MODEL CUB®5V - MINIATURE ELECTRONIC 5-DIGIT DC VOLTMETER

- FOURSelectable D.C. RANGES
  - 0 to 200 mV, 2 V, 20 V, 200 V
- MINIMUM AND MAXIMUM DISPLAY CAPTURE
- LCD, REFLECTIVE OR RED/GREEN LED BACKLIGHTING
- 0.48" (12.2 mm) HIGH DIGITS
- OPTIONAL SETPOINT OUTPUT CARDS
- OPTIONAL SERIAL COMMUNICATIONS CARDS (RS232 or RS485)
- OPTIONAL USB PROGRAMMING CARD
- OPERATES FROM 9 TO 28 VDC POWER SOURCE
- FRONT PANEL OR CRIMSON PROGRAMMABLE
- DISPLAY COLOR CHANGE CAPABILITY AT SETPOINT OUTPUT
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION

The CUB5 provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The CUB5V accepts a DC Voltage input signal and provides a display in the desired unit of measure. The meter also features minimum and maximum display capture, display offset, units indicator, and programmable user input. The display can be toggled either manually or automatically between the selected displays.

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

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

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

VOLTAGE

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

SAFETY SUMMARY

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

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

DIMENSIONS  In inches (mm)

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

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB5</td>
<td>CUB5V</td>
<td>DC Volt Meter with reflective display</td>
<td>CUB5VR00</td>
</tr>
<tr>
<td></td>
<td>CUB5VB00</td>
<td>DC Volt Meter with backlight display</td>
<td>CUB5VB00</td>
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<tr>
<td>Optional Plug-in Cards</td>
<td>CUB5RLY</td>
<td>Single Relay Option Card</td>
<td>CUB5RLY0</td>
</tr>
<tr>
<td></td>
<td>CUB5SNK</td>
<td>Dual Sinking Open Collector Output Card</td>
<td>CUB5SNK0</td>
</tr>
<tr>
<td></td>
<td>CUB5COM</td>
<td>RS485 Serial Communications Card</td>
<td>CUB5COM1</td>
</tr>
<tr>
<td></td>
<td>CUB5USB</td>
<td>USB Programming Card</td>
<td>CUB5USB00</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Accessories</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLPS</td>
<td>+12 VDC Micro-Line Power Supply, 85 to 250 VAC source, 400 mA max out</td>
<td>MLPS1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+24 VDC Micro-Line Power Supply, 85 to 250 VAC source, 200 mA max out</td>
<td>MLPS2000</td>
<td></td>
</tr>
<tr>
<td>CBLPRO</td>
<td>Programming Cable RS232 (RJ11-DB9)</td>
<td>CBLPROG0</td>
<td></td>
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<tr>
<td>CBLUSB</td>
<td>Communication Cable RS485 (RJ11-DB9)</td>
<td>CBLUSB2000</td>
<td></td>
</tr>
<tr>
<td>SFCRD</td>
<td>Crimson PC Configuration Software, Free Download Available¹</td>
<td>SFCRD2000</td>
<td></td>
</tr>
</tbody>
</table>

¹ Crimson software is a free download from http://www.redlion.net. System requirements for the software are listed on the download page.

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**GENERAL METER SPECIFICATIONS**

1. **DISPLAY**: 5 digit LCD 0.48” (12.2 mm) high digits
   - **CUB5VR00**: Reflective LCD with full viewing angle
   - **CUB5VB00**: Transmissive LCD with selectable red or green LED backlight, viewing angle optimized. Display color change capability with output state when using an output module.

2. **POWER**: Input voltage range is +9 to +28 VDC with short circuit and input polarity protection.

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

4. **SIGNAL INPUTS**:
   - **INPUT RANGE**
     - 200 mVDC
       - Accuracy: 0.1% of span
       - Impedance: 10.027 MΩ
       - Resolution: 70 ppm / °C
     - 2 VDC
       - Accuracy: 0.1% of span
       - Impedance: 10.027 MΩ
       - Resolution: 70 ppm / °C
     - 20 VDC
       - Accuracy: 0.1% of span
       - Impedance: 10.027 MΩ
       - Resolution: 70 ppm / °C
     - 200 VDC
       - Accuracy: 0.1% of span
       - Impedance: 10.027 MΩ
       - Resolution: 70 ppm / °C

