5 lbs (4.76 kg)

---

**1.0 INSTALLING THE METER**

**INSTALLATION**

The meter meets NEMA 4X/IP65 requirements when properly installed.

**INSTALLATION ENVIRONMENT**

The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided. The unit 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 front overlay. 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 side 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.
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 run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables: Fair-Rite #0443167251 (RLC# FCOR0000)
   - TDK #ZCAT3035-1330A
   - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner #FN610-1/07 (RLC# LFIL0000)
     - Schaffner #FN670-1.8/07
     - Corcom #1 VR3
   - Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubber: RLC# SNUB0000.

WIRING OVERVIEW

Electrical connections are made via pluggable terminal blocks located inside 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 on the label on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.4” (10 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).

WIRING CONNECTIONS

Internal removable terminal blocks are used for power and signal wiring. Access to terminal blocks is through conduit fittings. Remove end plates with ¼” nut driver. For LD4 versions, all wiring is on right side of unit. For LD2 versions, power and relay wiring is on the right side and the input, serial, DC out and user input is on the left side.

Connect drain wire from shielded cable(s) to screw on side plate for proper grounding.

3.1 Power Wiring

The power wiring is made via the 3 position terminal block (TBA) located inside the unit (right side). The DC out power is located: LD2 - left side, LD4 - right side

Power
Terminal 1: VAC/DC +
Terminal 2: VAC/DC -
Terminal 3: Protective Conductor Terminal

DC Out Power
Terminal 4: +24 VDC OUT
Terminal 6: User Common
3.2 USER INPUT WIRING

The User Input is located: LD2 - left side, LD4 - right side

Terminal 5: User Input
Terminal 6: User Comm

Sinking Logic

\[
\begin{array}{c}
\text{USER} \\
\text{USER COM} \\
\text{TBC}
\end{array}
\]

Sourcing Logic

\[
\begin{array}{c}
\text{USER} \\
\text{USER COM} \\
\text{TBC}
\end{array}
\]

CAUTION: Analog common is NOT isolated from user input common. In order to preserve the safety of the meter application, the DC 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 2.

3.3 SETPOINT (OUTPUT) WIRING

The setpoint relays use a six position terminal block (TBB) located inside the (right side).

Terminal 1: NC 1
Terminal 2: NO 2
Terminal 3: Relay 1 Common
Terminal 4: NC 1
Terminal 5: NO 2
Terminal 6: Relay 2 Common

3.4 INPUT WIRING

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

\[
\begin{array}{c}
\text{VOLT INPUT} \\
\text{INPUT COMMON} \\
\text{CURRENT INPUT} \\
+24 \text{ VDC EXC} \\
\text{USER INPUT} \\
\text{USER/EXC. COMMON}
\end{array}
\]

CAUTION: Analog common is NOT isolated from user input common. In order to preserve the safety of the meter application, the DC 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 2.

3.5 INPUT SIGNAL WIRING

Voltage Signal (self powered)
Terminal 1: +VDC
Terminal 2: -VDC

Current Signal (self powered)
Terminal 1: +ADC
Terminal 2: -ADC

Current Signal (2 wire requiring excitation)
Terminal 4: +EXC
Terminal 3: +ADC

Current Signal (3 wire requiring excitation)
Terminal 3: +ADC (signal)
Terminal 2: -ADC (common)
Terminal 4: +EXC

Voltage Signal (3 wire requiring excitation)
Terminal 1: +VDC (signal)
Terminal 2: -VDC (common)
Terminal 4: +EXC
3.6 SERIAL WIRING

The serial connections are made via terminal block TBD located inside the unit on the left side for the LD2 and on the right side for the LD4.

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 LD 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 LDA is limited to 38.4k 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

<table>
<thead>
<tr>
<th>BUTTON OPERATION</th>
<th>DISPLAY DESIGNATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>MAX - Maximum display capture value</td>
</tr>
<tr>
<td>SEL</td>
<td>MIN - Minimum display capture value</td>
</tr>
<tr>
<td>RST</td>
<td>“1” - To the left of the display indicates setpoint 1 output activated.</td>
</tr>
<tr>
<td></td>
<td>“2” - To the left of the display indicates setpoint 2 output activated.</td>
</tr>
</tbody>
</table>

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

OVERVIEW

PROGRAMMING MENU

PROGRAMMING MODE ENTRY (PAR BUTTON)

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

MODULE ENTRY (SEL & PAR BUTTONS)

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

MODULE MENU (PAR BUTTON)

Each module has a separate module menu (which is shown at the start of each module discussion). The PAR button is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to PRO. 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 button and RST button 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 rightmost digit). Pressing the RST button increments the digit by one or the user can hold the RST button and the digit will automatically scroll. The SEL button will select the next digit to the left. Pressing the PAR button will enter the value and move to the next parameter.

PROGRAMMING MODE EXIT (PAR BUTTON)

The Programming Mode is exited by pressing the PAR button with PRO 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.

### 5.1 MODULE 1 - SIGNAL INPUT PARAMETERS (I-IMP)

<table>
<thead>
<tr>
<th>Parameter Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INPUT RANGE</strong></td>
</tr>
<tr>
<td><strong>SELECTION</strong></td>
</tr>
<tr>
<td>200u</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>100</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.

<table>
<thead>
<tr>
<th><strong>DISPLAY DECIMAL POINT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display Value for Scaling Point 1</strong></td>
</tr>
<tr>
<td><strong>Display Value for Scaling Point 2</strong></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th><strong>DISPLAY OFFSET VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>-19999 to 19999</td>
</tr>
</tbody>
</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 removes the effects of offset. The decimal point follows the \texttt{dECP}$^\text{t}$ selection.

**FILTER SETTING**

\begin{verbatim}
FILTER

0 1 2 3

\end{verbatim}

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**

\begin{verbatim}
BAND

0 to 199

\end{verbatim}

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**

\begin{verbatim}
STYLE

KEY APPLY

\end{verbatim}

If Input Values and corresponding Display Values are known, the Key-in \(\texttt{tke}\) 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 \(\texttt{mpl}\) scaling style must be used.

**INPUT VALUE FOR SCALING POINT 1**

\begin{verbatim}
INP 1

0 to 29999

\end{verbatim}

For Key-in \(\texttt{tke}\) 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 \(\texttt{mpl}\) style, the meter shows the previously stored Input Value. To retain this value, press the \texttt{SEL}$^\text{a}$ button to advance to the next parameter. To change the Input Value, press the \texttt{RST}$^\text{v}$ button and apply the input signal to the meter. Adjust the signal source externally until the desired Input Value appears. Press the \texttt{SEL}$^\text{a}$ button to enter the value being displayed.

**DISPLAY VALUE FOR SCALING POINT 1**

\begin{verbatim}
DSP 1

-9999 to 99999

\end{verbatim}

Enter the first Display Value by using the front panel buttons. This is the same for \(\texttt{tke}\) and \(\texttt{mpl}\) scaling styles. The decimal point follows the \texttt{dECP}$^\text{t}$ selection.

**INPUT VALUE FOR SCALING POINT 2**

\begin{verbatim}
INP 2

0 to 29999

\end{verbatim}

For Key-in \(\texttt{tke}\) style, enter the known second Input Value using the front panel buttons.

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

**DISPLAY VALUE FOR SCALING POINT 2**

\begin{verbatim}
DSP 2

-19999 to 99999

\end{verbatim}

Enter the second Display Value by using the front panel buttons. This is the same for \(\texttt{tke}\) and \(\texttt{mpl}\) scaling styles. The decimal point follows the \texttt{dECP}$^\text{t}$ selection.

**General Notes on Scaling**

1. When using the Apply \(\texttt{mpl}\) 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 can not 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 \((\texttt{mp}1 / \texttt{dSP}1 & \texttt{mp}2 / \texttt{dSP}2)\).

**USER INPUT FUNCTION**

**DISPLAY MODE**

\begin{verbatim}
NO P-Loc P-r5t
Zero Input rESel
rSel

d-LEV d-SEL d-LEU

Pr

P-r5t

Print Request

Print and Reset

Setpoint 1 Reset

Setpoint 1 and 2 Reset

Print and Reset

Print Request

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 both setpoint 1 and 2 outputs.

**USER INPUT ASSIGNMENT**

**USER INPUT ACTIVE LEVEL**

Select whether the User Input is configured as active low or active high.
5.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-SEC)

### MAX DISPLAY ENABLE

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

Enables the Maximum Display Capture capability.

### MAX CAPTURE DELAY TIME

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>9999</td>
</tr>
</tbody>
</table>

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

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

Enables the Minimum Display Capture capability.

