TO HIGH SPEED PULSES FROM TTL, CMOS, OR OTHER ELECTRONIC SOURCES

AT A PRICE LESS THAN EQUIVALENT E.M.[ELECTROMECHANICAL] COUNTERS

The heart of the CUB is a tiny custom silicon chip developed by Red Lion Controls. This chip contains all of the counting and display circuits in an area less than 0.02 (0.5 mm) square inches. Via “micro-assembly”, the chip and other peripheral parts are attached to a substrate with the electrical connections being made ultrasonically - using wire approximately 1/3 the diameter of a human hair. The result is an entirely new concept in counting, that is not only cost effective, but opens the door to counting applications that until now were not economically feasible.

AND HERE ARE SOME MORE ADVANTAGES:

SELF POWERED
Self-Contained batteries eliminate the need for external power and prevent loss of count if power fails. Also provides for remote or portable applications. Battery operation also means elimination of shock hazard and allows the use of 2-conductor bell wire for count signals and micro-power input signals. Batteries are easily replaceable (2 “N” Cells, alkaline) and average battery life is four years.

HIGH SPEED
The 5 KHz count speed is at least 100 times faster than “high performance” E.M. counters. This opens up vast new application areas that previously were impossible, or at best, accommodated by expensive electronic counters costing 5 to 10 times as much.

FLEXIBILITY
Various count inputs allow use with switch contacts or high speed pulse outputs from electronic sensors and circuits. The reset function can be disabled, set up for front panel reset, remote reset, or both.

NO-WEAR, NO-NOISE
The CUB’s micro-circuits can accurately and silently accumulate enough counts in one hour to completely wear out an ordinary E.M. counter. More over, it can repeat this performance 3500 times (4 years) with just one set of batteries.

RELIABILITY
Internal “micro-assembly” construction withstands many times the “G” force of shock and vibration compared to conventional construction. CUB counters also feature elastomeric contacts. This eliminates long term problems associated with contact corrosion. Battery operation, a high degree of input filtering, plus an inherent common mode rejection ratio of more than 120 dB @ 50/60 Hz, provides ultra-high immunity from electrical noise interference.

RUGGED, SEALED FRONT-PANEL CONSTRUCTION
Housed in a die-cast metal case, CUB counters are front panel sealed and designed to meet NEMA 4/IP65 specifications, for wash-down and/or dust when properly installed.

SPECIFICATIONS
1. DISPLAY: 6-digit LCD
   CUB 1: 0.2” (5 mm) high
   CUB 2: 0.35” (9 mm) high
2. POWER SOURCE: No external power required. Operates from 2 “N” type alkaline batteries (supplied separately). Battery life up to 4 years or more. (See Note, at right.)
3. COUNT & RESET INPUT SIGNALS: Adapts to Count-Switch Contact Signals, Open-Collector Transistor Outputs, and Bi-Polar Drive Outputs as shown in the diagrams on the following page. Counter increments and resets on negative going (pull down) transition of count or reset signal.
4. OPERATING TEMPERATURE RANGE: 0° to 50°C (32° to 122°F)
5. STORAGE TEMPERATURE RANGE: -20° to +60°C (-4° to +140°F)
6. COUNT SPEED: Up to 50 Hz with switch contact input (counters have internal de-bounce circuits) or up to 5 KHz with solid-state electronic input (See diagrams on following page).

Note: Only Alkaline Cells are recommended for use with CUB Counters. DO NOT USE CARBON-ZINC BATTERIES since they have short life times and can leak electrolyte causing internal corrosion damage. When using switch contacts for count input or remote reset, normally open contact circuits are recommended. Switch contacts that remain normally-closed and are opened only briefly to signal a count, can reduce battery life to somewhat less than 4 years.

USE CUB COUNTERS WITH:
VCM • VOLTAGE CONVERTER MODULES for isolated, A.C., control voltage count inputs to 270 VAC,
LCM • LOGIC CONVERTER MODULES for interface with standard logic voltages & outputs,
PSMA • POWER SUPPLY & INTERFACE MODULE for operation with electronic sensors.
[See Accessory Section Of The Catalog]
Selection of desired operating modes is easily done by adding or moving terminal leads in the Input Connector Body. The connector body is polarized to prevent incorrect insertion, and locked in place by the battery cover to avoid accidental disengagement. Connectors are supplied with the 3 leads installed as shown below. A spare blue lead is supplied in the hardware pack.

TO REMOVE TERMINAL, insert blade of a small screwdriver into slot of connector body, and gently push in to disengage lock pawl. Pull terminal out.

WHEN INSERTING TERMINAL into connector body, make sure the lock pawl is toward the slot in the body. Push terminal in until lock pawl snaps into slot.

APPLICATION FLEXIBILITY VIA RECONNECT OPTIONS

Pulling the L.S. CNT. Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter (1meg resistor and 4700 pf cap) used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 14 µA (max. voltage drop 0.5 V) when ON. OFF-state leakage current must be less than 2 µA.

Reed switches, mercury wetted contacts, snap action limit switches, and silver alloy relay contacts with wiping action are usually satisfactory for generating count input signals. Motor starter contacts, tungsten contacts, and brush-type contacts should NOT be used.

Note: By parallel connecting both H.S. CNT. and L.S. CNT. inputs, count speed can be increased to 250 Hz if de-bounce is not needed.

LOW SPEED COUNT INPUT, 50 Hz MAX. [For 250 Hz see note in text]

Moving the white wire to the H.S. CNT. Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3.0 V maximum to avoid a charging current into the batteries which can cause premature battery failure or leakage. CMOS and TTL Logic outputs can be loaded with a resistor (R_L) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. Transistor output.

Connecting the RST. EN. (Reset Enable) Input to Common activates the front panel Reset button. When the front panel Reset button is to be deactivated, remove the yellow wire from the RST. EN. Input.

When Remote Reset is required, the blue wire in the hardware pack is inserted in the REM. RST. Input. Pulling this input low causes the counter to reset. The REM. RST. can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load and leakage are the same as for L.S. CNT. Input above.

Note: The RC protection circuit on the REM. RST. Input causes a delay of approximately 6 msec in Reset response.

INPUT PULSE EXCURSION LIMITS

\[ V_{IN \ (High)} = +2.7 \text{ V min.} +3.3 \text{ V max.} \]
\[ V_{IL \ (Low)} = +0.5 \text{ V max.} \]

Note: The PSMA Power Supply and Interface Module used for powering RLC sensors with CUB Counters, has proper interface output for direct drive to H.S. CNT.

RESET OPTIONS
After cutting opening in panel, slide the panel gasket over the rear of the counter body to the back of the bezel. Then slide counter through the panel cut-out. Install mounting clips on each side of counter body with mounting screws. Make sure the side rails or tabs of the clips fit into the recesses in the side of the counter body so that the "Tang Ends" or "Tabs" wedge between the panel opening and body as the screws are tightened.

BATTERY COVER REMOVAL & BATTERY INSERTION

CUB 1
The battery cover is held in place by upper and lower clasps that capture mating lock ramps on the cover. To remove, insert thumbnail and index fingernail in the gaps between the upper and lower clasps and the battery cover, and deflect the clasps slightly to clear the edges of the ramps while pulling out on the cover. To replace cover, simply push into place until both clasps snap into engagement with lock ramps.

CAUTION: Do not deflect clasps more than necessary to clear lock ramps. Excessive deflection can cause clasps to break off.

CUB 2
Slide battery cover to the left until the right hand lip disengages and pops out. To reinstall cover, insert left hand lips into case first, push cover to the left until right hand lip drops down and cover snaps back into place. Install batteries as shown below observing proper polarity.

CAUTION: Do not deflect clasps more than necessary to clear lock ramps. Excessive deflection can cause clasps to break off.

ELECTRICAL CONNECTIONS

There are certain considerations that should be observed when running the count and control signal wires. A length of wire can act like an antenna and the closer it is to a source of electrical noise, the more it becomes susceptible to that noise.

There are a few rules that should be followed when running these wires:
1. Never run count or control signal wires in the same conduit or raceway with AC power lines, conductors that feed motors, solenoids, SCR controls, heaters, etc.

2. Signal wires within enclosures should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

3. When shielded wire is used, connect the shield to the common of the CUB unit, and leave the other end of the shield disconnected and insulated from machine ground.

4. Mount the CUB in a panel that is grounded to the machine frame.

5. When using accessory devices such as LCM’s or PSM’s into the H.S. CNT. Input, the accessory devices should be mounted near the CUB Counter.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB 1</td>
<td>CUB 1 Miniature Electronic Counter</td>
<td>CUB10000</td>
</tr>
<tr>
<td>CUB 2</td>
<td>CUB 2 Gen. Purpose Industrial Electronic Counter</td>
<td>CUB20000</td>
</tr>
<tr>
<td>BNA</td>
<td>&quot;N&quot; Type Alkaline Batteries (Note 1)</td>
<td>BNA00000</td>
</tr>
<tr>
<td>HWK 1</td>
<td>CUB 1 Spare Hardware Kit (Note 2)</td>
<td>HWK10000</td>
</tr>
<tr>
<td>HWK 2</td>
<td>CUB 2 Spare Hardware Kit (Note 2)</td>
<td>HWK20000</td>
</tr>
<tr>
<td>ICA</td>
<td>Spare Input Connector &amp; Terminal Wires (Note 3)</td>
<td>ICA00000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

NOTES
1. Batteries NOT supplied with counters, order separately. 2 required per unit.
2. Counters supplied with required hardware. Includes 2 mounting clips & screws, panel gasket, 2-wire nuts & blue terminal wire.
3. Counters supplied with connector body & white, yellow, & black wires. Kit ICA includes connector body & one each of black, white, blue, & yellow terminal wires.
MODEL CUB 1 & 2 “XP” VERSION COUNTERS, INTRINSICALLY SAFE
FACTORY MUTUAL APPROVED FOR USE IN HAZARDOUS LOCATIONS
(I.E. EXPLOSIVE ENVIRONMENTS)

The CUB1XP and CUB2XP are specifically designed to provide intrinsically safe characteristics for use in hazardous locations. The units incorporate an internal debounce circuit for operation with count-switch contact input at speeds up to 50 Hz, and can be field connected for front panel or remote reset.

These counters use a custom designed LSI counter circuit chip, mounted on a gold-plated substrate and electrically connected by ultrasonic wire-bonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Using the latest in Micro-Electronic assembly and manufacturing techniques provides these units with the reliability and dependability required for industrial service.

SPECIFICATIONS

POWER SOURCE: 2, “N” size, 1.5 V Alkaline cells.
Hazardous rating applies only when the following approved cells are installed:
- DURACELL #MN9100
- PANASONIC #AMS
Substitution of any other cells voids approval for use in hazardous locations

NOMINAL BATTERY LIFE: Nominal battery life 4 years. (Count and Reset Contacts which remain closed for long periods of time will reduce battery life.)

COUNT INPUT: Switch Count Input, 14 µA contact burden. Max. OFF state leakage current 2 µA. (See Note at right)

REMOTE RESET: Switch Contact, same ratings as Count Input.

OPERATING TEMPERATURE RANGE: 0° to 50°C
COUNT SPEED: 50 Hz max. from switch contact with a 50% duty cycle.

WEIGHT (Less Batteries):
- CUB1XP - 4.45 oz (126 g)
- CUB2XP - 5.77 oz (164 g)

Note: Approval for operation in Hazardous Locations applies only for use with isolated Switch Contact Input to COUNT and REMOTE RESET INPUTS. Approval and Rating is voided if electronic sensors, VCM’s, or other active elements are used. Hazardous location rating also limits usage to approved batteries (See Power Source Specifications).

INPUT CONNECTIONS

Connections to the “XP” Version CUB Counters are made via a removable connector with 10 inch, 22-gauge terminal leads. Connections are made by twisting the leads to incoming wiring with the wire nuts included in the hardware pack.

Note: The removable connector with its terminal leads is a special assembly for use only with “XP” versions of CUB 1 and CUB 2. It cannot be interchanged with the connector assembly used on standard CUB Counters.

The count input signal is generated by the Count Switch that pulls the “CNT. SW. IN.” (green lead) low to “Common” (black) to increment the counter. Connecting the “RESET ENABLE” (yellow) to common, activates the front panel button allowing it to be used to reset the counter. If front panel reset is not desired, remove the yellow wire from the connector. If remote reset is required, the blue wire included in the hardware pack can be inserted in the (REM RST) location of the connector, and connected to Remote Reset Contacts. The counter can be connected for both front panel and remote reset.

Reed Switches, mercury-wetted contacts, snap-action limit switches, and silver-alloy contacts with wiping actions are usually ideal for count and reset inputs. Tungsten, heavy “clapper-type”, or brush-type contacts should not be used.

MECHANICAL SPECIFICATIONS & INSTALLATION (See Cub 1 & 2)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB1XP</td>
<td>CUB1 Cntr, Approved for Hazardous Location</td>
<td>CUB1XP00</td>
</tr>
<tr>
<td>CUB2XP</td>
<td>CUB2 Cntr, Approved for Hazardous Location</td>
<td>CUB2XP00</td>
</tr>
<tr>
<td>BNA</td>
<td>Approved “N” Type Alkaline Cells (See Note 1)</td>
<td>BNA000000</td>
</tr>
<tr>
<td>ICAXP</td>
<td>Spare Input Connector &amp; Terminal Wire Kit (See Note 2)</td>
<td>ICAXP0000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

NOTES
1. Batteries NOT supplied with counters
   Order separately (two per counter).
2. Counters supplied with connector and green, yellow, black and blue terminal wires. Spare Kit contains same.
3. Counters supplied with complete mounting hardware.
Counters should be mounted in a panel grounded to the machine frame. After cutting opening in panel, slide the panel gasket over the rear of the counter body to the back of the bezel. Then slide counter through the panel cut-out. Install mounting clips on each side of the counter body with mounting screws. Make sure the side rails or tabs of the clips fit into the recesses in the side of the counter body so that the “Tang Ends” or “Tabs” wedge between the panel opening and body as the screws are tightened.

**BATTERY COVER REMOVAL & BATTERY INSERTION**

**WARNING:** INSTALL ONLY APPROVED BATTERIES. USING OTHER BATTERIES WILL VOID APPROVAL FOR USE IN HAZARDOUS LOCATIONS. (See Specifications).

**CUB1XP**

The battery cover is held in place by upper and lower clasps that capture mating lock ramps on the cover. To remove, insert thumbnail and index finger nail in the gaps between the upper and lower clasps and the battery cover, and deflect the clasps slightly to clear the edges of the ramps while pulling out on the cover. To replace cover, simply push into place until both clasps snap into engagement with lock ramps.  

**CAUTION:** Do not deflect clasps more than necessary to clear lock ramps. Excessive deflection can cause clasps to break off.

**CUB2XP**

Slide battery cover to the left until the right hand lip disengages and pops out. To reinstall cover, insert left hand lips into case first, push cover to the left until right hand lip drops down and cover snaps back into place. Install batteries as shown below observing proper polarity.  

**Note:** Push battery spring clips to the left (toward connector) to completely free the batteries when removing or installing batteries. Conductive rubber battery contacts can be torn from their retaining pins if batteries are forced in.

**REMOVING & INSERTING CONNECTOR LEADS**

Connector and lead assemblies are shipped with counters with leads installed as shown. Connector body is held in place by the battery cover which must be removed to disengage connector.

**Removing Terminal:** Insert blade of a small screwdriver into slot of connector body, and gently push in to disengage the lock pawl. Pull terminal out.  

**Inserting Terminal:** When inserting into connector body, make sure the lock pawl is toward the slot in the body. Push terminal in until the lock pawl snaps in.

**REMOVING & INSERTING CONNECTOR LEADS**

Wiring runs to count-switches or to remote reset contacts can be made with almost any kind of wire and over distances of hundreds of feet, due to the advantages of low-voltage low-current operation. The inherent noise immunity and heavy filtering built into CUB Counters, permits use of unshielded wiring, however the following precautions are advisable especially in high electrical-noise environments.

1. Avoid long wire runs in cable troughs or conduits with power circuits.  
2. Mount the CUB in a panel that is grounded to the machine frame.
MODEL CUB2L - MINIATURE ELECTRONIC 6-DIGIT COUNTER

DESCRIPTION
The CUB2L counter is powered by an internal lithium battery, which will provide up to 10 years of continuous operation. This counter has a 6-digit LCD display with 0.35" (9.0 mm) high digits.

This counter uses a CMOS LSI counter circuit chip, mounted on a gold-plated substrate and electrically connected by ultrasonic wire-bonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Using the latest in micro-electronic assembly and manufacturing techniques provides units with the reliability and dependability required for industrial service.

The CUB2L is constructed of a rugged die-cast metal case with clear viewing window. The sealed front panel meets NEMA 4X/IP65 requirements for wash-down and/or dusty environments, when properly installed.

SPECIFICATIONS
1. DISPLAY: 6-digit LCD, 0.35" (9.0 mm) high.
2. POWER SOURCE: Internal 3.0 V lithium battery to provide up to 10 years of continuous operation. Battery life is dependent upon usage. Count and reset contacts which remain closed for long periods of time will reduce battery life.
3. HIGH SPEED INPUT: 5 KHz from 3.0 V to 6.0 V bi-polar output with a 50% duty cycle.
4. LOW SPEED INPUT: 50 Hz from switch contact or open collector transistor with a 50% duty cycle.
5. REMOTE RESET: 6 msec min. pulse width (active low) from 3.0 V to 6.0 V bi-polar output or an open collector transistor or a switch contact to ground.
6. OPERATING TEMPERATURE RANGE: -30° to +75°C
7. CONSTRUCTION: Rugged die-cast metal case with clear viewing window. The sealed front panel meets NEMA 4X/IP65 requirements when properly installed. Panel gasket and mounting clips included.
8. WEIGHT: 5.1 oz. (145 g)

ELECTRICAL CONNECTIONS
There are certain considerations that should be observed when running the count and control signal wires. A length of wire can act like an antenna and the closer it is to a source of electrical noise, the more it becomes susceptible to that noise.

There are a few rules that should be followed when running these wires:
1. Never run count or control signal wires in the same conduit or raceway with AC power lines, conductors that feed motors, solenoids, SCR controls, heaters, etc.
2. Signal wires within enclosures should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
3. When shielded wire is used, connect the shield to the common of the CUB unit, and leave the other end of the shield disconnected and insulated from machine ground.
4. Mount the CUB2L in a panel that is grounded to the machine frame.

Warning: Lithium battery may explode if incinerated. Signal input voltage should not exceed 6.0 VDC to prevent damage to the counter.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB2L</td>
<td>CUB 2 Counter with Lithium Battery</td>
<td>CUB2L000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
APPLICATION FLEXIBILITY VIA RECONNECT OPTIONS

Selection of desired operating modes is easily done by moving terminal leads in the Input Connector Body. The Connector body is polarized to prevent incorrect insertion, and locked in place by the connector latch to avoid accidental disengagement. Connectors are supplied with the 3 leads installed as shown at right. A spare blue lead is supplied in the hardware pack.

Removing Terminal: Insert blade of a small screwdriver into slot of connector body, and gently push in to disengage the locking pawl. Pull terminal out.

Inserting Terminal: When inserting into connector body, make sure the locking pawl is toward the slot in the body. Push terminal in until the locking pawl snaps into slot.

LOW SPEED COUNT INPUT, 50 Hz MAX. [For 250 Hz see note in text]

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter (1meg resistor and 4700 pf cap) used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 14 µA (max. voltage drop 0.5 V) when ON. OFF-state leakage current must be less than 2 µA.

Reed switches, mercury wetted contacts, snap action limit switches, and silver alloy relay contacts with wiping action are usually satisfactory for generating count input signals. Motor starter contacts, tungsten contacts, and brush-type contacts should NOT be used.

Note: By parallel connecting both “H.S. CNT.” and “L.S. CNT.” inputs, count speed can be increased to 250 Hz if de-bounce is not needed.

HIGH SPEED COUNT INPUT, 5 KHz MAX.

Moving the white wire to the “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 6.0 V maximum to avoid damage to the counter. Outputs higher than 6.0 V can be used with an external voltage divider, as shown.

RESET OPTIONS

Connecting the “RST. EN.” (Reset Enable) Input to Common activates the front panel Reset button. When the front panel Reset button is to be deactivated, remove the yellow wire from the “RST. EN.” Input.

When Remote Reset is required, the blue wire in the hardware pack is inserted in the “REM. RST.” Input. Pulling this input low causes the counter to reset. The “REM. RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load and leakage are the same as for “L.S. CNT.” Input above.

Note: The RC protection circuit on the “REM. RST.” Input causes a delay of approximately 6 msec in Reset response.
DESCRIPTION

The CUB2LU and CUB2LQ counters are powered by an internal Lithium Battery, which will provide up to 10 years of continuous operation. The chart below (right column) is a summary of the features of these counters. These counters use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate and electrically connected by ultrasonic wire-bonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Using the latest in micro-electronic assembly and manufacturing techniques provides units with the reliability and dependability required for industrial service.

SPECIFICATIONS

1. DISPLAY: 6-digit LCD - 0.35” (9.0 mm) high.
2. POWER SOURCE: Internal 3.0 V lithium battery to provide up to 10 years of continuous operation. Battery life is dependent upon usage. Signal and reset contacts which remain closed for long periods of time will reduce battery life.
3. SIGNAL INPUTS: *
   - CUB2LU:
     Count: 5,000 cps from a 3.0 V to 6.0 V bi-polar output with a 50% Duty cycle. 180 cps from an open collector transistor with a 50% Duty cycle.
     Down/Up: Counter will count “UP” when the Down/Up Input is grounded through switch contact, O.C. transistor or bi-polar output. Counter will count “DOWN” when the Down/Up Input is left open or driven high by a bi-polar output.
   - CUB2LQ:
     Count: 20,000 cps from a 3.0 V to 6.0 V bi-polar output with a 50% Duty cycle. 2,500 cps from an open collector transistor with a 50% Duty cycle.
     Quad.: Quadrature direction input to be 90° out of phase with the Count Input. Counter will count “UP” on the falling edge of the Count Input when the Quad Input is low. Counter will decrement on the rising edge of the Count Input when the Quad Input is low. No count change will occur when the Quad Input is high. (See Typical Applications, Quadrature Counting, Fig. 2.)
   * For contact inputs, external debounce filtering is required.
4. REMOTE RESET: Active low reset pulse width (as specified on the Chart below) from an open collector transistor, switch contact to ground, or a 3.0 V to 6.0 V bi-polar output.
5. OPERATING TEMPERATURE RANGE: -30°C to +75°C
6. WEIGHT: 5.1 oz (145 g).

Note: For additional application information, refer to the Cub 1 and Cub 2 Bulletin.

DIMENSIONS & INSTALLATION

Counters should be mounted in a panel grounded to the machine frame. After cutting opening in panel, slide the panel gasket over the rear of the counter body to the back of the bezel. Then slide counter through the panel cut-out. Install mounting clips on each side of counter body with mounting screws. Make sure the side rails of the clips fit into the recesses in the side of the counter body so that the “Tang Ends” wedge between the panel opening and body as the screws are tightened.

Warning: Lithium battery may explode if incinerated. Signal input voltage should not exceed 6.0 VDC to prevent damage to the counter.
Selection of desired operating modes is easily done by moving terminal leads in the Input Connector Body. The connector body is polarized to prevent incorrect insertion, and locked in place by the connector latch to avoid accidental disengagement. Connectors are supplied with the 4 leads installed as shown at right. A spare blue lead is supplied in the hardware pack.

**Removing Terminal:** Insert blade of a small screwdriver into slot of connector body, and gently push in to disengage the locking pawl. Pull terminal out.

**Inserting Terminal:** When inserting into connector body, make sure the locking pawl is toward the slot in the body. Push terminal in until the locking pawl snaps into slot.

**TYPICAL APPLICATIONS**

**UP/DOWN COUNTING - CUB2LU**

Up/Down counting can be accomplished by using a count source and a direction signal. The count signal is applied to the Count Input and the direction is applied to the Down/Up Input. The counter will increment on the falling edge of the Count Input when the Down/Up Input is held low. The counter will decrement on the falling edge of the Count Input when the Down/Up Input is held high. If the Down/Up Input is left open, the counter will decrement because it is pulled high through an internal pull-up resistor.

**QUADRATURE COUNTING - CUB2LQ**

When applying a quadrature signal to a CUB2LQ, as in positioning applications, the counter will increment with every falling edge of the Count Input if the Quad Input is low. The counter will decrement with every rising edge of the Count Input if the Quad Input is low. When the Quad Input is high, no change in count value will occur.

**POSITIONING WITH CUB2LQ AND RPGB**

The CUB2LQ can be used in positioning applications. An RPGB quadrature sensor powered by an APS Power Supply is connected to the Count and Quad Inputs of a CUB2LQ counter. Since the signal from the RPGB is a 0 to 12 V pulse, the amplitude must be limited to 6.0 V max. Therefore, a 1 kΩ resistor between the signal input and common is used to drop the voltage to an acceptable level.

**ELECTRICAL CONNECTIONS**

Wiring runs to count sensors or remote reset contacts can be made with almost any kind of wire and over distances of hundreds of feet, due to the advantages of low-voltage, low-current operation. The inherent noise immunity built into the CUB2LU and CUB2LQ, permits use of unshielded wiring in some applications, however the following precautions are advisable.

1. Avoid long wire runs in cable troughs or conduits with power circuits.
2. Mount the CUB2LU or CUB2LQ counter in a panel that is grounded to the machine frame.
3. Shielded wire is recommended in high electrical noise environments.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB2LU</td>
<td>CUB2L Up/Down Counter</td>
<td>CUB2LU00</td>
</tr>
<tr>
<td>CUB2LQ0</td>
<td>CUB2L Quad. Counter</td>
<td>CUB2LQ00</td>
</tr>
<tr>
<td>CUB2LQ1</td>
<td>CUB2L Quad., 1st Dec. Point Counter</td>
<td>CUB2LQ10</td>
</tr>
<tr>
<td>CUB2LQ2</td>
<td>CUB2L Quad., 2nd Dec. Point Counter</td>
<td>CUB2LQ20</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
MODEL CUB2L8 - MINIATURE ELECTRONIC 8-DIGIT COUNTER

DESCRIPTION
The CUB2L8 counter is powered by an internal lithium battery, which will provide up to 7 years of continuous operation. This counter has an 8-digit LCD display with 0.30" (7.6 mm) high digits.

This counter uses a CMOS LSI counter circuit chip, mounted on a gold-plated substrate and electrically connected by ultrasonic wire-bonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Using the latest in micro-electronic assembly and manufacturing techniques provides units with the reliability and dependability required for industrial service.

The CUB2L8 is constructed of a rugged die-cast metal case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 requirements for wash-down and/or dusty environments, when properly installed.

SPECIFICATIONS
1. DISPLAY: 8-digit LCD, 0.30" (7.6 mm) high.
2. POWER SOURCE: Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. Battery life is dependent upon usage. Count and reset contacts which remain closed for long periods of time will reduce battery life.
3. HIGH SPEED INPUT: 5 KHz from 3.0 V bi-polar output with a 50% duty cycle.
4. LOW SPEED INPUT: 30 Hz from switch contact or open collector transistor with a 50% duty cycle.
5. REMOTE RESET: 15 msec min. pulse width (active low) from a 3.0 V bi-polar output or an open collector transistor or a switch contact to ground.
6. OPERATING TEMPERATURE RANGE: -25° to +75°C
7. CONSTRUCTION: Rugged die-cast metal case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 requirements, when properly installed. Panel gasket and mounting clips included with unit.
8. WEIGHT: 5.1 oz. (145 g)

ELECTRICAL CONNECTIONS
There are certain considerations that should be observed when running the count and control signal wires. A length of wire can act like an antenna and the closer it is to a source of electrical noise, the more it becomes susceptible to that noise.

There are a few rules that should be followed when running these wires.
1. Never run count or control signal wires in the same conduit or raceway with AC power lines, conductors that feed motors, solenoids, SCR controls, heaters, etc.
2. Signal wires within enclosures should be routed as far away as possible from contactors, control relays, transformers, and other electrically "noisy" components.
3. When shielded wire is used, connect the shield to the common of the CUB unit, and leave the other end of the shield disconnected and insulated from machine ground.
4. Mount the CUB2L8 in a panel that is grounded to the machine frame.

DIMENSIONS & INSTALLATION
Counters should be mounted in a panel grounded to the machine frame. After cutting the panel opening, slide the panel gasket over the rear of the counter body to the back of the bezel lip. Then slide counter through the panel cut-out. Install mounting clips on each side of counter body with mounting screws. Make sure the side rails of the clips fit into the recesses in the side of the counter body so that the "Tang Ends" wedge between the panel opening and body as the screws are tightened.