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

6. **A/D CONVERTER**: 16 bit resolution
7. **RESPONSE TIME**
   - Display: 500 ms/sec min.
   - Output: 800 ms/sec max (with input filter setting of 0)
8. **NORMAL MODE REJECTION**: 60 dB 50/60 Hz
9. **USER INPUT (USR)**: Programmable input. Connect terminal to common (USR COMM) to activate function. Internal 10KΩ pull-up resistor to +9 to 28 VDC.
   - Threshold Levels: \( V_{IL} = 0.7 \text{ V} \) max; \( V_{IH} = 2.4 \text{ V} \) min; \( V_{MAX} = 28 \text{ VDC} \)
   - Response Time: 5 msec typ.; 50 msec debounce (activation and release)
10. **CONNECTIONS**: Wire clamping screw terminals
    - Wire Strip Length: 0.3” (7.5 mm)
    - Wire Gage: 30-14 AWG copper wire
    - Torque: 3.5 inch-lbs (0.395 N-m) max.
11. **MEMORY**: Nonvolatile E’PROM memory retains all programming parameters and max/min values when power is removed.
12. **CONSTRUCTION**: This unit is rated for Type 4X/IP65 requirements for indoor/outdoor use. Installation Category I, Pollution Degree 2. High impact plastic case with clear viewing window. Panel gasket and mounting clip included.
13. **ENVIRONMENTAL CONDITIONS**: Operating Temperature Range for CUB5VR00 -35 to 75°C
    Operating Temperature Range for CUB5VB00 depends on display color and intensity level as per below:

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

    **Storage Temperature**: -35 to 85°C
    **Operating and Storage Humidity**: 0 to 85% max. relative humidity (non-condensing)
    **Vibration to IEC 68-2-6**: Operational 5-500 Hz, 5 g.
    **Shock to IEC 68-2-27**: Operational 30 g
    **Altitude**: Up to 2000 meters
14. **CERTIFICATIONS AND COMPLIANCES**:
    **CE Approved**
    **EN 61326-1**: Immunity to Industrial Locations
    **Emission CISPR 11 Class A**
    **Safety requirements for electrical equipment for measurement, control, and laboratory use**: **EN 61010-1**: General Requirements
    **EN 61010-2-030**: Particular Requirements for Testing and Measuring Circuits
    **RoHS Compliant**
    **UL Recognized Component**: File #E179259
    **UL Listed**: File #E137808
    **Type 4X Indoor/Outdoor Enclosure rating (Face only)**
    **IP65 Enclosure rating (Face only)**
    **IP20 Enclosure rating (Rear of unit)**
    **Refer to EMC Installation Guidelines for additional information.**
15. **WEIGHT**: 3.2 oz (100 g)
OPTIONAL PLUG-IN CARDS

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

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

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

SINGLE RELAY CARD
Type: Single FORM-C relay
Isolation To Sensor & User Input Commons: 1400 Vrms for 1 min.
Working Voltage: 150 Vrms
Contact Rating: 1 amp @ 30 VDC resistive; 0.3 amp @ 125 V AC resistive
Life Expectancy: 100,000 minimum operations

DUAL SINKING OUTPUT CARD
Type: Non-isolated switched DC, N Channel open drain MOSFET
Current Rating: 100 mA max.

V_{DS ON}: 0.7 V @ 100 mA
V_{DS MAX}: 30 VDC
Offstate Leakage Current: 0.5 mA max.

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

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

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

1.0 INSTALLING THE METER

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

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

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

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

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

2.0 SETTING THE JUMPERS

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

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

REMOVE/REPLACE THE REAR COVER
To remove the rear cover, locate the cover locking tab below the 2nd and 3rd input terminals. To release the tab, insert a small, flat blade screwdriver between the tab and the plastic wall below the terminals. Inserting the screwdriver will provide enough pressure to release the tab locks. To replace the cover, align the cover with the input terminals and press down until the cover snaps into place.
### 3.0 INSTALLING PLUG-IN CARDS

The Plug-in cards are separately purchased option cards that perform specific functions. The cards plug into the main circuit board of the meter.

#### EMC INSTALLATION GUIDELINES

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

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

#### REMOVAL/REPLACE THE REAR COVER

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

### 4.0 WIRING THE METER

#### WIRING OVERVIEW

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

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

#### 4.1 POWER WIRING

**DC Power**

<table>
<thead>
<tr>
<th>Power Common</th>
<th>+9 to +28 VDC: +VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR COMMON</td>
<td>+9-28 VDC</td>
</tr>
</tbody>
</table>

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

**CAUTION:** The power circuit is not isolated from the signal circuit.

#### Line Filters for input power cables:

- **Fair-Rite part number 0443167251 (RLC part number FCOR0000)**
- **Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)**

6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.

a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.

b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.

**RCL part numbers: Snubber: SNUB0000**

**Varistor: ILS1500 or ILS23000**

7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument’s operation.