### MIN CAPTURE DELAY TIME

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>9999</td>
</tr>
</tbody>
</table>

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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</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 *r*EST*E* then return to *CodE* 00. Press the PAR button to exit the module.

### VIEW MODEL AND VERSION DISPLAY

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

---

### CALIBRATION

The LD uses stored calibration values to provide accurate measurements. Over time, the electrical characteristics of the components inside the LD 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 LD 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 LD.

#### 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 *CAL NO*.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads 0.0A for about 8 seconds.
5. With the positive lead of the DC current source unconnected, press PAR. Display reads CALC 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 CALC for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads *CAL 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 LD. Set the output of the voltage source to zero.
2. With the display at *CodE* 48, press the PAR button. Unit will display *CAL NO*.
3. Press the RST button to select the range to be calibrated.
4. Press the PAR button. Display reads 0.0v for about 8 seconds.
5. With the voltage source set to zero (or a dead short applied to the input), press PAR. Display reads CALC 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 CALC for about 8 seconds.
7. Repeat steps 3 through 6 for each input range to be calibrated. When display reads *CAL NO*, press the PAR button to exit calibration.
5.3 MODULE 3 - DISPLAY AND FRONT PANEL BUTTON PARAMETERS (3-dSP)

**DISPLAY UPDATE TIME**

![dSP-L]

This parameter sets the display update time in seconds.

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

![SEL]

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

**FRONT PANEL RESET ENABLE (RST)**

![Rst]

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

**ZERO DISPLAY WITH DISPLAY RESET**

![2ErD]

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**

![Scrol]

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 INTENSITY LEVEL**

![d-LEU]

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

**PROGRAMMING SECURITY CODE**

![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).

<table>
<thead>
<tr>
<th>USER INPUT FUNCTION</th>
<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>Active</td>
<td>0</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code entry at CodE prompt *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>CodE prompt</td>
<td>With correct code entry at CodE prompt *</td>
</tr>
<tr>
<td>P-Loc</td>
<td>Active</td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>CodE prompt</td>
<td>With correct code entry at CodE prompt *</td>
</tr>
<tr>
<td>Not Active</td>
<td></td>
<td>0-999</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
</tbody>
</table>
5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPe)

PARAMETER MENU

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 5PSel. Repeat steps for each setpoint to be programmed. Select NO to exit the module.

SETPOINT ENABLE

Select YES to enable Setpoint \( n \) and access the setup parameters. If NO is selected, the unit returns to 5PSel and Setpoint \( n \) 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 manual reset, serial reset command or meter power cycle. When the user input or RST button is activated (momentary action), the

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.

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

Setpoint Output Reset Actions

**OUTPUT RESET WITH DISPLAY RESET**

<table>
<thead>
<tr>
<th>Stb-n</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</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></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</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.

### 5.5 MODULE 5 - SERIAL SETUP PARAMETERS (5-SEr)

**PARAMETER MENU**

<table>
<thead>
<tr>
<th>bAud</th>
<th>dAlR</th>
<th>PRr</th>
<th>Addr</th>
<th>Abbr</th>
<th>OPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>Data Bit</td>
<td>Parity Bit</td>
<td>Meter Address</td>
<td>Abbreviated Printing</td>
<td>Print Options</td>
</tr>
</tbody>
</table>

Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the LD with those of the host computer or other serial device.

**BAUD RATE**

<table>
<thead>
<tr>
<th>bAud</th>
<th>300</th>
<th>1200</th>
<th>4800</th>
<th>9600</th>
<th>19200</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>2400</td>
<td>9600</td>
<td>38400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**DATA BIT**

<table>
<thead>
<tr>
<th>dAlR</th>
<th>7-b it</th>
<th>8-b it</th>
</tr>
</thead>
</table>

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

**PARITY BIT**

<table>
<thead>
<tr>
<th>PRr</th>
<th>No</th>
<th>Odd</th>
<th>Even</th>
</tr>
</thead>
</table>

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.
Sending Serial Commands and Data

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

Command Chart

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

Command String Construction

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

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

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>Value Description</th>
<th>MNEMONIC</th>
<th>Applicable Commands</th>
<th>Transmit Details (T and V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Input</td>
<td>MNEMONIC</td>
<td>NO</td>
<td>5 digit</td>
</tr>
<tr>
<td>B</td>
<td>Maximum</td>
<td>MAX</td>
<td>NO</td>
<td>5 digit</td>
</tr>
<tr>
<td>C</td>
<td>Minimum</td>
<td>MIN</td>
<td>NO</td>
<td>5 digit</td>
</tr>
<tr>
<td>D</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>NO</td>
<td>5 digit positive/4 digit negative</td>
</tr>
<tr>
<td>E</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>NO</td>
<td>5 digit positive/4 digit negative</td>
</tr>
</tbody>
</table>

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint 1 value
   String: N17VD350
2. Node address = 5, Read Input, response time of 50 msec min
   String: N5TA*
3. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31PS

Transmitting Data to the Meter

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

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.
**Receiving Data From The Meter**

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

**Full Field Transmission**

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

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

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

The numeric data is transmitted next. The numeric field (bytes 7 to 15) is 9 characters long. This field consists of a minus sign (for negative values), a floating decimal point (if applicable), and five positions for the requested value. The data within bytes 9 to 15 is right-aligned with leading spaces for any unfilled positions. When a requested value exceeds the meter’s display limits, decimal points are transmitted instead of a numeric value.

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

**Abbreviated Transmission**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-9</td>
<td>9 byte data field, 7 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>10</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>11</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>12</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

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

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

**Meter Response Examples:**

1. Node address = 17, full field response, Input = 875
   
   17 INP 875 <CR><LF>

2. Node address = 0, full field response, Setpoint 1 = -250.5
   
   SP1 -250.5<CR><LF>

3. Node address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   
   250<CR><LF><SP><CR><LF>

---

**Command Response Time**

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

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

\[
t_1 = \text{10 times the # of characters) / baud rate}
\]

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

If the meter is to reply with data, the time interval \(t_3\) is controlled by the use of the command terminating character. The '*' terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with 'S' results in a response time (\(t_3\)) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

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

\[
t_3 = \text{10 times the # of characters) / baud rate}
\]

The maximum serial throughput of the meter is limited to the sum of the times \(t_1\), \(t_2\) and \(t_3\).
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 meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop Bit

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

Character Frame Figure

![Character Frame Figure](image-url)
Press PAR key to enter Programming Mode.
GENERAL DESCRIPTION

The Large Serial Slave Display is a versatile display that accepts serial ASCII data from a host device and displays the received characters. The displayable data includes numeric, 7-segment alphabetic and certain punctuation characters. The 6-digit displays are available in either 2.25" or 4" high red LED digits with adjustable display intensity. The 2.25" high models are readable up to 130 feet. The 4" high models are readable up to 180 feet. Both versions are constructed of a NEMA 4X/IP65 enclosure in light weight aluminum.

The Serial Slave has two internal display buffers, allowing two separate display values or messages to be viewed. The main (primary) display typically shows dynamic data (count, rate, process, etc.), usually received directly from another meter. The secondary display typically shows a fixed message or value, such as a system or machine identifier, or a target production value. The main and secondary displays can be toggled either manually or automatically at a user selected toggle speed. Both displays are retained in memory when power is removed from the unit.

For single meter remote display applications, the Serial Slave can be connected directly to a Red Lion (or compatible) meter with RS232 or RS485 serial communications. The slave can display the meter value on its main display without requiring a PC or other serial interface.

Multiple slaves are connected using an RS485 serial bus. If unique meter addresses are assigned, specific data can be displayed by a single slave on the bus. When multiple slaves are assigned the same address, common data can be displayed by multiple units in different locations.

