MODEL CUB®5 - MINIATURE ELECTRONIC 8-DIGIT DUAL COUNTER AND RATE INDICATOR

GENERAL DESCRIPTION

The CUB®5 provides the user the ultimate in flexibility, from its complete user programming to the optional setpoint control and communication capability. The meter can be programmed as a single or dual counter with rate indication capability. The display can be toggled either manually or automatically between the selected displays.

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

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

The meter has two separate inputs which provide different functions depending on which operating mode is selected. Input A accepts the signal for the Count and/or Rate displays, while Input B accepts the signal for the Count display or direction control. In the anti-coincidence mode, both inputs are monitored simultaneously so that no counts are lost. The resulting display can be chosen as the sum or difference of the two inputs. The Rate Indicator 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 option cards. Setpoint capability is field installable with the addition of the selected displays.

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 V AC and provides up to 400 mA to drive the unit and sensors.

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**

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<td>+24 VDC Micro-Line Power Supply, 85 to 250 VAC source, 200 mA max out</td>
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<td></td>
<td>SFCRD</td>
<td>Crimson PC Configuration Software, Free Download Available(^1)</td>
<td>SFCRD200</td>
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<td>USB Programming Cable</td>
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\(^1\) Crimson software is a free download from http://www.redlion.net. System requirements for the software are listed on the download page.

**GENERAL METER SPECIFICATIONS**

1. **DISPLAY**: 8 digit LCD 0.46" (11.7 mm) high digits
   - CUB5R000: Reflective LCD with full viewing angle
   - CUB5B000: Transmissive LCD with selectable red or green LED backlight, viewing angle optimized. Display color change capability with output state when using an output module.

2. **POWER**: Input voltage range is +9 to +28 VDC with short circuit and input polarity protection. Must use an RLC model MLPS or an NEC Class 2 or Limited Power Source (LPS) rated power supply.

3. **COUNTER DISPLAYS**:  
   - **Counter A**: 8-digits, enabled in all count modes  
     - Display Range: -99999999 to 99999999  
     - Overflow Indication: Display flashes "\[ \]"  
   - **Counter B**: 7-digits, enabled in Dual Counter Mode or batch counting  
     - Display Designator: "\[ \]" to the left side of the display  
     - Display Range: 0 to 9999999 (positive count only)  
     - Overflow Indication: Display flashes "\[ \]"  
   - **Maximum Count Rates**: 50% duty cycle  
     - Without setpoint option card: 20 KHz (all count modes)  
     - With setpoint option card: 20 KHz for any count mode except Dual Counter (16 KHz), Quadrature x2 (14 KHz) and Quadrature x4 (13 KHz).

4. **RATE DISPLAY**: 6-digits, may be enabled or disabled in any count mode  
   - Display Designator: "\[ \]" to the left side of the display  
   - Display Range: 0 to 999999  
   - Over Range Display: "\[ \]"  
   - Maximum Frequency: 20 KHz  
   - Minimum Frequency: 0.01 Hz  
   - Accuracy: ±0.01%

5. **COUNT/RATE SIGNAL INPUTS (INP A and INP B)**:  
   - **Input A**: DIP switch selectable to accept pulses from a variety of sources.  
     - See Section 2.0 Setting the DIP Switches for Input A specifications.  
   - **Input B**: Logic signals only  
     - Trigger levels: \( V_{IL} = 0.7 \text{ V max} \); \( V_{IH} = 2.4 \text{ V min} \); \( V_{MAX} = 28 \text{ VDC} \)  
     - Current sinking: Internal 10KΩ pull-up resistor to +9 to +28 VDC  
     - Filter (LO Freq.): Damping capacitor provided for switch contact bounce.

6. **USER INPUT (USR)**: Programmable input. Connect to input common (INP 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)

7. **MEMORY**: Nonvolatile E\(^2\)PROM memory retains all programming parameters and count values when power is removed.

8. **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.

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

10. **ENVIRONMENTAL CONDITIONS**:  
    - Operating Temperature Range for CUB5R000: -35 to 75 °C  
    - 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)
    - Vibration to IEC 68-2-6: Operational 5-500 Hz, 5 g
    - Shock to IEC 68-2-27: Operational 40 g
    - Altitude: Up to 2000 meters

11. **CERTIFICATIONS AND COMPLIANCES**:  
    - CE Approved  
    - EN 61326-1: Immunity to Industrial Locations  
    - Emission CISPR 11 Class A

12. **SAFETY REQUIREMENTS**:  
    - Laboratory use: EN 61010-1: General Requirements  
    - EN 61010-2-030: Particular Requirements for Testing and Measuring Circuits  
    - RoHS Compliant  
    - 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.
### 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.