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

#### 4.2 USER INPUT WIRING

**Sinking Logic**

Connect external switching device between the

USR INP +

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

**CAUTION:** The user input of the meter is internally pulled up to +9 to +28 V with 10 K resistance.
4.3 INPUT WIRING

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

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

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

4.4 SETPOINT (OUTPUT) WIRING

**SINGLE SETPOINT RELAY PLUG-IN CARD**

**ELECTRICAL CONNECTIONS**

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

**ELECTRICAL CONNECTIONS**

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

4.5 SERIAL COMMUNICATION WIRING

**SERIAL COMMUNICATIONS PLUG-IN CARD**

**RJ11 CONNECTOR PIN OUTS**

4.6 USB PROGRAMMING

**USB PROGRAMMING PLUG-IN CARD**
5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

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

OPERATING MODE DISPLAY DESIGNATORS
MAX - Maximum display capture value
MIN - Minimum display capture value

“1” - To the right of the display indicates setpoint 1 output activated.
“2” - To the right of the display indicates setpoint 2 output activated.

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

6.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

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

MODULE ENTRY (SEL & RST BUTTONS)
The Programming Menu is organized into separate modules. These modules group together parameters that are related in function. The display will alternate between Pr and the present module. The RST button is used to select the desired module. The displayed module is entered by pressing the SEL button.

MODULE MENU (SEL BUTTON)
Each module has a separate module menu (which is shown at the start of each module discussion). The SEL button is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pr. Programming may continue by accessing additional modules.

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

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

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

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

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

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

Indicates Program Mode Alternating Display

Parameter

Selection/Value

Factory Settings are shown.
### 6.1 MODULE 1 - SIGNAL INPUT PARAMETERS (I-1NP)

#### PARAMETER MENU

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Range</td>
<td><strong>RANGE</strong></td>
<td>200.00 mV</td>
</tr>
<tr>
<td>Display Decimal Point</td>
<td><strong>dECP</strong></td>
<td>0</td>
</tr>
<tr>
<td>Display Offset Value</td>
<td><strong>OFSET</strong></td>
<td>0.00</td>
</tr>
<tr>
<td>Filter Setting</td>
<td><strong>FILTr</strong></td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Filter Band</td>
<td><strong>bANd</strong></td>
<td>0 to 99 display units</td>
</tr>
<tr>
<td>Display Value for Scaling Point 1</td>
<td><strong>dSP 1</strong></td>
<td>0 to 19999</td>
</tr>
<tr>
<td>Display Value for Scaling Point 2</td>
<td><strong>dSP 2</strong></td>
<td>0 to 19999</td>
</tr>
</tbody>
</table>

#### CUB5V INPUT RANGE

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

#### DISPLAY DECIMAL POINT

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

#### DISPLAY OFFSET VALUE

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

#### FILTER SETTING

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

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

#### FILTER BAND

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

#### SCALING STYLE

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

#### INPUT VALUE FOR SCALING POINT 1

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

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

#### DISPLAY VALUE FOR SCALING POINT 1

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

#### INPUT VALUE FOR SCALING POINT 2

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

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

#### DISPLAY VALUE FOR SCALING POINT 2

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

### General Notes on Scaling

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

**DISPLAY MODE**

- **No Function**
- **P-Loc**
- **Zero Input** (Edge triggered)
- **Reset (Edge triggered)**
- **Display Hold**
- **Display Select** (Edge triggered)
- **Display Intensity Level** (Edge triggered)
- **Backlight Color** (Edge triggered)

**DESCRIPTION**

- User Input disabled.
- See Programming Mode Access chart (Module 3).
- Zero the Input Display value causing Display Reading to be Offset.
- Holds the assigned display, but all other meter functions continue as long as activated (maintained action).
- Advance once for each activation.
- Increase intensity one level for each activation (backlight version only).
- Change backlight color with each activation (backlight version only).

**USER INPUT FUNCTION**

**DISPLAY MODE**

- **Pr**
- **P-rSt**
- **rSt-1**
- **rSt-2**
- **rSt-12**

**DESCRIPTION**

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

**USER INPUT ASSIGNMENT**

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

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

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**MAX DISPLAY ENABLE**

- NO
- YES

Enables the Maximum Display Capture capability.

**MAX CAPTURE DELAY TIME**

- **HI-En**
  - NO to 9999 seconds

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

**MIN DISPLAY ENABLE**

- NO
- YES

Enables the Minimum Display Capture capability.

**MIN CAPTURE DELAY TIME**

- **LO-En**
  - NO to 9999 seconds

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**

- **rSt**
  - NO
  - YES

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

---

**FACTORY SERVICE OPERATIONS**

**DESCRIPTION**

- Print Request followed by a momentary reset of the assigned value(s).
- Print and Reset
- Setpoint 1 Reset
- Setpoint 2 Reset
- Setpoint 1 and 2 Reset

**USER INPUT FUNCTION**

**DISPLAY MODE**

- **Pr**
- **P-rSt**
- **rSt-1**
- **rSt-2**
- **rSt-12**

**DESCRIPTION**

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

**VIEW VERSION DISPLAY**

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

**CALIBRATION**

The CUB5V uses stored voltage calibration values to provide accurate voltage measurements. Over time, the electrical characteristics of the components inside the meter will slowly change, with the result that the stored calibration values no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration of the CUB5V involves an input voltage calibration, which should only be performed by individuals experienced in calibrating electronic equipment. Allow a 30 minute warm up before performing any calibration related procedures. The following procedures should be performed at an ambient temperature of 15 to 35°C (59 to 95°F).