Serial communications parameters are fully programmable, with baud rates up to 38.4Kbps. Special command characters allow display selection and display intensity adjustment through the serial input. In addition to the serial input, a programmable User Input is provided to perform a variety of meter functions.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

1. DISPLAY: 6-digit 2.25" (57 mm) or 4" (101 mm) adjustable intensity Red LED

2. POWER REQUIREMENTS:
   AC POWER: 50 to 250 VAC 50/60 Hz, 26 VA
   DC POWER: 21.6 to 250 VDC, 11 W
   Isolation: 2300 VRMS for 1 min. to all inputs and outputs

3. SERIAL INPUT:
   RS485 SERIAL COMMUNICATIONS
   Type: Multi-point balanced interface (isolated)
   Baud Rate: 300 to 38400
   Data Format: 7/8 bits; odd, even, or no parity
   Bus Address: 0 to 99; max 32 meters per line
   RS232 SERIAL COMMUNICATIONS
   Type: Half duplex (isolated)
   Baud Rate: 300 to 38400
   Data Format: 7/8 bits; odd, even, or no parity

4. USER INPUT (Programmable Function Input):
   Active low logic, internal 7.8 KΩ pull-up resistor to +12V.
   Trigger levels: \( V_{IL} = 1.0 \text{ V max} \); \( V_{IH} = 2.4 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)
   Response time: 10 msec typ; 50 msec debounce (activation & release)

5. MEMORY: Nonvolatile E2PROM retains all programming parameters, main and secondary displays when power is removed.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>X (Length)</th>
<th>Y (Height)</th>
<th>Z (Center)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2SS66P0</td>
<td>16 (406.4)</td>
<td>4 (101.6)</td>
<td>12 (304.8)</td>
</tr>
<tr>
<td>LD4SS66P0</td>
<td>26 (660.4)</td>
<td>7.875 (200)</td>
<td>22 (558.8)</td>
</tr>
</tbody>
</table>
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 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 (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.
   d. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD2SS6P0</td>
<td>2.25&quot; High 6-Digit Red LED Serial Slave Display, RS232/RS485 Serial Communications</td>
<td>LD2SS6P0</td>
</tr>
<tr>
<td>LD4SS6P0</td>
<td>2.25&quot; High 6-Digit Red LED Serial Slave Display, RS232/RS485 Serial Communications</td>
<td>LD4SS6P0</td>
</tr>
</tbody>
</table>

1.0 INSTALLING THE METER

INSTALLATION

The meter meets NEMA 4X/IP65 requirements when properly installed.

INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the operating temperature. Placing the unit near devices that generate excessive heat should be avoided. The unit should only be cleaned with a soft cloth and neutral soap and water. Placing the unit near devices that generate excessive heat should be avoided. The unit should only be cleaned with a soft cloth and neutral soap and water.

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

MOUNTING INSTRUCTIONS

This display is designed to be wall mounted or suspended from a ceiling truss or other suitable structure capable of supporting the LDSS. Caution should be exercised when hanging the display to provide for the safety of personnel. If hanging the LDSS, run the suspension cables (or chains) through the mounting bracket holes. For wall mounting use #10-32 size bolts.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

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

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables:
     - Fair-Rite # 0443167251 (RLC# FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward # 28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1-07 (RLC# LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom # 1 VR3
   - Note: Reference manufacturer's instructions when installing a line filter.

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

7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubber: RLC# SNUB0000.

---

**WIRING OVERVIEW**

Electrical connections are made via pluggable terminal blocks located inside 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 on the label on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.4" (10 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).

---

**2.1 POWER WIRING**

The power wiring is made via the 3 position terminal block (TBA) located inside unit (right side).

**AC Power**
- Terminal 1: VAC/DC +
- Terminal 2: VAC/DC -
- Terminal 3: Earth Ground

---

**2.2 USER INPUT WIRING**

The User Input is wired to Terminals 1 and 2 of TBB as shown.

**Sinking Logic**
- Terminal 5: User Input
- Terminal 6: Common
2.3 SERIAL WIRING

The serial connections are made via terminal block TBD located inside the unit on the left side for the LD2 and on the right side for the LD4.

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 LD 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 LDSS is limited to 38.4k 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.

3.0 REVIEWING THE FRONT PANEL KEYS AND DISPLAY

DISPLAY DESIGNATOR

“2” - To the far right of the display indicates the secondary display is shown.

If display scroll is enabled, the display will toggle automatically between the main and secondary display at the selected scroll interval.
4.0 PROGRAMMING THE METER

PROGRAMMING MODE ENTRY (PAR KEY)

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible, then it is locked by either a security code or a hardware lock (See Module 2).

MODULE ENTRY (SEL▲ & PAR KEYS)

The Programming Menu is organized into two modules. These modules group together parameters that are related in function. The display will alternate between $Pr$ and the present module. The SEL▲ key is used to select the desired module. The displayed module is entered by pressing the PAR key.

MODULE MENU (PAR KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to $Pr$ and the present module. 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▼ keys are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

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

PROGRAMMING MODE EXIT (PAR KEY)

The Programming Mode is exited by pressing the PAR key 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 or in the event of corrupted program data.

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.

4.1 MODULE 1 - INPUT SETUP PARAMETERS ( $I^1$-INP )

Module 1 is the programming module for the Input Setup Parameters. This includes the Serial Input setup parameters and the User Input function. Set the Serial Input parameters to match the settings of the host device.

BAUD RATE

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

DATA BIT

Select either 7- or 8-bit data word length to match that of the host device.
**Parity Bit**

This parameter only appears when the Data Bit parameter is set to 7-bit. Set the parity bit to match that of the host device. If parity is set to **No**, an additional stop bit is used to force the frame size to 10 bits.

**Meter Address**

Enter the meter (node) address. With a single slave unit, an address is not required and a value of zero should be used. This is the case with an RS232 connection, where only one Serial Slave is connected to the host.

With multiple Serial Slaves connected on an RS485 bus, a unique address number must be assigned to each unit in order to send data to a specific slave on the bus. If multiple slaves are assigned the same address (including zero), common data can be sent to, and displayed by multiple slave units on the bus.

**Data Receive Delay Time**

Upon receiving a terminator character <CR>, the Serial Slave disables serial data reception for the time duration entered in this parameter. Using a delay allows the Serial Slave to ignore additional characters such as a <LF> or second <CR>, which often follow a serial data string. This value is entered in seconds and hundredths of seconds format, with a 10 msec minimum delay time.

(See "Data Receive Delay Timing" in the Communications section for additional timing details.)

---

**4.2 Module 2 - Display and Front Panel Key Parameters (2-**d**SP)**

### User Input Function

<table>
<thead>
<tr>
<th>DISPLAY MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No Function</td>
</tr>
<tr>
<td><strong>ProLoc</strong></td>
<td>Program Mode Lock-out</td>
</tr>
<tr>
<td><strong>rSt-E</strong></td>
<td>Momentary Reset (Edge triggered)</td>
</tr>
<tr>
<td><strong>rSt-L</strong></td>
<td>Maintained Reset</td>
</tr>
<tr>
<td><strong>d-HOLD</strong></td>
<td>Display Hold</td>
</tr>
<tr>
<td><strong>d-SEL</strong></td>
<td>Display Select (Edge triggered)</td>
</tr>
<tr>
<td><strong>d-LEU</strong></td>
<td>Display Intensity Level (Edge triggered)</td>
</tr>
</tbody>
</table>

Select the display to which the User Input Function applies. The User Input Assignment only appears if the secondary display is enabled and a selection of reset or display hold is chosen for the User Input Function.

Assignment choices include the main (primary) and/or secondary display, or the display which is shown at the moment the User Input is activated (**d**SP).

**Note:** For reset selection, main display resets to zero. Secondary display resets to all blanks. Secondary display resets to all blanks.

### Secondary Display Enable

Select **YES** to enable the secondary display. A “2” on the far right of the display always appears when the secondary display is shown.

### Front Panel Display Select Enable (SE**L**)

Select **YES** to allow the SE**L** key to toggle between the main and secondary displays. This parameter only appears if the secondary display is enabled.

### Display Scroll Interval

Select the time interval at which the display automatically toggles between the main and secondary displays. Select **No** to disable automatic scrolling. This parameter only appears if the secondary display is enabled.

### Front Panel Display Reset Enable (RST**V**)

This parameter allows the RST**V** key to reset the main (primary) and/or secondary display (if enabled), or the display which is currently shown (**d**SP). Select **No** to disable the RST**V** key.

**Note:** Main display resets to zero. Secondary display resets to all blanks.
Serial Slave Communications

Displayable Characters

The ASCII characters that the Serial Slave can display are as follows:

- **Numeric**: 0 to 9
- **Alphabetic** (7-segment): A, b, c, d, E, e, F, G, H, h, i, J, K, l, N, n, O, p, q, r, s, t, U, u, V, v, Y, Z

Non-displayable alphabetic characters will be replaced with a blank if received. These include M, W and X.

**Note**: Both uppercase and lowercase ASCII characters are accepted. If a displayable difference exists, characters will be shown in the case received.

**Punctuation**: period, comma, and colon (all displayed as decimal point); minus (dash), blank

Display and Serial Buffer Capacity

The Serial Slave display is right aligned and has the capacity of displaying six characters. When less than six characters are received, blank spaces are placed in front of the characters. If more than six characters are received, only the last six are displayed.

