

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



- LCD, REFLECTIVE OR GREEN/RED LED BACKLIGHTING
- 0.46" (11.7 mm) HIGH DIGITS
- OPTIONAL RELAY OUTPUT MODULE
- OPTIONAL SERIAL COMMUNICATIONS MODULE (RS232 or RS485)
- COUNT SPEEDS UP TO 20 KHz
- OPERATES FROM 9 TO 28 VDC POWER SOURCE
- PROGRAMMABLE SCALING FOR COUNT AND RATE
- BI-DIRECTIONAL COUNTING, UP/DOWN CONTROL
- QUADRATURE SENSING (UP TO 4 TIMES RESOLUTION)
- DISPLAY COLOR CHANGE CAPABILITY AT PRESET OUTPUT
- NEMA 4X/IP65 SEALED FRONT BEZEL

### GENERAL DESCRIPTION

The CUB5 provides the user the ultimate in flexibility, from it's complete user programming to the optional relay output capability. The meter can be programmed as a single or dual counter with rate indication capability. The display can be toggled either manually or automatically between the selected displays.

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

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

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

The capability of the CUB5 can be easily expanded with the addition of an option module. Setpoint capability is field installable with the addition of the CUB5RLY0, relay output module. Serial communications capability for RS232 or RS485 is added with a serial option module.

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

### COUNTER

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

### RATE

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

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

### SAFETY SUMMARY

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

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



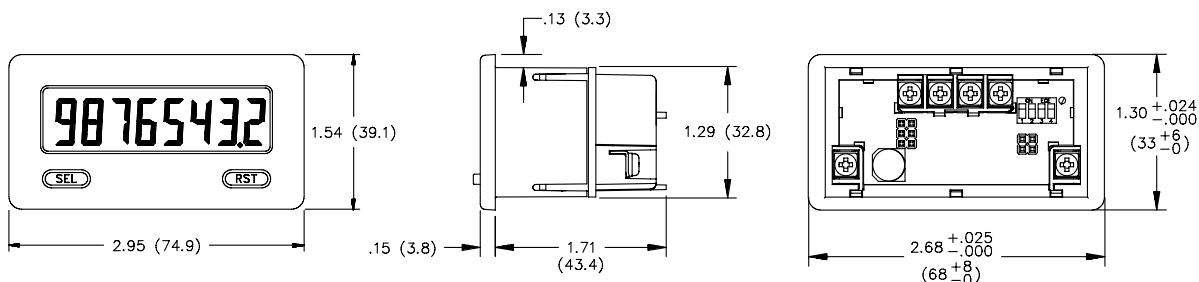
**CAUTION: Read complete instructions prior to installation and operation of the unit.**



**CAUTION: Risk of electric shock.**

### DIMENSIONS In inches (mm)

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



# ORDERING INFORMATION

| TYPE                   | MODEL NO. | DESCRIPTION   | PART NUMBER |
|------------------------|-----------|---|-------------|
| CUB5                   | CUB5R     | Dual Counter & Rate Indicator with Reflective Display | CUB5R000    |
|                        | CUB5B     | Dual Counter & Rate Indicator with Backlight Display  | CUB5B000    |
| Optional Plug-in Cards | CUB5RLY   | Single Relay Option Card                              | CUB5RLY0    |
|                        | CUB5COM   | RS485 Serial Communications Card                      | CUB5COM1    |
|                        |           | RS232 Serial Communications Card                      | CUB5COM2    |
| Accessory              | MLPS1     | Micro-Line Power Supply, 85 to 250 VAC                | MLPS1000    |

# GENERAL METER SPECIFICATIONS

- DISPLAY:** 8 digit LCD 0.46" (11.7 mm) high digits  
**CUB5R000:** Reflective LCD with full viewing angle  
**CUB5B000:** Selectable transmissive red or green backlight LED with viewing angle optimized. Display color change capability at preset when using a relay module.
- POWER:** Input voltage range is +9 to +28 VDC with short circuit and input polarity protection. Must use an RLC model MLPS1 or a Class 2 or SELV rated power supply.