**Single Relay Output Card (One setpoint only)**

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

**Dual Sinking Output Card (One or two setpoints)**

- **Type:** Non-isolated switched DC, N Channel open drain MOSFET
- **Current Rating:** 100 mA max.

### 1.0 Installing the Meter

**Installation**

The meter meets NEMA Type 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.

**Bezel Panel**

- **Panel Gasket**
- **Mounting Screw**
- **Mounting Clip**
- **Nut Fastener**

**1.0 Installing the Meter**

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

### 2.0 Setting the DIP Switches

**Setting the Input DIP Switches**

To access the switches, remove the rear cover of the meter as described below. A bank of 4 switches is located in the upper right hand corner. After setting the switches, install any optional plug-in cards before replacing the rear cover (see next section).

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

**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.

### 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.

**Usb Programming Card**

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

### 2.0 Setting the DIP Switches

**Switch 1**

**Logic:** Input A trigger levels $V_{IL} = 1.25$ V max.; $V_{IH} = 2.75$ V min.; $V_{MAX} = 28$ VDC

**Mag:** 200 mV peak input sensitivity; 100 mV hysteresis; maximum input voltage: ±40 V peak (28 Vrms); Must also have SRC switch ON.

(Not recommended with counting applications.)

**Switch 2**

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

**SRC:** Adds internal 3.9 kΩ pull-down resistor, 7.2 mA max. @ 28 VDC max.

**Switches 3 and 4**

**H/F Frequency:** Removes damping capacitor and allows max. frequency.

**L/F Frequency:** Adds a damping capacitor for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec.
3.0 Installing Plug-In Cards

The Plug-in cards are separately purchased option cards that perform specific functions. The cards plug into the main circuit board of the meter. After installing the cards, replace the rear cover before wiring the meter.

![Plug-in Cards Diagram]

**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.

**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.

### 4.0 Wiring the Meter

#### Wiring Overview

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

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

#### EMC Installation Guidelines

Although 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.
4. Long cable runs are more susceptible to EMI pickup than short cable runs.
5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:
   - 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.
   RLC part numbers: Snubber: SNU09000
   Varistor: ILS11500 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.

#### 4.1 Power Wiring

**DC Power**

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

![Power Wiring Diagram]

#### 4.2 User Input Wiring

**Sinking Logic**

INP COMM  INP B  INP A  INP USR

Connect external switching device between the User Input terminal and Input Common.

The user input of the meter is internally pulled up to +9 to +28 V with 10 K resistance. The input is active when it is pulled low (<1 V).
4.3 INPUT WIRING

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

4.4 SETPOINT (OUTPUT) WIRING

**SINGLE SETPOINT RELAY PLUG-IN CARD**

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

4.5 SERIAL COMMUNICATION WIRING

**SERIAL COMMUNICATIONS PLUG-IN CARD**

4.6 USB PROGRAMMING

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

### ENTERING PROGRAM MODE
- Press and hold for 2 seconds to activate.

### PROGRAMMING MODE OPERATION
- Store selected parameter and index to next parameter.
- Advances through the program menu.
- Increments selected parameter value or selection.

### OPERATING MODE DISPLAY DESIGNATORS
- "Φ" - To the left of the display is the rate value.
- "B" - To the left of the display is the Counter B value (dual count or batch).
- "1" and "2" - Indicates setpoint 1 and 2 output status.

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

6.0 PROGRAMMING THE METER

### OVERVIEW

#### PROGRAMMING MENU

![Diagram of Programming Menu]

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

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

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

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

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

**PROGRAMMING MODE EXIT (SEL KEY)**
The Programming Mode is exited by pressing the SEL key with 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 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]

Factory Settings are shown.
6.1 MODULE 1 - INPUT SETUP PARAMETERS (1-INPUt)

PARAMETER MENU

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

COUNT MODE

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

DISPLAY

MODE

INPUT A ACTION

INPUT B ACTION

COUNTER A DECIMAL POSITION

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

COUNTER A SCALE FACTOR

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

COUNTER A RESET ACTION

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

COUNTER A COUNT DIRECTION

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

COUNTER A COUNT LOAD VALUE

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

COUNTER B BATCH COUNT ENABLE

The Counter B batch count function internally counts the number of output activations of the selected setpoint(s). The count source for the batch counter can be SP1, SP2 or both. Batch counting is available in all count modes except Dual Counter, which uses an external input signal for Counter B. This parameter only appears if a Setpoint Output option card is installed.

COUNTER B DECIMAL POSITION

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

COUNTER B SCALE FACTOR

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

COUNTER RESET AT POWER-UP

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

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

Module 2 is the programming for the rate parameters. 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. The rate value is shown with an annunciator of "R" in the Display Mode.