The unit has two internal display buffers, allowing two separate values or command strings sent to perform specific display functions. The format for sending data is shown below:

```
N xx I d6 d5 d4 d3 d2 d1 <CR>
```

- **N** - Required to address a specific slave unit in a multiple unit loop.
- **xx** - Two-digit meter address. Single digit address requires leading zero.
- **I** - Format identifier character (see below). Omit for main display data.
- **d6-d1** - The last 6 characters before the <CR> will be shown, if displayable.
- **<CR>** - Carriage Return (0DH) used as string terminator character.

**Data and Command String Formatting**

Data sent to the Serial Slave must be formatted as either main display data, secondary display data or command strings sent to perform specific display functions. The format for sending data is shown below:

```
N xx I d6 d5 d4 d3 d2 d1 <CR>
```

- **N** - Required to address a specific slave unit in a multiple unit loop.
- **xx** - Two-digit meter address. Single digit address requires leading zero.
- **I** - Format identifier character (see below). Omit for main display data.
- **d6-d1** - The last 6 characters before the <CR> will be shown, if displayable.
- **<CR>** - Carriage Return (0DH) used as string terminator character.

The format identifier character <I> dictates how the Serial Slave interprets a data string as follows:

- **(omit)** - No character indicates main display data
- **#** - Indicates secondary display data
- **@** - Display select command, followed by display identifier character
  - main <1>: or secondary <2> (ex: @1<CR> select main display)
- **%** - Display intensity command, followed by intensity level character
  - <1> to <5> (ex: %3<CR> set display intensity level to 3)

**Downloading Data from a G3 to an LDSS**

**Communications**

- **Port**: RS232 Comms Raw Serial Port
- **Port Driver**: <system> Raw Serial Port

**Programming**

```
PortPrint(2, "N01" + IntToText(Var1, 10, 6) + "\r");
```

This program is called from the Global On Tick. It sends ”N01” (the address of the LDSS), followed by the ASCII equivalent of Var1, then a carriage return.
Data Receive Delay Timing

Upon receiving a string terminator character \(<\text{CR}>\), the Serial Slave requires a delay time to process the received data and prepare for the next string. During this delay, the meter disables serial data reception.

The Data Receive Delay Time is programmable in Module 1, with a minimum delay of 10 mSec. By extending this delay, the Serial Slave can ignore data sent by the host which is not intended for display. This data includes additional characters such as a \(<\text{LF}>\) or redundant \(<\text{CR}>\), which might follow a serial data string. This could also include additional data strings sent as part of a data block, where only the first string is intended for the Serial Slave display. In this case, the delay time should be programmed to exceed the total transmission time for the entire data block. This results in the Serial Slave displaying the first string of the data block and disabling data reception during transmission of the additional strings.

The Receive Delay Time must be set to expire at a point where no data is being sent to the Serial Slave. This prevents the unit from enabling data reception in the middle of a character or data string, which could result in an incorrect display when the string is processed.

Timing Diagram for Data Reception
MODEL LPAX - 5 DIGIT LARGE PAX DISPLAY FOR ANALOG INPUTS

- LARGE LED DISPLAY READABLE TO 70 FEET
- VARIOUS ANALOG INPUT MODULES; DC VOLTAGE AND CURRENT PROCESS SIGNALS, TRUE RMS VOLTAGE AND CURRENT, THERMOCOUPLE OR RTD, STRAIN GAGE/Bridge
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- CUSTOM UNITS LABEL WITH BACKLIGHT
- PROGRAMMABLE USER INPUTS
- PROGRAMMABLE FUNCTION KEYS
- UNIVERSAL AC/DC POWERED MODELS
- CRIMSON PROGRAMMING SOFTWARE
- NEMA 4/IP65

GENERAL DESCRIPTION

The LPAX Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. Whether your measurement is temperature, weight, or flow, the LPAX can satisfy your requirement. With the use of a units label and backlighting, the display can be tailored to show the actual engineering unit, which further enhances the display. This LPAX display accepts various analog inputs through the use of input modules (MPAX) which allow the unit to adapt to most any application. The MPAX Modules offer the same features as our highly successful PAX Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the LPAX a truly Intelligent Panel Meter.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 1.5" (38 mm) Red LED
   5-Digit: (-19999 to 99999)

2. POWER REQUIREMENTS:
   AC Modules: 85 to 250 VAC, 50/60 Hz, 18 VA
   DC Modules: 11 to 36 VDC or 24 VAC ±10%, 50/60 Hz, 14 W

3. INPUT: Accepts analog input modules, see “Selecting your display components.”

4. ANNUNCIATORS:
   LPAX0500: MAX, MIN, TOT, SP1, SP2, SP3, and SP4
   Optional units label with backlight

5. KEYPAD: Five tactile membrane switches integrated into the front panel

6. CERTIFICATIONS AND COMPLIANCES:
   UL Recognized Component, File #E179259, UL61010A-1, CSA 22.2 No. 1010-1
   Recognized to US 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 4 Enclosure rating (Face only), UL50
   IEEE CB Scheme Test Certificate #US80/43/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

EMC specifications determined by the MPAX module.

DIMENSIONS In inches (mm)

PANEL CUT-OUT

This document provided by Barr-Thorp Electric Co., Inc.  800-473-9123  www.barr-thorp.com
7. ENVIRONMENTAL CONDITIONS:
Operating Temperature Range: Determined by the MPAX module
Storage Temperature Range: -40 to 60°C
Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
Altitude: Up to 2000 meters

8. MOUNTING REQUIREMENTS:
Max. panel thickness is 0.375" (9.5 mm)
Min. panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm)

9. MODULE INSTALLATION:
24-pin shrouded connector on LPAX engages connector on MPAX module upon installation. Shroud ensures proper alignment by providing a lead-in for the module connector.

About the MPAX Input Modules
The MPAX Module serves as the input to the LPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX Module.

Note: The MPAX provides the operating power for the LPAX, therefore you must select either the AC or DC MPAX corresponding with your application and available power.

Selecting Your Display Components
To build a complete display unit, you will need an LPAX and an MPAX Input Module. The LPAX is only a display and will not operate without an MPAX Module. Please use the following chart to identify the appropriate MPAX Module (including supply power) and LPAX Display that will satisfy your application.

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>INPUT RANGES</th>
<th>MPAX MODULES *</th>
<th>LPAX DISPLAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal DC Inputs</td>
<td>DC Voltage 200 mV, 2 V, 20 V, 300 V</td>
<td>MPAXD000</td>
<td>LPA0500</td>
</tr>
<tr>
<td></td>
<td>DC Current 200 µA, 2 mA, 20 mA, 200 mA, 2 Amp</td>
<td>MPAXD010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resistance 100 ohm, 1000 ohm, 10 K ohm</td>
<td>LPA0500</td>
<td></td>
</tr>
<tr>
<td>Process Inputs</td>
<td>0-20 mA or 0-10 VDC</td>
<td>MPAXP000</td>
<td>LPA0500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPAXP010</td>
<td></td>
</tr>
<tr>
<td>Temperature Inputs</td>
<td>Thermocouples-T, E, J, K, R, S, B, N, C, or Custom Scaling</td>
<td>MPAXT000</td>
<td>LPA0500</td>
</tr>
<tr>
<td></td>
<td>RTD's-100 ohm Pt (platinum) 385/392, 120 ohm Nickel 672, or 10 ohm Copper 427</td>
<td>MPAXT010</td>
<td></td>
</tr>
<tr>
<td>Strain Gage/ Load Cell</td>
<td>24 mV or 240 mV</td>
<td>MPAXS000</td>
<td>LPA0500</td>
</tr>
<tr>
<td>True RMS AC Voltage/Current</td>
<td>AC Voltage 200 mV, 2 V, 20 V, 300 V</td>
<td>MPAXH000</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>AC Current 200 µA, 2 mA, 20 mA, 200 mA, 5 Amp</td>
<td>LPA0500</td>
<td></td>
</tr>
</tbody>
</table>

*For detailed Module specifications, see corresponding PAX literature. (i.e. For MPAXD specifications, see the PAXD literature)

OPTIONAL PLUG-IN CARDS AND ACCESSORIES

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

Adding Option Cards
The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

COMMUNICATION CARDS (PAXCDC)
A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232 or RS485 Cards must be used.

PAXCDC1* - RS485 Serial
PAXCDC2* - RS232 Serial
PAXCDC3 - DeviceNet

*Units available in various connector configurations.

SETPOINT CARDS (PAXCDS)
The MPAX series has four 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 NPN open collector

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 the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

UNITS LABEL (LX)
The LPAX Display has an area on the front panel designed for a custom units label. The units label is applied directly to the panel in the embossed area. The units backlight is then turned on via programming.

Available on 5-digit version only. Refer to the LPAX Accessories Bulletin for a list of available units labels.