Warning: Lithium battery may explode if incinerated. Signal input voltage should not exceed 3.0 VDC to prevent damage to the counter.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB2L8</td>
<td>CUB2 8-Digit Counter w/Lithium Battery</td>
<td>CUB2L800</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
Selection of desired operating modes is easily done by moving terminal leads in the Input Connector Body. The Connector body is polarized to prevent incorrect insertion, and locked in place by the connector latch to avoid accidental disengagement. Connectors are supplied with the 3 leads installed as shown at right. A spare blue lead is supplied in the hardware pack.

**Removing Terminal:** Insert blade of a small screwdriver into slot of connector body, and gently push in to disengage the locking pawl. Pull terminal out.

**Inserting Terminal:** When inserting into connector body, make sure the locking pawl is toward the slot in the body. Push terminal in until the locking pawl snaps into slot.

---

**APPLICATION FLEXIBILITY VIA RECONNECT OPTIONS**

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter (1 meg resistor and 0.015 pf cap) used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 14 µA (max. voltage drop 0.5 V) when ON. OFF-state leakage current must be less than 2 µA.

Reed switches, mercury wetted contacts, snap action limit switches, and silver alloy relay contacts with wiping action are usually satisfactory for generating count input signals. Motor starter contacts, tungsten contacts, and brush-type contacts should **NOT** be used. Normally open contacts are recommended for longer battery life and greater noise immunity.

---

**LOW SPEED COUNT INPUT, 30 Hz MAX.**

![Diagram](image)

Moving the white wire to the “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3.0 V maximum to avoid damage to the counter. Outputs higher than 3.0 V can be used with an external voltage divider, as shown.

---

**HIGH SPEED COUNT INPUT, 5 KHz MAX.**

![Diagram](image)

---

**RESET OPTIONS**

Connecting the “RST. EN.” (Reset Enable) Input to Common activates the front panel Reset button. To deactivate the front panel Reset button, remove the yellow wire from the “RST. EN.” Input.

When Remote Reset is required, the blue wire in the hardware pack is inserted in the “REM. RST.” Input. Pulling this input low causes the counter to reset. The “REM. RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load and leakage are the same as for “L.S. CNT.” Input above.

**Note:** The RC protection circuit on the “REM. RST.” Input causes a delay of approximately 15 msec in Reset response.
MODEL CUB 3 & CUB3R - GENERAL PURPOSE, MINIATURE ELECTRONIC COUNTERS
ECONOMICAL REPLACEMENT FOR ELECTRO-MECHANICAL COUNTERS

DESCRIPTION
The CUB3s are miniature electronic counters. The CUB3 has front panel reset, while the CUB3R has remote reset. These units fill a wide variety of applications.

The CUB3s feature a rugged reinforced nylon case that snap-fits into a standard rectangular opening without screws or other hardware. Hook-up is simply a matter of connecting two wires, and since the operating voltage is only 3 V and with currents in microamps, almost any kind of wire can be used. No external power is required since the internal batteries provide years of uninterruptible service. In addition to these advantages, the CUB 3’s offer the inherent ruggedness, reliability, and permanence of completely integrated circuitry, embedded in a single monolithic, silicon, micro-chip.

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

SPECIFICATIONS
1. DISPLAY: 6-Digit, LCD, 0.2” (5.1 mm) High.
2. POWER: 3 Volts supplied by 2 replaceable Alkaline “N” Cells. Nominal battery life 4 years. Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.
3. RESET:
   CUB 3 - Via front panel reset button only.
   CUB 3R - (Remote Reset Only) Switch Contact or Solid State Transistor Switch (See Connections). Contact burden 14 µA; Max. OFF-State leakage current must be less than 2 µA. Counter resets with negative pulse with a min. pulse width of 5 msec.
4. COUNT INPUT: Switch Contact or Solid-State Transistor Switch (See Connections). Contact burden 14 µA; Max. OFF-State leakage current must be less than 2 µA. Counter increments on negative going edge of input.
5. COUNT SPEED: 100 counts/sec (6000 counts/min). Min. input pulse width 5 msec, with 5 msec spacing between count pulses.
6. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: -30° to +75°C
   Storage Temperature: -40° to +80°C
   Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
   Altitude: Up to 2000 meters
7. CERTIFICATIONS AND COMPLIANCES:
   SAFETY
   IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   ELECTROMAGNETIC COMPATIBILITY
   Immunity to EN 50082-2
   Electrostatic discharge EN 61000-4-2
   Level 2; 4 Kv contact
   Level 3; 8 Kv air
   Electromagnetic RF fields EN 61000-4-3
   Level 3; 10 V/m
   80 MHz - 1 GHz
   Fast transients (burst) EN 61000-4-4
   Level 4; 2 Kv I/O
   RF conducted interference EN 61000-4-6
   Level 3; 10 V/µs
   150 KHz - 80 MHz
   Power frequency magnetic fields EN 61000-4-8
   Level 4; 30 A/m
   900 MHz, ±5 MHz
   200 Hz, 50% duty cycle
   Emissions to EN 50081-2
   RF interference EN 55011
   Enclosure class A
   Power mains class A
   Note: Refer to the EMC Installation Guidelines section of this bulletin for additional information.
8. CONSTRUCTION: Installation Category I, Pollution Degree 2
9. WEIGHT: 3 oz. (85 g) [Less Batteries]

ORDERING INFORMATION
<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB3</td>
<td>CUB3 (Front Panel Reset Only)</td>
<td>CUB30000</td>
</tr>
<tr>
<td>CUB3R</td>
<td>CUB3 (Remote Reset Only)</td>
<td>CUB3R000</td>
</tr>
<tr>
<td>BNA</td>
<td>1.5 V Alkaline “N” Cells (2 Req’d)</td>
<td>BNA00000</td>
</tr>
</tbody>
</table>

Note: Batteries not supplied with counter, order separately.

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

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Listed below are some additional EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. The following EMI suppression devices (or equivalent) are recommended:
   - **Ferrite Suppression Cores for signal and control cables**
     - Fair-Rite # 0443167251 (RLC #FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward #28B2029-0A

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

**ELECTRICAL CONNECTIONS & COUNT INPUTS**

The CUB 3s can be supplied with count input signals from mechanical switch contacts or solid-state switches (NPN or PNP transistors) as shown in the diagrams below. Reed switches, mercury-wetted contacts, snap-action limit switches, and silver alloy contacts with wiping action are usually satisfactory choices for mechanical switch input. Heavy “clapper-type” contacts such as used in contactors or large machine tool relays, tungsten contacts, or brush type contacts are not recommended as count input devices.

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL CUB3L & CUB3LR - General Purpose, Miniature Electronic Counters With Lithium Battery - Economical Replacement For Electro-Mechanical Counters

- WIDE TEMPERATURE RANGE (-30° to +75°C)
- IDEAL FOR PORTABLE, MOBILE, OR STATIONARY INDUSTRIAL APPLICATIONS
- AVAILABLE IN TWO VERSIONS: FRONT PANEL RESET OR REMOTE RESET
- LOW COST/HIGH PERFORMANCE
- OPERATES FROM SWITCH CONTACT OR OPEN COLLECTOR INPUTS
- PROVIDES YEARS OF SILENT OPERATION WITHOUT MECHANICAL WEAR
- SELF POWERED, ELIMINATES POWER WIRING
- BUILT-IN STRAIN RELIEF
- EASY SNAP-IN MOUNTING IN 1" X 2" (25 mm x 50 mm) PANEL OPENING

DESCRIPTION

The CUB3Ls are miniature electronic counters. The CUB3L has front panel reset, while the CUB3LR has remote reset. These units fill a wide variety of applications. The CUB3Ls feature a rugged reinforced nylon case that snap-fits into a standard rectangular opening without screws or other hardware. Hook-up is simply a matter of connecting two wires, and since the operating voltage is only 3 V and with currents in microamps, almost any kind of wire can be used. No external power is required since the internal batteries provide years of uninterrupted service. In addition to these advantages, the CUB3Ls offer the inherent ruggedness, reliability, and permanence of completely integrated circuitry, embedded in a single monolithic, silicon, micro-chip.

SAFETY SUMMARY

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

WARNING: Lithium battery may explode if incinerated. Signal input voltage should not exceed 3.0 VDC to prevent damage to the battery.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB3L</td>
<td>CUB3L (Front Panel Reset Only) w/Lith Bat.</td>
<td>CUB3L000</td>
</tr>
<tr>
<td>CUB3LR</td>
<td>CUB3LR (Remote Reset Only) w/Lith Bat.</td>
<td>CUB3LR000</td>
</tr>
</tbody>
</table>

SPECIFICATIONS

1. DISPLAY: 6-Digit, LCD, 0.2" (5.1 mm) High.
2. POWER: 3 V supplied by a lithium battery. Nominal battery life 10 years, depending on usage.
3. RESET:
   - CUB3L - Via front panel reset button only.
   - CUB3LR - (Remote Reset Only) Switch Contact or Solid State Transistor Switch (See Connections). Contact burden 14 µA; Max. OFF-State leakage current must be less than 2 µA. Counter resets with negative pulse on a min. pulse width of 5 msec.
4. COUNT INPUT: Switch Contact or Solid-State Transistor Switch (See Connections), Contact burden 14 µA; Max. OFF-State leakage current must be less than 2 µA. Counter increments on negative going edge of input.
5. COUNT SPEED: 100 counts/sec (6000 counts/min). Min. input pulse width 5 msec, with 5 msec spacing between count pulses.
6. ENVIRONMENTAL CONDITIONS:
   - Operating Temperature: -30° to +75°C
   - Storage Temperature: -40° to +80°C
   - Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
   - Altitude: Up to 2000 meters
7. CERTIFICATIONS AND COMPLIANCE:
   - SAFETY: IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   - ELECTROMAGNETIC COMPATIBILITY: Immunity to EN 50082-2
     - Electrostatic discharge: EN 61000-4-2
       - Level 2: 4 Kv contact Level 3: 8 Kv air
       - Level 3: 10 V/m 80 MHz - 1 GHz
     - Electromagnetic RF fields: EN 61000-4-3
       - Level 4: 2 Kv I/O Level 3: 10 Vrms 150 KHz - 80 MHz
     - Fast transients (burst): EN 61000-4-4
       - Level 4: 30 A/m 900 MHz, ±5 MHz 200 Hz, 50% duty cycle
     - RF conducted interference: EN 61000-4-6
       - Level 4: 2 K v I/O Level 3: 10 V/m 150 KHz - 80 MHz
     - Power frequency magnetic fields: EN 61000-4-8
       - Level 4: 30 A/m Level 3: 10 V/m 900 MHz, ±5 MHz
     - Simulation of cordless telephones: ENV 50204
       - ENV 50204
     - Emissions to EN 50081-2
       - RF interference: EN 55011
         - Enclosure class B
   - 900 MHz, ±5 MHz
   - 200 Hz, 50% duty cycle
   - Note: Refer to the EMC Compliance Installation section of this bulletin for additional information.

8. CONSTRUCTION: Installation Category I, Pollution Degree 2
9. WEIGHT: 3 oz. (85 g) [less batteries]
EMC COMPLIANCE INSTALLATION

This unit complies with the Electromagnetic Compatibility (EMC) standards listed in the specifications. Compliance to the EMC standards was demonstrated by means of a test set-up using the following installation methods:

1. Unit installed in a metal panel mounted to an open aluminum rack connected to earth ground (protective earth).
2. Shielded (screened) cables for Signal and Control inputs with shield drain wire connected to earth ground at the mounting panel only.

It should be noted that the methods listed above may not be necessary for every unit installation. For the purpose of EMC testing, the input line on the unit was connected with 25 feet (8 m) of cable. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful installation or a troublesome installation.

ADDITIONAL EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Listed below are some additional EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   - Fair-Rite # 0443167251 (RLC #FCOR0000)
   - TDK # ZCAT3035-1330A
   - Steward #28B2029-0A0

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

INSTALLATION ENVIRONMENT

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

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

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

ELECTRICAL CONNECTIONS & COUNT INPUTS

The CUB3Ls can be supplied with count input signals from mechanical switch contacts or solid-state switches (NPN or PNP transistors) as shown in the diagrams below. Reed switches, mercury-wetted contacts, snap-action limit switches, and silver alloy contacts with wiping action are usually satisfactory choices for mechanical switch input. Heavy “clapper-type” contacts such as used in contactors or large machine tool relays, tungsten contacts, or brush type contacts are not recommended as count input devices.

TROUBLESHOOTING

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

The CUB4 offers a large display in a miniature package. There are three CUB4 counters to choose from; the CUB4L (6-digit counter), CUB4L8 (8-digit counter), and the CUB4L8W (8-digit counter with voltage input). You also have a choice of three displays; reflective, red backlight or green backlight.

The backlight versions require power from an external 9–28 VDC supply. The optional power supply (MLPS1000) is designed to be attached directly to the rear of the CUB4 and is powered from an 85–250 V AC source. The power supply provides 12 VDC @ 400 mA to power the backlight and sensor, if required.

The CUB4 series has a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber reset button meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

**SAFETY SUMMARY**

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

**SPECIFICATIONS**

1. **DISPLAY:**
   - CUB4L: 6-Digit, LCD, 0.48” (12.2 mm) high digits.
   - CUB4L8 & CUB4L8W: 8-Digit, LCD, 0.46” (11.7 mm) high digits.

2. **POWER SOURCE:** Internal 3.0 V lithium battery to provide up to 6 years of continuous operation. Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time will reduce battery life.

3. **BACKLIGHT POWER REQUIREMENTS:**
   - 9 to 28 VDC, 35 mA typical, 50 mA max. Above 26 VDC, derate operating temperature to 50°C.
   - Must use the MLPS or a Class 2 or SELV rated power supply.

4. **INPUTS:**
   - All Inputs: \( V_{IL} \) (low) = 0.5 V max.
   - Low Speed Input (CUB4L & CUB4L8): 30 Hz from switch contact or open collector transistor with a 50% duty cycle.
   - Low Speed Input (CUB4L8W): 10 to 300 VAC/DC, 50/60 Hz, 30 cps max. \( V_{IL} = 0.5 \) VDC max. Unit counts on positive going edge. Will not operate with Triac outputs.
   - High Speed Input (CUB4L): 5 KHz from 4.0 V to 28.0 V bipolar output with a 50% duty cycle.
   - High Speed Input (CUB4L8): 5 KHz at 2.0 V (3 V max) bipolar output with a 50% duty cycle.

5. **Remote Reset:**
   - CUB4L: 15 msec min. pulse width (active low) from 4.0 V to 28.0 V bipolar output or an open collector transistor or a switch contact to common.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB4L (6-digit)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L000</td>
</tr>
<tr>
<td>Counter w/Yel-Gm Backlighting</td>
<td>CUB4L010</td>
<td></td>
</tr>
<tr>
<td>Counter w/Red Backlighting</td>
<td>CUB4L020</td>
<td></td>
</tr>
<tr>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L040</td>
<td></td>
</tr>
<tr>
<td>CUB4L8 (8-digit)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L800</td>
</tr>
<tr>
<td>Counter w/Yel-Gm Backlighting</td>
<td>CUB4L810</td>
<td></td>
</tr>
<tr>
<td>Counter w/Red Backlighting</td>
<td>CUB4L820</td>
<td></td>
</tr>
<tr>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L840</td>
<td></td>
</tr>
<tr>
<td>CUB4L8W (8-digit w/VCM)</td>
<td>Counter Positive Image Reflective</td>
<td>CUB4L8W0</td>
</tr>
<tr>
<td>Counter w/Yel-Gm Backlighting</td>
<td>CUB4L8W1</td>
<td></td>
</tr>
<tr>
<td>Counter w/Red Backlighting</td>
<td>CUB4L8W2</td>
<td></td>
</tr>
<tr>
<td>Counter Positive Image Reflective w/V+ Terminal</td>
<td>CUB4L8W4</td>
<td></td>
</tr>
<tr>
<td>MLPS</td>
<td>Micro Line/Sensor Power Supply</td>
<td>MLPS1000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

**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.
CUB4L8 & CUB4L8W: 15 msec min. pulse width (active low) from 3.0 V bipolar output or an open collector transistor or a switch contact to common.

5. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: 0 to 60°C (above 50°C, derate backlight operating voltage to 26 VDC max.).
   Storage Temperature: -30 to 85°C
   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
   Vibration According to IEC 68-2-6: 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5g’s.
   Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.

6. CERTIFICATIONS AND COMPLIANCES:

SAFETY
UL Recognized Component, File # E179259, UL 61010-1, CSA C22.2 No. 61010-1
Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
Type 4X Enclosure rating (Face only), UL50
IECEE CB Scheme Test Certificate # US/9257/UL,
CB Scheme Test Report # E179259-V01-S02
Issued by Underwriters Laboratories, Inc.
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529

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. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the panel as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   **Ferrite Suppression Cores for signal and control cables:**
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A6

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

   **Note:** Reference manufacturer’s instructions when installing a line filter.

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

7. CONSTRUCTION:
   This unit is rated for NEMA 4X/IP65 indoor use. Installation Category I, Pollution Degree 2

8. WEIGHT: 3 oz. (85 grams)

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

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.

Installation
The CUB4 series of products meet NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosure panel. A sponge rubber gasket and mounting clip are provided for sealing the unit in the panel cut-out.

The following procedure assures proper installation:
1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove the center section of the panel gasket and discard.
3. Slide gasket over rear of the unit until the mounting clip is against the back of the bezel. The mounting clip has latching features which engage into mating features on the CUB4 housing. Note: It is necessary to hold the unit in place when sliding mounting clip into position.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the panel as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   **Ferrite Suppression Cores for signal and control cables:**
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A6

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

   **Note:** Reference manufacturer’s instructions when installing a line filter.

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

6. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed about 75 to 80% of its original thickness. (Recommended torque is 28 to 36 in-oz.) If not, gradually turn mounting screws to further compress gasket.

7. If gasket is not adequately compressed, and mounting screws can no longer be turned, loosen mounting screws and check that mounting clip is latched as close as possible to panel.
Repeat procedure for tightening mounting screws.
WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. When wiring the unit, use the label to identify the wire position with the proper function. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

Note: The Reflective CUB4 will NOT have a screw terminal installed at the V+ terminal, since it is NOT required for operation and is not internally connected. Refer to the Ordering Information for the part number of a reflective model that will accommodate the MLPS.

Warning: Lithium battery may explode if incinerated.
Caution: All leads will be at the same line potential as the input leads.

CUB4L AND CUB4L8 LOW SPEED COUNT INPUT, 30 Hz MAX.

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 14 µA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 µA. Motor starter contacts, tungsten contacts, and brush-type contacts should NOT be used.

CUB4L8W L.S. INPUT, 30 CPS MAX.

The CUB4L8W accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 300 V at count speeds up to 30 cps. The unit counts on the positive going edge of the input signal.

WARNING: Any lead may be at hazardous live input potential. External wiring and devices connected to the unit must be rated the same as applied signal input voltage and be properly isolated from Class 2 or SELV circuitry.

CUB4L HIGH SPEED COUNT INPUT, 5 KHz MAX.

The “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs. Input drive voltage must be limited to 28.0 V maximum to avoid damage to the counter.

INPUT PULSE EXCURSION LIMITS

\[ V_{ih} \text{ (High)} = +4.0 \text{ V min., } +28.0 \text{ V max.} \]
\[ V_{il} \text{ (Low)} = +0.5 \text{ V max.} \]
**TROUBLESHOOTING**

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

---

**RESET OPTIONS**

Connecting a wire from the “RST. EN.” (Reset Enable) Input terminal to Common will enable the front panel Reset button. When Remote Reset is required, a wire is connected from the “REM. RST.” input terminal to Common. Pulling this input low causes the counter to reset. The “REM. RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load and leakage are the same as for “L.S. CNT.” Input above.

*Note: The RC protection circuit on the “REM. RST.” Input causes a delay of approximately 15 msec in Reset response.*

---

**BACKLIGHT OPTION**

Optional backlight versions of the CUB4 require an external 9-28 VDC power supply. The external supply is connected between the V+ and Common terminals as shown in the drawing.

Red Lion Controls optional power supply (MLPS1000) is designed to be attached directly to the rear of a CUB4 and is powered from a 85 to 250 V AC source. The MLPS provides power for unit backlighting and a sensor.

**WARNING:** When connecting the wiring for a backlight CUB4L8W measuring an AC input voltage, the neutral of the single phase AC signal is connected to Terminal 1 (COM), and line (hot) is connected to Terminal 5 (LS). The DC supply for the backlighting is connected as shown in the drawing. Three phase AC applications require an isolation transformer.

---

**INPUT PULSE EXCURSION LIMITS**

- **V_IN** (High) = 2.0 V min., 3.0 V max.
- **V_H** (Low) = ±0.5 V max.

---

**CUB4L8 HIGH SPEED COUNT INPUT, 5 Hz MAX.**

The “H.S. CNT.” Input allows the CUB Counter to operate at speeds up to 5 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL logic outputs can be loaded with a resistor (R1) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. transistor output.

---

**FIG 1**

**FIG 2**

**FIG 3**

---

**R values for Fig 2 & 3**

<table>
<thead>
<tr>
<th>Value</th>
<th>R (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5 V</td>
<td>2.2 K</td>
</tr>
<tr>
<td>+12 V</td>
<td>10 K</td>
</tr>
<tr>
<td>+18 V</td>
<td>16 K</td>
</tr>
<tr>
<td>+24 V</td>
<td>24 K</td>
</tr>
</tbody>
</table>

---

Red Lion Controls
20 Willow Springs Circle
York PA 17406
Tel +1 (717) 767-6511
Fax +1 (717) 764-0839

Red Lion Controls AP
31, Kaki Bukit Road 3,
#06-04/05 TechLink
Singapore 417818
Tel +65 6744-6613
Fax +65 6743-3360

Red Lion Controls BV
Printerweg 10
NL - 3821 AD Amersfoort
Tel +31 (0) 334 723 225
Fax +31 (0) 334 893 793
MODEL CUB7 - MINIATURE ELECTRONIC 8 DIGIT COUNTER

- LCD, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING (9-28 VDC power supply required for versions with LED backlighting)
- 0.35" (8.90 mm) HIGH DIGITS
- REPLACEABLE INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF UNINTERRUPTED OPERATION (Battery included)
- NEMA 4X/IP65 SEALED FRONT BEZEL
- COUNT SPEEDS UP TO 10 KHz (CUB7)
- WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS
- FITS DIN STANDARD CUT-OUT 1.77" (45 mm) x 0.874" (22.2 mm)

DESCRIPTION

The CUB7 series is an 8-digit miniature counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting or red backlighting. The backlight versions require an external 9 to 28 VDC power supply.

The CUB7 series use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7 series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber reset button meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

SAFETY SUMMARY

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

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

SPECIFICATIONS

1. DISPLAY: 8-digit LCD, 0.35" (8.90 mm) high digits.
2. POWER SOURCE: Replaceable Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. (Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.)
3. BACKLIGHT POWER REQUIREMENTS: 9 to 28 VDC; 35 mA. typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use a Class 2 or SELV rated power supply.
4. INPUTS: VIL (low) = 0.5 V max
   Low speed input: 30 Hz from switch contact or open collector transistor with 50% duty cycle
   High speed input: VIH (high) = 2.0 V min. (3 V max). 10KHz max from 3.0 V bipolar output with a 50% duty cycle
5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7 *</td>
<td>Counter Positive Image Reflective</td>
<td>CUB70000</td>
</tr>
<tr>
<td></td>
<td>Counter W/Yel-Grn Backlighting</td>
<td>CUB70010</td>
</tr>
<tr>
<td></td>
<td>Counter W/Red Backlighting</td>
<td>CUB70020</td>
</tr>
<tr>
<td>BNL</td>
<td>3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

*Battery is included with unit.

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.

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

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

*Battery is included with unit.
6. CERTIFICATIONS AND COMPLIANCES:

SAFETY
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP65 Enclosure rating (Face only), IEC 529
UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
Type 4X Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY
Immunity to EN 50082-2
Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
Fast transients (burst) EN 61000-4-4 Level 4; 2 K V/µs
RF conducted interference EN 61000-4-6 Level 3; 10 V/m
Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m
Simulation of cordless telephone ENV 50204 Level 3; 10 V/m

Emissions to EN 50081-1
RF interference EN 55022 Enclosure class B

Notes:
1. Burst to DC backlight power had a power line filter installed RLC #LFIL0000 or equivalent at the unit.
2. Self-recoverable loss of performance during EMI disturbance at 10 V/rms to backlight power lines.
   LCD segments may flicker during EMI disturbance.
   For operation without loss of performance:
   Install power line filter RLC #LFIL0000 or equivalent at the unit.
   Refer to the EMC Installation Guidelines section of this bulletin for additional information.

7. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC. (Backlight versions)
Storage Temperature Range: -30 to 80°C
Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C
Altitude: Up to 2000 meters

8. CONSTRUCTION: High impact plastic case with clear viewing window.
The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.

9. WEIGHT: 2 oz. (57 grams) [with battery]

---

**CUB7 LOW SPEED COUNT INPUT, 30 Hz MAX.**

Pulling the “L.S. CNT.” Input to Common with a mechanical or solid-state switch increments the counter. The low pass filter (2.2 MΩ resistor and 0.0068 µf capacitor) used with a Schmidt trigger circuit debounces mechanical switch signals. The switch load is 6 µA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 µA.

Motor starter contacts, tungsten contacts, and brush-type contacts should not be used.

---

**CUB7 HIGH SPEED COUNT INPUT, 10 KHz MAX.**

The “H.S. CNT.” Input allows the CUB7 to operate at speeds up to 10 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL Logic outputs can be loaded with a resistor (Rt) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. Transistor output.
EMC INSTALLATION GUIDELINES

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables: Fair-Rite # 0443167251 (RLC #FCOR0000)
   - Ferrite Suppression Cores for signal and control cables: TDK # ZCAT3035-1330A
   - Ferrite Suppression Cores for signal and control cables: Steward #28B2029-0A0

   Line Filters for input power cables:
   - Schaffner # FN610-1/07 (RLC #LFIL0000)
   - Schaffner # FN670-1/8/07
   - Corcom #1VR3

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

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

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

INSTALLATION ENVIRONMENT

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

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

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

Installation

The CUB7 series of products meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket and mounting clip are provided for installing the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove and discard the center section of the gasket. Slide the panel gasket over the rear of the unit to the back of the bezel. Insert the mounting screws onto both sides of mounting clip. Tip of screw should NOT project from hole in mounting clip.
3. Install CUB7 unit through the panel cut-out until front bezel flange contacts the panel.
4. Slide the mounting clip over the rear of the unit until the clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the CUB7 housing.
   Note: It is necessary to hold the unit in place when sliding mounting clip into position.
5. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed to about 75 to 80% of its original thickness. If not, gradually turn mounting screws to further compress gasket.
6. If gasket is not adequately compressed and the mounting screws can no longer be turned, loosen mounting screws, and check that mounting clip is latched as close as possible to the panel.
7. Repeat from step #5 for tightening mounting screws.
**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove battery cover, push upward in the direction of the arrow on rear cover (See drawing at right), until the cover unlatches. Pull cover straight out from unit to fully remove.
3. Remove old battery* and replace with an RLC battery (BNL10000).
4. Replace cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7 series when properly installed

* - Dispose of properly.

![Battery Cover Diagram]

**WARNING:** Lithium battery may explode if incinerated.

---

**RESET OPTIONS (CUB7 SERIES)**

Connecting a wire from the RST. EN. (Reset Enable) Input terminal to Common will enable the front panel Reset button.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load is 15 µA (max. voltage drop 0.5 V) when on. The off-state leakage current must be less than 2 µA.

*Note:* The RC protection circuit on the “RST.” Input causes a delay of approximately 15 msec in Reset response.

---

**BACKLIGHT OPTION (CUB7 SERIES)**

Optional backlight versions of the CUB7 series require an external 9-28 VDC power supply. The external supply is connected between V+ and Common terminals as shown by the solid line in the drawing.

---

**TROUBLESHOOTING**

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

---

**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, profits, lost profits, and other matters which Buyer, its employees, or sub-contractors or any may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL CUB7P PROGRAMMABLE ELECTRONIC 8-DIGIT COUNTER

DESCRIPTION
The CUB7P is an 8-digit miniature programmable counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting, or red backlighting. Backlight units require an external 9 to 28 VDC power supply.

The CUB7P is available in either Low Speed Contact or High Speed Logic. The Contact versions (CUB7P0xxx) operate from a switch contact or an NPN open collector transistor. The Logic versions (CUB7P2xx) operate from 3 VDC logic output or from an NPN open collector transistor.

The CUB7P has a programmable prescaler that can be set for any value between 0.0001 and 1.9999. The decimal point position can be set anywhere from 0 (no D.P.) to 0.000000 or no Leading Zero Blanking. Both the prescaler and DP selection are accessed using the front panel PGM and RESET push buttons. See Programming for details. Note that the count, prescaler and DP values will be lost if the battery is removed. See BATTERY INSTALLATION for additional information.