RATE ENABLE

RATE DECIMAL POINT

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

SCALING FOR COUNT INDICATION

The CUB5'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 CUB5 to scale or multiply the input pulses by a scale factor to achieve the desired display units (feet, meters, gallons, etc.).

The Count Scale Factor Value can range from 00.0001 to 99.9999. It is important to note that the precision of a counter application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. The following formula is used to calculate the scale factor.

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

WHERE:

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

Decimal Point Position:
0  = 1
0.0 = 10
0.00 = 100
0.000 = 1000
0.0000 = 10000
0.00000 = 100000

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

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

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

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

USER INPUT FUNCTION

USER INPUT ASSIGNMENT

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

USER INPUT FUNCTION

DISPLAY MODE DESCRIPTION

NO No Function
Pro Loc Program Mode Lock-out
Inh db Inhibit
rSEl E Maintained Reset
Stor E Store
Stor rSt Store and Reset
d-SElECT Display Select *
d-LEVEL Display Intensity Level *
d-COLOR Backlight Color *
Pr inb Print Request
Prnt-rSt Print and Reset *
Prnt-r5t Print Request
Backlight Color *
Prnt-rSt Print and Reset *
Prnt-r5t Print Request
Setpoint 1 and 2 Reset *
Setpoint 2 Reset *
Setpoint 1 Reset *
Print and Reset *
Print Request
Backlight Color *
Edge triggered reset of the selected counter(s) after storing the count.
Advance once for each activation
Increase intensity one level for each activation. (backlight version only)
Change backlight color with each activation (backlight version only)
Serial transmit of the active parameters selected in the Print Options (Module 5)
Same as Print Request followed by a momentary reset of the selected counter(s).
Reset Setpoint 1 output
Reset Setpoint 2 output
Same as Print Request followed by a momentary reset of the selected counter(s).
Reset Setpoint 1 and 2 Reset *
Reset Setpoint 1 and 2 outputs

Note: * indicates Edge Triggered function. Other functions are Level Active (maintained)
INPUT FREQUENCY CALCULATION

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

SCALING FOR RATE INDICATION

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

SCALING CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (\( \text{RAtE dSP} \)) and Scaling Input (\( \text{RAtE INP} \)). No further calculations are needed.

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

<table>
<thead>
<tr>
<th>RATE PER</th>
<th>DISPLAY (( \text{RAtE dSP} ))</th>
<th>INPUT (( \text{RAtE INP} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second</td>
<td>1</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Minute</td>
<td>60</td>
<td># of pulses per unit</td>
</tr>
<tr>
<td>Hour</td>
<td>3600</td>
<td># of pulses per unit</td>
</tr>
</tbody>
</table>

NOTES:

1. If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) than Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

EXAMPLE:

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

RATE LOW UPDATE TIME

\[ \text{LO-Udt} \]

0.1 to 999 seconds

The Low Update Time is the minimum amount of time between display updates for the rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady.

RATE HIGH UPDATE TIME

\[ \text{HI-Udt} \]

0.2 to 999 seconds

The High Update Time is the maximum amount of time before the rate display is forced to zero. (For more explanation, refer to Rate Value Calculation.) The High Update Time must be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.
The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used independently or along with the Program Mode Lock-out (Pro Loc) selection in the User Input Function parameter (Module 1).

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

Entering a Security Code from 1-99 enables Quick Programming mode, and displays a sublist to select what values appear in the Quick Programming menu. All applicable values set to YES in the sublist will be accessible in Quick Programming. The sublist includes Setpoint values (SP1 VAL, SP2 VAL), Output Time-out values (SP1 tOUT, SP2 tOUT), Counter A Count Load value (CntA Ld) and the Display Intensity Level (d-LEVEL) for backlight units.

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

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

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

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

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

**DISPLAY SCROLL ENABLE**

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

**DISPLAY COLOR (BACKLIGHT UNIT ONLY)**

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

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

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

**SOFTWARE VERSION DISPLAY**

Select YES to momentarily display the meter software version before advancing to the next parameter. The software version is also displayed at power-up.

**LOAD FACTORY DEFAULT SETTINGS**

The YES selection will return the meter to the factory default settings. The meter will display rESet and then return to Pr0, at which time all settings have been changed.

* Entering Code 222 allows access regardless of security code.
The Setpoint Output Parameters are only active when an optional Setpoint Output Module is installed in the meter. Some parameters in the menu will not appear depending on the Setpoint Assignment and Setpoint Output Action. The Setpoint Parameter Availability chart below illustrates this.

**SETPOINT SELECT**

Select the Setpoint Output to be programmed, starting with Setpoint 1. The "n" in the following parameters reflects the chosen Setpoint number. After Setpoint 1 is completely programmed, the display returns to SPl SEL. Repeat steps for Setpoint 2 if both Setpoints are used in the application.