PROGRAMMING SOFTWARE (CRIMSON)
Crimson is a Windows® based program that allows configuration of the LPAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the LPAX meter. The LPAX 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.
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the LPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards

If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX

To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about ¼” from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

Installing the Labels

Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

Removing The MPAX Module

To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (⅛" or ⅛") into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.
2.0 INSTALLING THE DISPLAY

LPAX DISPLAY INSTALLATION

The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six # 10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

Environment And Cleaning

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system 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.

3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

TROUBLESHOOTING

For technical assistance, contact technical support.

ORDERING INFORMATION

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<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
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<td><strong>MB</strong></td>
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* See the LPAX Accessory Bulletin or our web site for available units labels.
** Crimson software is available for download from http://www.redlion.net/
MODEL LPAX - 6 DIGIT LARGE PAX DISPLAY FOR DIGITAL INPUTS

- LARGE LED DISPLAY READABLE TO 70 FEET
- VARIOUS DIGITAL INPUT MODULES;
  COUNT AND RATE INPUT
  CLOCK/TIMER
  SERIAL SLAVE
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- PROGRAMMABLE USER INPUTS
- PROGRAMMABLE FUNCTION KEYS
- UNIVERSAL AC/DC POWERED MODELS
- PC SOFTWARE FOR METER CONFIGURATION
- NEMA 4/IP65

GENERAL DESCRIPTION
The LPAX Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. Whether your measurement is rate, count, or time, the LPAX can satisfy your requirement. These LPAX displays accept various digital inputs through the use of input modules (MPAX) which allow the unit to adapt to most any application. The MPAX Modules offer the same features as our highly successful PAX Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the LPAX a truly Intelligent Panel Meter.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS
Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 1.5" (38 mm) Red LED
   - 6-Digit (LPAX0600): (−999999 to 9999999)
   - 6-Digit (LPAXCK00): (0 to 999999)

2. POWER REQUIREMENTS:
   - AC Modules: 85 to 250 V AC, 50/60 Hz, 18 VA
   - DC Modules: 11 to 36 VDC or 24 VAC ±10%, 50/60 Hz, 14 W

3. INPUT: Accepts digital input modules, see “Selecting Your Display Components and Option Cards.”

4. ANNUNCIATORS:
   - LPAX0600: A, B, C, SP1, SP2, SP3, and SP4
   - LPAXCK00: TMR, CNT, DAT, SP1, SP2, SP3, and SP4

5. KEYPAD: Five tactile membrane switches integrated into the front panel

6. CERTIFICATIONS AND COMPLIANCES:
   - SAFETY
     - UL Recognized Component, File #E179259, UL61010A-1, CSA 22.2 No. 1010-1
     - Recognized to US 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 4 Enclosure rating (Face Only), UL50
     - IECEE CB Scheme Test Certificate # US/8843/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
     - EMC specifications determined by the MPAX module.
About the MPAX Input Modules

The MPAX Module serves as the input to the LPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX module.

Note: The MPAX provides the operating power for the LPAX, therefore you must select either the AC or DC MPAX corresponding with your application and available power.

Selecting Your Display Components and Option Cards

To build a complete display unit, you will need an LPAX and an MPAX Input Module. The LPAX is only a display and will not operate without an MPAX module. Please use the following chart to identify the appropriate MPAX module (including supply power) and LPAX Display that will satisfy your application.

### SIGNAL TYPE

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>MPAX MODULES**</th>
<th>LPAX DISPLAYS</th>
<th>OPTIONAL PLUG-IN CARD COMATIBILITY</th>
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<td>Count</td>
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<td>Rate</td>
<td>MPAXR000</td>
<td>LPAXR000</td>
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<td>Clock/Timer</td>
<td>MPAXC000</td>
<td>LPAXC000</td>
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<tr>
<td>Timer</td>
<td>MPAXC010</td>
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</table>

*For detailed module and plug-in card specifications, see corresponding PAX literature. (i.e. For MPAXI specifications, see the PAXI literature)

**The LPAXCK will only operate with the Clock/Timer MPAX input module.

### OPTIONAL PLUG-IN CARDS AND ACCESSORIES

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

Adding Option Cards

The MPAX series meters can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDO). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

**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 Crimson (for MPAXI) or SFPAK (for MPAXCK or MPAXTM), the RS232 or RS485 Cards must be used.

PAXCDC010 - RS485 Serial (Terminal)  PAXCDC30 - DeviceNet
PAXCDC011 - RS485 Serial (Connector)  PAXCDC40 - Modbus (Terminal)
PAXCDC20 - RS232 Serial (Terminal)  PAXCDC41 - Modbus (Connector)
PAXCDC23 - RS232 Serial (Connector)  PAXCDC50 - Profibus-DP

**SETPOINT CARDS (PAXCDS)**

The MPAX series has four 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:
- Dual relay, FORM-C, Normally open & closed
- Quad relay, FORM-A, Normally open only
- Isolated quad sinking NPN open collector
- Isolated quad sourcing PNP open collector

**PROGRAMMING SOFTWARE CRIMSON - MPAXI Only**

Crimson is a Windows® based program that allows configuration of the LPAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the LPAX meter. The LPAX 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.

**SFPAX - MPAXCK and MPAXTM Only**

The SFPAK is a Windows® based program that allows configuration of the LPAX meter from a PC. Using the SFPAK makes it easier to program the LPAX meter and allows saving the PAX program in a PC file for future use. On-line help is available within the software. A PAX serial plug-in card is required to program the meter using the software.

**LINEAR DC OUTPUT (PAXCDO)**

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 the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

PAXCDO10 - Retransmitted Analog Output Card

**10. CONNECTIONS:** All wiring connections are made to the MPAX module via high compression cage-clamp terminal blocks. Wiring instructions are provided with the MPAX module.

**CAUTION:** DISCONNECT ALL POWER BEFORE INSTALLING OR REMOVING MODULE

**11. CONSTRUCTION:** Steel front panel, enclosure, and rear cover with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4/IP65 specifications for indoor use when properly installed. Installation Category II, Pollution Degree 2. Panel gasket and keps nuts included.

**12. WEIGHT:** 2.7 lbs (1.2 kg) (less module)
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module or load circuits until the module is properly installed in the LPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards
If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX
To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about ¼” from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

Installing the Labels
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

Removing The MPAX Module
To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (¼" or ½") into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.
2.0 INSTALLING THE DISPLAY

LPAX DISPLAY INSTALLATION
The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060” (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six # 10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

Environment And Cleaning
The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system 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.

Figure 3, Installing The LPAX Into A Panel

3.0 WIRING AND PROGRAMMING THE DISPLAY
Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

TROUBLESHOOTING
For technical assistance, contact technical support.

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<td></td>
<td>ENC9**</td>
<td>NEMA 4 Enclosure for LPAX</td>
<td>ENC90000</td>
</tr>
<tr>
<td></td>
<td>SHR**</td>
<td>Shroud for LPAX</td>
<td>SHRPLTPX0</td>
</tr>
<tr>
<td></td>
<td>MB**</td>
<td>Mounting Bracket for LPAX</td>
<td>MBLPA0X0</td>
</tr>
</tbody>
</table>

*Refer to “Selecting Your Display Components and Option Cards.”
**Available as a FREE download from the Red Lion website. www.redlion.net
MODEL LPAXDA- 5 DIGIT LARGE PAX DISPLAY FOR DUAL ANALOG INPUTS

- LARGE LED DISPLAY READABLE TO 70 FEET
- DUAL PROCESS SIGNAL INPUT MODULE
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- CUSTOM UNITS LABEL WITH BACKLIGHT
- PROGRAMMABLE USER INPUTS
- PROGRAMMABLE FUNCTION KEYS
- UNIVERSAL AC/DC POWERED MODELS
- CRIMSON SOFTWARE FOR METER CONFIGURATION
- NEMA 4/IP65