The CUB7P counters use a CMOS LSI chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7P series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber buttons meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

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

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

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7P</td>
<td>Counter; Positive Image Reflective</td>
<td>CUB7P000</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Yel-Grn Backlighting</td>
<td>CUB7P010</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Red Backlighting</td>
<td>CUB7P020</td>
</tr>
<tr>
<td>*CUB7P</td>
<td>Counter; Positive Image Reflective</td>
<td>CUB7P200</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Yel-Grn Backlighting</td>
<td>CUB7P210</td>
</tr>
<tr>
<td></td>
<td>Counter, w/Red Backlighting</td>
<td>CUB7P220</td>
</tr>
<tr>
<td>BNL</td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

* Battery is included with unit.

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.
SPECIFICATIONS

1. DISPLAY: 8-digit LCD, 0.35" (8.90 mm) high digits.
2. POWER SOURCE: Replaceable Internal 3.0 V lithium battery to provide up to 6 years of continuous operation. (Battery life is dependent upon usage. Contacts that remain closed for long periods of time reduce battery life.)
3. BACKLIGHT POWER REQUIREMENTS: 9 to 28 VDC; 35 mA, typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C.
   Must use the MLPS or a Class 2 or SELV rated power supply.
4. SIGNAL INPUT: (LS terminal #4) See Count Edge under Programming for incrementing edge of input signal.
   Contact Input (CUB7P0xx): 30 Hz max. from Switch Contact or solid state Transistor Switch to Common with a 50% duty cycle. Contact burden 7 μA max.
   Logic Input (CUB7P2xx): 10 kHz max. from a 3.0V bipolar output or 200 Hz max. from a solid state Transistor Switch to Common with a 50% duty cycle. Contact burden 7 μA max.
5. REMOTE RESET: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.
6. ENVIRONMENTAL CONDITIONS:
   Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC (Backlight versions). Storage Temperature: -30 to 80°C
   Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C,
   Altitude: Up to 2000 meters
7. CERTIFICATIONS AND COMPLIANCE:
   SAFETY
   UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IEC-61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2
- Electrostatic discharge EN 61000-4-2
  - Level 2; 4 Kv contact
  - Level 3; 8 Kv air
- Electromagnetic RF fields EN 61000-4-3
  - Level 3; 10 V/m
  - 80 MHz - 1 GHz
- Fast transients (burst) EN 61000-4-4
  - Level 4; 2 Kv I/O
  - Level 3; 2 Kv power
- RF conducted interference EN 61000-4-6
  - Level 3; 10 V/m
  - 150 KHz - 80 MHz
  - Simulation of cordless telephone ENV 50204
    - Level 3; 10 V/m
    - 900 MHz ± 5 MHz
    - 200 Hz, 50% duty cycle

Emissions to EN 50081-1
- RF interference EN 55022
  - Enclosure class B

Notes
1. Backlit powered units require a power line filter to be installed, RLC LFIL0000 or equivalent, so as not to impair the function of the backlighting.
   Refer to EMC Installation Guidelines for additional information.
8. CONNECTIONS: Wire clamping screw terminals
   Wire Strip Length: 0.3" (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 5 inch-lbs (0.565 N-m) max.
9. CONSTRUCTION: High impact plastic case with clear viewing window.
   The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.
10. WEIGHT: 2 oz. (57 grams) [with battery]

PROGRAMMING

The CUB7P has programmable prescale values and decimal point positions. These values are changed using the front panel push buttons. Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front panel push buttons.

Note: Upon entering the PGM mode for the first time, the Prescaler value is set to 0.0000. Some value between 0.0001 and 1.9999 must be entered in order for the CUB7P to operate properly. Previously stored values are retained until changed by the user.

With the front panel push buttons enabled, press the PGM button to enter the program mode. The CUB7P display will change to the current prescale value, with the least significant digit flashing at a 2 Hz rate. The prescale value can be set to any value between 0.0001 and 1.9999. Press the RST button to increment the flashing digit to the desired value. Pressing the PGM button will lock in the value of the flashing digit and advance to the next significant digit. The most significant digit can only be set to 0 or 1. When the entire prescale value has been programmed, press the PGM button once to enable decimal point selection. Any new count pulses will be accumulated using the new prescale value.

After performing the prescale selection, the display will show 0.0000. Decimal point positions can be set for:

0.000
0.00
0.0
0

Press the RST button until the desired decimal point position is displayed. Press the PGM button to select that position and return to the counter mode. Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the programmed values.

Note: The incrementing edge of the count signal will change when the PGM button is pressed for the first time. To avoid incorrect display information, it is recommended that the CUB7P be reset after making programming changes.

COUNT EDGE

Accessing program mode for the first time will complement the incrementing edge of the count signal. The table below shows the incrementing edge of the count signal for the different versions of the CUB7P.

<table>
<thead>
<tr>
<th>VERSION</th>
<th>AFTER INSTALLING OR REPLACING BATTERY</th>
<th>AFTER ENTERING PROGRAM MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7P0 (Contact)</td>
<td>Rising Edge</td>
<td>Falling Edge</td>
</tr>
<tr>
<td>CUB7P2 (Logic)</td>
<td>Rising Edge</td>
<td>Falling Edge</td>
</tr>
</tbody>
</table>
EMC INSTALLATION GUIDELINES

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

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

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

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

WARNING: Lithium battery may explode if incinerated.

BATTERY INSTALLATION

1. Remove all power to the unit before removing battery cover.
2. To remove the battery cover, push upward in the direction of the arrow on the rear cover (See drawing below), until the cover unlatches. Pull the cover straight out from unit to fully remove.
3. Remove old battery* and replace it with an RLC battery (BNL10000). Observe proper polarity when replacing the battery as shown in the drawing.
4. Replace the cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7P when properly installed.

* - Dispose of properly.

WARNING: Lithium battery may explode if incinerated.
The “LS.” Input allows the CUB7P to operate at speeds up to 10 KHz when driven by bi-polar outputs or external circuits having an output impedance of 3.3 KΩ or less. Input drive voltage must be limited to 3 V maximum to avoid damage to the counter. CMOS and TTL Logic outputs can be loaded with a resistor (R₁) to limit drive voltage, or a voltage divider can be used as shown for the PNP O.C. Transistor output.

### INSTALLATION

The CUB7P meets NEMA 4X/IP65 requirements for indoor use when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for a washdown environment. A sponge rubber gasket and mounting clip are provided for installing the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove and discard the center section of the gasket.
3. Slide the panel gasket over the rear of the counter body to the back of the bezel. Install CUB7P unit through the panel cut-out.
4. Insert the mounting screws onto both sides of mounting clip. Tip of screw should NOT project from hole in mounting clip.
5. Slide the mounting clip over the rear of the unit until the clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the CUB7P housing.
6. Note: It is necessary to hold the unit in place when sliding mounting clip into position.
7. Alternately tighten each screw to ensure uniform gasket pressure. Visually inspect the front panel gasket. The gasket should be compressed to about 75 to 80% of its original thickness. If not, gradually turn mounting screws to further compress gasket.
8. If the gasket is not adequately compressed and the mounting screws can no longer be turned, loosen mounting screws, and check that the mounting clip is latched as close as possible to the panel.
9. Repeat from step #5 for tightening mounting screws.
**RESET AND PROGRAM OPTIONS**

Connecting a wire from the RST EN (Reset Enable) or the HS (Program Enable) Input terminals to Common will enable the front panel Reset or Program buttons respectively.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. The Switch load is 15 µA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 µA.

Connecting the “L.S.” Input to Common with a mechanical or solid-state switch increments the counter. The switch load is 7 µA (max. voltage drop 0.5 V) when ON. The OFF-state leakage current must be less than 2 µA.

Note: The RC protection circuit on the “RST.” Input causes a delay of approximately 15 msec in Reset response.

Reed switches, mercury wetted contacts, snap action limit switches, and silver alloy relay contacts with wiping action are usually satisfactory for input activation. Motor starter contacts, tungsten contacts, and brush-type contacts should not be used.
Optional backlight versions of the CUB7P require an external 9 to 26 VDC power supply. The external supply is connected between the V+ and common terminals as shown in the drawing.

PROGRAMMING EXAMPLES

SCALING A COUNTER

Example: An encoder generates 600 pulses per foot. The Desired Display is tenths of inches. The Prescaler is determined using the formula below.

\[ \text{Prescaler} = \frac{\text{Desired Display Units} \times \text{Decimal Point Value}}{\text{Number of Pulses}} \]

Where:
- Desired Display = The number of Desired Display units (revolutions, feet, 10ths of feet, meters, etc.).
- Number of Pulses = The number of pulses required to achieve the Desired Display
- Decimal Point Value = The desired decimal point placement on the display.

Example: Display tenths of inches when using

\[ \text{Prescaler} = \frac{1 \text{ (inch)} \times 10 \text{ (Decimal Point Value)}}{600 \text{ pulses/foot} \times 1 \text{ foot/12 inches}} \]

\[ = \frac{10}{50} = 0.2 \]

BACKLIGHT OPTION

Optional backlight versions of the CUB7P require an external 9 to 26 VDC power supply. The external supply is connected between the V+ and common terminals as shown in the drawing.

APPLICATION - TOTAL YARDS OF MATERIAL

A fabric manufacturer wants to know, as economically as possible, how many whole yards of material his lines are running. The CUB7P000 will meet his process requirements. The encoder measuring the material, generates a one pulse per foot output signal. To obtain the desired display of yards measured, a prescale value of 0.3333 is programmed. To program the prescale value, connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable the front panel push buttons (See PROGRAMMING for more details.). Remove these wires after programming to prevent accidental changes to the prescale value. At the end of each shift, the machine operator records the total shown on the display and resets the counter to zero via key switch.

TROUBLESHOOTING

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

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
**MODEL CUB7W - MINIATURE ELECTRONIC 8 DIGIT COUNTER**

- LCD, REFLECTIVE OR TRANSMISSIVE WITH YELLOW/GREEN OR RED LED BACKLIGHTING (9-28 VDC power supply required for versions with LED backlighting)
- 0.35” (8.90 mm) HIGH DIGITS
- REPLACEABLE INTERNAL LITHIUM BATTERY PROVIDES UP TO 7 YEARS OF UNINTERRUPTED OPERATION
- NEMA 4X/IP65 SEALED FRONT BEZEL
- COUNT INPUT FROM 10 to 300 VAC/DC (CUB7W)
- WIRE CONNECTION MADE VIA SCREW CLAMP TYPE TERMINALS
- FITS DIN STANDARD CUT-OUT 1.77” (45 mm) x 0.874” (22.2 mm)

**DESCRIPTION**

The CUB7 series is an 8-digit miniature counter with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective, Negative Image Transmissive with yellow/green backlighting or red backlighting. The backlight versions require an external 9 to 28 VDC power supply.

The CUB7 series use a CMOS LSI counter circuit chip, mounted on a gold-plated substrate, that is electrically connected by ultrasonic wire-bonding. Proven micro-electronic assembly and manufacturing techniques provide these units with the reliability and dependability required for industrial service.

The CUB7 series is housed in a lightweight, high impact plastic case with a clear viewing window. The sealed front panel with the silicone rubber reset button meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

**SAFETY SUMMARY**

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

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

**SPECIFICATIONS**

1. **DISPLAY**: 8-digit LCD, 0.35” (8.90 mm) high digits.
2. **POWER SOURCE**: Replaceable Internal 3.0 V lithium battery to provide up to 7 years of continuous operation. (Battery life is dependent upon usage. Count and reset contacts that remain closed for long periods of time reduce battery life.)
3. **BACKLIGHT POWER REQUIREMENTS**: 9 to 28 VDC; 35 mA. typical, 50 mA max. Above 26 VDC, derate max. operating temperature to 40°C. Must use a Class 2 or SELV rated power supply for CUB70.
4. **INPUTS**: VIL (low) = 0.5 V max
   - Low speed input: 10 to 300 VAC/DC, 50/60 Hz, 30 cps max. 150 V max for backlight versions. Unit counts on positive going edge.
   - Note: For Triac inputs, use the standard CUB70 with a TCM module.
5. **REMOTE RESET**: 15 msec min. pulse width (active low) from 3.0 V bipolar output, an open collector transistor, or a switch contact to common.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUB7W *</td>
<td>Counter Positive Image Reflective</td>
<td>CUB7W000</td>
</tr>
<tr>
<td></td>
<td>Counter w/Yel-Gm Backlighting</td>
<td>CUB7W010</td>
</tr>
<tr>
<td></td>
<td>Counter w/Red Backlighting</td>
<td>CUB7W020</td>
</tr>
<tr>
<td>BNL</td>
<td>3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

*Battery is included with unit.

**DIMENSIONS In inches (mm)**

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15” (54.8) H x 3.00” (76.2) W.
6. CERTIFICATIONS AND COMPLIANCES:

SAFETY
- IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
- IP65 Enclosure rating (Face only), IEC 529
- Type 4X Enclosure rating (Face only), UL 50

ELECTROMAGNETIC COMPATIBILITY

<table>
<thead>
<tr>
<th>Immunity to EN 50082-2</th>
<th>Electrostatic discharge</th>
<th>Electromagnetic RF fields</th>
<th>Fast transients (burst)</th>
<th>RF conducted interference</th>
<th>Power frequency magnetic fields</th>
<th>Simulation of cordless telephone</th>
<th>Emissions to EN 50851-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-2</td>
<td>EN 61000-4-2</td>
<td>EN 61000-4-3</td>
<td>EN 61000-4-4</td>
<td>EN 61000-4-6</td>
<td>EN 61000-4-8</td>
<td>ENV 50204</td>
<td>EN 55022</td>
</tr>
<tr>
<td>Level 2; 4 V contact</td>
<td>Level 3; 8 V air</td>
<td>Level 3; 10 V/m</td>
<td>Level 4; 2 V/m</td>
<td>Level 3; 10 V/m</td>
<td>Level 4; 30 A/m</td>
<td>Level 3; 10 V/m</td>
<td>EN 55022</td>
</tr>
<tr>
<td>Level 3; 4 kV contact</td>
<td>Level 3; 8 kV air</td>
<td>Level 4; 2 kV/m</td>
<td>Level 2; 1 K/v/m</td>
<td>Level 3; 2 kV power</td>
<td>Level 3; 20 A/m</td>
<td>Level 3; 20 A/m</td>
<td>EN 55022</td>
</tr>
<tr>
<td>80 MHz - 1 GHz</td>
<td>20 MHz - 300 MHz</td>
<td>150 KHz - 80 MHz</td>
<td>100 MHz - 300 MHz</td>
<td>300 MHz - 3 GHz</td>
<td>900 MHz ± 5 MHz</td>
<td>200 Hz, 50% duty cycle</td>
<td>EN 55022</td>
</tr>
</tbody>
</table>

| Notes: |
| 1. Burst to DC backlight power had a power line filter installed RLC #LFIL0000 or equivalent at the unit. |
| 2. Self-recoverable loss of performance during EMI disturbance at 10 V/rms to backlight power lines. |
| LCD segments may flicker during EMI disturbance. |
| For operation without loss of performance: Install power line filter RLC #LFIL0000 or equivalent at the unit. Refer to the EMC Installation Guidelines section of this bulletin for additional information. |

7. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: 0 to 50°C Derate max. operating temperature to 40°C above 26 VDC. (Backlight versions)
Storage Temperature Range: -30 to 80°C
Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C
Altitude: Up to 2000 meters

8. CONSTRUCTION: High impact plastic case with clear viewing window. The front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. Installation Category I, Pollution Degree 2. Panel gasket and mounting clip included.

9. WEIGHT: 2 oz. (57 grams) [with battery]

EMC INSTALLATION GUIDELINES

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

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

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

Ferrite Suppression Cores for signal and control cables:
- TDK # ZCAT3035-1330A
- Steward #28B2029-0A
- Line Filters for input power cables:
  - Schaffner # FN610-1/07 (RLC #LFIL0000)
  - Schaffner # FN670-1.8/07
- Corcom #1VR3

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

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

WIRING CONNECTIONS

The electrical connections are made via screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also, wiring should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the battery cover to identify the wire position with the proper strip. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the screw-clamp and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two #14 AWG wires.

WARNING: Lithium battery may explode if incinerated. All leads will be at the same line potential as the input leads.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.
**L. S. INPUT, 30 CPS MAX.**

The CUB7W accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 300 V at count speeds up to 30 cps. The unit counts on the positive going edge of the input signal.

**WARNING:** Any lead may be at hazardous live input potential. External wiring and devices connected to the unit must be rated the same as applied signal input voltage and be properly isolated from Class 2 or SELV circuitry.

---

**INSTALLATION ENVIRONMENT**

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

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

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

**Installation**

The CUB7 series of products meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. The viewing window and reset button are factory sealed for a washdown environment. A sponge rubber gasket and mounting clip are provided for installing the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean around panel opening.
2. Carefully remove and discard the center section of the gasket. Slide the panel gasket over the rear of the unit to the back of the bezel. Insert the mounting screws onto both sides of mounting clip. Tip of screw should NOT project from hole in mounting clip.
3. Install CUB7 unit through the panel cut-out until front bezel flange contacts the panel.
4. Slide the mounting clip over the rear of the unit until the clip is against the back of the panel. The mounting clip has latching features which engage into mating features on the CUB7 housing.

---

**BATTERY INSTALLATION**

1. Remove all power to the unit before removing battery cover.
2. To remove battery cover, push upward in the direction of the arrow on rear cover (See drawing at right), until the cover unlatches. Pull cover straight out from unit to fully remove.
3. Remove old battery* and replace with an RLC battery (BNL10000). Observe proper polarity when replacing battery as shown in drawing.
4. Replace cover. The battery cover is keyed so that it cannot be placed upside down. The arrow on the rear of the cover should point toward the top of the CUB7 series when properly installed.

---

**WARNING:** Lithium battery may explode if incinerated.
**RESET OPTIONS (CUB7 SERIES)**

Connecting a wire from the RST. EN. (Reset Enable) Input terminal to Common will enable the front panel Reset button.

Pulling the “RST.” input low causes the counter to reset. The “RST.” can be pulled low by either a mechanical switch or solid-state transistor switch. Switch load is 15 µA (max. voltage drop 0.5 V) when on. The off-state leakage current must be less than 2 µA.

Note: The RC protection circuit on the “RST.” Input causes a delay of approximately 15 msec in Reset response.

---

**BACKLIGHT OPTION (CUB7 SERIES)**

Optional backlight versions of the CUB7 series require an external 9-28 VDC power supply. The external supply is connected between V+ and Common terminals as shown by the solid line in the drawing.

**WARNING:** When connecting the signal wiring for a backlit CUB7W measuring an AC input voltage, the neutral of the single phase AC signal is connected to Terminal 1 (COM), and line (hot) is connected to Terminal 4 (LS) as shown by the dashed line in the drawing. The DC supply for the backlighting is connected between V+ and Common as shown by the solid line in the drawing. Three phase AC applications require an isolation transformer.

---

**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
DESCRIPTION
The CUB Controller Counter is a versatile compact presettable counter. Batch counting indication is a feature of the Model CUBCB. All data set-ups are stored in a non-volatile internal memory. When power is removed, count and batch totals are saved.

The CUB Controller Counter features eight different DIP switch selectable counting modes. The timed output is programmed via the front panel buttons. The unit also has a built-in self-test which checks the display driver and microprocessor hardware. The self-test can be run at any time without losing counts.

Power and Output connections are made at a terminal block at the rear of the unit. The Input connections are made via a five pin polarized connector on the bottom of the unit. This connector includes the count input, remote reset, front panel reset enable, and signal common.

The metal front bezel meets NEMA 4/IP65 specifications for wash down and/or dusty environments when properly installed.

SPECIFICATIONS
1. DISPLAY: 6-Digit LCD, 0.2" (5.1 mm.) high digits.
2. POWER REQUIREMENTS:
   A.C. Power Versions: 115 VAC ±10%, 50/60 Hz, 0.5 VA.
   230 VAC ±10%, 50/60 Hz, 0.5 VA.
   10 to 28 VAC ±10%, 50/60 Hz, 2.5 VA.
   D.C. Power Version: 10 to 28 VDC, 1 W.
3. OUTPUT RELAY:
   Type: Form-A.
   Max. Power: 50 VA
   Max. Voltage: 250 VAC/DC
4. SIGNAL INPUT:
   Connect to the white wire (CNT./TIM.) and black wire (Common) of the five position connector. The unit counts on the negative edge of the input signal.
   High Frequency Operation: DIP switch position 1 OFF. 12 KHz, 50% duty cycle.
   Low Frequency Operation: DIP switch position 1 ON. Limits count speed to 50 Hz.
   Note: These units will operate with RLC VCM modules E through H.
   Threshold Levels: VIH = 3.3 V, VIL = 1.0 V
   Current Sourcing: 30 VDC max, use external 560-1000 Ω pull-down resistor to comm to count.
   Current Sinking: Internal 5 KΩ pull-up to +5 VDC, IMAX = 1.2 mA.
5. REMOTE RESET: Blue wire must be inserted into the five position connector.
   Threshold levels: VIH = 2.5 V, VIL = 0.8 V, VMAX = 5 V. Response time = 10 msec max.
   Current Sinking: IMAX = 750 µA.
6. MEMORY: Non-volatile EPROM retains all programmed information when power is removed or interrupted.
   Max. Current: 0.75 Amps
   Operate Time: 0.5 msec. nominal
   Release Time: 0.3 msec. nominal
   Note: Relay output can switch an RLC DPDT relay P/N RLY30000 (115 VAC-10 Amp).
   Programmable Timed Output: 0.01 sec. to 99.99 sec. ±1% +10 msec. max.
   Current Sourcing: 30 VDC max, use external 560-1000 Ω pull-down resistor to comm to count.
   Current Sinking: Internal 5 KΩ pull-up to +5 VDC, IMAX = 1.2 mA.
7. DIMENSIONS: “In inches [mm]”
   Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.77" (70.4)H x 2.77" (70.4)W.
**SPECIFICATIONS (Cont’d)**

7. OPERATION TEMPERATURE
   RANGE: 0°C to 50°C.

8. STORAGE TEMPERATURE
   RANGE: -20°C to 60°C.

9. CONSTRUCTION: Metal front bezel that meets NEMA 4/IP65 requirements for wash down and dusty environments when properly installed. Case body is black high impact plastic (Panel gasket, mounting clips and screws included with unit).

10. CONNECTIONS:
    **Power & Output:** Terminal block at rear of unit.
        **Input:** Five position polarized connector that plugs in at bottom side of unit.

11. WEIGHT: 9.2 oz. (261 g)

---

**DIP SWITCH SET-UP**

The DIP switches are under the cover at the rear of the unit. DIP Switch position one selects high or low frequency signal input operation.

**SW1 OFF** - High Frequency operation, allows a count input signal up to 12 KHz.

**SW1 ON** - Low Frequency operation, limits the count input signal to 50 Hz. When using switch contact closures or VCM’s to generate count input signals, the unit should be placed into low frequency operation.

DIP switch positions two, three, and four select one of the eight possible operating modes, as described in the next section.

---

**MODES OF OPERATION**

There are eight available modes of operation which are determined by the settings of the DIP switches. During automatic reset counts are missed if the count rate is not exceeded.

A manual reset can be performed from the front panel “R” button if enabled or by the remote reset wire. When the “R” button is pressed or the remote reset is connected to common, the internal reset line goes low. At release of the reset, the reset line goes high.

- **MODE 0  LATCH OUTPUT AT PRESET, MANUAL RESET TO ZERO**
  - The unit counts up from zero to the preset value. When the preset value is reached, the output relay closes and counts continue to accumulate. When a manual reset is performed, the output relay opens and the count goes to zero. At release of the reset, the cycle starts again.

- **MODE 1  ONE SHOT, MANUAL RESET TO ZERO**
  - The unit counts up from zero to the preset value. When the preset value is reached, the output relay opens and the count continues to accumulate.
  - Note: When using this mode, a manual reset must be performed to close the relay output. The relay output closes at the release of the reset.
  - When a manual reset is performed, the output remains opened and the count does not accumulate. At release of the reset, the relay output closes, the count goes to zero, and the cycle starts again.
  - If power is removed before the count reaches the preset value, the relay output does not close when power is restored, a manual reset must be performed.

- **MODE 2  TIMED OUTPUT AT PRESET, MANUAL RESET TO ZERO**
  - The unit counts up from zero to the preset value. When the preset value is reached, the output relay closes for the amount of time programmed and the count continues to accumulate. A manual reset causes the count to go to zero and at release of the reset, the cycle starts again.

- **MODE 3  TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AT PRESET**
  - The unit counts up from zero to the preset value. When the preset value is reached, the output relay closes for the amount of time programmed. The counter will automatically reset to zero at the beginning of the timed output and continue to accumulate counts.

- **MODE 4  LATCH OUTPUT AT ZERO, MANUAL RESET TO PRESET**
  - The unit counts down from the preset value to zero. When zero is reached, the output relay closes, the counter rolls over to 999999 and continues to decrement. When a manual reset is performed, the output deactivates and the count goes to the preset value. At release of the reset, the cycle starts again.

- **MODE 5  ONE SHOT, MANUAL RESET TO PRESET**
  - The unit counts down from the preset value to zero. When zero is reached, the output relay opens, the counter rolls over to 999999 and continues to decrement.
  - Note: When using this mode, a manual reset must be performed to close the relay output. The relay output closes at the release of the reset.
  - When a manual reset is performed, the output remains opened and the count does not accumulate. At release of the reset, the output relay closes, the count goes to the preset value, and the cycle starts again.
  - If power is removed before the count reaches zero, the relay output does not close when power is restored, a manual reset must be performed.

- **MODE 6  TIMED OUTPUT AT ZERO, MANUAL RESET TO PRESET**
  - The unit counts down from the preset value to zero. When zero is reached, the output relay closes for the amount of time programmed, the counter rolls over to 999999 and continues to decrement. A manual reset causes the count to go to zero and at release of the reset, the cycle starts again.

- **MODE 7  TIMED OUTPUT AT ZERO, AUTOMATIC RESET TO PRESET AT ZERO**
  - The unit counts down from the preset value to zero. When zero is reached, the output relay closes for the amount of time programmed. The counter will automatically reset to the preset value at the beginning of the timed output and continue to decrement counts.

---

**CONSTRUCTION:**

**WEIGHT:** 9.2 oz. (261 g)

**RANGE:**

- **20° to 60°C**
- **0° to 50°C**

**TERMINAL BLOCK**

- **5 position** polarized connector that plugs in at bottom side of unit.

**OUNTING CLIPS AND SCREWS INCLUDED**

**IMPACT PLASTIC (Panel gasket, Installation Requirements for Wash Down and Dusty Environments when Properly Installed), Case Body is Black High Impact Plastic**

**CONNECTIONS:**

- **Terminal Block**
- **Mounting Clips and Screws Included**
- **Impact Plastic (Panel Gasket)**
- **Installation Requirements for Wash Down and Dusty Environments when Properly Installed**
- **Case Body is Black High Impact Plastic**

---

**OPERATION**

- **High Frequency operation, allows a count input signal up to 12 KHz.**
- **Low Frequency operation, limits the count input signal to 50 Hz.**

---

**DISPLAY**

- **STORAGE TEMPERATURE**
  - **RANGE:**
    - **20° to 60°C**
    - **0° to 50°C**

---

**BLOCK DIAGRAM**

- **POWER SUPPLY**
- **+5V**
- **N.O. RELAY**
- **10K**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
- **+5V**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
- **+5V**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
- **+5V**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
- **+5V**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
- **+5V**
- **10K**
- **1K**
- **SW1**
- **RESET**
- **NONVOLATILE MEMORY**
- **COUNT**
- **PROCESS CIRCUITRY**
**POWER & OUTPUT CONNECTIONS**

The Power and Output electrical connections are made via screw-clamp terminals located on the back of the unit. When wiring the unit, refer to the stamping below the terminal block to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to one #14 AWG wire.

**AC POWER WIRING VERSION**

The AC power is connected to the two left terminals as viewed from the rear of the unit. There are three A.C. version types available.

**INSTALLATION**

Before installing the CUB Controller into the panel, the user should first become familiar with the operation of the unit. Also, it may be desirable to program the unit and set the appropriate DIP switches for the application.

When programming is complete, all parameters will be saved in nonvolatile memory. The CUB Controller should be installed in a location that does not exceed the maximum operating temperature.

The CUB Controller is designed with a high degree of electrical noise immunity. However, installing the unit away from noise sources such as relays, solenoids, motors, etc. should be considered.

To reduce the chance of noise spikes entering the AC line and affecting the unit, the AC power should be relatively “clean” and within the specified 10% variation limit. Connecting power from heavily loaded circuits or circuits that also power loads that cycle on and off, (contactors, relays, motors, etc.) should be avoided.

**DC POWER WIRING VERSION**

The DC power is connected to the two left terminals as viewed from the rear of the unit. The DC plus (+) power is connected to the left-most terminal and the DC common directly to the right of the plus terminal. The DC power source must be capable of supplying the unit’s rated power of 1 watt. DC power common is internally connected to the input connection common.