| MODEL NUMBER | DISPLAY COLOR         | INPUT CURRENT WITHOUT CUB5RLY0 | INPUT CURRENT WITH CUB5RLY0 |
|--------------|-----------------------|--------------------------------|-----------------------------|
| CUB5R000     | ---                   | 10 mA                          | 30 mA                       |
| CUB5B000     | Red (max intensity)   | 85 mA                          | 115 mA                      |
| CUB5B000     | Green (max intensity) | 95 mA                          | 125 mA                      |

- COUNTER DISPLAYS:**  
**Counter A:** 8-digits, enabled in all count modes  
 Display Range: -9999999 to 9999999  
 Overflow Indication: Display flashes "Err"
- Counter B:** 7-digits, enabled in Dual Counter mode only  
 Display Designator: "b" to the left side of the display  
 Display Range: 0 to 9999999 (positive count only)  
 Overflow Indication: Display flashes "Err"
- Maximum Count Rates:** 50% duty cycle  
 Without setpoint option card: 20 KHz (all count modes)  
 With setpoint option card: 20 KHz for any count mode except Quadrature x4 (18 KHz) and Dual Counter (17 KHz)
- RATE DISPLAY:** 6-digits, may be enabled or disabled in any mode  
**Display Designator:** "R" to the left side of the display  
**Display Range:** 0 to 999999  
**Over Range Display:** "R 888888"  
**Maximum Frequency:** 20 KHz  
**Minimum Frequency:** 0.01 Hz  
**Accuracy:** ±0.01%
- COUNT/RATE SIGNAL INPUTS (INP A and INP B):**  
**Input A:** DIP switch selectable to accept pulses from a variety of sources. See Section 2.0 Setting the DIP Switches for Input A specifications.  
**Input B:** Logic signals only  
 Trigger levels:  $V_{IL} = 1.0$  V max;  $V_{IH} = 2.4$  V min;  $V_{MAX} = 28$  VDC  
 Current sinking: Internal 10KΩ pull-up resistor to +9 to 28 VDC  
 Filter (LO Freq.): Damping capacitor provided for switch contact bounce.  
 Limits input frequency to 50 Hz and input pulse widths to 10 msec min.
- USER INPUT (USR):** Programmable input. Connect terminal to common to activate function. Internal 10KW pull-up resistor to +9 to 28 VDC.  
**Threshold Levels:**  $V_{IL} = 1.0$  V max;  $V_{IH} = 2.4$  V min;  $V_{MAX} = 28$  VDC  
**Response Time:** 5 msec typ.; 50 msec debounce (activation and release)
- MEMORY:** Nonvolatile E2PROM memory retains all programming parameters and count values when power is removed.
- CONNECTIONS:** Wire clamping screw terminals  
**Wire Strip Length:** 0.3" (7.5 mm)  
**Wire Gauge:** 30-14 AWG copper wire  
**Torque:** 5 inch-lbs (0.565 N-m) max.

- ENVIRONMENTAL CONDITIONS:**  
**Operating Temperature Range for CUB5R000:** -35 to 75°C  
**Operating Temperature Range for CUB5B000 depends on display color and intensity level as per below:**

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

- Storage Temperature:** -35 to 85°C  
**Operating and Storage Humidity:** 0 to 85% max. relative humidity (non-condensing)  
**Altitude:** Up to 2000 meters

- CERTIFICATIONS AND COMPLIANCES:**  
**SAFETY**

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

#### 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<br>4 kV contact discharge<br>8 kV air discharge |
| Electromagnetic RF fields       | EN 61000-4-3 | Criterion A<br>10 V/m                                       |
| Fast transients (burst)         | EN 61000-4-4 | Criterion A<br>2 kV power<br>1 kV signal                    |
| Surge                           | EN 61000-4-5 | Criterion A<br>1 kV L-L,<br>2 kV L&N-E power                |
| RF conducted interference       | EN 61000-4-6 | Criterion A<br>3 V/rms                                      |
| Power frequency magnetic fields | EN 61000-4-8 | Criterion A<br>30 A/m                                       |

#### Emissions:

|           |          |         |
|-----------|----------|---------|
| Emissions | EN 55011 | Class A |
|-----------|----------|---------|

#### Notes:

- Criterion A: Normal operation within specified limits.
- Criterion B: Temporary loss of performance from which the unit self-recovers.