GENERAL DESCRIPTION
The LPAXDA Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. With the use of a units label and backlighting, the display can be tailored to show the actual engineering unit, which further enhances the display. This LPAXDA display accepts various analog inputs through the use of input modules (MPAXDP) which allow the unit to adapt to most any application. The MPAXDP Modules offer the same features as our highly successful PAXDP Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the LPAXDA a truly Intelligent Panel Meter.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS
Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 1.5” (38 mm) Red LED 5-Digit: (-19999 to 99999)
2. POWER REQUIREMENTS:
   AC Modules: 85 to 250 VAC, 50/60 Hz, 21 VA
   DC Modules: 18 to 36 VDC, 13 W or 24 VAC ±10%, 50/60 Hz, 16 VA
3. INPUT: Accepts analog input modules, see “Selecting your display components.”
4. ANNUNCIATORS:
   LPAXDA00: A, B, C, SP1, SP2, SP3, and SP4
   Optional units label with backlight
5. KEYPAD: Five tactile membrane switches integrated into the front panel
6. CERTIFICATIONS AND COMPLIANCES:
   UL Recognized Component, File #E179259, UL3101-1, CSA 22.2 No. 1010-1
   Recognized to US 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 4 Enclosure rating (Face only), UL50
   IECCE CB Scheme Test Certificate #UL/8843/UL
   CB Scheme Test Report #04ME11209-20041018
   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
   ELECTROMAGNETIC COMPATIBILITY
   EMC specifications determined by the MPAX module.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>PANEL CUT-OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>234 (59.4) D1A, THRU. TYP.</td>
</tr>
<tr>
<td>9.29 (236 C4)</td>
</tr>
<tr>
<td>2X 4.725 (120.0)</td>
</tr>
</tbody>
</table>

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
7. ENVIRONMENTAL CONDITIONS:
Operating Temperature Range: Determined by the MPAX module
Storage Temperature Range: -40 to 60°C
Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
Altitude: Up to 2000 meters

8. MOUNTING REQUIREMENTS:
Max. panel thickness is 0.375" (9.5 mm)
Min. panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm)

9. MODULE INSTALLATION:
24-pin shrouded connector on LPAX engages connector on MPAX module upon installation. Shroud ensures proper alignment by providing a lead-in for the module connector.

About the MPAX Input Modules
The MPAX Module serves as the input to the LPAX Display. The MPAX module provides input scaling which allows the LPAX to display most any engineering unit. Once the MPAX is inserted into the LPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX Module.

Note: The MPAX provides the operating power for the LPAX, therefore you must select either the AC or DC MPAX corresponding with your application and available power.

Selecting Your Display Components
To build a complete display unit, you will need an LPAXDP and an MPAXDP Input Module. The LPAX is only a display and will not operate without an MPAX Module. Please use the following chart to identify the appropriate MPAX Module (including supply power) and LPAX Display that will satisfy your application.

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>INPUT RANGES</th>
<th>MPAX MODULES *</th>
<th>LPAX DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Process Inputs</td>
<td>0-20 mA or 0-10 VDC</td>
<td>MPAXDP00</td>
<td>MPAXDP10</td>
</tr>
</tbody>
</table>

*For detailed Module specifications, see corresponding PAX literature. (i.e. For MPAXDP specifications, see the PAXDP literature)

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

Adding Option Cards
The MPAX series modules can be fitted with up to three optional plug-in cards. However, only one card from each function type can be installed at a time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The cards can be installed initially or at a later date. Each optional plug-in card is shipped with installation and programming instructions.

COMMUNICATION CARDS (PAXCDC)
A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232 or RS485 Cards must be used.

<table>
<thead>
<tr>
<th>PAXCDC1* - RS485 Serial</th>
<th>PAXCDC4* - Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAXCDC2* - RS232 Serial</td>
<td>PAXCDC50 - Profibus-DP</td>
</tr>
<tr>
<td>PAXCDC30 - DeviceNet</td>
<td></td>
</tr>
</tbody>
</table>

*Units available in various connector configurations.

SETPOINT CARDS (PAXCDS)
The MPAX series has four 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:

<table>
<thead>
<tr>
<th>PAXCDS10 - Dual Relay, FORM-C, Normally open &amp; closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAXCDS20 - Quad Relay, FORM-A, Normally open only</td>
</tr>
<tr>
<td>PAXCDS30 - Isolated quad sinking NPN open collector</td>
</tr>
<tr>
<td>PAXCDS40 - Isolated quad sourcing PNP open collector</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 the input, max, min, or total display value. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

UNITS LABEL (LX)
The LPAX Display has an area on the front panel designed for a custom units label. The units label is applied directly to the panel in the embossed area. The units backlight is then turned on via programming.

Refer to the LPAX Accessories Bulletin for a list of available units labels.

PROGRAMMING SOFTWARE
Crimson 2 (SFCRD2) is a Windows® based program for configuring and updating the firmware of the MPAXDP meter from a PC. Using Crimson 2 makes programming the MPAXDP meter easier and allows the user to save the MPAXDP database in a PC file for future use. Crimson is available as a free download from Red Lion’s website, or it can be purchased on CD.

The first time Crimson 2 is run from the File menu, select “New” to display a dialog and select the MPAXDP. The screen will display icons that represent the various programming sections of the MPAXDP. 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.
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the LPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the LPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards
If your application requires option cards, they should be installed into the MPAX before it is installed into the LPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX
To install the MPAX Module, align the module with the opening in the LPAX case, as illustrated. The module must be oriented as shown, with terminal #1 toward the top of the LPAX case. Carefully slide the module into the LPAX case. The LPAX and MPAX connectors will begin to engage about 1/4" from the bottom. At this point, apply a small amount of pressure to the rear of the MPAX module to fully engage the connection. Be sure the module fully snaps into the slots at the rear of the LPAX case. The display is ready for installation.

Installing the Labels
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the LPAX in the positions shown in the drawing.

Removing The MPAX Module
To remove the MPAX Module from the LPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (1/16" or 1/8") into the narrow slot between the LPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the LPAX case, keeping it properly aligned with the case opening.

Figure 1, Installing an MPAX Module and Option Cards

Figure 2, Removing an MPAX Module
2.0 INSTALLING THE DISPLAY

LPAX DISPLAY INSTALLATION
The LPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 3. Install six # 10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the LPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

Environment And Cleaning
The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system 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.

3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the LPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>LPAXDA</td>
<td>5-Digit, Large Display for Analog MPAXDP Modules</td>
<td>LPAXDA00</td>
</tr>
<tr>
<td>Analog Input Module</td>
<td>MPAXDP</td>
<td>Dual Process Input Module, AC Powered</td>
<td>MPAXDP00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dual Process Input Module, DC/24 VAC Powered</td>
<td>MPAXDP10</td>
</tr>
<tr>
<td>PAXCDS</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 Sourcing Open Collector Output Card</td>
<td>PAXCDS40</td>
</tr>
<tr>
<td>Optional Plug-In Cards</td>
<td>PAXCDC</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>SFCRD2</td>
<td>PC Configuration Software for Windows 98, ME, 2000, XP</td>
<td>SFCRD200</td>
</tr>
<tr>
<td></td>
<td>ENC9</td>
<td>NEMA 4 Enclosure for LPAX</td>
<td>ENC90000</td>
</tr>
<tr>
<td></td>
<td>SHR</td>
<td>Shroud for LPAX</td>
<td>SHRLPA0X</td>
</tr>
<tr>
<td></td>
<td>MB</td>
<td>Mounting Bracket for LPAX</td>
<td>MBLPA0X00</td>
</tr>
</tbody>
</table>

* See the LPAX Accessory Bulletin or our web site for available units labels.
MODEL EPAX- 5 DIGIT EXTRA LARGE PAX DISPLAY FOR ANALOG INPUTS

- LARGE LED DISPLAY READABLE TO 180 FEET
- VARIOUS ANALOG INPUT MODULES;
  - DC VOLTAGE AND CURRENT
  - TRUE RMS VOLTAGE AND CURRENT
  - THERMOCOUPLE OR RTD
  - STRAIN GAGE/BRIDGE
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- PROGRAMMABLE USER INPUTS
- UNIVERSAL AC POWERED (85 to 250 VAC)
- CRIMSON PROGRAMMING SOFTWARE
- NEMA 4X/IP65

GENERAL DESCRIPTION

The EPAX is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. Whether your measurement is voltage, current, process, temperature, or strain gage, the EPAX can satisfy your requirement. The EPAX accepts various analog inputs through the use of input modules (MPAX) which allow the unit to adapt to most any application. The MPAX Modules offer the same features as our highly successful PAX Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the EPAX a truly Intelligent Panel Meter.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS

Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 4” (101 mm) Red LED
2. POWER REQUIREMENTS:
   - MPAX Modules: 85 to 250 V AC, 50/60 Hz, 18 VA
   - EPAX Display: 85 to 250 V AC, 50/60 Hz, 10 VA
3. INPUT: Accepts analog input modules, see “Selecting Your Display Components and Option Cards.”
4. ANNUNCIATORS:
   - Display Indication: Three vertical dots on the left side of the unit identify the displays for the following modes:
     - TOP Maximum
     - MIDDLE Minimum
     - BOTTOM Total
   - Setpoint Indication: Four vertical dots on the right side of the unit identify the setpoint “ON” condition, with SP 1 being the top position through SP 4 at the bottom.
5. EPAX Programming: The unit is a large display, designed to be remotely mounted. Therefore, the unit does not have a programming keypad. Unit programming should be accomplished by one of the following methods:
   - Rear Terminal Block: External switches can be wired via the terminal block to allow unit programming. A minimum of 3 switches would be required.
   - Optional Programming Remote (EPAXPGM0): This option provides a 10 foot interconnecting cable and programming box. The Programming Remote contains buttons similar to the PAX, allowing easy programming of the EPAX display.
   - Optional Serial Programming: Like all PAX units, you can purchase an RS232 or RS485 Comm Card and program the unit via Crimson, a Windows® based software program.