**OUTPUT WIRING**

The normally open (N.O.) output relay is connected to the two right-most terminals as viewed from the rear of the unit. Care must be taken to ensure that the maximum rating specifications are not exceeded, as this will shorten the life of, or permanently damage the internal relay.

If more power handling capability or varied contact arrangement is required, use an accessory relay.

DPDT RELAY P/N - RLY30000 (115 VAC-10 Amp)

Socket P/N SKT10000 is required for each relay purchased, see Ordering Information.
FRONT PANEL DESCRIPTION
The front panel has a clear viewing window to view the six digit LCD display. The front panel meets NEMA 4/IP65 requirements when properly installed. The unit has three front panel buttons for control and data entering. Each button’s function is described below.

BUTTON FUNCTIONS
R - The Reset button is active when the reset enable wire (yellow) is connected to common (black wire). In any operating mode, a manual reset action will occur when the “R” button is pressed. For the counter/batch version a manual reset only affects the display that is viewed.

The Reset button is used with the “E” button to initiate the self-test. Also, it is used with the “P” button to enter the programming mode for the timed output value.

P - The Preset button is used to view the preset value in the normal operating mode. After release of the button, the preset value will be displayed for about 5 seconds. When used with the “E” button, it allows entry into programming of the preset value. Once in the preset programming mode, the “P” button is used to advance to the next digit to be modified. Also, it is used with the “R” button to enter the programming mode for the timed output value.

E - The Enter button is used in the programming modes to increment the value of the selected digit. The Enter button is used with “R” button to initiate the self-test. Also, it is used with the “P” button to enter the programming mode for the preset value.

CUB Controller Batch version units use the Enter button to toggle between the count and batch display.

PROGRAM PRESET VALUE
The factory default Preset Value is 500, to enter a different value, the operator must enter the Preset Value Programming Mode by performing the following steps.

Note: In the programming mode, the unit can continue to accumulate counts and activate the output.

1. Press and hold the “P” button then press the “R” button. The current preset value will be displayed with the Least Significant Digit (LSD) flashing. Release both buttons.

Note: The front panel reset button must be enabled.

2. Press the “E” button to increment the value of the flashing digit. Pressing and holding the “E” button will continuously increment the digit. After nine is reached, the digit goes to zero and starts over.

3. Press the “P” button to advance to the next digit which will flash. Set the value of this digit by using the “E” button. Repeat this procedure until all digits have been set to the desired value.

After setting the most significant digit, press the “P” button to enter the new value. The unit automatically returns to the normal operating mode. The new preset value is displayed and takes effect immediately.

In the Preset Value programming mode, if the “P” or “E” button is not pressed within 15 seconds, the unit will return to the normal operating mode with the previous value retained.

PROGRAM TIMED OUTPUT VALUE
The factory default Timed Output Value is 0.10 sec, but can be programmed from 0.01 to 99.99 seconds. To enter a different value, the operator must enter the Timed Output Value Programming Mode by performing the following steps.

Note: In the programming mode, the unit can continue to accumulate counts and activate the output.

1. Press and hold the “P” button then press the “R” button. The current time value will be displayed with the Least Significant Digit (LSD) flashing. Release both buttons.

Note: The front panel reset button must be enabled.

2. Press the “E” button to increment the value of the flashing digit. Pressing and holding the “E” button will continuously increment the digit. After nine is reached, the digit goes to zero and starts over.

3. Press the “P” button to advance to the next digit which will flash. Set the value of this digit by using the “E” button. Repeat this procedure until all four digits have been set to the desired value.

After setting the most significant digit the unit automatically returns to the normal operating mode with the preset value displayed. The new timed output value takes effect immediately, unless the timed output has been activated.

In the Timed Output Value programming mode, if the “P” or “E” button is not pressed within 15 seconds, the unit will return to the normal operating mode with the previous value retained.

BATCH COUNTING OPERATION
The CUB Controller Batch version (CUBCB) has the same features as the counter version with the additional capability of displaying a batch count. Pressing the Enter button toggles between the count and batch display.

The batch count display will increment one count every time the counter display reaches the preset value. Unlike the count display, the batch display has leading zeros.

The batch display and count display are independent of each other as far as a manual reset is concerned. The batch count is reset to zero when a manual reset is performed, only while the batch value is displayed.

Note: The count value and relay output are not affected.

The count value will perform an automatic reset even when the batch count is displayed. To perform a manual reset, the count value must be displayed.

Note: The batch value is not affected.
SELF TEST

The self-test feature can be activated without affecting the count. This test will verify that the LCD digits operate, the DIP switch settings and relay operation can also be checked.

To enter the self-test, perform the following (Front panel reset must be enabled).

1. Press and hold the E button, then press the R button.
2. Release both buttons.

The display will cycle all the digits on the display each for about half a second and in the sequence shown below. To rapidly advance through the display routine, continually press and release the “P” or the “E” button.

DIGITS CYCLED ON THE DISPLAY

| 000000 |
| 111111 |
| 222222 |
| 333333 |
| 444444 |
| 555555 |
| 666666 |
| 777777 |
| 888888 |
| 999999 |

BLANK DISPLAY

| 101010 |
| 121212 |
| 323232 |
| 343434 |
| 545454 |
| 565656 |
| 767676 |
| 787878 |
| 989898 |

The next portion of the self-test corresponds to the position of the DIP switches. The four DIP switch positions are indicated on the display.

The most significant digit (MSD) corresponds to position one and the least significant digit to position four of the DIP switches. The MSD will always be a “1” regardless of the switch setting. The other three digits will be a “1” if the switch is on or a “0” if the switch is off. Switches can be toggled at this stage of the test and the display will indicate the change.

If an input signal is applied during the test, be aware that as the DIP switch positions change, the count mode operation matches the switch settings immediately.

During the DIP switch test, the Output Relay Test can be performed. Press and hold the E button to cause the Normally Open relay to close. Releasing and pressing the E button can be performed as many times as desired. If the relay was already closed pressing the E button will not change the state, until the button is released. If testing of the relay is not desired, press the “P” button to exit self-test.

Note: If the relay test is not performed, the state of the relay will remain the same as it was prior to self-test. If the relay is tested, the relay output will be open after exiting self-test, regardless of the mode selection. A manual reset should be performed if necessary.

Caution: The operator should know that the relay test will close the contacts. Therefore be aware of any hazardous or undesirable conditions in the operating system.

The unit will automatically return to the normal operating mode if a DIP switch or the enter button is not used within 15 seconds.

TYPICAL APPLICATIONS

CONTROLLING LENGTH OF MATERIAL

A CUB Controller is used to control the length of a fine wire that is wound onto a large spool. When the desired amount of wire is wound onto the spool, the Controller stops the system.

The Controller is set-up for Mode 0 operation (Latch output at preset, manual reset to zero). A Model LSC sensor, with an open collector output and a 10 pulse per foot wheel, is used to generate signals for the Controller. The output of the sensor is directly connected to the input of the Controller.

With a signal of 10 pulses per foot of wire and 10,000 feet of wire to be wound on each spool, the preset is set for 100,000. The Controller is set for high frequency operation, due to the 20 feet per second speed at which the system operates.

When the preset value is reached, the output relay closes, and stops the system. The operator then cuts the wire, changes the spool, resets the Controller, and restarts the process. This system is set up with remote reset capabilities which will allow the operator to reset the Controller from the wire cutting station. The Front Panel reset is disabled which prevents resetting of the count from the front panel.
TYPICAL APPLICATIONS (Cont’d)

SORTING PARTS FOR QUALITY CONTROL

The CUB Controller is installed to divert one part out of every one thousand parts for quality control/inspection purposes. The Batch display of the Controller keeps a running total of the number of inspected parts.

A proximity sensor counts the parts as they pass by on the conveyor. When one thousand is reached, one count is added to the batch total and the relay of the CUB Controller closes which closes the accessory relay. This activates the gate-solenoid, diverting the part to the inspection line. The CUB Controller’s timed output is set for 0.8 seconds which allows enough time for the part to pass onto the quality control line. The gate then returns to its normal position when the timed output ends.

A proximity sensor, with a switch contact closure, is used to sense the parts as they pass the sensing point. To eliminate the possibility of extra counts due to switch contact “bouncing”, the CUB Controller is set for low frequency operation. The unit operates in Mode 3 (Timed output at preset, automatic reset to zero at preset). This mode allows the unit to count to the preset value, at which time the output relay closes, and stays closed for 0.8 seconds. The CUB Controller resets itself at the beginning of the relay closure and is then ready to accept new counts.

The CUB Controller relay energizes the accessory relay (P/N RLY30000) to switch the large current required to energize the gate-solenoid.

As shown in the drawing, the yellow input wire is connected to ground which enables the front panel reset button.

To view the number of inspected parts produced in a given shift, the operator can press the “E” button to toggle to the batch display.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUBC</td>
<td>Cub Controller</td>
<td>CUBC0010 10 to 28 VAC CUBC0020 10 to 28 VDC CUBC0030 CUBC0000</td>
</tr>
<tr>
<td>CUBCB</td>
<td>Cub Controller Batch</td>
<td>CUBCB0010 10 to 28 VAC CUBCB0020 10 to 28 VDC CUBCB0030 CUBCB0000</td>
</tr>
<tr>
<td>RLY</td>
<td>DPDT Plug-in Relay</td>
<td>RLY30000</td>
</tr>
<tr>
<td>SKT</td>
<td>Octal Base Socket</td>
<td>SKT10000</td>
</tr>
<tr>
<td>SNUB</td>
<td>R-C Snubber Inductive Load Suppressor</td>
<td>SNUB0000</td>
</tr>
</tbody>
</table>

For Information on Pricing, Enclosures, & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or subcontractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-577) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

Red Lion Controls
20 Willow Springs Circle
York PA 17402
Tel +1 (717) 767-6511
Fax +1 (717) 764-0839

Red Lion Controls France
56 Boulevard du Courcerin, Batiment 21,
Zi Pariest F-77183 Croissy Beaubourg
Tel +33 (64) 80 12 12
Fax +33 (64) 80 12 13

Red Lion UK Ltd
Tapton Park
Chesterfield S41 OTZ
Tel +44 (1246) 22 21 22
Fax +44 (1246) 22 12 22
The GEMINI 3300 is an extremely versatile unit that offers the user flexibility in batch counting applications. The unit features three integrated counters in one package; a Process Counter, a Batch Counter, and a Totalizing Counter. The Process Counter is used to monitor the progress of the count within the Batch. The Process Counter has 2 Presets associated with it, Preset 1 & Preset 2. Preset 1 is typically used as a “slow-down” output in cut-to-length applications. When the Process Counter reaches Preset 2 or zero (in Reset To Preset modes), the Process Counter will increment or decrement the Batch Counter and activate Output 2, and Relay 2 (optional). When the Batch Count equals the Batch Preset or Zero, the Batch output, Output B (Solid-state only), will activate. The Process and Batch count can be independently programmed to auto-cycle back to zero (or Preset) or be programmed for manual Reset To Zero (or Preset) operation. The Totalizing Counter increments for every Process Count received. It can be used as a running total per shift, day, etc.

The GEMINI 3300 offers a choice of programmable Input Response Modes to cover bi-directional, anti-coincidence, and quadrature applications. The input circuitry is switch selectable to accept signals from a wide variety of sources including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.

There are two ways to reset the count values of the GEMINI 3300. One method is with the Reset pushbutton or rear terminal which will reset the counters as selected in the programming of the Reset Button and Terminal Actuation Modes. The second method is available to provide means to reset each count individually. This method requires pressing two pushbuttons. First press and hold the “E” button, then press the “P” button for Process Count, or the “P” button for Batch Count. A “Counter Load” feature is provided which allows changing any of the three count values utilizing the front panel pushbuttons.

The GEMINI 3300 Current Loop Communications option provides the capability of two-way serial communications between the GEMINI 3300 and a variety of equipment, such as a printer, remote terminal, programmable controller, or host computer. The baud rate can be set to 300, 600, 1200, or 2400 baud. The format for transmitted and received data is 1 start bit, 7 data bits, 1 parity bit (odd), and a stop bit. When utilizing an external power supply (30 VDC max), up to sixteen units can be installed in the loop, each with an individual address. When utilizing the Gemini’s 20 mA current source, up to seven units can be installed in a loop. The Count Values, Presets, and Scale Factor can be interrogated or changed by sending the proper command codes and numerical data (if required) to the unit. Other functions, such as resetting the various counters, can also be performed. Various “Print Options” can be selected to automatically interrogate the Count Values, Presets, and Scale Factor by activating the “Print Request” terminal or by sending a “Transmit Per Print Option” (P) command.

The construction of the GEMINI 3300 features a metal die-cast bezel offering maximum durability with a high quality appearance. The sealed front panel bezel meets NEMA 4/IP65 specifications for wash-down and/or dust when properly installed. Electrical connections are made via plug-in terminal strips. Clamp-type pressure plate terminals accept stripped #14 AWG wire without lugs.

**SPECIFICATIONS**

1. **DISPLAY**: 6-digit 0.56" (14.2 mm) High LED display.
2. **POWER REQUIREMENTS**
   - **AC Power**: Switch selectable 115/230 VAC (±10%), 50/60 Hz, 20 VA
   - **DC Power**: 11 to 14 VDC @ 0.7 amp max.
3. **SENSOR POWER**: +12 VDC (±25%) @ 100 mA.
4. **MEMORY**: Non-volatile E2PROM memory retains all programming information, count values, and Counter Load Values when power is removed or interrupted.
5. **POWER CYCLES (ON/OFF)**: 100,000 min.
6. **DATA RETENTION**: 10 yrs min.
7. **INPUTS A AND B**: Switch selectable to accept count pulses from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.

**DIMENSIONS** In inches (mm)

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>2.70 (68.6)</td>
</tr>
<tr>
<td>Button</td>
<td>1.01 (25.8)</td>
</tr>
<tr>
<td>Panel Cut-Out</td>
<td>2.50 (63.5)</td>
</tr>
</tbody>
</table>

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 6.8” (173 mm) W.
Current Sourcing: Unit provides pull-down resistor for sensors with current sourcing output. (Max. input voltage = 28 VDC @ 7 mA).

Current Sinking: Unit provides pull-up load for sensors with current sinking output. (Max. sensor current = 1.6 mA).

Debounce: Damping capacitor provided for switch contact debounce. Limits count speed to 100 Hz max. with 50% duty cycle.

Lo Bias: Input trigger levels $V_{IL} = 1.5$ V, $V_{IH} = 3.75$ V.

Hi Bias: Input trigger levels $V_{IL} = 5.5$ V, $V_{IH} = 7.5$ V.

Note: Bias levels given are $\pm 10\% @ 12$ VDC. They vary proportionally with sensor supply voltage at “DC OUT” terminal.

6. MAGNETIC PICKUP INPUT:

- Sensitivity: 150 mV/peak (typical @ 12 VDC)
- Hysteresis: 100 mV
- Input Impedance: 26.5 KΩ @ 60 Hz
- Maximum Input Voltage: ±50 V peak

7. MAXIMUM COUNT RATES:

<table>
<thead>
<tr>
<th>MODE</th>
<th>X1</th>
<th>X2</th>
<th>X4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni- or Bi-Directional</td>
<td>10 KHz</td>
<td>6.5 KHz</td>
<td></td>
</tr>
<tr>
<td>Anti-Coincidence</td>
<td>9 KHz</td>
<td>5 KHz</td>
<td></td>
</tr>
<tr>
<td>Quadrature</td>
<td>4.25 KHz</td>
<td>4.25 KHz</td>
<td>3 KHz</td>
</tr>
</tbody>
</table>

8. CONTROL INPUTS:

- Reset: Active low ($V_{IL} = 1.5$ V max.) internally pulled up to +12 VDC ($I_{SNK} = 3$ mA), activation and deactivation response time = 10 msec.
- Program Disable: Active low ($V_{IL} = 1.5$ V max.) internally pulled up to +5 VDC ($I_{SNK} = 1$ mA).
- Print Request: - (GEM331XX only) Active low ($V_{IL} = 1.5$ V max.) internally pulled up to +5 VDC ($I_{SNK} = 1$ mA).

9. SERIAL COMMUNICATIONS (Optional):

- Type: Bi-directional 20 mA current loop, 20 mA source provided. (Powers up to seven units in a loop with internal current source.)
- Baud Rate: Programmable 300 to 2400.
- Maximum Address: 16 units (0 to 15). (Actual number in a single loop is limited by serial hardware specifications.)
- Data Format: - 1 bit frame, Odd parity (one start bit, 7 data bits, one odd parity bit, and one stop bit).
- Serial Hardware Specifications:
  - SO: Output Transistor Rating: $V_{MAX} = 30$ VDC, $V_{SAT} = 1$ VMAX @ 20 mA. (Can address 16 units in a loop)
  - SI: Input Diode Rating: $V_{P} = 1.25$ VTP, 1.5 VMAX
  - Note: The compliance voltage rating of the source must be greater than the sum of the voltage drops around the loop.

10. OUTPUT(S):

- Solid-State: Current sinking NPN Open Collector Transistors. $I_{SNK} = 100$ mA max. @ $V_{CE} = 1V$, $V_{OH} = 30$ VDC max. (Internal Zener diode protection).
- Relays: Mounted on a field-replaceable PC board. Form C contacts rated at 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load).
- Relay Life Expectancy: 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)
- Programmable Timed Outputs: The timed outputs can be set from 0.01 to 599.99 seconds, ±0.05% + 10 msec.

11. CONSTRUCTION:

- Metal die-cast bezel, plastic case. This unit is rated for NEMA 4/IP65 indoor use. Installation Category II, Pollution Degree 2

12. 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 4 Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY:
- Immunity to EN 50082-2
  - Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact ¹
  - Level 3; 8 Kv air
  - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
  - 80 MHz - 1 GHz
  - Fast transients (burst) EN 61000-4-4 Level 2; 4 Kv I/O
  - Level 3; 2 Kv power ²
  - RF conducted interference EN 61000-4-6 Level 3; 10 V/m
  - 150 KHz - 80 MHz
  - Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m

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

Notes:
1. Metal bezel of unit connected with ground lead from rear bezel screw to metal mounting panel.
2. When the unit is DC powered, a power line filter (RLC# LFIL0000 or equivalent) was installed, so as not to impair the function of the unit. Refer to the EMC Compliance Installation section of the manual for additional information.

13. ENVIRONMENTAL CONDITIONS:
- Operating Temperature: 0 to 50°C
- Storage Temperature: -40 to 70°C
- Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0 to 50°C
- Altitude: Up to 2000 meters

WEIGHT: 2.1 lbs. (0.9 kg)

PROGRAMMABLE FUNCTIONS

PRESET(S) Range 0 to 999999

SCALE FACTOR
- 5-digit input scaling, 0.0001 to 5.9999 (Process and total counters).

SCALE MULTIPLIER
- Multiplies the contents of the 9-digit internal Process and Total Counters by a factor of 1, 0.1, 0.01, or 0.001 to view the desired number of significant digits on the display.

INPUTS A & B RESPONSE MODES
- Count (A) with Inhibit (B)
- Count (A) with UP/DN Control (B)
- 2-Input Anti-coincidence Counting Quadrature

FREQUENCY DOUBLING
- Registers counts on both edges of input signal.

RESET ACTION (Automatic and Manual)

- Reset-to-0: Output activates when counter equals the Preset value, counter returns to zero when reset.
- Reset-to-Preset: Output activates when counter equals zero, counter returns to Preset value when reset.

RESET BUTTON AND TERMINAL ACTUATION MODES
- Selects which counters will be reset when Reset button or terminal is activated.

2-BUTTON RESET
- Allows individual counters to be reset independently, regardless of the Manual Reset mode selected.

COUNTER LOAD VALUE
- Allows counter values to be changed via the front panel.

DECIMAL POINT AND LEADING ZERO BLANKING
- Decimal point programmable to desired location. Leading zero blanking, when selected, begins with second digit to the left of the decimal point.

PROCESS OUTPUT 1 & 2 TERMINATION MODES
- Terminate At “Other” Output Start
- Terminate At “Other” Output End
- Terminate At Manual Reset
- Terminate At Manual Reset End
- Terminate After Timed Output

BATCH OUTPUT TERMINATION MODES
- Terminate At Manual Reset
- Terminate At Manual End
- Terminate After Timed Output B

TIMED OUTPUTS
- Programmable from 0.01 to 599.99 seconds. Accurate to ±(0.05% + 10 msec).

FRONT PANEL LOCKOUT MODES
- When the “Program Disable” control input is activated, the ability to change front panel programmed functions will be prevented as per the following modes:
  - Complete Front Panel Disable
  - Presets Enabled Only
  - Scale Factor Enabled Only
  - Both Presets and Scale Factor Enabled
  - Presets, Counter Load Values And 2-Button Reset Enabled
  - Note: In all the modes above, the Reset (“R”) button and terminal can be enabled or disabled. The reset (“R”) button may be disabled independently by the setting of a DIP switch.

SELF-TEST
- Performs a complete check on the display and output circuitry along with a functional check on the microprocessor circuitry. Self-test is non-destructive and may be performed during a process without losing counts.
PROGRAMMING

The GEMINI 3300 input circuit set-up is programmed using DIP switches on the rear of the unit. All other functions are programmed through the front panel pushbuttons.

To program or interrogate a function, the user first enters a two-digit function code. The unit will then display that function code along with a single digit representing the present mode of operation. Programming changes are made by changing the single-digit mode identifier.

EXAMPLE: The function code representing the “Inputs A and B Response Modes” is 43. The mode identifiers for this function are:

1) Count (A) with Inhibit (B)
2) Count (A) with Up/Down Control (B)
3) 2-Input Anti-Coincidence Add (A)/Subtract (B)
4) 2-Input Anti-Coincidence Summing
5) Quadrature
6) Quadrature X 4

To interrogate the counting modes, press 43:
Unit displays the function code along with mode identifier 1 (Count with inhibit).

To change the counting mode to “Count with UP/DN control”, press 2:

To enter and save the new mode, Press “E”:
Unit enters new mode and returns display to the present count value.

The GEMINI 3300 can display any of the three count values: The Process (P) Count, the Batch (B) Count, or the Total (T) Count.

Three indicator LEDs along the left side of the window indicate which count is currently being displayed.

To display a different count value:
Press the “DISP” pushbutton repeatedly until the indicator corresponding to the desired count turns on.

The most commonly used functions, Presets and Scale Factor, have dedicated pushbuttons associated with them. When the Process Count is on the display, pressing “P”(1) or “P”(2) will display Preset 1 or 2. When the Batch Count is on the display, pressing “P”(1) will display the Batch Preset. Pressing the “SF” key when viewing any count value, will display the Scale Factor. To change any digit of that value, the user presses the pushbutton directly below that particular digit, which is then scrolled until the desired value is obtained. Each digit is changed, if necessary, in the same manner until the complete Preset or Scale Factor value is registered on the display. Pressing the “E” pushbutton completes the entry sequence.

To interrogate the Batch Preset value, Press “DISP” if necessary, until the Batch Count value is on the display (B annunciator is lit);

Press “P”(1):
Unit displays the current Batch Preset value.

To change the Batch Preset value:
Any digit may be changed by pressing the pushbutton directly below it. Release the pushbutton when the digit reaches the desired value.

Press “E” to enter new Batch Preset value:
The GEMINI 3300 will then return to displaying the count value.
LENGTH PROCESSING UTILIZING SCALE FACTOR

Many times in web type processes it is necessary to scale the input to reflect the desired engineering units. In this application, a plastic bag webbing process is being measured with a 10 pulse LSC sensor (length sensor and one foot circumference wheel). The output of the LSC is the input to the GEMINI 3300. The requirements are for a readout and control in 10ths of yards. Thus for every additional yard, the display must increment by 10 counts. A decimal point in the 10ths position will be programmed to provide the desired display of 1.0 for each yard the process advances. In order to scale the existing input of 30 pulses per yard to the desired display reading of 10 (without decimal point), the scale multiplier is programmed as 0.1 and the scale factor is programmed to 3.3333. After this has been accomplished, the process control Output 2 is programmed to energize every 40.5 yards to cut the web in proper lengths. Ten yards before cut, process control Output 1 is to activate to provide a slow-down output. The Batch counter, which advances 1 count for each cut, can be set to stop the entire process at a desired production run limit. In this system, the production records require total yards produced every 24 hours regardless of the particular run in progress. The totalizing counter of the GEMINI 3300 solves the requirement. The unit can be programmed so that the Reset Button resets only the Process and Batch Counters and not the Total Count. This would prevent reset of the Total Count when setting up for each new production run. The daily tally of the total can be accomplished by a manual reading. To reset the total count, a count value of zero can be loaded into the Total Counter (using “Counter Load Value”), or a reset command can be issued if using the serial communication capability of the GEMINI 3300.

TYPICAL BATCH COUNTER APPLICATIONS (Cont’d)

A typical batching application, shown above, requires two separate control functions. The first counts the production items in process (candy bars) and then provides a relay control output to the sealing mechanism (when 24 candy bars are to be sealed in a distribution box and placed on a stack). The Batch Counter of the GEMINI 3300 advances each time a distribution box is sealed. Another packaging mechanism is required to activate when 10 distribution boxes are stacked, ready to be shrink-wrapped with clear plastic. Both the Process and Batch Counters are programmed to reset and Run at the two preset numbers. For the shrink-wrap mechanism system to operate properly, it must not activate until the Process relay deactivates after the 24th bar of the 10th box. To achieve this, the power is fed to the Process Relay 2 common and the normally closed contact is connected to the common of the Batch Relay. When the process Output 2 fires, it disconnects power to the Batch relay which fires simultaneously with the Process Relay at the end of a batch. The batch timed output must be equal to the amount of time required for the shrink-wrap process plus the time required for the Process Output 2. The Process Output 2 energizes for 0.50 seconds and the required shrink-wrap process time is 4 seconds, so the batch timed output required is 4.50 seconds. The times are easily programmed via the front panel. The GEMINI 3300 allows the operator to maintain a watch on the Process, Batch, or Total Counts by simply pressing the “DISP” button to sequence the display to the desired count.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>W/20 mA CURRENT LOOP</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEM33</td>
<td>Gemini 3300</td>
<td></td>
<td>GEM33060</td>
</tr>
<tr>
<td>_</td>
<td>Gemini 2000/3300 Relay Board</td>
<td>No</td>
<td>RLYBD002</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures, & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.
# Gemini 3300 Batch Counter Programming Chart

**Feature & Mode Selection**

## Detailed Mode Menus

### Load Factory Settings

- (1) Loads unit with factory settings

### Inputs A & B Response Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>A = CNT., B = INH.</td>
</tr>
<tr>
<td>(2)</td>
<td>A = CNT., B = UP/DN</td>
</tr>
<tr>
<td>(3)</td>
<td>A = CNT. UP, B = CNT. DN.</td>
</tr>
<tr>
<td>(4)</td>
<td>A = CNT. UP, B = CNT. UP</td>
</tr>
<tr>
<td>(5)</td>
<td>Quadrature X1</td>
</tr>
<tr>
<td>(6)</td>
<td>Quadrature X4</td>
</tr>
</tbody>
</table>

### Input Pulse Edges Registering Counts*

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>NEG. GOING EDGES ONLY</td>
</tr>
<tr>
<td>(2)</td>
<td>BOTH + &amp; - EDGES</td>
</tr>
<tr>
<td></td>
<td>(1 count/pulse)</td>
</tr>
<tr>
<td></td>
<td>(2 counts/pulse)</td>
</tr>
</tbody>
</table>

*Not accessible with Quadrature X4 Counter Input Response Mode.