Select NO to exit the Setpoint programming module. The number of Setpoints available is dependent on the Setpoint option module installed.

**SETPOINT 2 ENABLE (SP2 Only)**

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

**SETPOINT ASSIGNMENT**

Select the display to which the Setpoint is assigned.

**SETPOINT PARAMETER AVAILABILITY**

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

<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>Latched Output Mode</td>
<td>When Count = Setpoint</td>
<td>At Manual Reset (if Spn rSt = YES)</td>
</tr>
<tr>
<td>TIMED</td>
<td>Timed Output Mode</td>
<td>When Count = Setpoint</td>
<td>After Setpoint Output Time-Out</td>
</tr>
<tr>
<td>BOUNDARY</td>
<td>Boundary Mode</td>
<td>When Count ≥ Setpoint</td>
<td>When Count &lt; Setpoint</td>
</tr>
</tbody>
</table>

* *Boudary Mode (High Acting Type)*

<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>Spn L Out</td>
<td>Setpoint Output Time-out Value</td>
<td>Timed Out</td>
<td>Boundary</td>
</tr>
<tr>
<td>Spn V</td>
<td>Setpoint Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn O</td>
<td>Setpoint Output Logic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn L</td>
<td>Setpoint Annunciator</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn P</td>
<td>Setpoint Output Power-up State</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Spn l Type</td>
<td>Setpoint Boundary Type</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn Sb</td>
<td>Standby Operation (Low acting only)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn R</td>
<td>Counter Auto Reset</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Spn OFF2</td>
<td>SP1 Output Off at SP2 (SP1 only)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Spn OFF1</td>
<td>SP2 Output Off at SP1 (SP2 only)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Spn r St</td>
<td>Output Reset with Manual Reset</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Spn c H</td>
<td>Change Display Color w/ Output State</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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

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

SETPOINT OUTPUT LOGIC

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

SETPOINT ANNUNCIATOR

Normal (NO) displays the setpoint annunciator when the corresponding output is “on”. Reverse (RE) displays the setpoint annunciator when the output is “off”.

SETPOINT OUTPUT POWER-UP STATE

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

SETPOINT BOUNDARY TYPE

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

SETPOINT STANDBY OPERATION

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

CHANGE DISPLAY COLOR WITH OUTPUT STATE

This parameter enables the backlight CUBS5 to switch the backlight color when the output state changes. This parameter is only active for the backlight version.
The Serial Setup Parameters are only active when one of the optional serial communication/programming cards is installed in the meter.

Refer to the CUB5USB bulletin for details on the CUB5 USB programming and programming requirements. This section replaces the bulletin shipped with the RS232 and RS485 serial communications plug-in cards. Discard the separate bulletin when using those serial plug-in cards with the CUB5B and CUB5R.

### Baud Rate

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>1200</td>
</tr>
<tr>
<td>4800</td>
<td>9600</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>Data Bit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-b</td>
<td>8-b</td>
</tr>
</tbody>
</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>Parity Bit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odd</td>
<td>Even</td>
</tr>
</tbody>
</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 OFF, 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.)
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, and 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>

### 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>8 digit positive?7 digit negative (with minus sign)</td>
</tr>
<tr>
<td>B</td>
<td>Counter B</td>
<td>CTB</td>
<td>T, V, R</td>
<td>7 digit, positive only</td>
</tr>
<tr>
<td>C</td>
<td>Rate</td>
<td>RTE</td>
<td>T</td>
<td>6 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 (Reset Output 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 (Reset Output 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 Count Load Value</td>
<td>CLD</td>
<td>T, V</td>
<td>8 digit positive?7 digit negative (with minus sign)</td>
</tr>
</tbody>
</table>

### Command String Construction

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

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

### 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: N31P$,

### Transmitting Data to the Meter

Numerical 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>7-18</td>
<td>12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt; (carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt; (line feed)</td>
</tr>
<tr>
<td>21</td>
<td>&lt;SP&gt;* (Space)</td>
</tr>
<tr>
<td>22</td>
<td>&lt;CR&gt;* (carriage return)</td>
</tr>
<tr>
<td>23</td>
<td>&lt;LF&gt;* (line feed)</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

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

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

Meter Response Examples:
1. Node address = 17, full field response, Counter A = 875
   
   17 CTA 875 <CR><LF>

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

3. Node address = 0, abbreviated response, Setpoint I = 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 $t_1$ depends on the number of characters and baud rate of the channel.

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

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 ‘*’ or ‘$’ terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the command terminating character. The ‘*’ or ‘$’ terminating character 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.

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.

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

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

Communication Format

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

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

* Voltage levels at the Receiver

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

Start Bit and Data Bits

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

Parity Bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The CUB5 meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop Bit

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