DIMENSIONS In inches (mm)

[Diagram showing dimensions]
6. 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.
Listed, File #E137804, UL508, CSA C22.2 No. 14-M95
Listed by Underwriters Laboratories, Inc. to U.S. and Canadian safety standards
Type 4X Indoor Enclosure rating (Face only), UL50
IEC CB Scheme Test Certificate #US/8843A/UL
CB Scheme Test Report #04ME11209-20041018
IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY

EMC specifications determined by the MPAX module.

7. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: Determined by the MPAX module
Storage Temperature Range: -40 to 60°C
Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
Altitude: Up to 2000 meters

8. MOUNTING REQUIREMENTS:

Max. panel thickness is 0.375" (9.5 mm)
Min. panel thickness for NEMA 4/IP65 sealing is 0.060" (1.52 mm)

About the MPAX Input Modules

The MPAX Module serves as the input to the EPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the EPAX to display most any engineering unit. Once the MPAX is inserted into the EPAX, the unit has the same functions and capabilities of our PAX Series Intelligent Panel Meters. A full set of PAX programming instructions will be included with the MPAX module.

Selecting Your Display Components and Option Cards

To build a complete display unit, you will need an EPAX and an MPAX Input Module. The EPAX is only a display and will not operate without an MPAX module. Please use the following chart to identify the appropriate MPAX module and EPAX Display that will satisfy your application.

<table>
<thead>
<tr>
<th>SIGNAL TYPE</th>
<th>MPAX MODULES*</th>
<th>EPAX DISPLAYS</th>
<th>OPTIONAL PLUG-IN CARD</th>
<th>COMMS</th>
<th>ANALOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal DC Inputs</td>
<td>MPAXD000</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Process Inputs</td>
<td>MPAXP000</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Temperature Inputs</td>
<td>MPAXT000</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Strain Gage/Loadcell</td>
<td>MPAXS000</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>True RMS AC Voltage/Current</td>
<td>MPAXH000</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Dual Process Inputs</td>
<td>MPAXDP00</td>
<td>EPAX0500</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

* For detailed module and plug-in card specifications, see corresponding PAX literature. (i.e. For MPAXD specifications, see the PAXD literature)

Optional Plug-in Cards and Accessories

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 of the PAX Bulletin. 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.

Setpoint Alarms Plug-in 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

Analog Output Plug-in Card (PAXCDL)

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

PAXCDL10 - Retransmitted Analog Output Card

Communication Plug-in Cards (PAXCDC)

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, the RS232 or RS485 Cards must be used.

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

Programming Software

Crimson is a Windows® based program that allows configuration of the EPAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the EPAX meter. The EPAX 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.
1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the EPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the EPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards
If your application requires option cards, they should be installed into the MPAX before it is installed into the EPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX
Remove the MPAX case (plastic) from the rear of the EPAX by removing the two screws and pulling off the metal holding bracket. Install the MPAX into plastic case by aligning the front connector of the MPAX with the hole in the front of the plastic case. The module must be oriented as shown with terminal #1 toward the top of the EPAX case. Next, insert the MPAX case into the EPAX by lightly pushing the connector of the MPAX into the connector of the EPAX PC board. Place holding bracket over the plastic case and install the two screws.

Installing the Labels
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the EPAX in the positions shown in the drawing.

Removing The MPAX Module
To remove the MPAX Module from the EPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (3/16" or 1/4") into the narrow slot between the EPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the EPAX case, keeping it properly aligned with the case opening.

Figure 1, Installing an MPAX Module and Option Cards

Figure 2, Removing an MPAX Module
2.0 INSTALLING THE DISPLAY

**EPAX DISPLAY INSTALLATION**

The EPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060” (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown in Figure 3. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 4. Install 14 #10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the EPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

**Environment And Cleaning**

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system 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.

---

**Figure 3, Panel Cut-out for the EPAX**

**Figure 4, Installing The EPAX Into A Panel**
3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the EPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

Note: Both the EPAX and the MPAX module require power. It is recommended to connect the primary AC power to the EPAX terminal block, then jumper to the MPAX module.

EPAX PROGRAMMING

The unit is a large display, designed to be remotely mounted. Therefore, the unit does not have a programming keypad. Unit programming must be accomplished by one of the following three methods:

Optional Programming Remote (EPAXPGM0)

This optional programming remote plugs into the EPAX through an RJ12 connector and a 10 foot cable. The buttons on the programming box function the same as the PAX unit. Simply program the EPAX exactly as the PAX instructions indicate. The programming box can be left connected to the EPAX for future programming changes or can be disconnected and used to program additional EPAX units.

Rear Terminal Block

External normally open switches can be wired via the terminal block to allow unit programming. A minimum of 3 switches would be required. Each external switch must be wired between the key and the common terminal.

EPAX TERMINAL BLOCK

Optional Serial Programming

Like all PAX units, you can purchase an RS232 or RS485 Communications Card and program the unit via Crimson, a Windows® based software program.
## ORDERING INFORMATION

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<th>PART NUMBERS</th>
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<td>ENC12</td>
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*Refer to “Selecting Your Display Components and Option Cards.”

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

## TROUBLESHOOTING

For technical assistance, contact technical support.
MODEL EPAX- 6 DIGIT EXTRA LARGE PAX DISPLAY FOR DIGITAL INPUTS

- LARGE LED DISPLAY READABLE TO 180 FEET
- VARIOUS DIGITAL INPUT MODULES;
  - COUNT AND RATE INPUT
  - CLOCK/TIMER
  - SERIAL SLAVE
- ALARMS, ANALOG OUTPUT, AND COMMUNICATION
- PROGRAMMABLE USER INPUTS
- UNIVERSAL AC POWERED (85 to 250 VAC)
- PC SOFTWARE FOR METER CONFIGURATION
- NEMA 4X/IP65

GENERAL DESCRIPTION
The EPAX Display is a versatile display that can increase productivity by offering the plant floor or production area a large visual display of their current status. Whether your measurement is rate, count, or time, the EPAX can satisfy your requirement. The EPAX displays accept various digital inputs through the use of input modules (MPAX) which allow the unit to adapt to most any application. The MPAX Modules offer the same features as our highly successful PAX Series Panel Meters. Additional plug-in option cards can add alarms, analog output, and communication/bus capabilities, making the EPAX a truly Intelligent Panel Meter.

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.

The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

SPECIFICATIONS
Additional specifications, wiring, programming, and information for the individual MPAX models are contained in the corresponding standard PAX literature. This PAX literature is shipped with the ordered MPAX model.

1. DISPLAY: 4” (101 mm) Red LED
   6-Digit (EPAX0600): (-99999 to 999999)

2. POWER REQUIREMENTS:
   AC MPAX Modules: 85 to 250 VAC, 50/60 Hz, 18 VA
   EPAX Display: 85 to 250 VAC, 50/60 Hz, 10 VA

3. INPUT: Accepts digital input modules, see “Selecting Your Display Components and Option Cards.”

4. ANNUNCIATORS:
   Display Indication
   - Three vertical dots on the left side of the unit identify the displays for the following modules:

<table>
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<tr>
<th>TOP</th>
<th>MIDDLE</th>
<th>BOTTOM</th>
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<tr>
<td>Display A</td>
<td>Display B</td>
<td>Display C</td>
</tr>
<tr>
<td>Timer</td>
<td>Count</td>
<td>Date</td>
</tr>
</tbody>
</table>

   Setpoint Indication
   - Four vertical dots on the right side of the unit identify the setpoint “ON” condition, with SP 1 being the top position through SP 4 at the bottom.

5. EPAX Programming: The unit is a large display, designed to be remotely mounted. Therefore, the unit does not have a programming keypad. Unit programming should be accomplished by one of the following methods:
   - Rear Terminal Block: External switches can be wired via the terminal block to allow unit programming. A minimum of 3 switches would be required.
   - Optional Programming Remote (EPAXPGM0): This option provides a 10 foot interconnecting cable and programming box. The Programming Remote contains buttons similar to the PAX, allowing easy programming of the EPAX display.
   - Optional Serial Programming: Like all PAX units, you can purchase an RS232 or RS485 Comms Card and program the unit via Windows® based software programs.