### Scale Multiplier

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>x1</td>
</tr>
<tr>
<td>(2)</td>
<td>x0.1</td>
</tr>
<tr>
<td>(3)</td>
<td>x0.01</td>
</tr>
<tr>
<td>(4)</td>
<td>x0.001</td>
</tr>
</tbody>
</table>

### Decimal Point & Leading Zero Blanking

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>0</td>
</tr>
<tr>
<td>(2)</td>
<td>0.0</td>
</tr>
<tr>
<td>(3)</td>
<td>0.00</td>
</tr>
<tr>
<td>(4)</td>
<td>0.000</td>
</tr>
<tr>
<td>(5)</td>
<td>0.0000</td>
</tr>
<tr>
<td>(6)</td>
<td>0.00000</td>
</tr>
</tbody>
</table>

### Process Output 1 Termination Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>AT OUTPUT 1 START</th>
<th>AT OUTPUT 1 END</th>
<th>AT RESSET START</th>
<th>AT RESSET END</th>
<th>AFTER TIMED OUTPUT 1</th>
<th>OUTPUT 1 NORMALLY OFF</th>
<th>OUTPUT 1 NORMALLY ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(2)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(3)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(4)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(5)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(5)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### Timed Process Output 1 Value

Timed Output Value range: 0.01 to 599.99 sec

### Process Output 2 Termination Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>AT OUTPUT 1 START</th>
<th>AT OUTPUT 1 END</th>
<th>AT RESSET START</th>
<th>AT RESSET END</th>
<th>AFTER TIMED OUTPUT 2</th>
<th>OUTPUT 2 NORMALLY OFF</th>
<th>OUTPUT 2 NORMALLY ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(2)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(3)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(4)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(5)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(5)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### Timed Process Output 2 Value

Timed Output Value range: 0.01 to 599.99 sec

### Reset Button & Terminal Actuation Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Reset Process</th>
<th>Reset Batch</th>
<th>Reset Total</th>
<th>Maintained Reset</th>
<th>Momentary Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(1)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(2)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(2)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(3)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(3)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(4)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>(4)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
### PROCESS COUNTER RESET MODES

<table>
<thead>
<tr>
<th>MODE</th>
<th>RESET TO ZERO</th>
<th>RESET TO P.PRSST 2</th>
<th>AUTO RST AFTER TIMED OUT.2</th>
<th>AUTO RST AT TIMED OUT.2</th>
<th>PRESET TRACKING DISABLED</th>
<th>PRESET TRACKING ENABLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-1)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-2)</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-3)</td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-4)</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>(-5)</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>(6)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(-6)</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

### BATCH COUNTER RESET MODES

<table>
<thead>
<tr>
<th>MODE</th>
<th>RESET TO ZERO</th>
<th>RESET TO PRESET B.</th>
<th>AUTO RST AFTER TIMED OUT. B.</th>
<th>AUTO RST AT TIMED OUT. B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6)</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### BATCH OUTPUT TERMINATION MODES

<table>
<thead>
<tr>
<th>MODE</th>
<th>AT RESET START</th>
<th>AT RESET END</th>
<th>AFTER TIMED OUTPUT B</th>
<th>OB-SNK NORMALLY &quot;OFF&quot;</th>
<th>OB-SNK NORMALLY &quot;ON&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(-3)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(4)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(-4)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(5)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(-5)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(6)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>(-6)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

### TIMED BATCH OUTPUT VALUE

Timed Output Value range; 0.01 to 599.99 sec

### "OPERATOR ACCESSIBLE FUNCTIONS" MODES

(With "PGM. DIS." terminal to "COMM")

<table>
<thead>
<tr>
<th>MODE</th>
<th>PRESET VALUES</th>
<th>SCALE FACTOR</th>
<th>COUNTER LOAD VALUES</th>
<th>2-BUTTON RESET</th>
<th>RESET BITTON &amp; TERMINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-1)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-2)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-3)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-4)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>(-5)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>(6)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>(-6)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>
GEMINI 3300 PROGRAMMING

SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 3300

1. Be systematic about programming! Plan out the exact features & functions you need for your application. Write out the code entries you need from start to finish, and then enter the codes completely. Don’t start in the middle of the program codes & make arbitrary entries to “see what it will do.” This is a sure way to create confusing results. Finally, after you are done, record your program & file it where you can find it later if you want to make changes. You can use this card to write in your codes in the program ladder on the reverse side, together with any fixed data entries, for convenient future reference.

2. Watch out for conflicting modes! The programs in the GEMINI 3300 have been written to prevent illegal code entry.

However, to provide optimum flexibility, some reliance must be placed on the programmer to avoid conflicting codes.

3. The GEMINI 3300 can be interrogated at any time to see what modes & data entries have been made. Such interrogation can be made during a counting cycle or a sample time run without interrupting the normal counting process. In the lockout mode, all functions can also be interrogated, but those functions locked out cannot be changed. Making changes in program modes or data during a run is not recommended since mid-cycle changes can result in unanticipated outputs for that particular cycle.

PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION ★
(Appplies To Programming Chart)

To enter a programmable function or mode, enter the function selector code desired and then select the particular mode identifier required.

For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit).

It will then display the entered code on the L.H. side.

[46 ] (DISPLAY READOUT)

Next, enter the mode identifier (button #3) that defines the decimal point location & LZB condition. This code is displayed on the right.

[46 3 ] (DISPLAY READOUT)

Now, enter this new selection by pressing the “E” button.

PROGRAMMING PROCEDURE FOR DATA ENTRY

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings. (i.e. Buttons “S”, “Z”, “P”, or “SP”). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by depressing the button directly below the digits to be changed.

After the new data value is obtained, the “E” button is depressed to enter the new value.

[53, 55, 65 ] TIMED OUTPUT VALUES ★

Entering Code “53, 55, or 65” will call up the Timed Output 1, 2, or B Value in seconds & hundredths. The value can be set to the new value by incrementing each digit with the button underneath that digit.

Press the “E” button to enter the new Timed Output value. (Max. Timed Output value = 599.99 sec.)

[S.F. ] SCALE FACTOR

One stroke of the “S.F.” (3) button calls up the current Scale Factor. (The Scale Factor is the multiplier used to convert the actual count to the direct readout display). The value can be changed by incrementing each digit with the button below it. Pressing the “E” key enters the new S.F. The S.F. can be set at any value from 0.0001 to 5.9999.

[P(1), P(2) ] PRESETS

With the Process Count on the display, pressing the “P(1)” or “P(2)” button calls up the preset 1 or 2 value. With the Batch count on the display, pressing the “P(1)” value calls up the Batch preset value. They can then be changed by incrementing each digit with the button below it. Press the “E” button to enter the new Preset.

★ Program before connecting “PGM. DIS.” to “COMMON”.

SELF TEST ROUTINE 6, +/-

Depressing “6” & then “+/-” starts the self test routine by lighting all decimal points, then all 9’s, all 8’s, all 7’s etc., until alternate 8’s & 9’s are displayed. At this time, the output can be manually activated for testing by pressing the “P(1)” or “P(2)” button (Process only).

(The Output test is disabled when “PGM. DIS.” terminal is pulled to “COMMON”). An automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 3300.)
**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The PAX Lite Counter, Model PAXLC, is a versatile totalizing counter that can be adapted to a wide variety of counting, measuring, and positioning readout applications.

The unit features a programmable scale factor, front panel and remote reset, store, inhibit, and a count rate of 25 KHz, while offering an economical solution to any totalizing need.

The PAXLC accepts digital inputs from a variety of sources including switch contacts, NPN-OC and TTL outputs, as well as most standard Red Lion sensors. The input can be scaled to display any desired unit of measure by simply using the programmable scale factor. The meter can accept bi-directional and unidirectional signals.

The meter is programmed through the front panel buttons and the use of DIP switches. The Down Arrow Key will also function as a front panel display reset. Once the front panel programming is complete, the buttons can be disabled by a DIP switch setting.

The meter has been specifically designed for harsh industrial environments. With a NEMA 4X/IP65 sealed bezel and extensive testing to meet CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

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

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

CAUTION: Risk of electric shock.

DIMENSIONS  In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.
TABLE OF CONTENTS

Ordering Information . . . . . . . . . . . . . . . . . . . 2
General Meter Specifications . . . . . . . . . . . . . . 3
Installing the Meter . . . . . . . . . . . . . . . . . . . . . 3
Setting the Switches . . . . . . . . . . . . . . . . . . . . 4
Wiring the Meter . . . . . . . . . . . . . . . . . . . . . . 4
Reviewing the Front Buttons and Display . . . . . 6
Scaling the Meter . . . . . . . . . . . . . . . . . . . . . . 6
Programming the Meter . . . . . . . . . . . . . . . . . 7

ORDERING INFORMATION

Meter Part Numbers

| PAXL | 0 | 0 |

C6 - 6 Digit Counter
C8 - 8 Digit Counter
1. DISPLAY: 6-digit, 0.56” (14.2 mm) or 8-digit, 0.4” (10.1 mm)
   7-segment LED
Display Range: 6-digit, -999999 to 999999 or 8-digit, -9999999 to 99999999
   Display Overflow indicated by flashing dot to the right of digit 1
   Decimal points are programmed by front panel keys
2. POWER:
   AC Power: 115/230 VAC, switch selectable. Allowable power line variation
   ±10%, 50/60 Hz, 6 VA.
   Isolation: 2300 Vrms for 1 min. to input and DC Out/In.
   DC Power: 10 to 16 VDC @ 0.1 A max.
3. SENSORS POWER: 9 to 17.5 VDC @ 100 mA max.
4. KEYPAD: 3 programming keys, the ▼ (Down Arrow) key can also function
   as the front panel reset button
5. COUNT INPUT: (DIP switch selectable)
   - Accepts pulses from a variety of sources including switch contacts, NPN-
     OC and TTL Outputs, as well as most standard Red Lion sensors
   Logic State: Active Low
   - Input trigger levels VIL = 1.5 V max.; VIH = 3.75 V min.
   Current Sinking: Internal 7.8 KΩ pull-up-to +12 VDC, I max = 1.9 mA
   Current Source: Internal 3.9 KΩ pull-down, 8 mA max. @ 30 VDC max.
   Filter: Damping capacitor provided for switch contact bounce. Limits input
   frequency to 50 Hz and input pulse widths to 10 msec. minimum.
6. MAXIMUM COUNT RATE: 25 KHz max.
7. CONTROL INPUT:
   Count Up/Down Control, Remote Reset, Inhibit, and Store
   Max. Continuous Input: 30 VDC
   Isolation To Sensor Input Commons: Not isolated
   Logic State: Active Low. 22 KΩ pull-up-to +12 V
   Active: V IN < 0.9 VDC
   Inactive: V IN > 3.6 VDC
   Response Time:
   Up/Down and Inhibit: 25 μsec max.
   Reset and Store: 10 msec max.
8. MEMORY:
   Nonvolatile EPROM retains all programmable parameters and count values.
9. ENVIRONMENTAL CONDITIONS
   Operating Temperature Range: 0 to 60°C
   Storage Temperature Range: -40 to 60°C
   Operating and Storage Humidity: 0 to 85% max. relative humidity
   non-condensing
   Altitude: Up to 2000 meters
10. CERTIFICATIONS AND COMPLIANCE:
   SAFETY
   UL Recognized Component, File # E179259, UL61010A-1, CSA C22.2
   No. 1010-1
   Recognized to U.S. and Canadian requirements under the Component
   Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File # EI37808, UL508, CSA C22.2 No. 14-M95
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IEC6 CB Scheme Test Certificate # UL/8843/UL
   CB Scheme Test Report # 04ME1209-20041018
   Issued by Underwriters Laboratories, Inc.
   IEC 61010-1, IEC 61010-1: Safety requirements for electrical
   equipment for measurement, control, and laboratory use, Part 1.
   IP65 Enclosure rating (Face only), IEC 529
   IP20 Enclosure rating (Rear of unit), IEC 529
   EMISSIONS AND IMMUNITY:
   Emissions and Immunity to EN 61326: Electrical Equipment for
   Measurement, Control and Laboratory use.
   Immunity to Industrial Locations:
   Electrostatic discharge EN 61000-4-2 Criterion A
   4 kV contact discharge 8 kV air discharge
   Electromagnetic RF fields EN 61000-4-3 Criterion A
   10 V/m
   Fast transients (burst) EN 61000-4-4 Criterion A
   ±10%, 50/60 Hz, 6 V A.
   ±10%, 50/60 Hz, 6 V A.
   Surge EN 61000-4-5 Criterion A
   1 kV L&N-E power
   2 kV power
   2 kV signal
   RF conducted interference EN 61000-4-6 Criterion A
   1 kV signal
   1 V/m
   3 V/m
   Power frequency magnetic fields EN 61000-4-8 Criterion A
   30 A/m
   Voltage dip/interruptions EN 61000-4-11 Criterion A
   0.5 cycle
   EMISSIONS:
   Emissions EN 55011 Class B
   Notes:
   2. EM filter placed on the DC power supply, when DC powered: Corcom
   #1VB3 or Schaffner #FN610-1/07 (RLC #LFIL0000).
   11. CONNECTIONS:
   High compression cage-clamp terminal block
   Wire Strip Length: 0.3” (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 4.5 inch-lbs (0.51 N-m) max.
   12. CONSTRUCTION:
   This unit is rated for NEMA 4X/IP65 outdoor use.
   IP20 Touch safe. Install Category II, Pollution Degree 2. One piece
   bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and
   mounting clip included.
   13. WEIGHT:
   12 oz. (340 g)

1.0 INSTALLING THE METER

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

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

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

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

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

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

Power Selection Switch

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

Setup DIP Switches

A DIP switch is at the rear of the meter. It is used to set up the input, enable/disable programming and front panel reset functions. For the correct input setup, refer to 3.3 Wiring the Meter.

Switch 1

- **SNK**: Adds internal 7.8 KΩ pull-up resistor to +12 VDC; IMAX = 1.9 mA

Switch 2

- **SRC**: Adds internal 3.9 KΩ pull-down resistor, 8 mA max. @ 30 VDC max.

Switch 3

- **HI Frequency**: Removes damping capacitor and allows max. frequency.
- **LO Frequency**: Limits input frequency to 50 Hz and input pulse widths to 10 msec.

Note: The remote reset terminal is not disabled by this switch.

Switch 4

- **LOGIC**: Input trigger levels VIL = 1.5 V max; VIH = 3.75 V max.
- **MAG**: Not used for count applications.

Switch 5

- **Enable Programming**: Enables programming through the front panel buttons.
- **Disables Programming**: Disables the front panel buttons from any programming changes.

Switch 6

- **Enable Reset**: Enables the front panel reset (down arrow key).
- **Disable Reset**: Disables the front panel reset key.

3.0 WIRING THE METER

WIRING OVERVIEW

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

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3” (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

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

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables: Ferrite Suppression Cores: Fair-Rite # 0443167251 (RLC# FCOR0000) TDK # ZCAT3035-1300A Steward # 28B2029-0A0 Line Filters for input power cables: Schaffner # FN610-1/07 (RLC# LFIL0000) Schaffner # FN670-1.5/07 Corcom # 1 VR3 Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC# SNUB0000.
### 3.1 POWER WIRING

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

**DC Power**
- Terminal 3: +VDC
- Terminal 4: COMM

---

### 3.2 CONTROL INPUT WIRING

The PAXLC provides a number of control inputs, including Store, Reset, Inhibit and Up/Down control. These inputs are active low (connected to common), so the external switching device should be connected between the control input and common terminals.

**Up/Down** - This input determines the direction of the count. Unconnected, the meter will count up. When input is pulled low, the meter will count down.

**Reset** - When this input is pulled low, the meter will reset to zero. If the input remains low or connected to common, the meter will be held in the reset mode, and not able to count.

**Inhibit** - When low, this input will prevent the meter from counting. If the input remains low or connected to common, the meter will not be able to count.

**Store** - A low will stop the display from updating. It will freeze the display as long as the input is held low. Once released the display will update to the current count display.

---

### 3.3 INPUT WIRING

**Current Sourcing Output**

**Current Sinking Output**

**Switch or Isolated Transistor; Current Source**

**Switch or Isolated Transistor; Current Sink**

**Emitter Follower; Current Source**

*Switch position is application dependent.*
4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

5.0 SCALING THE METER

In many industrial applications, a meter is required to totalize the output of an operation or event. The pulses from a sensor are received by the PAXLC, and then totalized on the display. In many cases the incoming pulses do not represent the desired display readout. For those applications, a scale factor can be entered into the meter, scaling the pulses to obtain the desired readout. The following formula will help provide the scaling values to achieve the desired readout.

\[
SF = \frac{DR}{EPU}
\]

**WHERE:**
- **SF** = Scale Factor
- **DR** = Desired Readout* (Single unit of measure, i.e. foot, gallon, etc.)
- **EPU** = Existing Pulses per Unit (Number of pulses per single unit of measure, i.e. foot, gallons, etc.)

*For applications requiring a decimal point, select and program the appropriate decimal point. When calculating the Scale Factor, use the whole value of the number to be displayed, for example, 1.0 feet, the Desired Readout in this case is 10. Do not use decimal points in the Scaling Formula.

**Example 1:**
This application involves counting cases from a production line. The sensor provides a pulse for every can produced. The desired readout is in cases, therefore the incoming pulses need to be converted to obtain the proper readout. The following is used to calculate scale factor.

\[
SF = \frac{DR}{EPU}
\]

**Where:**
- **SF** = Scale Factor
- **DR** = 1 case
- **EPU** = 12 cans/case

**Calculation:**
- \[SF = \frac{1}{12}\]  
  \[SF = 0.83333\]

Since the Calculated Scale Factor Value is less than 9.99999, it can be entered directly into the meter. The Scale Multiplier can be left at 1.

**Front Panel Reset**

<table>
<thead>
<tr>
<th>KEY</th>
<th>DISPLAY MODE OPERATION</th>
<th>PROGRAMMING MODE OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>Access Programming Mode</td>
<td>Store selected parameter and index to next parameter</td>
</tr>
<tr>
<td>▲</td>
<td>No Function</td>
<td>Increment selected digit of parameter value</td>
</tr>
<tr>
<td>▼</td>
<td>Front Panel Reset</td>
<td>Select digit position in parameter value</td>
</tr>
</tbody>
</table>

**Front Panel:** 8.8.8.8.8

**Par**
The Totalizer has four programmable parameters which are entered in the sequence shown above, using the front panel push buttons. Before programming, refer to the section on Scaling the Meter to determine the Decimal Position, Scale Factor and Scale Multiplier to use for the specific application.

Note: Programming mode can be locked out with the Program Disable DIP switch. With the switch in the Disabled (up) position the meter will not enter programming mode. Refer to the section on DIP switch setup.

**PROGRAMMING MODE ENTRY**
Press the PAR key to enter Programming Mode. The meter briefly displays $%&$ followed by the first programming parameter described below.

**PROGRAMMING PARAMETERS**
In programming mode, the display alternates between the parameter and the current selection or value for that parameter. The dual display with arrows is used below to illustrate the alternating display. The selection choices or value range for each parameter is shown to the right of the alternating display.

### DECIMAL POSITION
Decimal Position
- `$%&$` (up arrow)
- `$%&$` (down arrow)

This parameter selects the decimal point position on the display.
Press the arrow keys (▲ or ▼) to sequence through the selection list until the desired selection is shown. Press the PAR key to save the displayed selection and advance to the next parameter.

### SCALE FACTOR
Scale Factor
- `100000`
- `0.00000` to `999999`

The number of input counts is multiplied by the Scale Factor and the Scale Multiplier to obtain the desired process value. A Scale Multiplier of 1 will result in only the Scale Factor affecting the display. (See details on scaling calculations.)
Press the arrow keys (▲ or ▼) to sequence through the selection list until the desired selection is displayed. Press the PAR key to save the selection and exit programming mode.

### SCALE MULTIPLIER
The number of input counts is multiplied by the Scale Multiplier and the Scale Factor to obtain the desired process value. A Scale Multiplier of 1 will result in only the Scale Factor affecting the display. (See details on scaling calculations.)
Press the arrow keys (▲ or ▼) to sequence through the selection list until the desired selection is displayed. Press the PAR key to save the selection and exit programming mode.

### COUNTER RESET AT POWER-UP
The totalizer may be programmed to reset at each meter power-up.

**PROGRAMMING MODE EXIT**
The meter exits Programming Mode when the PAR key is pressed to save the Scale Multiplier selection. The meter briefly displays `End` upon exiting Programming Mode. All programmed selections are now transferred to the non-volatile memory and the meter returns to the Counter display.

(If power loss occurs during programming mode, verify parameter changes and reprogram, if necessary, when power is restored.)

**PROGRAMMING MODE TIME OUT**
The Programming Mode has an automatic time out feature. If no keypad activity is detected for approximately 60 seconds, the meter automatically exits Programming Mode. The meter briefly displays `End` and returns to the Counter display. When automatic timeout occurs, any changes that were made to the parameter currently being programmed, will not be saved.

**FACTORY SETTINGS**
The factory settings for the programming parameters are shown above in the alternating display illustrations. The factory settings can be easily restored by removing power from the meter, and then pressing and holding the PAR key while power is reapplied. The meter displays `End` until the PAR key is released. The normal power-up sequence then resumes, with the factory settings loaded and saved in non-volatile memory. The Count is reset to 0.

Note: The Program Disable DIP switch must be in the Enabled (down) position to allow loading factory settings. See section on DIP switch setup.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
DESCRIPTION

The LNXN presettable counter is an economical and reliable solution to dual preset level requirements. This unit features current sinking input configurations, a high/low count frequency DIP switch, programmable timed outputs, prescale capability with disable switch, non-volatile memory, and many other features which will satisfy most dual preset applications.

The LNXN Counter has two main counting actions, Reset to Zero (RTZ) and Reset to Preset (RTP). There are sixteen modes of operation for the LNXN dual preset unit.

All parameters are programmed through the front panel buttons. The LNXN counter has an internal non-volatile memory device which eliminates the need for battery back-up. When power is removed, this device will maintain all data set-ups necessary for system operation. A Program Disable terminal is provided, which can be used to prevent accidental changes or tampering by unauthorized personnel to the presets, prescale or timed output values. The front panel reset button can also be enabled or disabled by a rear panel DIP switch. This counter also has an on-line self-test, which can be run at any time without missing counts or missing a preset value.

Power, input, and output connections are made via a fixed terminal block at the rear of the unit. DIP switches at the rear of the unit are used to set up the input configuration and to set the desired mode of operation.

The LNXN has a sealed high impact plastic bezel and meets NEMA 4X/IP65 specifications for wash-down and/or dust, when properly installed.

SAFETY SUMMARY

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

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

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

DIMENSIONS “In inches [mm]”

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.7” (68.6)H x 4.0” (101.6)W.
### SPECIFICATIONS

1. **DISPLAY:** 6-digit, 0.3" (7.6 mm) high LCD display.

2. **POWER REQUIREMENTS:**
   - 25 mA @ 5 VDC (±5%) or 25 mA @ 10 to 30 VDC.
   - Must use a Class 2 or SELV rated power supply.

3. **COUNT INPUT:** Accepts count pulses from a variety of sources, including switch contacts and outputs from CMOS or TTL circuits.
   - Current Sinking: Switch contacts and outputs from CMOS or TTL circuits. Must use a Class 2 or SELV rated power supply.
   - 25 mA @ 10 to 30 VDC.
   - 25 mA @ 5 VDC (±5%) or 25 mA @ 10 to 30 VDC.

4. **PRESCALE VALUE RANGE:** 0.00001 to 9.99999.

5. **MAXIMUM COUNT RATES:**
   - High Frequency: The following chart lists the count rates for all the possible prescale values. (maximum square wave input for all electronic sensors, under all modes of operation.)
   - Low Frequency: 50 Hz max. for switch contact closures. Note: These units will operate with VCM (E through H) modules.

6. **CONTROL INPUTS:**
   - Active low (VIL = 0.5 V max.) internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA).
   - debounce: Switch selectable damping capacitor provided for switch contact debounce. Limits count speed to 50 Hz max. with 50% duty cycle.
   - Input trigger levels: VIL = 2.3 V, VIH = 3.1 V.

7. **MEMORY RETENTION:**
   - 10 years min. for the switch settings of a specific mode.

8. **MEMORY RETENTION:**
   - 10 years min.

9. **INPUT, POWER, AND OUTPUT CONNECTIONS:**
   - Fixed terminal block.

10. **CERTIFICATIONS AND COMPLIANCES:**
    - **EMC EMISSIONS:**
      - CISPR 11 Radiated and conducted emissions
    - **EMC IMMUNITY:**
      - Meets EN 50082-2: Industrial Environment.
      - ENV 50140 - Radio-frequency conducted electromagnetic field
      - EN 61000-4-2 - Electrical fast transient/burst (ESD) + 10% + 10 μsec
      - EN 61000-4-2 - Electromagnetic Susceptibility (ESM) + 10% + 10 μsec
      - CISPR 11 Radiated and conducted emissions

11. **ENVIRONMENTAL CONDITIONS:**
    - Operating Temperature: 0 to 50°C
    - Storage Temperature: -40 to 70°C
    - Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C
    - Altitude: Up to 2000 meters

12. **CONSTRUCTION:**
    - Black plastic front bezel with black plastic insert.
    - Front panel meets NEMA 4X/IP65 requirements for indoor use when properly installed. (Panel gasket, mounting clip, nut fasteners, and screws included with unit.) Installation Category I, Pollution Degree 2.

13. **WEIGHT:** 0.2 lbs (91 g).

### INPUT CONFIGURATION, FRONT PANEL RESET, & DIP SWITCH SET-UP

The DIP switches are located at the rear of the unit. DIP switch 1 is used to select high or low frequency. DIP switch 2 is used to enable or disable the front panel reset button. DIP switch 7 is used to enable or disable prescale changes. DIP switches 3 to 6 are used to select the mode of operation. Refer to the block diagram of the unit for the details of count and control circuitry.

### SWITCH SET-UP

- **S1 - HI FRQ:** Removes damping capacitor and allows operation up to the maximum frequency (See max count rates in specifications).
- **LO FRQ:** Connects damping capacitor for switch contact debounce.
- **S2 - DIS.RST:** Enables front panel reset.
- **EN, RST:** Enables front panel reset.
- **S3 to S6:** These are the mode select DIP switches. See Modes of Operation for the switch settings of a specific mode.
- **S7 - PRESCALE EN./DIS.:** When S7 is in the DOWN position, prescale information can be changed. When S7 is in the UP position, prescale information cannot be changed.
The DIP switches for the various operating modes are located at the rear of the unit. For Reset to Zero modes, the UP/DN terminal is normally not connected to common (count up). For Reset to Preset modes, the UP/DN terminal is normally connected to common (count down). The unit will maintain normal operating functions if the direction is reversed.

MODES OF OPERATION, DIP SWITCH SET-UP

Notes:
1. During automatic reset, no counts will be missed if the count rate does not exceed the maximum count rate specified. A manual reset, either from the front panel reset (if enabled) or remote reset overrides any condition or state of the counter and begins the cycle again.
2. In modes four, five, twelve, and thirteen the output may appear to be latched if the time delay is longer than the time required to count from the reset condition to the preset point.

MODES OF OPERATION FOR DUAL PRESET LNXN COUNTER

MODE 0  LATCH OUTPUTS AT PRESET, MANUAL RESET TO ZERO
The unit counts from zero, when preset 1 is reached, output 1 turns on and counts continue to accumulate. When preset 2 is reached, output 2 turns on and counts continue to accumulate. When a manual reset is performed, the count resets to zero and the outputs turn off.

† - When down count is desired. (such as reset to preset modes of operation) the “UP/DN” terminal must be tied to the “COMM.” terminal.
* - Prescale EN/DIS. Switch. Switch S7 must be in the DOWN (Enable) position for information to be changed.
EMC INSTALLATION GUIDELINES

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Installing them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables:
     - Fair-Rite # 0443167251 (RLC #FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC #LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom #1VB3

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

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

6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubbers:
   - RLC #SNUB0000

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to one 14-gauge, two 18-gauge or four 20-gauge wire(s).

INPUT CONNECTIONS

Input connections are made on the terminal block at the rear of the unit, refer to numbers on the label to identify the position number with the proper function.

- **Terminal 2** - “COMM.” (common) Is the common line to which the sensor and other input commons are connected.
- **Terminal 3** - “CNT.IN” (count input) When the signal is pulled low, a count will be registered. (See Count Input and Count Rates under the Specifications Section.)
- **Terminal 6** - “UP/DN” (count direction control) When this terminal is not connected to common, the count direction is “UP”. When connected to common, the count direction is “DOWN”.
- **Terminal 7** - “PGM.DIS.” (program disable) When this terminal is not connected to common, the following values can be programmed using the front panel buttons:
  - Preset Values
  - Prescale Value (if S7 is DOWN)
  - Decimal Point Position
  - Timed Output Values

Outputs can also be tested during self-test under this condition (See Self-Test description for further details). When connected to common, changing these values and testing the outputs is no longer possible.

- **Terminal 8** - “RMT.RST.” (remote reset) When connected to common, a manual reset is performed. The outputs turn off (if activated) and the count display is reset. As long as this terminal is low, the unit is held at reset.

CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS

<table>
<thead>
<tr>
<th>INTERFACING WITH CMOS OR TTL</th>
<th>CURRENT SINK CONNECTED (Count on closing)</th>
<th>SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.) (Count on turn on)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Interfacing Diagram]</td>
<td>![Current Sink Diagram]</td>
<td>![Sensors Diagram]</td>
</tr>
</tbody>
</table>

NOTES:

1. **HI/LO FRQ. SELECTION**
   The “HI/LO FRQ.” Selection switch must be set on “LO FRQ.” when switch contacts are used to generate count input signals. The “LO FRQ.” mode also provides very high immunity against electrical noise pickup. It is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The “LO FRQ.” mode can be used with any type of sensor output, provided count pulse widths never decrease below 10 msecs, and the count rate does not exceed 50 Hz.

2. **VIL and VIH levels given are nominal values ±5%.

3. When shielded cable is used, the shield should be connected to “COMM.” at the counter and left unconnected at sensor end.
POWER & OUTPUT CONNECTIONS

Power and output connections are made to the terminal block, located at the rear of the unit.

The Primary DC power is connected to terminals 1 and 2. DC plus (+) power is connected to terminal 1 and the minus (-) is connected to terminal 2.