**CAUTION:** The accuracy of the calibration equipment will directly affect the accuracy of the CUB5V.

**Voltage Calibration**

1. Connect a precision DC voltage source with an accuracy of 0.01% or better to the INP+ (positive) and COMM (negative) terminals of the CUB5V. Set the output of the voltage source to zero.
2. With the display at Code OFF, press and hold the SEL button for 2 seconds. Unit will display Code 00. Press the SEL button to exit the module.
3. Press the SEL button to select the range to be calibrated.
4. Press the SEL button. Display reads 000. Press the SEL button. Display reads Code 0. If the display reads Code 00, press the SEL button.
5. With the voltage source set to zero (or a dead short applied to the input), press SEL. Display reads Code 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.)
7. Repeat steps through 6 for each input range to be calibrated. When display reads Code OFF, press the SEL button to exit calibration.
The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (P-Loc) in the User Input Function parameter (Module 1).

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

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

### PROGRAMMING SECURITY CODE

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

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

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

<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>0</td>
<td>0</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
<tr>
<td></td>
<td>1-99</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>100-999</td>
<td>100-999</td>
<td>CodE prompt</td>
<td>With correct code entry at CodE prompt *</td>
</tr>
</tbody>
</table>

| P-Loc               | Active           | 0             | Programming Lock                  | No Access                   |
|                     | 1-99             | 1-99          | Quick Programming                 | No Access                   |
|                     | 100-999          | 100-999       | CodE prompt                       | With correct code entry at CodE prompt * |

| Not Active          | 0-999            | 0-999         | Full Programming                  | Immediate Access            |

* Entering Code 222 allows access regardless of security code.
The Setpoint Output Parameters are only active when an optional output module is installed in the meter.

**SETPOINT SELECT**

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

**SETPOINT 2 ENABLE**

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

**SETPOINT ACTION**

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 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.)

\[ L \cdot dt \cdot y \] = 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 \cdot dt \cdot y reset if it is not activated at power up.)

OUTPUT RESET WITH DISPLAY RESET

\[ \begin{align*}
\text{YES} & \quad \text{NO} \\
\text{YES} & \quad \text{NO}
\end{align*} \]

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

\[ \begin{align*}
\text{YES} & \quad \text{NO} \\
\text{YES} & \quad \text{NO}
\end{align*} \]

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

CHANGE DISPLAY COLOR w/OUTPUT STATE

\[ \begin{align*}
\text{YES} & \quad \text{NO} \\
\text{YES} & \quad \text{NO}
\end{align*} \]

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

6.5 MODULE 5 - SERIAL SETUP PARAMETERS (5·5Er)

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

Refer to the CUB5COM bulletin for details on CUB5 RS232 or RS485 serial communications.

Refer to the CUB5USB bulletin for details on the CUB5 USB programming and programming requirements.

LIMITED WARRANTY

(a) Red Lion Controls Inc., Sixnet Inc., N-Tron Corporation, or Blue Tree Wireless Data, Inc. (the “Company”) warrants that all Products shall be free from defects in material and workmanship under normal use for the period of time provided in “Statement of Warranty Periods” (available at www.redlion.net) current at the time of shipment of the Products (the “Warranty Period”). EXCEPT FOR THE ABOVE-STATED WARRANTY, COMPANY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING ANY (A) WARRANTY OF MERCHANTABILITY; (B) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (C) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE. Customer shall be responsible for determining that a Product is suitable for Customer’s use and that such use complies with any applicable local, state or federal law.

(b) The Company shall not be liable for a breach of the warranty set forth in paragraph (a) if (i) the defect is a result of Customer’s failure to store, install, commission or maintain the Product according to specifications; (ii) Customer alters or repairs such Product without the prior written consent of Company.

(c) Subject to paragraph (b), with respect to any such Product during the Warranty Period, Company shall, in its sole discretion, either (i) repair or replace the Product; or (ii) credit or refund the price of Product provided that, if Company so requests, Customer shall, at Company’s expense, return such Product to Company.

(d) THE REMEDIES SET FORTH IN PARAGRAPH (c) SHALL BE THE CUSTOMER’S SOLE AND EXCLUSIVE REMEDY AND COMPANY’S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN PARAGRAPH (a).
Press and hold SEL button to enter Programming Mode.