DIMENSIONS In inches (mm)

- 4.65 (118.1)
- 7.22 (183.4)
- 6.09 (154.7)
- 3.60 (91.5)
- 24.77 (629.2)

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6. 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 Indoor Enclosure rating (Face only), UL50
IECEE CB Scheme Test Certificate #US/8843/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
EMC specifications determined by the MPAX module.

7. ENVIRONMENTAL CONDITIONS:
Operating Temperature Range: Determined by the MPAX module
Storage Temperature Range: -40 to 60°C
Operating and Storage Humidity: 0 to 85% max. RH (non-condensing)
Altitude: Up to 2000 meters

8. MOUNTING REQUIREMENTS:
Max. panel thickness is 0.375" (9.5 mm)
Min. panel thickness for NEMA 4/IP65 sealing is 0.060" (1.52 mm)

About the MPAX Input Modules
The MPAX Module serves as the input to the EPAX Display. There are several different modules to cover a variety of inputs. The MPAX module provides input scaling which allows the EPAX to display most any engineering unit. Once the MPAX is inserted into the EPAX, the unit has the same functions and capabilities of the EPAX meter using the software.

Selecting Your Display Components and Option Cards
To build a complete display unit, you will need an EPAX and an MPAX Input Module. The EPAX is only a display and will not operate without an MPAX module. Please use the following chart to identify the appropriate MPAX module and EPAX Display that will satisfy your application.

ASSISTANCE
Add the MPAX Input Modules
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 of the PAX Bulletin. 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.

Optional Plug-In Cards and Accessories
WARNING: Disconnect all power to the unit before installing plug-in cards.

9. MODULE INSTALLATION:
24-pin shrouded connector on EPAX engages connector on MPAX module upon installation. Shroud ensures proper alignment by providing a lead-in for the module connector.

10. CONNECTIONS: Wiring connections are made to the EPAX terminal block and MPAX module via high compression cage-clamp terminal blocks.

MPAX Module Wiring: Instructions are provided in the corresponding PAX Bulletin.

EPAX Terminal Block Wiring:
Wire Strip Length: 0.3" (7.5 mm)
Wire Gage: 30-12 AWG copper wire
Maximum Torque: 5-7 inch-lbs (0.58-0.81 N-m)

CAUTION: DISCONNECT ALL POWER BEFORE INSTALLING OR REMOVING MODULE

11. CONSTRUCTION: Aluminum front panel, enclosure, and rear cover with textured black polyurethane paint for scratch and corrosion resistance protection. Sealed front panel meets NEMA 4X/IP65 specifications for indoor use when properly installed. Installation Category II, Pollution Degree 2. Panel gasket and keps nuts included.

12. WEIGHT: 5 lbs (2.25 kg) (less module)

Optional Plug-In Cards (PAXCDC)
A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson (for MPAXI000) or SFPAX (for MPAXCK00 or MPAXTM00), the RS232 or RS485 Cards must be used.

PAXCDC10 - RS485 Serial (Terminal) PAXCDC1C - RS485 Serial (Connector)
PAXCDC20 - RS232 Serial (Terminal) PAXCDC2C - RS232 Serial (Connector)
PAXCDC30 - DeviceNet PAXCDC4 - Modbus (Connector)
PAXCDC40 - Modbus (Terminal) PAXCDC4C - Modbus (Connector)
PAXCDC50 - Profibus-DP

Programming Software
CRIMSON - MPAXI000 Only
Crimson is a Windows® based program that allows configuration of the EPAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the EPAX meter. The EPAX 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.

SFPAX - MPAXCK00 and MPAXTM00 Only
The SFPAX is a Windows® based program that allows configuration of the EPAX meter from a PC. Using the SFPAX makes it easier to program the EPAX meter and allows saving the PAX program in a PC file for future use. On-line help is available within the software. A PAX serial plug-in card is required to program the meter using the software.

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1.0 ASSEMBLING THE DISPLAY

CAUTION: The MPAX main circuit board and the option cards contain static sensitive components. Before handling the module or the cards, discharge static charges from your body by touching a grounded bare metal object. Handle the module by the rear plastic cover only, and the option cards by the board edges. Dirt, oil or other contaminants that contact the circuit boards or components can adversely affect circuit operation.

WARNING: Exposed line voltage exists on the MPAX main circuit board and the option cards. DO NOT apply power to the module OR load circuits until the module is properly installed in the EPAX case.

NOTE: All module and option card labels must be installed as shown for safety purposes.

Prior to installing the EPAX Display, it is recommended that the MPAX and any option cards be assembled first. This will allow you the opportunity to insure all the boards are fitted properly into their connectors.

Installing the Option Cards
If your application requires option cards, they should be installed into the MPAX before it is installed into the EPAX Display. Refer to the literature enclosed with the option cards for installation instruction.

Installing the MPAX
Remove the MPAX case (plastic) from the rear of the EPAX by removing the two screws and pulling off the metal holding bracket. Install the MPAX into plastic case by aligning the front connector of the MPAX with the hole in the front of the plastic case. The module must be oriented as shown with terminal #1 toward the top of the EPAX case. Next, insert the MPAX case into the EPAX by lightly pushing the connector of the MPAX into the connector of the EPAX PC board. Place holding bracket over the plastic case and install the two screws.

Installing the Labels
Each option card and the MPAX are shipped with a connection label. These labels must be applied to the rear of the EPAX in the positions shown in the drawing.

Removing The MPAX Module
To remove the MPAX Module from the EPAX Display, first remove all power and load circuits. Then insert a flat screwdriver blade (1/8" or 1/4") into the narrow slot between the EPAX rear cover plate and the module’s plastic cover as illustrated in Figure 2. Twist the screwdriver in the direction shown to disengage the internal connectors while firmly squeezing and pulling back on the rear finger tabs (top and bottom). Carefully slide the module out of the EPAX case, keeping it properly aligned with the case opening.

Figure 1, Installing an MPAX Module and Option Cards
Figure 2, Removing an MPAX Module
2.0 INSTALLING THE DISPLAY

EPAX DISPLAY INSTALLATION

The EPAX display is intended to be mounted into a panel or enclosure. The display is provided with a gasket to provide a water-tight seal. The recommended minimum panel thickness for NEMA 4/IP65 sealing is 0.060" (1.57 mm).

For panel mounting, prepare the panel cut-out to the dimensions shown in Figure 3. The supplied template may be used to mark the cut-out and hole locations on the panel. After the panel cut-out has been deburred, slide the panel gasket over the rear of the display and onto the mounting studs. Insert the display into the panel cut-out as illustrated in Figure 4. Install 14 #10-32 keps nuts (supplied) and tighten evenly for uniform gasket compression. Do not over-tighten the nuts.

By using additional mounting accessories, the EPAX can be surface-wall mounted, suspended, or bottom mounted. Separate installation instructions are provided with the mounting accessories.

Environment And Cleaning

The display should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the system 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.

Figure 3, Panel Cut-out for the EPAX

Figure 4, Installing The EPAX Into A Panel
3.0 WIRING AND PROGRAMMING THE DISPLAY

Once assembled, the EPAX and MPAX have all the same functions and capabilities of our PAX Series Intelligent Panel Meters. Therefore, you will find the appropriate PAX information packed with the MPAX Module. Simply follow the instructions to wire and program the display for your application.

Note: Both the EPAX and the MPAX module require power. It is recommended to connect the primary AC power to the EPAX terminal block, then jumper to the MPAX module.

EPAX PROGRAMMING

The unit is a large display, designed to be remotely mounted. Therefore, the unit does not have a programming keypad. Unit programming must be accomplished by one of the following three methods:

Optional Programming Remote (EPAXPGM0)

This optional programming remote plugs into the EPAX through an RJ12 connector and a 10 foot cable. The buttons on the programming box function the same as the PAX unit. Simply program the EPAX exactly as the PAX instructions indicate. The programming box can be left connected to the EPAX for future programming changes or can be disconnected and used to program additional EPAX units.

Rear Terminal Block

External normally open switches can be wired via the terminal block to allow unit programming. A minimum of 3 switches would be required. Each external switch must be wired between the key and the common terminal.

EPAX TERMINAL BLOCK

85 - 250VAC
50/60Hz @ 5VA
DSP KEY
PAR KEY
F1 KEY
F2 KEY
RST KEY
COMM

Optional Serial Programming

Like all PAX units, you can purchase an RS232 or RS485 Comms Card and program the unit via Windows® based software programs.
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*Refer to “Selecting Your Display Components and Option Cards.”

**Available as a FREE download from the Red Lion website. www.redlion.net

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