Terminals 4 & 5 are used to connect to the solid-state outputs. Terminal 2 is used as common for the solid state outputs.

When switching an inductive load with solid state outputs, it is recommended that an EMI device such as a snubber (RLC #SNUB0000) be installed at the load.

Note: Snubber leakage current can cause some electro-mechanical devices to be held on.

POWER-UP DIAGNOSTICS

Upon applying power, the LNXN counter performs an internal self-diagnostic test of all the stored data. If the data test results do not agree, a “P” appears on the right side of the display. Normal operation of the unit will continue while the “P” is displayed. Press the “E” button to remove the “P” and check all data set-up values to be certain they are correct.

DISPLAY SCROLLING

To set the display to scroll, press and hold the “E” button and then press the left-most button on the front panel. To stop the scrolling, repeat the above step.

DISPLAY SCROLLING SEQUENCE

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
</table>
| P1  | Value of P1 | Value of P2 | Count Value | Press the “E” button to enter the value into the unit’s memory.

FIRST: Press “P1” or “P2”. This displays the respective preset value, which remains displayed for approximately 10 seconds after release of the button. At this time, the preset display mode can be exited, without change, by pressing the “E” button.

SECOND: Once the preset value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired preset value is obtained.

THIRD: Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new preset value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

PROGRAM TIMED OUTPUT VALUE

The factory default Timed Output Value is 0.10 seconds, but can be programmed from 0.01 to 99.99 seconds. To enter a different value, the operator must enter the Timed Output Value Programming Mode by performing the following steps.

Note: During the displaying, changing, and entering of a new timed output value, all functions of the unit are operational (i.e. counting, resetting, outputs activating, etc.)

FIRST: Set S2 Reset EN./DIS. switch to the UP position (Enable).

SECOND: Press and hold the “P1”. or “P2” button and then press the “R” button. The respective timed output value is displayed and remains displayed for approximately 10 seconds after release of the button. At this time, the timed output display mode can be exited, without change, by pressing the “E” button.

THIRD: Once the timed output value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired timed output value is obtained.

FOURTH: Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new timed output value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

PROGRAM PRESCALE VALUE

The factory default Prescale Value is 1.0000, but can be programmed from 0.00001 to 9,999,999. To enter a different value, the operator must enter the Prescale Value Programming Mode by performing the following steps.

Note: During the displaying, changing, and entering of a new prescale value, all functions of the unit are operational (i.e. counting, resetting, outputs activating, etc.)

FIRST: Set S7 Prescale “EN./DIS.” switch to the DOWN “P” position (Enable).

SECOND: Press the “PS” button. This displays the prescale value which remains displayed for approximately 10 seconds after release of the button. At this time, the prescale mode can be exited without change by pressing the “E” button.

THIRD: Once the prescale value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired prescale value is obtained.

FOURTH: Press the “E” (Enter) button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new prescale value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

FIFTH: Return S7 to the UP “P” position (Disable) if desired.

PROGRAM DECIMAL POINT

The LNXN has the capability of displaying a decimal point in one of five positions. The decimal point selection can be done at any time without missing counts or preset outputs. The factory default for the Decimal Point Position is none. To program a decimal point, the operator must enter the Decimal Point Selection Mode by performing the following steps.

Note: During the displaying, changing, and entering of a new decimal point value, all functions of the unit are operational (i.e. counting, resetting, outputs activating)

FIRST: Press and release the left-most button on the front panel. This places the LNXN in the decimal point select mode.
SECOND: Press the digit button which corresponds to the desired decimal point position. A decimal point will appear to the right of the digit selected. If the right-most digit button (P1) is selected, the decimal point is turned off.

THIRD: At the time the decimal point is selected, the unit automatically returns to normal operation. No further action is required by the operator.

* - To enter any new data into the LNXN, the “PGM.DIS.” terminal must not be connected to common.

SELF-TEST

The self-test feature can be activated without affecting the count, missing a preset point, affecting the timed output durations, or interfering with control functions. This test verifies that all digits operate. Also, the DIP switch settings and the outputs can be tested.

If the outputs are not tested, the state of the outputs remain the same as they were prior to self-test. If the outputs are tested in self-test, the outputs will be off after exiting self-test.

Rapid advance of the self-test routine can be done by pressing and releasing any of the front panel buttons except for the “R” button. (Pressing “R” at any time, except when entering the timed output mode, resets the unit.)

To enter self-test, press the two left-hand digit buttons (on the front panel) simultaneously. At this time, the display will cycle all the digits on the display each for about half a second and in the sequence shown below.

<table>
<thead>
<tr>
<th>Digits Cycled on the Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000</td>
</tr>
<tr>
<td>111111</td>
</tr>
<tr>
<td>222222</td>
</tr>
<tr>
<td>333333</td>
</tr>
<tr>
<td>444444</td>
</tr>
<tr>
<td>555555</td>
</tr>
<tr>
<td>666666</td>
</tr>
<tr>
<td>777777</td>
</tr>
<tr>
<td>888888</td>
</tr>
<tr>
<td>999999</td>
</tr>
<tr>
<td>Blank Display</td>
</tr>
</tbody>
</table>

The next portion of self-test displays a group of four ones and zeros. The two left-most digits always appear as zeros. The third digit represents the prescale enable/disable DIP switch setting. With prescale enabled, the digit shows a zero, and with it disabled the digit shows a one. The fourth digit represents program disable (PGM.DIS). A zero represents a high at this terminal and a one represents a low. A second set of digits are the settings of the mode select switches (DIP switches 3 to 6). This pattern directly corresponds to the number representing the mode of operation. If the switches are changed while at this point in the self-test, the settings can be seen to change. These changes do not affect counter operation immediately, but any changes will take effect when self-test is exited. When the switch is “DOWN”, the digit shows a one. When the switch is “UP”, the digit shows a zero.

During the time the mode switch settings are displayed, the outputs can be tested. To activate the outputs, press “P1” for output 1 or “P2” for output 2. If no testing of the outputs is required, press the “E” button until the unit exits self-test (the unit returns to normal display mode). Also, if no activity occurs on the switches or the front panel button within 18 seconds after the unit pauses at the mode switch display, the unit automatically exits self-test.

Note: The “PGM.DIS.” terminal must not be connected to common for the outputs to be activated.

Caution: The operator should use care when testing the outputs, so as not to cause any undesirable or hazardous conditions in the system.

INITIAL POWER-UP & FACTORY SETTINGS

When the unit is shipped from the factory, the values and the following modes are set as shown.

- Preset 1 = 500
- Preset 2 = 1,000
- Prescale Value = 1.000000
- Count Value = 0
- Timed Output Values = 0.10 second

DIP Switch Settings

All switches are moved to the “DOWN” position except for the reset enable switch, which is moved “UP”. With the switches in these positions, the unit is operating in mode zero (latch-on at preset, manual reset to zero). The input is set for high frequency operation and the prescale can be changed.

PRESCALE ENABLE/DISABLE SWITCH

When this switch (#7) is in the enable position (DOWN), the prescale value can be changed (See Program Prescale Value). When this switch is in the disable position (UP), the prescale value cannot be changed.

The prescale value cannot be changed if Program Disable is activated even though the “PS. EN./DIS.” switch is in the Enable position.

CALCULATING THE PRESCALER

The LNXN is factory set to provide 1 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. In these applications it will be necessary for the LNXN to scale or multiply the input pulses by a prescaler to achieve the proper display units (feet, meters, gallons, widgets, etc.).

The “Prescale”, denoted as “K”, is simply the total amount of scaling required. It is obtained by dividing the “Display Units” by the “Number of Pulses” as shown in the Formula below.

\[ K = \text{Display Units} / \text{Number of Pulses} \]

WHERE:

- Display Units - The number of units (revolutions, feet, 10ths of feet, meters, etc.) that would be acquired after the “Number of Pulses” has occurred.
- Number of Pulses - The number of pulses required to achieve the number of “Display Units”. 

Initial Power-Up & Factory Settings

When the unit is shipped from the factory, the values and the following modes are set as shown.
**Installation Environment**

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

The bezel should be cleaned only with a soft cloth and neutral soap product.

Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

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

---

**APPLICATION FOR DUAL PRESET LNXN COUNTER**

A pharmaceutical company must run tests of different compounds before the government grants a license to manufacture the product. Many locations will be involved in the testing. Therefore, a portable dispenser is needed to distribute the mixture to the test sites.

This application requires the control of 2 motors which dispense a solute and solvent into a vat for testing of different substances. The ratio of solute to solvent will vary from vat to vat. Also the unit must be portable. A LNXN2 counter is used to satisfy the above requirements. In this application, the LNXN is set to operate in mode 8, Reset to Preset, with both outputs terminating at Manual Reset. Front Panel Reset is disabled. Preset 2 is set for 20, the total amount of solvent needed. Preset 1 controls the amount of solute. This number can range anywhere between 1 and 19 for this application. The solid state outputs are connected to the motor controller which then controls motors 1 and 2.

The system operation is as follows: The Start button is pressed which resets the LNXN and starts both motors running. The LNXN starts counting down from preset 2. When preset 1 is reached, output 1 turns on and stops motor 1 from dispensing solute. When the counter reaches 0, output 2 turns on and stops motor 2 from dispensing any more solvent.

The following is a list of the DIP switch settings and terminal connections to meet the process requirements.

**DIP Switches**

- S1 LO FRQ: Up
- S2 DIS.RST: Down
- S3: Up
- S4: Down (Switches 3 to 6 set the mode of operation)
- S5: Down to Mode 8 (Latch output at Preset 1 and 2)
- S6: Down
- S7 PS DIS: Up

**Terminal Connections**

- Terminal 1 (5VDC): Positive side of battery
- Terminal 2 (Comm): Negative side of battery
- Terminal 3 (CNT.IN): To Encoder
- Terminal 4 (01): Motor Control
- Terminal 5 (02): Motor Control
- Terminal 6 (UP/DN): To Terminal 2 (Comm.)
- Terminal 7 (PGM.DIS): No Connection
- Terminal 8 (RMT.RST): To Start/Reset switch

**Front Panel Programming**

- Preset 1: 3
- Preset 2: 20
- Prescale: 1.0000
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 VDC</td>
</tr>
<tr>
<td>LNXXN2</td>
<td>NPN Input/Output Dual Preset Counter</td>
<td>LNXXN2040</td>
</tr>
</tbody>
</table>

For information on Pricing, Enclosures, and Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

TROUBLESHOOTING

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

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter. No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
**MODELS APLT - 10 KHZ, APOLLO TOTALIZING COUNTER AND PBLT - 4/6 DIGIT MODULE FOR USE WITH THE LARGE DIGIT DISPLAY (LDD)**

- **DESCRIPTION**
  The Apollo Totalizer, Model APLT and module (Model PBLT), are versatile totalizing counters that can be adapted to a wide variety of counting, measuring, and positioning readout applications. The APLT/PBLT features non-volatile memory, various control inputs, wide variety of sensor acceptance, and high count rate (10 KHz), which makes it an economical solution to any totalizing need. The units use the RLC standard programmable count input circuit. This input circuit accepts count pulses from all RLC sensors and from most other available sensors. It also accepts switch contact, voltage or current level signals as well as outputs from TTL and CMOS circuits.

  The selection of control inputs provides an additional degree of application flexibility. These control inputs allow the APLT/PBLT to be used in a variety of specialized measuring applications that go well beyond routine counting. The APLT/PBLT totalizer can be used as a stand-alone counter or as a system component with other RLC counters and/or accessory items to provide complex counting, timing, and control functions not available in any single instrument.

  These units have an internal non-volatile memory device which eliminates the need for battery back-up. When AC power is removed, this device will maintain all data necessary for system operation. The front panel reset button can also be enabled or disabled by a side panel DIP switch. This unit also has a self-test feature which is activated during power-up (self-test DIP switch must be enabled).

  Power and input connections are made via a removable terminal strip located at the rear of the unit. This strip can accept one #14 AWG wire. DIP switches at the side of the unit are used to program the input configuration. The APLT has a sealed metal die-cast bezel which meets NEMA 4/IP65 specifications for wash-down and/or dust, when properly installed. Two mounting clips are provided for easy panel installation. The 6-digit totalizer’s, 0.56” high LED display is readable to 23 feet (7 M), while the 8-digit totalizer’s, 0.36” high LED display is readable to 15 feet (4.6 M).

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

- **SPECIFICATIONS**
  1. **DISPLAY (APLT):** 6-Digit, 0.56” (14.2 mm) high LED display.
  2. **POWER REQUIREMENTS:**
     - **APLT:**
       - **AC Operation:** Available in two voltage ranges. 115/230 VAC (±10%), 50/60 Hz, 14 V A 6-digit, 15.5 V A 8-digit.
       - **DC Operation:** 11 to 14 VDC @ 0.6 A max.
     - **PBLT:**
       - **AC Operation:** Switch selected via the LDD power supply board, 115/230 (±10%), 50/60 Hz, 10 VA for 4-digit, 15 VA for 6-digit (including LDD)
  3. **SENSOR POWER:** +12 VDC (+25%) @ 100 mA max.
  4. **COUNT INPUT:** Switch selectable to accept count pulses from a variety of sources, including switch contacts, output from CMOS or TTL circuits, and all standard RLC sensors.

**DIMENSIONS “In inches (mm)”**

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1” (53.4) H x 5.5” (140) W.
**SPECIFICATIONS (Con’t)**

4. **COUNT INPUTS:** (Con’t)
   - **Current Sourcing:** The unit provides 3.9 KΩ pull-down load for sensors with current sourcing outputs. (Max. input voltage: 28 VDC @ 7 mA.)
   - **Current Sinking:** The unit provides 7.8 KΩ pull-up load for sensors with current sinking outputs. (Max. sensor current: 1.6 mA.)
   - **Debounce:** Damping capacitor provided for switch contact debounce. Limits count speed to 100 Hz max. with 50% duty cycle.
   - **Lo Bias:** Input trigger levels $V_{IL} = 1.5$ V, $V_{IH} = 3.75$ V.
   - **Hi Bias:** Input trigger levels $V_{IL} = 5.5$ V, $V_{IH} = 7.5$ V.
   - **Note:** Bias levels ±10% @ 12 VDC sensor voltage. These levels vary proportionally with sensor supply voltage.

5. **MAXIMUM COUNT RATE:**
   - **High Frequency:** 10,000 Hz max. for all electronic sensors. Signal must be square wave inputs.
   - **Low Frequency:** 100 Hz for switch contact closure.
   - **Note:** Unit will operate with VCM [E-H] modules.

6. **CONTROL INPUTS:**
   - **Up/Down Control:** Active low ($V_{IL} = 1.5$ V max.), internally pulled up to 5 VDC through a 10 KΩ resistor ($R_{ISNK} = 0.5$ mA). Response time = 50 μsec. This input determines the direction of the count. When it is at 5 VDC, the unit will count up. When this terminal is at a low (zero volts), the unit will count down.
   - **Remote Reset:** Active low ($V_{IL} = 1.5$ V max.), internally pulled up to 5 VDC through a 10 KΩ resistor ($R_{ISNK} = 0.5$ mA). Response time = 50 μsec. A low will stop the display from updating. When the voltage goes back to +5 VDC, the display is reset to zero.
   - **Front Panel Reset:** When pressed, the display stops updating. When released, the display is reset to zero.
   - **Inhibit:** Active low ($V_{IL} = 1.5$ V max.), internally pulled up to 5 VDC through a 10 KΩ resistor ($R_{ISNK} = 0.5$ mA). Response time = 50 μsec. A low will prevent the unit from counting.
   - **Store:** Active low ($V_{IL} = 1.5$ V max.), internally pulled up to 5 VDC through a 10 KΩ resistor ($R_{ISNK} = 0.5$ mA). A low will stop the display from updating. When the voltage level goes back to +5 VDC, the display will show the current count value.

7. **MEMORY RETENTION:** Uses a “no power E’PROM,” which maintains all information when the power is removed. The life expectancy of this device is at least 100,000 power down cycles, and the length of memory retention for a single power down can be as long as 10 yrs.

8. **CERTIFICATIONS AND COMPLIANCES:**
   - **EMC EMISSIONS:** Meets EN 50081-2: Industrial Environment. CISPR 11 Radiated and conducted emissions
   - **EMC IMMUNITY:** Meets EN 50082-2: Industrial Environment. ENV 50140 - Radio-frequency radiated electromagnetic field ENV 50141 - Radio-frequency conducted electromagnetic field EN 61000-4-2 - Electrostatic discharge (ESD) EN 61000-4-4 - Electrical fast transient/burst (EFT) EN 61000-4-8 - Power frequency magnetic field

---

**INPUT SET-UP**

The selection of input set-up is accomplished by the first four of seven DIP switches, located along the side of the unit. DIP switches 1 to 3 are used to configure the input and DIP switch 4 is used to enable or disable the front panel reset button. Each switch is discussed below.

- **S1 - S2:** Provides a 7.8 KΩ pull-up resistor for sensors with sinking outputs.
- **S1 - S3:** Provides a 3.9 KΩ pull-down resistor for sensors with sourcing outputs.
- **S4 - S5:** Enables front panel reset.

**POWER-UP DIAGNOSTICS**

Upon applying power, the unit performs an internal self-diagnostic test of the stored data. If the tests do not agree, an “E” appears on the right side of the display. The unit must be reset (by Remote reset or Front Panel) before normal operations can continue. If the error persists, replace the unit.

---

Notes for APLT only:
1. EMI filter placed on the DC power supply, when DC powered : Corcom #1VR3 or Schaffner #FN610-1/S7 (RLC #LFIL0000).
2. Metal bezel of the unit connected to earth ground (protective earth) at the mounting panel.
3. Refer to the EMC Installation Guidelines section of this bulletin for additional information.

9. **INPUT AND POWER CONNECTIONS:** There is a plug-in compression type, barrier strip located at the rear of the unit. This strip can be removed from the rear of the unit for ease of wiring. After wiring is complete, the connector can be plugged back onto the unit.

10. **ENVIRONMENTAL CONDITIONS:**
    - **Operating Temperature:** 0°C to 50°C.
    - **Storage Temperature:** -40°C to 70°C.
    - **Operating and Storage Humidity:** 85% max. relative humidity (non-condensing) from 0°C to 50°C
    - **Altitude:** Up to 2000 meters

11. **CONSTRUCTION:** Die-cast metal bezel with black, high impact plastic case insert. Front panel meets NEMA 4/IP65 requirements for indoor use when properly installed. Installation Category II, Pollution Degree 2 (Panel gasket and mounting clip included with unit.)

12. **WEIGHT:**
    - **APLT:** 1.5 lbs. (0.7 kg)
    - **PBLT:** 0.4 lbs. (0.18 kg)
DECIMAL POINT SELECTION

The selection of decimal point is accomplished by DIP switches 5 and 6. The table at right shows what combination of switches is needed to obtain the desired decimal point location. The unit always has leading zero blanking.

<table>
<thead>
<tr>
<th>SW5</th>
<th>SW6</th>
<th>D.P. LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0)</td>
<td>(0)</td>
<td>0</td>
</tr>
<tr>
<td>(0)</td>
<td>(1)</td>
<td>0.0</td>
</tr>
<tr>
<td>(1)</td>
<td>(0)</td>
<td>0.00</td>
</tr>
<tr>
<td>(1)</td>
<td>(1)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

SELF-TEST

There is a built-in self-test feature which can only be activated immediately after power-up (the unit will not count while in self-test). To activate self-test, set the self-test DIP switch (number 7) to the enable position. Then power the unit up. With this test, all digits are cycled through starting with a string of all zeros. This will be shown for about half a second, then a string of ones will appear for about the same time duration. Following these, a string of twos and so on, up to nines will be displayed. After the nines are shown, a string of decimal points will appear. Next, an interlace pattern of 1, 0, 1, 0, 1, 0, 1, 0, then 1, 2, 1, 2, 1, 2, and so on until all digits from zero to nine have been displayed.

The next portion of self-test will display a group of ones and/or zeros.

Digit 8 (MSD) = N/A
7 = N/A
6 = 1 if STORE is pulled low
5 = 1 if INHIBIT is pulled low
4 = 1 if UP/DN is pulled low
3 = 1 if RESET is pulled low
2 = 1 if DIP switch 6 is ON
1 (LSD) = 1 if DIP switch 5 is ON

EMC INSTALLATION GUIDELINES

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

1. The unit should be mounted in a metal enclosure, that is properly connected to protective earth.
   a. If the bezel is exposed to high Electro-Static Discharge (ESD) levels, above 4 kV, it should be connected to protective earth. This can be done by making sure the metal bezel makes proper contact to the panel cut-out or connecting the bezel screw with a spade terminal and wire to protective earth.
   b. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
      a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
      b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
      c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
   3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
   4. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
   5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure.

The following EMI suppression devices (or equivalent) are recommended:
- Ferrite Suppression Cores for signal and control cables:
  - Fair-Rite # 043167251 (RLC # FCOR0000)
  - TDK # ZCAT3035-1330A
  - Steward # 28B2029-0A
- Corcom # 1VR3

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

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

INPUT & POWER CONNECTIONS

As depicted in the drawing showing the rear view of the Apollo Totalizer, there is a terminal block where all wiring connections are made. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Remove the block for easy access to the terminal screws. Enclosed with the PBLT module is an adhesive backed label(s) showing the terminal block pin-out. This label is for wiring reference only, do not use for specifications. This label should be applied to the appropriate location by the user.

CAUTION: The terminal block should NOT be removed with power applied to the unit. The module should not be removed from the LDD with power applied to the LDD or the module.

Terminals 1 and 2 are the primary AC power terminals (marked AC power, located on the left-hand side of the block). For best results, the AC power should be relatively “clean” and within the specified ±10% variation limits. Drawing power from heavily loaded circuits, or from circuits that also power loads that cycle on and off, should be avoided.

Terminal 3 is the “DC IN” terminal. (APLT only) A +11 to +14 VDC is applied here which will operate the unit when AC power is not available.

Terminal 4 is the “DC OUT” (+12 VDC) terminal. This is for sensor supply and can provide up to 100 mA of current.

Terminal 5 is the “COMM.” (Common) terminal, which is the common line to which the sensor and other input commons are connected.

Terminal 6 is the “COUNT” (Count Input) terminal. When the signal at this terminal is pulled low (Zero volts), a count will be registered. (See “Count Input Rates” under Specifications section.)

Terminal 7 is the “UP/DN” (Count Direction Control) terminal. When this terminal is at a high level, the count direction is “UP”. When the terminal is grounded, the count direction is “DOWN”.

Terminal 8 is the “REM. RST.” (Remote Reset) terminal. When this terminal is at a low level (connected to COMMON), the display will stop updating. When the voltage goes back to +5 VDC, the display will reset to zero.

Terminal 9 is the “INHIBIT” terminal. When this terminal is at a low level (connected to COMMON), the unit will not register any counts.

Terminal 10 is the “STORE” terminal. When this terminal is at a low level (connected to COMMON), the unit will stop updating the display (latch). Counting will continue. When the terminal goes back high, the display will update to the latest count value.
### NOTES:

1. **SENSOR SUPPLY VOLTAGE AND CURRENT**
   
   The +12 V sensor supply voltage on the “DC OUT” Terminal is nominal with ±25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.

2. **HI/LO FRQ. SELECTION**
   
   The “HI/LO FRQ.” Selection switch must be set on “LO FRQ.” when switch contacts are used to generate count input signals. Since the “LO FRQ.” mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used, whenever possible, with electronic sensor outputs, as added insurance. The “LO FRQ.” mode can be used with any type of sensor output, provided count pulse widths never decrease below 5 milliseconds, and the count rate does not exceed 100 cps.

3. **VIL and VIH levels given are nominal values ±10% when counter voltage on “DC OUT” Terminal is +12 VDC. These nominal values will vary in proportion to the variations in “DC OUT” Terminal voltage, caused by line voltage and load changes.**

4. **When shielded cable is used, the shield should be connected to “COMM.” at the counter and left unconnected at sensor end.**
**INSTALLATION ENVIRONMENT**

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

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

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

**INSTALLATION**

PBLT installation information is contained in the LDD bulletin. Refer to that bulletin for instructions on installing the module.

The unit meets NEMA 4/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8" / 3.2 mm.)

After the panel cut-out has been completed and deburred, carefully slide the panel gasket over the rear of the unit to the back of the bezel. Insert the unit into the panel.

As depicted in the drawing, install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side.

Install each of the mounting clips by inserting the wide lip of the clips into the wide end of the hole, located on either side of the case. Then snap the clip onto the case.

Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal.

**CAUTION:** Only minimum pressure is required to seal panel. Do **NOT** overtighten screws.

**LENGTH MEASUREMENT SYSTEM**

The web system, shown in the drawing above, accumulates the total length of paper wound onto a roll. An LSC length sensor feeds 10 pulses into the totalizer for every foot of paper wound onto the roll. Therefore, the Apollo Totalizer is set up to display a decimal point in the tenth's position so the unit will directly display in tenth's of feet. The unit has the front panel reset disabled so reset can only occur through the remote reset terminal. The “STORE” terminal is connected through a push button to common. This allows the operator to “freeze” the display (no counts are lost) so the latest reading can be recorded. (Note: With the Apollo Totalizer non-volatile memory, the system can be turned off at any stage winding and the Apollo will retain, in its internal memory, the amount of paper already wound onto the roll.)

**TYPICAL APPLICATION**

**TROUBLESHOOTING**

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

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>APLT</td>
<td>Apollo 6-Digit Totalizer</td>
<td>APLT0610, APLT0600</td>
</tr>
<tr>
<td></td>
<td>Apollo 8-Digit Totalizer</td>
<td>APLT0810, APLT0800</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.

**PERSONALITY MODULE**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBLT*</td>
<td>Apollo 6-Digit Totalizer Module for use with the 4 or 6 Digit Large Digit Display</td>
<td>PBLT0600</td>
</tr>
</tbody>
</table>

*Requires an LDD for use.
MODEL SCP - 10 KHZ PRESETTABLE COUNTER WITHOUT DISPLAY -
ECONOMY PLUS THESE HIGH PERFORMANCE FEATURES:

- AVAILABLE IN 2, 4, or 6-DIGIT VERSIONS
- COUNT INPUT PROGRAMMABLE FOR ALL STANDARD SENSORS & FOR COUNT SWITCHES
- RESET ON POWER-UP
- TWO COMPLEMENTARY SOLID-STATE OUTPUTS
  1. Primary output to drive control relay
  2. Auxiliary output (inverted) for external circuitry.
- RESET-TO-ZERO (RTZ) ACTION WITH FIVE SELECTABLE
  RESET MODES
  1. Manual Reset - Timed output
  3. Automatic Cycle Reset & Run at Preset
  4. Automatic Cycle Reset & Run at End of Timeout
  5. Automatic Cycle - Prescale Divider
- CONTROL INPUTS FOR:
  1. Remote Reset
  2. Count Inhibit
  3. Up/Down Count Direction

DESCRIPTION

The Model SCP is an economical and reliable answer to a wide variety of machine control, batching and pre-scale dividing applications. With dual complementary outputs, count input configuration set-up switches to accept almost any sensor output, five reset cycle modes, and control inputs for remote reset, up/down counting, and inhibit functions, the SCP offers extremely broad application flexibility. Based on solid-state technology proven in tens of thousands of field applications, this unit features outstanding reliability and noise immunity.

In operation, the desired preset count is dialed in by means of digital thumbwheel switches on the front panel. The number entered on the switches is loaded into an internal comparator when the counter is reset to 0, or at the end of a count cycle, and cannot be changed once the count has started. This avoids the problem of an operator inadvertently changing a thumbwheel switch position once a run has started, or accidental overrun which can occur with a counter that may be set “on-the-fly”.

The front panel also contains three LED lights to indicate status of the counter. A “count” light illuminates whenever the count signal is high. At slow count rates, individual counts can be observed by the blinking of this light, and at higher count rates, the light blinks merge into a continuous glow. A “preset” light signals that the preset count has been reached. The “reset” indicator lights and stays on as long as the reset condition exists.

Connections are made to the Model SCP via a terminal strip at the rear. Clamp-Type pressure plate terminals accept stripped #14 wire without lugs. (Tinning of stranded wire is recommended for easy installation.)

SPECIFICATIONS

1. PRIMARY SUPPLY VOLTAGE: Available in four voltage ranges, 50/60 Hz (See Ordering Information). Allowable supply voltage variation ±10%. Input power 4 VA. Also operates from +12 VDC Supply (See Application Notes).

2.*SENSOR OUTPUT POWER (TERM."A"):
   +12 VDC ±15% @ 50 mA.

3. RESET & PRESET TIMING PARAMETERS:
   A. COUNT-AFTER-RESET - Count will accept new counts, 75 µsec after reset is removed.
   B. New preset value entry takes place during reset or during timed output. If a new preset value is entered after a count cycle has started, the original preset value remains in affect for that cycle. The new value will be loaded in at the end of the cycle and will be in effect for the next cycle.