Refer to EMC Installation Guidelines for additional information.

- CONSTRUCTION:** This unit is rated for NEMA 4X/IP65 requirements for indoor use. Installation Category I, Pollution Degree 2. High impact plastic case with clear viewing window. Panel gasket and mounting clip included.
- WEIGHT:** 3.2 oz (100 g)

# OPTIONAL PLUG-IN CARDS

## ADDING OPTION CARDS

The CUB5 meters can be fitted with optional relay card 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.

### RELAY CARD

- Type:** Single FORM-C relay
- Isolation To Sensor & User Input Commons:** 1400 Vrms for 1 min.
- Working Voltage:** 150 Vrms
- Contact Rating:** 1 amp @ 30 VDC resistive; 0.3 amp @ 125 VAC resistive
- Life Expectancy:** 100,000 minimum operations
- Response Time:**
  - Turn On Time: 4 msec max.
  - Turn Off Time: 4 msec max.
- Time Accuracy:**  $\pm 0.01\%$



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

### RS485 SERIAL COMMUNICATIONS CARD

- Type:** RS485 multi-point balanced interface (non-isolated)
- Baud Rate:** 300 to 19.2k
- 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)

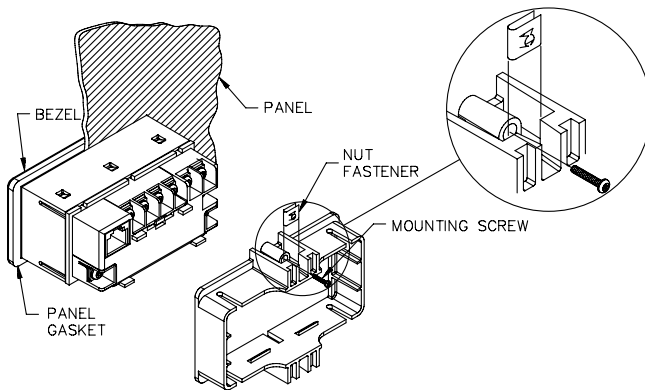
### RS232 SERIAL COMMUNICATIONS CARD

- Type:** RS232 half duplex (non-isolated)
- Baud Rate:** 300 to 19.2k
- Data Format:** 7/8 bits; odd, even, or no parity

# 1.0 INSTALLING THE METER

## INSTALLATION

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



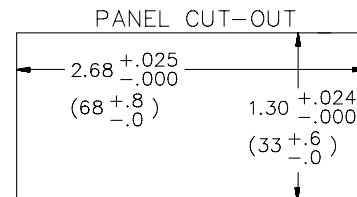
While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug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

## INSTALLATION ENVIRONMENT

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

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

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



# 2.0 SETTING THE DIP SWITCHES

To access the switches, remove the rear cover of the meter. A bank of 4 switches is located in the upper right hand corner.



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

## REMOVING THE REAR COVER

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

## SETTING THE INPUT DIP SWITCHES

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

### SWITCH 1

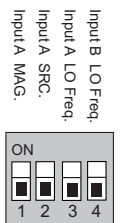
**LOGIC:** Input A trigger levels  $V_{IL} = 1.25 \text{ V max.}$ ;  $V_{IH} = 2.75 \text{ V min.}$ ;  $V_{MAX} = 28 \text{ VAC}$

**MAG:** 200 mV peak input sensitivity; 100 mV hysteresis; maximum voltage:  $\pm 40 \text{ V peak}$  (28 Vrms); Must also have SRC switch ON. (Not recommended with counting applications.)

### SWITCH 2

**SNK.:** Adds internal 7.8 K $\Omega$  pull-up resistor to +9 to 28 VDC,  $I_{MAX} = 3.8 \text{ mA}$ .

**SRC.:** Adds internal 3.9 K $\Omega$  pull-down resistor, 7.2 mA max. @ 28 VDC max.



### SWITCHES 3 and 4

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

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