4. OUTPUTS:
   SNK OUT - Primary output (current sinking) to drive control relay, 100 mA max. Output turns “ON” (goes low) when preset count is reached.
   SRC OUT - Aux. Output (inverted) delivers +12 VDC @ +10 mA when preset count is reached.

5. CURRENT DRAIN FROM BATTERY BACKUP: 60 mA without Sensor and Relay Output load. (See Accessories Section of Catalog for Non-Interruptible Power Supplies.)

6. OPERATING TEMPERATURE RANGE: -20° to +50°C

7. CONSTRUCTION: Steel Case, Aluminum Bezel and Panel, Black Epoxy Coated.

8. WEIGHT: 1.2 lbs. (0.54 Kg)

*See SC Series Sensor Input Connections & Input Configuration Switch Set-up, Note 1 or the “Applications” Section of the Catalog.
RESET MODE & CYCLE SWITCHES

S4 - ON: ENABLES Front Panel Reset Button
OFF: DISABLES Front Panel Reset

S5 - ON: AUTO RST* - Causes counter to automatically reset either upon reaching the preset count or after time-out of output as determined by S6.
OFF: INST* - Causes counter to reset automatically with S5 ON at instant preset count is reached.

S6 - ON: T.D. RST* - Causes counter to reset automatically at end of output time delay.
OFF: INST* - Causes counter to reset automatically at instant preset count is reached.

S7 - ON: LATCH - causes outputs to latch after reaching preset. Outputs stay ON until manually reset by Front Panel Button or Remote Reset.
OFF: T.D. - Allows outputs to respond to normal time delayed dropout.

S8 - ON: LG. DLY. - Sets adjustable Time Delay Range to 0.05 - 1 sec.
OFF: SHT. - Sets adjustable Time Delay to 0.7 - 15 msec.

* Remote Reset (R) and Front Panel Reset (if ENABLED) will always reset the counter regardless of automatic setup mode used.

MODEL SCP INPUT/OUTPUT CONNECTIONS & PROGRAMMING SWITCHES

RESET CYCLE MODES - SWITCHES S5, 6, 7 & 8

MODE 1 LATCH AT PRESET, MANUAL RESET
Counts from zero, activates and latches outputs ON at preset. Front panel button (if enabled) or remote reset (Terminal "R") returns counter to zero and deactivates outputs. Accepts new count pulses 75 µsec after reset is removed.

MODE 2 MOMENTARY OUTPUT AT PRESET, MANUAL RESET
Counts from zero and activates outputs momentarily at preset. Momentary output time is adjustable from 0.05 to 1 second. Count can proceed upward if not reset, and if count direction is then reversed, by pulling U/D down to B, the outputs will again reactivate as the count decrements down through preset a second time. Outputs activate each time the count passes through preset provided time-out from previous pass has concluded. Front panel reset (if enabled) or remote reset (R) returns the counter to zero and interrupts output if time-out has not concluded. Unit is ready to accept new counts 75 µsec after removal of reset.

MODE 3 AUTOMATIC CYCLE - RESET & RUN AT PRESET
Counts from zero, activates outputs momentarily at preset and simultaneously resets counter to zero, ready to accept new counts for next cycle 75 µsec after resetting. Momentary output time is adjustable from 0.05 to 1 sec. Output ON-time must be less than time required to count from zero to reset for proper Mode 3 operation.

MODE 4 AUTO. CYCLE - RESET & RUN AFTER TIME-OUT
Counts from zero, activates outputs momentarily at preset. Counter resets to zero at conclusion of output time-out and is ready to accept new counts for the next cycle 75 µsec after reset.

MODE 5 AUTO. CYCLE - PRESCALE DIVIDER
Identical to Mode 3 except momentary output time delay range switched to “short” range (0.7 to 15 msec) by placing S8 in OFF position. The shorter time-out allows the SCP to be used as a pre-scaling divider providing output pulses in excess of 1 KHz to the input of another counter.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NO. OF DIGITS</th>
<th>PART NO.'S FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCP</td>
<td>SC Series Preset Cnr w/o Display</td>
<td>2</td>
<td>SCP00210 SCP00200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>SCP00410 SCP00400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>SCP00610 SCP00600</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.
**MODEL SCP - 100 KHZ PRESETTABLE COUNTER WITHOUT DISPLAY - ECONOMY PLUS THESE HIGH PERFORMANCE FEATURES:**

- AVAILABLE IN 4 or 6-DIGIT VERSIONS
- COUNT INPUT PROGRAMMABLE FOR ALL STANDARD SENSORS & FOR COUNT SWITCHES
- RESET ON POWER-UP
- TWO COMPLEMENTARY SOLID-STATE OUTPUTS
  1. Primary output to drive control relay
  2. Auxiliary output (inverted) for external circuitry
- RESET-TO-ZERO (RTZ) ACTION WITH FIVE SELECTABLE RESET MODES
  1. Manual Reset - Timed Output
  3. Automatic Cycle Reset & Run at Preset
  4. Automatic Cycle Reset & Run at end of Timeout
  5. Automatic Cycle - Prescale Divider
- CONTROL INPUTS FOR:
  1. Remote Reset
  2. Count Inhibit
  3. Up/Down Count Direction

**DESCRIPTION**

The Model SCP is an economical and reliable answer to a wide variety of machine control, batching and pre-scale dividing applications. With dual complementary outputs, count input configuration set-up switches to accept almost any sensor output, five reset cycle modes, and control inputs for remote reset, up/down counting, and inhibit functions, the SCP offers extremely broad application flexibility. Based on solid-state technology proven in tens of thousands of field applications, this unit features outstanding reliability and noise immunity.

In operation, the desired preset count is dialed in by means of digital thumbwheel switches on the front panel. The number entered on the switches is loaded into an internal comparator when the counter is reset to 0, or at the end of a count cycle, and can not be changed once the count has started. This avoids the problem of an operator inadvertently changing a thumbwheel switch position once a run has started, or accidental overrun which can occur with a counter that may be set “on-the-fly”.

The front panel also contains three LED lights to indicate status of the counter. A “count” light illuminates whenever the count signal is high. At slow count rates, individual counts can be observed by the blinking of this light, and at higher count rates, the light blinks merge into a continuous glow. A “preset” light signals that the preset count has been reached. The “reset” indicator lights and stays on as long as the reset condition exists.

Connections are made to the Model SCP via a terminal strip at the rear. Clamp-Type pressure plate terminals accept stripped #14 wire without lugs. (Tinning of stranded wire is recommended for easy installation.)

**SPECIFICATIONS**

1. PRIMARY SUPPLY VOLTAGE: Available in two voltage ranges. 115/230 VAC (±10%), 50/60 Hz, 4 VA. Also operates from +12 VDC Supply (See Application Notes).
2. SENSOR OUTPUT POWER (TERM.”A”):
   +12 VDC ±15% @ 50 mA max.
3. RESET & PRESET TIMING PARAMETERS:
   A. COUNT-AFTER-RESET - Counter will accept new counts 7.5 µsec after reset is removed.
   B. New preset value entry takes place during reset or during timed output. If a new preset value is entered after a count cycle has started, the original preset value remains in effect for that cycle. The new value will be loaded in at the end of the cycle and will be in effect for the next cycle.
4. OUTPUTS:
   SNK OUT - Primary output (current sinking) to drive control relay load, 100 mA max. Output turns “ON” (goes low) when preset count is reached.
   SRC OUT - Aux. Output (inverted) delivers +12 VDC @ +10 mA when preset count is reached.
5. CURRENT DRAIN FROM BATTERY BACKUP: 60 mA without sensor and relay output load. (See Accessories Section of Catalog for Non-Interruptible Power Supplies)
6. OPERATING TEMPERATURE RANGE: -20° to +50°C
7. CONSTRUCTION: Steel Case, Aluminum Bezel and Panel, Black Epoxy Coated.
8. WEIGHT: 1.2 lbs. (0.54 Kg)

* - See SC Series Sensor Input Connections & Input Configuration Switch Set-up, Note 1 or Applications Section of the Catalog.

**DIMENSIONS “In inches (mm)”**
RESET MODE & CYCLE SWITCHES

S4 - ON: Enables Front Panel Reset Button
OFF: Disables Front Panel Reset

S5 - ON: AUTO RST* - Causes counter to automatically reset either upon reaching the preset count or after time-out of output as determined by S6.
OFF: MAN. - Counter will reset only in response to a reset signal from the Front Panel Button (if ENABLED) or Remote Reset (R).

S6 - ON: T.D. RST* - Causes counter to reset automatically (with S5 ON) at end of output time delay.
OFF: INST* - Causes counter to reset automatically (with S5 ON) at instant preset count is reached.

S7 - ON: LATCH - Causes outputs to latch after reaching preset. Outputs stay ON until manually reset by Front Panel Button or Remote Reset.
OFF: T.D. - Allows outputs to respond to normal time delayed dropout.

S8 - ON: LG. DLY - Sets adjustable Time Delay Range to 0.05 - 1 sec.
OFF: SHT. - Sets adjustable Time Delay to 0.7 - 15 msec.

* Remote Reset (R) and Front Panel Reset (if ENABLED) will always reset the counter regardless of automatic setup mode used.

TYPICAL APPLICATION CONNECTIONS & SET-UP

A typical length-measuring wind/rewind application involving up/down counting to accommodate forward and reverse web motion and provision for remote reset.

RESET CYCLE MODES - SWITCHES S5, 6, 7 & 8

MODE 1 - LATCH AT PRESET, MANUAL RESET
Counts from zero, activates and latches outputs ON at preset. Front panel button (if enabled) or remote reset (Term. “R”) returns counter to zero and deactivates outputs. Accepts new count pulses 7.5 µsec after reset is removed.

MODE 2 - MOMENTARY OUTPUT AT PRESET, MANUAL RESET
Counts from zero and activates outputs momentarily at preset. Momentary output time is adjustable from 0.05 to 1 second. Count can proceed upward if not reset, and if count direction is then reversed, by pulling Up/Down to B, the outputs will again reactivate as the count decrements down through preset a second time. Output activates each time count passes through preset provided time-out from previous pass has concluded. Front panel reset (if enabled) or remote reset (R) returns the counter to zero and interrupts output if time-out has not concluded. Unit is ready to accept new counts 7.5 µsec after removal of reset.

MODE 3 - AUTOMATIC CYCLE - RESET & RUN AT PRESET
Counts from zero, activates outputs momentarily at preset and simultaneously resets counter to zero, ready to accept new counts for next cycle 7.5 µsec after resetting. Momentary output time is adjustable from 0.05 to 1 sec. Output ON-time must be less than time required to count from zero to reset for proper Mode 3 operation.

MODE 4 - AUTO. CYCLE - RESET & RUN AFTER TIME-OUT
Counts from zero, activates outputs momentarily at preset. Counter resets to zero at conclusion of output time-out and is ready to accept new counts for the next cycle 7.5 µsec after reset.

MODE 5 - AUTO. CYCLE - PRESCALE DIVIDER
Identical to Mode 3 except momentary output time delay range switched to “short” range (0.7 to 15 msec) by placing S8 in OFF position. The shorter time-out allows the SCP to be used as a pre-scaling divider providing output pulses in excess of 1 KHz to the input of another counter.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NO. OF DIGITS</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCP</td>
<td>100 KHz Preset Counter w/o Display</td>
<td>4</td>
<td>SCP00411 SCP00401</td>
</tr>
<tr>
<td>SCP</td>
<td>6 SCP00611 SCP00601</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits see the RLC Catalog or contact your local RLC distributor.
1. BATTERY BACK-UP & DISPLAY LIGHT (L) OPERATION
SC Counters can be operated from +12 VDC batteries or power supplies. (+12 V DC is connected to Term. "A" and minus to "B")

2. REMOTE RESET (R) - Counter will be reset when this input is pulled low (to Term. "B") by a remote contact or NPN O.C. output. Response time to Reset input is 2 µsec. Counter is ready to accept new counts 7.5 µsec after removal of reset. (Front panel reset button on all Models may be enabled or disabled via configuration switch on rear.)

3. UP/DOWN (U/D) - With U/D Terminal open, counters increment (count "UP") to increase the accumulated number. When U/D is pulled low, the counter will decrement (count "DOWN") to decrease the accumulated number. Response time to change count direction is 2 µsec. Note: SC Counters count in complementary numbers when counting down through zero, i.e. the counting sequence when decrementing is 3, 2, 1, 0, 999999, 999998, 999997, etc.

4. INHIBIT (I) - Counter is inhibited from accepting counts as long as "I" is pulled low to Term. "B". Response time for initiation is 2 µsec, and release is 4 µsec.

5. OUTPUTS (Preset Counters) - All SC Presettable counters have 2 complementary outputs per preset level (Models SC2DU and SC2DD have two sets of outputs, one set for each preset level).
SNK OUT - Primary output for driving a relay coil. Output goes low to energize relay at end of count cycle. This output is rated V_{OL} = 0.6 V @ 100 mA, V_{OH} = 12 V max. (Internal suppression diode limits V_{OH} to +12 V internal supply and higher external supply cannot be used.)
SRC OUT - Auxiliary output goes high at end of a count cycle. This output is actually Bi-Polar, will source or sink 10 mA, and may be used for count input to other counters or external electronic control circuits.

6. RESSET-TO-PRESET (RTP) & RESSET-TO-ZERO (RTZ) ACTION
SC Presettable Counters when Reset, return the counter either to zero or to the Preset value (Start Count) as determined by the Reset Action.
MODEL SCP - Fixed RTZ action
MODEL SCD - Programmable for RTZ or RTP action
MODEL SC2DU - Fixed RTZ action
MODEL SC2DD - Fixed RTP action
Reset actions do not determine UP/DOWN count direction. Count direction is controlled only by the U/D terminal which must be connected to "B" when down-counting is required.
The schematic diagram at right shows the details of the 100 KHz SCP count
input circuit, the terminals used for sensor connection and the configuration set-
up switches. These switches are the first three switches in the switch bank and
are designated S1, S2 and S3 from left to right. The functions of these switches
are as follows:

S1 - ON (SRC): Provides 3.9 kΩ Pull-down load for sensors with sourcing
outputs. (Max. sensor current, 3 mA)
OFF (SNK): Provides a 7.8 kΩ Pull-up load for sensors with sinking
outputs. (Max. sensor current, 1.6 mA)

S2 - ON (LO FRQ): Connects damping cap for switch contact debounce.
Limits count speed to 100 cps maximum. Min. count pulse
ON/OFF times-5 msec. (See Note 2)
OFF (HI FRQ): Removes damping cap, allows operation to 100 KHz.
Min count pulse ON/OFF times-5 µsec.

S3 - ON (LO BIAS): Sets input trigger levels to the low range to accept logic
pulses with 0 to +5 V swings. (VIL = 1.5 V, VIH = 3.75 V, See
Note 3)
OFF (HI BIAS): Sets input trigger levels at mid-range to accept outputs
from 2-wire proximity sensors, resistive photo-cells and
logic pulses with full 0 to +12 V swings. (VIL = 5.5 V, VIH
= 7.5 V, See Note 3)

NOTES:

1. SENSOR SUPPLY VOLTAGE AND CURRENT
Sensor supply voltage on Term. “A” is +12 VDC nominal with ±15% variation due to line and internal load variation. All RLC sensors will accommodate this variation. Maximum sensor current rating varies depending on the specific counter model (See Specifications of specific model). This rating is the maximum allowable sensor current when all digits of a 6-digit unit display 8’s, and with 100 mA relay load(s) on preset counters. If all 6 digits are not used, an additional 45 mA is available for each digit not displayed. 4-digit models will deliver an additional 90 mA over the current rating stated. SC counter power supplies are not regulated, and in multiple counter (or counter/tachometer) installations all terminal “A’s” and “B’s” can be paralleled for load sharing. For unusually high sensor current requirements, use Accessory Power Supply (See Accessory Section of Catalog).

2. HI/LO FRQ. SELECTION
The HI/LO FRQ Selection switch MUST be set on LO FRQ when switch contacts are used to generate count input signals. Since the LO FRQ mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used whenever possible with electronic sensor outputs, as added insurance. The LO FRQ mode can be used with any type of sensor output provided count pulses never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. VIL and VIH levels given are nominal values ±10% when counter voltage on terminal A is +12 VDC. These nominal values will vary in proportion to the variations in Terminal A voltage caused by line voltage and load changes.

4. When shielded cable is used, shield should be connected to terminal B at
counter and left unconnected at sensor end.

5. The Count Input (Terminal C), can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V a limiting resistor and zener diode should be used to limit the voltage at Terminal C. Negative input voltages to Count Input (Terminal C), will damage the input circuit. If the possibility exists that the input voltage can swing negative, an external shunt or series diode should be used to block the negative swing.
MODEL SCD - 100 KHZ PRESETTABLE COUNTER WITH 0.43” (11 MM) L.E.D. DISPLAY

DESCRIPTION
This high-performance presettable counter is based on solid-state technology proven in tens of thousands of field applications, and incorporates features that have made it an industry standard. With dual complementary outputs, input configuration programmability, selectable reset cycle modes and a full complement of control inputs, the Model SCD can handle practically any application for single level preset counting.

The Model SCD features two selectable counting actions. With RTZ (Reset-to-Zero) action, the counter resets to zero and counts up, actuating the outputs when it reaches the preset value. When RTP (Reset-to-Preset) action is selected, the counter is loaded with the preset number at the start of a cycle and counts down to activate the outputs when the count reaches zero.

The preset value entered on the thumbwheel switches is loaded at the end of a cycle (when the outputs are active) and during reset time. This prevents inadvertent changes in the preset number once a run has started and also avoids accidental over-runs that can occur with counters that allow “setting-on-the-fly”.

Electrical connections are made to terminal strips on the rear of the unit. These pressure clamp screw terminals accept stripped wires up to #12 AWG and do not require lugs.

SPECIFICATIONS
1. PRIMARY SUPPLY VOLTAGE: Available in two voltage ranges. 115/230 VAC (±10%), 50/60 Hz, 11.2 VA. Also operates from +12 VDC Supply (See Application Notes).

2. SENSOR OUTPUT POWER (TERM. “A”): +12 VDC ±15% @ 100 mA.

3. RESET & PRESET TIMING PARAMETERS:
   A. COUNT-AFTER-RESET - With RTZ action new counts can be accepted 7.5 µsec after reset. With RTP action new counts can be accepted 1 msec after reset.
   B. Preset loading occurs on timed output or reset.

4. OUTPUTS:
   SNK OUT - Primary output (current sinking) to drive control relay, 100 mA max. This output goes low when preset count (RTZ) or zero count (RTP) is reached.
   SRC OUT - Aux. Output (inverted) operates synchronously with O SNK to deliver +12 VDC @ 10 mA.

5. CURRENT DRAIN FROM BATTERY BACKUP: 60 mA with displays blanked and without sensor or output loads. 350 mA (6-digit), 260 mA (4-digit) with full display on (all 8’s) but less sensor and output load.

6. OPERATING TEMPERATURE RANGE: -20° to +50°C


8. WEIGHT: 2.0 lbs. (0.91 Kg)

DIMENSIONS “In inches (mm)”
RESET MODE & CYCLE SWITCHES

S4 - ON: ENABLES Front Panel Reset Button
OFF: DISABLES Front Panel Reset

S5 - ON: AUTO RST*: Causes counter to automatically reset upon reaching the preset count. Reset may be instantaneous or maintained for the duration of the output time delay. (See S6)
OFF: MAN.: Counter will reset only in response to Front Panel Button (if ENABLED) or Remote Reset (R).

S6 - ON: T.D. RST*: Counter automatically resets at preset (with S5 ON) and is held at reset for duration of time-out.
OFF: INST*: Counter automatically resets at preset (with S5 ON) and is instantly ready to accept new counts.

S7 - ON: LATCH - causes outputs to latch after reaching preset. Outputs stay ON until manually reset by Front Panel Button or Remote Reset.
OFF: T.D. - Allows outputs to respond to normal time delayed dropout.

S8 - ON: R.T.P. (Reset-to-Preset) - Counter resets to the number entered in on thumbwheel Preset Switches, and outputs activate when count reaches zero. (Jumper req’d from U/D to B for down counting.)
OFF: R.T.Z. (Reset-to-Zero) - Counter resets to zero and outputs activate when count reaches number entered on T.W. Preset Switches.

* Remote reset (R) and Front Panel Reset (if ENABLED) will always take precedence and reset the counter regardless of automatic setup mode used.

TYPICAL APPLICATION CONNECTIONS & SET-UP

A Preset counter application using photo-electric sensing to count products making up a “batch” (case, carton, bundle or other group). At the end of each “batch”, “SNK OUT” output actuates a bundler and the “SRC OUT” output signals a Model SCT which totalizes batches. Terminals “A” and “B” of Model SCT are paralleled with SCD to share load.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NO. OF DIGITS</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCD</td>
<td>100 KHz 1-Preset Counter w/Display</td>
<td>4</td>
<td>230 VAC SCD00411 SCD00401 115 VAC SCD00611 SCD00601</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
1. Battery Back-Up & Display Light (L) Operation
SC Counters can be operated from +12 VDC batteries or power supplies. (+12 VDC is connected to Term. “A” and minus to “B”). When the counter is powered by +12 VDC, and Term. “L” is pulled high to “A”, the display will remain activated and all counter functions will operate. When Term. “L” is opened the counter will continue to accumulate counts, with display blanked to conserve power (“L” is normally held high by applied A.C. line voltage).

With SCD preset counters, opening “L” while operating from +12 VDC also disables the preset entry function. This can cause an aborted count accumulation if a preset level is reached after a line-failure. A normally-closed contact should be used to connect “L” to “A” when these counters are battery-backed. This allows normal operation to continue on power-loss until the machine comes to a stop. Then the switch can be opened to conserve power.

(For Non-Interruptible Power Supply see Accessory Section of the Catalog)

2. Remote Reset (R) - Counter will be reset when this input is pulled low (to Term. “B”) by a remote contact or NPN O.C. output. Response time to Reset input is 2 µsec. Counter is ready to accept new counts 7.5 µsec after removal of reset. (Front panel reset button on all Models may be enabled or disabled via configuration switch on rear.)

3. Up/Down (U/D) - With U/D Terminal open counters increment (count “UP”) to increase the accumulated number. When U/D is pulled low the counter will decrement (count “DOWN”) to decrease the accumulated number. Response time to change count direction is 2 µsec.

Note: SC Counters count in complementary numbers when counting down through zero, i.e. the counting sequence when decrementing is 3, 2, 1, 0, 999999, 999998, 999997, etc.

4. Inhibit (i) - Counter is inhibited from accepting counts as long as “I” is pulled low to Term. “B”. Response time for initiation is 2 µsec, and release is 4 µsec.

5. Outputs (Preset Counters) - All SC Presettable counters have 2 complementary outputs per preset level (Models SC2DU and SC2DD have two sets of outputs, one set for each preset level).

SNK OUT - Primary output for driving a relay coil. Output goes low to energize relay at end of count cycle. This output is rated V_{OL} = 0.6 V @ 100 mA, V_{OH} = 12 V max. (Internal suppression diode limits V_{OH} to +12 V internal supply and higher external supply cannot be used.)

SRC OUT - Auxiliary output goes high at end of a count cycle. This output is actually Bi-Polar, will source or sink 10 mA, and may be used for count input to other counters or external electronic control circuits.

6. Reset-To-Preset (RTP) & Reset-To-Zero (RTZ) Action
SC Presettable Counters when Reset, return the counter either to zero or to the Preset value (Start Count) as determined by the Reset Action.

MODEL SCP - Fixed RTZ action
MODEL SCD - Programmable for RTZ or RTP action

Reset actions do not determine U/D terminal direction. Count direction is controlled only by the U/D terminal which must be connected to “B” when down-counting is required.
The schematic diagram at right shows the details of the 100 KHz SCD count input circuit, the terminals used for sensor connection and the configuration setup switches. These switches are the first three switches in the switch bank and are designated S1, S2 and S3 from left to right. The functions of these switches are as follows:

**S1 - ON (SRC):** Provides 3.9 KΩ pull-down load for sensors with sourcing outputs. (Max. sensor current, 3 mA)

**OFF (SNK):** Provides a 7.8 KΩ pull-up load for sensors with sinking outputs. (Max. sensor current, 1.6 mA)

**S2 - ON (LO FRQ):** Connects damping cap for switch contact debounce. Limits count speed to 100 cps maximum. Min. count pulse ON/OFF times - 5 msec. (See Note 2)

**OFF (HI FRQ):** Removes damping cap, allows operation to 100 KHz. Min count pulse ON/OFF times - 5 µsec.

**S3 - ON (LO BIAS):** Sets input trigger levels to the low range to accept logic pulses with 0 to +5 V swings. (VIL = 1.5 V, VIH = 3.75 V, See Note 3)

**OFF (HI BIAS):** Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells and logic pulses with full 0 to +12 V swings. (VIL = 5.5 V, VIH = 7.5 V, See Note 3)

---

1. **SENSOR SUPPLY VOLTAGE AND CURRENT**
   - Sensor supply voltage on Term. “A” is +12 VDC nominal with ±15% variation due to line and internal load variation. All RLC sensors will accommodate this variation. Maximum sensor current rating varies depending on the specific counter model. See Specifications of specific model). This rating is the maximum allowable sensor current when all digits of a 6-digit unit display 8’s, and with 100 mA relay load(s) on preset counters. If all 6 digits are not used, an additional 45 mA is available for each digit not displayed. 4-digit models will deliver an additional 90 mA over the current rating stated. SC counter power supplies are not regulated, and in multiple counter (or counter/tachometer) installations all terminal “A’s” and “B’s” can be paralleled for load sharing. For unusually high sensor current requirements, use Accessory Power Supply (See Accessory Section of Catalog).

2. **HI/LO FRQ. SELECTION**
   - The HI/LO FRQ Selection switch MUST be set on LO FRQ when switch contacts are used to generate count input signals. Since the LO FRQ mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used whenever possible with electronic sensor outputs, as added insurance. The LO FRQ mode can be used with any type of sensor output provided count pulses never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. **VIL and VIH levels given are nominal values ±10% when counter voltage on terminal A is +12 VDC. These nominal values will vary in proportion to the variations in Terminal A voltage caused by line voltage and load changes.**

4. **When shielded cable is used, shield should be connected to terminal B at counter and left unconnected at sensor end.**

5. **The Count Input (Terminal C), can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V a limiting resistor and zener diode should be used to limit the voltage at Terminal C. Negative input voltages to Count Input (Terminal C), will damage the input circuit. If the possibility exists that the input voltage can swing negative, an external shunt or series diode should be used to block the negative swing.**
MODEL SCD - 10 KHZ PRESETTABLE COUNTER WITH 0.43” (11 MM) L.E.D. DISPLAY

DESCRIPTION
This high-performance presettable counter is based on solid-state technology proven in tens of thousands of field applications, and incorporates features that have made it an industry standard. With dual complementary outputs, input configuration programmability, selectable reset cycle modes and a full complement of control inputs, the Model SCD can handle practically any application for single level preset counting.

The Model SCD features two selectable counting actions. With RTZ (Reset-to-Zero) action, the counter resets to zero and counts up, actuating the outputs when it reaches the preset value. When RTP (Reset-to-Preset) action is selected, the counter is loaded with the preset number at the start of a cycle and counts down to activate the outputs when the count reaches zero.

The preset value entered on the thumbwheel switches is loaded at the end of a cycle (when the outputs are active) and during reset time. This prevents inadvertent changes in the preset number once a run has started and also avoids accidental over-runs that can occur with counters that allow "setting-on-the-fly".

Electrical connections are made to terminal strips on the rear of the unit. These pressure clamp screw terminals accept stripped wires up to #12 AWG and do not require lugs.

* - See SC Series Sensor Input Connections & Input Configuration Switch Setup, Note 1 or “Applications” Section of the Catalog.

SPECIFICATIONS
1. PRIMARY SUPPLY VOLTAGE: Available in two voltage ranges, 50/60 Hz (See Ordering Information). Allowable voltage variation ±10%. Input power 11.2 VA. Also operates from +12 VDC Supply (See Application Notes).
2. SENSOR OUTPUT POWER (TERM."A") +12 VDC ±15% @ 100 mA.
3. RESET & PRESET TIMING PARAMETERS:
   A. COUNT-AFTER-RESET - With RTZ action new counts can be accepted 75 µsec after reset. With RTP action new counts can be accepted 1 msec after reset.
   B. Preset loading occurs on timed output or reset.
4. OUTPUTS:
   SNK OUT - Primary output (current sinking) to drive control relay, 100 mA max. This output goes low when preset count (RTZ) or zero count (RTP) is reached.
   SRC OUT - Aux. Output (inverted) operates synchronously with “SNK OUT” to deliver +12 VDC @ 10 mA.
5. CURRENT DRAIN FROM BATTERY BACKUP: 60 mA with displays blanked and without sensor or output loads. 350 mA (6-digit), 260 mA (4-digit) with full display on (all 8’s) but less sensor and output load.
6. OPERATING TEMPERATURE RANGE: -20°C to +50°C
8. WEIGHT: 2.0 lbs (0.91 Kg)

DIMENSIONS “In inches (mm)”
RESET MODE & CYCLE SWITCHES

S4 - ON: Enables Front Panel Reset Button
OFF: Disables Front Panel Reset

S5 - ON: AUTO RST* - Causes counter to automatically reset upon reaching the preset count. Reset may be instantaneous or maintained for the duration of the output time delay. (See S6)
OFF: MAN. - Counter will reset only in response to Front Panel Button (if ENABLED) or Remote Reset (R).

S6 - ON: T.D. RST* - Counter automatically resets at preset (with S5 ON) and is held at reset for duration of time-out.
OFF: INST* - Counter automatically resets at preset (with S5 ON) and is instantly ready to accept new counts.

S7 - ON: LATCH - causes outputs to latch after reaching preset. Outputs stay ON until manually reset by Front Panel Button or Remote Reset.
OFF: T.D. - Allows outputs to respond to normal time delayed dropout.

S8 - ON: R.T.P. (Reset-to-Preset) - Counter resets to the number entered in thumbwheel Preset Switches, and outputs activate when count reaches zero. (Jumper req’d from U/D to B for down counting.)
OFF: R.T.Z. (Reset-to-Zero) - Counter resets to zero and outputs activate when count reaches number entered on T.W. Preset Switches.

* Remote reset (R) and Front Panel Reset (if ENABLED) will always take precedence and reset the counter regardless of automatic setup mode used.
† When down count is desired, (such as reset to preset modes of operation) the “UP/DN” terminal must be tied to the “COMM” terminal.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NO. OF DIGITS</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCD</td>
<td>10 KHz 1-Preset Cntm w/Display</td>
<td>4</td>
<td>SCDD00410 SCDD00400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>230 VAC 115 VAC</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
1. BATTERY BACK-UP & DISPLAY LIGHT (L) OPERATION

SC Counters can be operated from +12 VDC batteries or power supplies. (+12 VDC is connected to Term. “A” and minus to “B”). When the counter is powered by +12 VDC, and Term. “L” is pulled high to “A”, the display will remain activated and all counter functions will operate. When Term. “L” is opened the counter will continue to accumulate counts, with display blanked to conserve power (“L” is normally held high by applied A.C. line voltage).

With SCD and SC2 preset counters, opening “L” while operating from +12 VDC also disables the preset entry function. This can cause an aborted count accumulation if a preset level is reached after a line-failure. A normally-closed contact should be used to connect “L” to “A” when these counters are battery-backed. This allows normal operation to continue on power-loss until the machine comes to a stop. Then the switch can be opened to conserve power. (For Non-Interruptible Power Supply see Accessory Section of the Catalog)

2. REMOTE RESET (R) - Counter will be reset when this input is pulled low (to Term. “B”) by a remote contact or NPN O.C. output. Response time to Reset input is 10 µsec. Time required after release of Reset before new counts are accepted varies for each model. Check specifications of specific model being used. (Front panel reset button on all Models may be enabled or disabled via configuration switch on rear.) (Also See Note 7)

3. UP/DOWN (U/D) - With U/D Terminal open, counters increment (count “UP”) to increase the accumulated number. When U/D is pulled low, the counter will decrement (count “DOWN”) to decrease the accumulated number. Response time to change in count direction is 10 µsec.

Note: SC Counters count in complementary numbers when counting down through zero, i.e. the counting sequence when decrementing is 3, 2, 1, 0, 999999, 999998, 999997, etc. (Also See Note 7)

4. INHIBIT (I) - Counter is inhibited from accepting counts as long as “I” is pulled low to Term. “B”. Response time for initiation is 10 µsec, and release is 25 µsec.

5. STORE (S) - (Available on Model SCT Totalizer only.) When Term. “S” is open, the display functions normally and continuously updates as new counts are received. When Terminal “S” is pulled low, the display latches (freezes) to display the count existing immediately prior to being latched. The internal counter however, continues accumulating new counts and is unaffected by the Store function. When “S” is again open and allowed to go high, the display immediately reads out the current count.

6. OUTPUTS (SNK OUT & SRC OUT) (Preset Counters)

All SC Presettable counters have 2 complementary outputs per preset level (Models SC2DU and SC2DD have two sets of outputs, one set for each preset level).

SNK OUT - Primary output for driving a relay coil. Output goes low to energize relay at end of count cycle. This output is rated VOH = 0.6 V @ 100 mA, VOH = 12 V max. (Internal suppression diode limits VOH to +12 V internal supply and higher external supply cannot be used.)

SRC OUT - Auxiliary output goes high at end of a count cycle. This output is actually Bi-Polar, will source or sink 10 mA, and may be used for count input to other counters or external electronic control circuits.

7. RESET-TO-PRESET (RTP) & RESET-TO-ZERO (RTZ) ACTION

SC Presettable Counters when Reset, return the counter either to zero or to the Preset value (Start Count) as determined by the Reset Action.

MODEL SCP - Fixed RTZ action
MODEL SCD - Programmable for RTZ or RTP action
MODEL SC2DU - Fixed RTZ action
MODEL SC2DD - Fixed RTP action

Reset actions do not determine UP/DOWN count direction. Count direction is controlled only by the U/D terminal which must be connected to “B” when down-counting is required.
### SENSORS INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

All SC Series Counters use identical count input circuits. Sensor Input Connections and Input Configuration Switch Set-ups are the same for all.

The schematic diagram at right shows the details of the count input circuit, the terminals used for sensor connection and the configuration set-up switches. These switches are always the first three switches in the switch bank and are designated S1, S2 and S3 from left to right. The functions of these switches are as follows:

- **S1 - ON (SRC):** Provides 3.9 kΩ Pull-down load for sensors with sourcing outputs. (Max. sensor current, 3 mA)
  - OFF (SNK): Provides a 7.8 kΩ Pull-up load for sensors with sinking outputs. (Max. sensor current, 1.6 mA)

- **S2 - ON (LO FRQ):** Connects damping cap for switch contact debounce. Limits count speed to 100 cps maximum. Min. count pulse ON/OFF times-5 msec. (See Note 2)
  - OFF (HI FRQ): Removes damping cap, allows operation to 10 KHz. Min count pulse ON/OFF times-50 µsec.

- **S3 - ON (LO BIAS):** Sets input trigger levels to the low range to accept logic pulses with 0 to +5 V swings. (VIL = 1.5 V, VIH = 3.75 V, See Note 3)
  - OFF (HI BIAS): Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells and logic pulses with full 0 to +12 V swings. (VIL = 5.5 V, VIH = 7.5 V, See Note 3)

#### CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS

<table>
<thead>
<tr>
<th>COUNT SWITCH OR ISOLATED TRANSISTOR OUTPUTS</th>
<th>SENSORS WITH CURRENT SINK OUTPUT (PNP O.C.) (INCREMENTS ON TURN-OFF)</th>
<th>SENSORS WITH CURRENT SOURCE OUTPUT (NPN O.C.) (INCREMENTS ON TURN-ON)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT SOURCE CONNECTED (INCREMENT ON CLOSING)</td>
<td>CURRENT SINK CONNECTED (INCREMENT ON OPENING)</td>
<td>SENSOR POWER (NOTE 1)</td>
</tr>
<tr>
<td>A B C</td>
<td>A B C</td>
<td>+12V</td>
</tr>
<tr>
<td>RLC SENSOR MODELS: MPS, RR &amp; PR PHOTO ELECTRICS</td>
<td>A B C</td>
<td>+12V</td>
</tr>
</tbody>
</table>

#### NOTES:

1. **Senser Supply Voltage and Current**
   - Sensor supply voltage on Term. “A” is +12 VDC nominal with ±15% variation due to line and internal load variation. (All RLC sensors will accommodate this variation). Maximum sensor current rating varies depending on the specific counter model (See Specifications of specific model). This rating is the maximum allowable sensor current when all digits of a 6-digit unit display 8’s, and with 100 mA relay load(s) on preset counters. If all 6 digits are not used, an additional 45 mA is available for each digit not displayed. 4-digit models will deliver an additional 90 mA over the current rating stated. SC counter power supplies are not regulated, and in multiple counter (or counter/tachometer) installations all terminal “A’s” and “B’s” can be paralleled for load sharing. For unusually high sensor current requirements, use Accessory Power Supply (See Accessory Section of Catalog).

2. **HI/LO FRQ. SELECTION**
   - The HI/LO FRQ Selection switch MUST be set on LO FRQ when switch contacts are used to generate count input signals. Since the LO FRQ mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used whenever possible with electronic sensor outputs, as added insurance. The LO FRQ mode can be used with any type of sensor output provided count pulse widths never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. **VIL and VIH levels given are nominal values ±10% when counter voltage on terminal A is +12 VDC. These nominal values will vary in proportion to the variations in Terminal A voltage caused by line voltage and load changes.**

4. **When shielded cable is used, shield should be connected to terminal B at counter and left unconnected at sensor end.**

5. **The Count Input (Terminal C), can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V a limiting resistor and zener diode should be used to limit the voltage at Terminal C. Negative input voltages to Count Input (Terminal C), will damage the input circuit. If the possibility exists that the input voltage can swing negative, an external shunt or series diode should be used to block the negative swing.**
MODEL PAX - 1/8 DIN DIGITAL INPUT PANEL METERS

- COUNT, RATE AND SLAVE DISPLAY
- 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- 10 POINT SCALING FOR NON-LINEAR PROCESSES (PAXI)
- FOUR SETPOINT ALARM OUTPUTS (W/Option Card)
- RETRANSMITTED ANALOG OUTPUT (W/Option Card) (PAXI)
- COMMUNICATION AND BUS CAPABILITIES (W/Option Card) (PAXI)
- BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP
- PC SOFTWARE AVAILABLE FOR METER CONFIGURATION (PAXI)
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION

The PAX Digital Input Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. Available in three different models, PAXC Counter, PAXR Rate Meter and the PAXI which offers both counting and rate in the same package. Refer to pages 4 - 5 for the details on the specific models. The PAXC and PAXR offer only the Setpoint Option, while the PAXI is the fully featured version offering all the capabilities as outlined in this bulletin. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

The meters employ a bright 0.56" LED display. The unit is available with a red sunlight readable or standard green LED display. The intensity of the display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The meters accept digital inputs from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups and all standard RLC sensors. The meter can accept directional, uni-directional or Quadrature signals simultaneously. The maximum input signal varies up to 34 KHz depending on the count mode and function configurations programmed. Each input signal can be independently scaled to various process values.

The Rate Meters provide a MAX and MIN reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The meters have four setpoint outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and Bus Capabilities are also available as option cards for the PAXI only. These include RS232, RS485, Modbus, DeviceNet, and Profibus-DP. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meters have a feature that allows a remote computer to directly control the outputs of the meter. With an RS232 or RS485 card installed, it is possible to configure the meter using a Windows® based program. The configuration data can be saved to a file for later recall.

A linear DC output signal is available as an optional Plug-in card for the PAXI only. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track any of the counter or rate displays.

Once the meters have been initially configured, the parameter list may be locked out from further modification in its entirety or only the setpoint values can be made accessible.

The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

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

Do not use this 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 2.1" (53.4) H x 5" (127) W.
**ORDERING INFORMATION**

### Meter Part Numbers

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

- **C**: Counter
- **R**: Rate Meter
- **I**: Counter/Rate Meter
- **0**: Red, Sunlight Readable Display
- **1**: Green Display
- **0**: 85 to 250 VAC
- **1**: 11 to 36 VDC, 24 VAC

**Option Card and Accessories Part Numbers**

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>Description</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Plug-In Cards</td>
<td>PAXCDS</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Relay Output Card</td>
<td>PAXCDS20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sinking Open Collector Output Card</td>
<td>PAXCDS30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quad Setpoint Sourcing Open Collector Output Card</td>
<td>PAXCDS40</td>
</tr>
<tr>
<td></td>
<td>PAXCDC</td>
<td>RS485 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS485 Serial Communications Output Card with Dual RJ11 Connector</td>
<td>PAXCDC1C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS232 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDC20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended RS232 Serial Communications Output Card with 9 Pin D Connector</td>
<td>PAXCDC2C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DeviceNet Communications Card</td>
<td>PAXCDC30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modbus Communications Card</td>
<td>PAXCDC40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended Modbus Communications Card with Dual RJ11 Connector</td>
<td>PAXCDC4C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profinbus-DP Communications Card</td>
<td>PAXCDC50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog Output Card</td>
<td>PAXCDL10</td>
</tr>
<tr>
<td>Accessories</td>
<td>SFPAX*</td>
<td>PC Configuration Software for Windows 3.x and 95 (3.5&quot; disk)</td>
<td>SFPAX</td>
</tr>
</tbody>
</table>

*Software can be downloaded from www.redlion-controls.com

Shaded areas are only available for the PAXI.
1. **DISPLAY:** 6 digit, 0.56" (14.2 mm) red sunlight readable or standard green LED

2. **POWER:**
   - **AC Versions:**
     - AC Power: 85 to 250 V AC, 50/60 Hz, 18 VA
     - Isolation: 2300 Vrms for 1 min. to all inputs and outputs. (300 V working)
   - **DC Versions:**
     - DC Power: 11 to 36 VDC, 14 W
       - (derate operating temperature to 40°C if operating <15 VDC and three plug-in option cards are installed)
     - AC Power: 24 VAC, ± 10%, 50/60 Hz, 15 VA
     - Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).

3. **SENSOR POWER:**
   - 12 VDC, ±10%, 100 mA max. Short circuit protected

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

5. **USER INPUTS:** Three programmable user inputs
   - Max. Continuous Input: 30 VDC
   - Isolation To Sensor Input Commons: Not isolated
   - Logic State: Jumper selectable for sink/source logic

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

7. **CERTIFICATIONS AND COMPLIANCES:**
   - **SAFETY**
     - UL Recognized Component, File #E179259, UL3101-1, CSA C22.2 No. 1010-1
     - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
     - UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95
     - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
     - Type 4X Enclosure rating (Face only), UL50
     - IEC/EN CB Scheme Test Certificate #UL58348B/UL
     - CB Scheme Test Report #02ME04503-04120202
     - Issued by Underwriters Laboratories, Inc.
     - IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
     - IP65 Enclosure rating (Face only), IEC 529
     - IP20 Enclosure rating (Rear of unit), IEC 529

8. **ELECTROMAGNETIC COMPATIBILITY**
   - **Immunity to EN 50082-2**
     - Electrostatic discharge: EN 61000-4-2
       - Level 2: 4 Kv contact
       - Level 3: 8 Kv air
     - Electromagnetic RF fields: EN 61000-4-3
       - Level 3: 10 V/m
       - 80 MHz - 1 GHz
     - Fast transients (burst): EN 61000-4-4
       - Level 4: 2 Kv I/O
       - Level 3: 2 Kv power
     - RF conducted interference: EN 61000-4-6
       - Level 3: 10 V/rms
       - 150 KHz - 80 MHz
       - Level 3: 10 V/m
       - 900 MHz ±5 MHz
       - 200 Hz, 50% duty cycle

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

   - **Note:**
     - Refer to EMC Installation Guidelines section of the bulletin for additional information.

9. **ENVIRONMENTAL CONDITIONS:**
   - **Operating Temperature Range:** 0 to 50°C (0 to 45°C with all three plug-in cards installed)
   - **Storage Temperature Range:** -40 to 60°C
   - **Operating and Storage Humidity:** 0 to 85% max. relative humidity non-condensing
   - **Altitude:** Up to 2000 meters

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

11. **CONSTRUCTION:**
    - This unit is rated for NEMA 4X/IP65 outdoor use.

12. **WEIGHT:** 10.1 oz. (286 g)
MODEL PAXC - 1/8 DIN COUNTER

PAXC SPECIFICATIONS

MAXIMUM SIGNAL FREQUENCIES:
To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

<table>
<thead>
<tr>
<th>FUNCTION QUESTIONS</th>
<th>Single: Counter A or B</th>
<th>Dual: Counter A &amp; B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are any setpoints used?</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Is Counter C used?</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

COUNT MODE (Values are in KHz)
- Count x1: 34, 25, 18, 15, 13, 12, 9, 7.5
- Count x2: 17, 13, 9, 7, 5, 4
- Quadrature x1: 22, 19, 12, 10, 7, 6, 4, 3.5
- Quadrature x2: 17, 13, 9, 7, 6, 4, 3.5
- Quadrature x4: 8, 6, 4, 3

Notes:
1. Counter Modes are explained in the Module 1 programming section.
2. Listed values are with frequency DIP switch set on HI frequency.

ANNUNCIATORS:
- A - Counter A
- B - Counter B
- C - Counter C
- ± - Upper significant digit display of counter
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

COUNTER DISPLAYS:
- Maximum display: 8 digits: ±99999999 (greater than 6 digits display alternates between high order and low order.)
- Inputs A and B: DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.
- Logic: Input trigger levels VIL = 1.5 V max.; VIH = 3.75 V min.
- Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, IMAX = 1.9 mA.
- Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.
- Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.
- Dual Count Modes:
  - When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

MODEL PAXR - 1/8 DIN RATE METER

PAXR SPECIFICATIONS

ANNUNCIATORS:
- r - Rate
- H - Maximum (High) Rate
- L - Minimum (Low) Rate
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

RATE DISPLAY:
- Accuracy: ±0.01%
- Minimum Frequency: 0.01 Hz
- Maximum Frequency: 34 KHz
- Maximum Display: 5 Digits: 99999
- Adjustable Display (low) Update: 0.1 to 99.9 seconds
- Over Range Display: "r $99999"

INPUT A:
- DIP switch selectable to accept pulses from a variety of sources including TTL outputs, magnetic pickups and all standard RLC sensors.
- Logic: Input trigger levels VIL = 1.5 V max.; VIH = 3.75 V min.
- Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, IMAX = 1.9 mA.
- Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.
- Magnetic Pickup:
  - Sensitivity: 200 mV peak
  - Hysteresis: 100 mV
  - Input impedance: 3.9 KΩ @ 60 Hz
  - Maximum input voltage: ±40 V peak, 30 Vrms

- 5-DIGIT LED DISPLAY
- RATE INDICATION
- MINIMUM/MAXIMUM RATE DISPLAYS
- SETPOINT ALARM OUTPUTS (W/Plug-in card)
MODEL PAXI - 1/8 DIN COUNTER/RATE METER

- COUNT, RATE AND SLAVE DISPLAY
- 6-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- 10 POINT SCALING (FOR NON-LINEAR PROCESSES)
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- BUS CAPABILITIES; DEVICEENET, MODBUS, AND PROFIBUS-DP
- PC SOFTWARE AVAILABLE FOR METER CONFIGURATION

PAXI SPECIFICATIONS

MAXIMUM SIGNAL FREQUENCIES TABLE
To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

<table>
<thead>
<tr>
<th>FUNCTION QUESTIONS</th>
<th>Single: Counter A or B (with/without rate) or Rate only</th>
<th>Dual: Counter A &amp; B or Rate not assigned to active single counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are any setpoints used?</td>
<td>Y Y Y Y</td>
<td>N N N N</td>
</tr>
<tr>
<td>Is Prescaler Output used?</td>
<td>Y Y Y Y</td>
<td>N N Y Y</td>
</tr>
<tr>
<td>Is Counter C used?</td>
<td>N Y N Y</td>
<td>N Y N Y</td>
</tr>
<tr>
<td>COUNT MODE</td>
<td>(Values are in KHz)</td>
<td>(Values are in KHz)</td>
</tr>
<tr>
<td>Count x1</td>
<td>34 25 21 17</td>
<td>13 12 13 11</td>
</tr>
<tr>
<td>Count x2</td>
<td>17 13 16 12</td>
<td>9 7 8 7</td>
</tr>
<tr>
<td>Quadrature x1</td>
<td>22 19 20 17</td>
<td>7* 6* 6* 5*</td>
</tr>
<tr>
<td>Quadrature x2</td>
<td>17 13 16 12</td>
<td>9 7 8 6</td>
</tr>
<tr>
<td>Quadrature x4</td>
<td>8 6 8 6</td>
<td>4 3 4 3</td>
</tr>
<tr>
<td>Rate Only</td>
<td>34 N/A 21 N/A</td>
<td>34 N/A 21 N/A</td>
</tr>
</tbody>
</table>

Notes:
1. Counter Modes are explained in the Module 1 programming section.
2. If using Rate with single counter with direction or quadrature, assign it to Input A for the listed frequency.
3. * Double the listed value for Rate frequency.
4. Listed values are with frequency DIP switch set on HI frequency.
5. Derate listed frequencies by 20% during serial communications. (Placing a 5 msec. delay between serial characters will eliminate the derating.)

ANNUNCIATORS:
- A - Counter A
- B - Counter B
- C - Counter C
- r - Rate
- H - Maximum (High) Rate
- L - Minimum (Low) Rate
- D - Upper significant digit display of counter
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

RATE DISPLAY:
- Accuracy: ±0.01%
- Minimum Frequency: 0.01 Hz
- Maximum Frequency: see Max Signal Frequencies Table.
- Maximum Display: 5 Digits: 999999
- Adjustable Display (low) Update: 0.1 to 99.9 seconds
- Over Range Display: "r D L D L"

COUNTER DISPLAYS:
- Maximum display: 8 digits: ± 99999999 (greater than 6 digits display
Alternates between high order and low order.)

INPUTS A and B:
- DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.
- LOGIC: Input trigger levels VIL = 1.5 V max.; VIH = 3.75 V min.
- Current sinking: Internal 7.8 KΩ pull-up to +12 VDC, IMAX = 1.9 mA.
- Current sourcing: Internal 3.9 KΩ pull-down, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.
- Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.
- MAGNETIC PICKUP:
  - Sensitivity: 200 mV peak
  - Hysteresis: 100 mV
  - Input impedance: 3.9 KΩ @ 60 Hz
- Maximum input voltage: ±40 V peak, 30 Vrms

DUAL COUNT MODES:
- When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

PRESCALER OUTPUT:
- NPN Open Collector: ISNK = 100 mA max. @ VIL = 1 VDC max. VGH = 30 VDC max. With duty cycle of 25% min. and 50% max.
WARNING: Disconnect all power to the unit before installing Plug-in cards.

Adding Option Cards
The PAX and MPAX series meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

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

PAXCDC10 - RS485 Serial (Connector)  PAXCDC20 - RS485 Serial (Terminal)  PAXCDC3C - Modbus (Connector)  PAXCDC40 - Modbus (Terminal)
PAXCDC4C - Modbus (Connector)  PAXCDC50 - Profibus-DP

SERIAL COMMUNICATIONS CARD
Type: RS485 or RS232
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Data: 7/8 bits
Baud: 300 to 19,200
Parity: no, odd or even
Bus Address: Selectable 0 to 99, Max. 32 meters per line (RS485)
Transmit Delay: Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

DEVICENET™ CARD
Compatibility: Group 2 Server Only, not UCMM capable
Baud Rates: 12 5Kbaud, 250 Kbaud, and 500 Kbaud
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume 1 Section 10.2.2
Node Isolation: Bus powered, isolated node
Host Isolation: 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

MODBUS CARD
Type: RS485; RTU and ASCII MODBUS modes
Isolation To Sensor & User Input Commons: 500 Vrms for 1 minute.
Working Voltage: 50 V. Not Isolated from all other commons.
Baud Rates: 300 to 38400.
Data: 7/8 bits
Parity: No, Odd, or Even
Addresses: 1 to 247.
Transmit Delay: Programmable; See Transmit Delay explanation.

PROFIBUS-DP CARD
Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASCII
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rates: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud
Station Address: 0 to 126, set by the master over the network. Address stored in non-volatile memory.
Connection: 9-pin Female D-Sub connector
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

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

OPTIONAL PLUG-IN OUTPUT CARDS

- QUAD SINKING OPEN COLLECTOR CARD
- QUAD SOURCING OPEN COLLECTOR CARD
- QUAD RELAY CARD
- DUAL RELAY CARD
- ANALOG OUTPUT CARD

SETPOINT CARDS (PAXCDS)
The PAX and MPAX series have 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:
PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
PAXCDS20 - Quad Relay, FORM-A, Normally open only
PAXCDS30 - Isolated quad sinking NPN open collector
PAXCDS40 - Isolated quad sourcing PNP open collector

DUAL RELAY CARD
Type: Two FORM-C relays
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min.
Working Voltage: 240 Vrms
Contact Rating:
One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @ 120 VAC, inductive load
Total current with both relays energized not to exceed 5 amps
Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads
Response Time: 5 msec. nominal with 3 msec. nominal release
Time Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD RELAY CARD
Type: Four FORM-A relays
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min.
Working Voltage: 250 Vrms
Contact Rating:
One Relay Energized: 3 amps @ 250 VAC or 30 VDC (resistive load), 1/10 HP @ 120 VAC, inductive load
Total current with all four relays energized not to exceed 4 amps
Life Expectancy: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads
Response Time: 5 msec. nominal with 3 msec. nominal release
Time Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD SINKING OPEN COLLECTOR CARD
Type: Four isolated sinking NPN transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating: 100 mA max @ VSA T= 0.7 V max. VMAX = 30 V
Response Time: Counter = 25 µsec; Rate = Low Update time
Time Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

QUAD SOURCING OPEN COLLECTOR CARD
Type: Four isolated sourcing PNP transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating: Internal supply: 24 VDC ± 10% , 30 mA max. total
External supply: 30 VDC max., 100 mA max. each output
Response Time: Counter = 25 µsec; Rate = Low Update time
Time Accuracy: Counter = ± 0.01% + 10 msec.
Rate = ± 0.01% + 20 msec.

PAXI LINEAR DC OUTPUT (PAXCDL)
Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.
PAXCDL10 - Retransmitted Analog Output Card

ANALOG OUTPUT CARD
Types: 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Accuracy: 0.17% of FS (18 to 28°C); 0.4% of FS (0 to 50°C)
Resolution: 1/3500
Compliance: 10 VDC; 10 KΩ load min., 20 mA: 500 Ω load max.
Response Time: 50 msec. max., 10 msec. typ.
1.0 Installing The Meter

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

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

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

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

2.0 Setting the Jumper and Dip Switches

To access the jumper and switches, remove the meter base from the meter case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

2.1 Setting the Jumper
The meter has one jumper for user input logic. When using the user inputs this jumper must be set before applying power. The Main Circuit Board figure shows the location of the jumper and DIP switch.
The user input jumper determines signal logic for the user inputs, when they are used with user functions or for input signal direction. All user inputs are set by this jumper.

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

2.2 Setting the Input Dip Switches
The meter has six DIP switches for Input A and Input B terminal set-up that must be set before applying power. NOTE: The PAXR only uses switches 1-3.

SWITCHES 3 and 6
Hi Frequency: Removes damping capacitor and allows max. frequency.
LO Frequency: Adds a damping capacitor for switch contact bounce. Also limits input frequency to 50 Hz and input pulse widths to 10 usec.

SWITCHES 2 and 5
SRC.: Adds internal 3.9 KΩ pull-down resistor, 7.3 mA max. @ 28 VDC, VMAX = 30 VDC.
SNK.: Adds internal 7.8 KΩ pull-up resistor to +12 VDC, IMAX = 1.9 mA.

SWITCHES 1 and 4
LOGIC: Input trigger levels VIH = 1.5 V max.; VIL = 3.75 V min.
MAG: 200 mV peak input (must also have SRC on). Not recommended with counting applications.
The Plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The Plug-in cards have many unique functions when used with the PAX. The literature that comes with these cards should be discarded, unless it specifically states in the Plug-in Card literature that the information applies to the PAX. Note: The PAXC and PAXR only use the setpoint option card.

CAUTION: The Plug-in card 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.

**To Install:**
1. With the case open, locate the Plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.*
2. Install the Plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the Plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the Plug-in card label to the bottom side of the meter in the designated area. Do Not Cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly.

**Quad Sourcing Open Collector Output Card Supply Select**

* If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.
WIRING OVERVIEW
Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter’s voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3” (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm), two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

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

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

4.0 Wiring the Meter

4.1 POWER WIRING

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

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

4.2 USER INPUT WIRING
Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If User Input 1 and/or 2 are wired for quadrature or directional counting, an additional switching device should not be connected to that User Input terminal. Only the appropriate User Input terminal has to be wired.

**Sinking Logic**
Terminals 7-9
Connect external switching device between the appropriate User Input terminal and User Comm.

The user inputs of the meter are internally pulled up to +12 V with 5.1 K resistance. The input is active when it is pulled low (<0.9 V).

**Sourcing Logic**
Terminals 7-9:
+ VDC through external switching device
Terminal 10:
-VDC through external switching device

The user inputs of the meter are internally pulled down to 0 V with 5.1 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.
4.3 INPUT WIRING

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

If you are wiring Input B, connect signal to Terminal 6 instead of 5, and set DIP switches 4, 5, and 6 to the positions shown for 1, 2, and 3.

<table>
<thead>
<tr>
<th>Magnetic Pickup</th>
<th>AC Inputs From Tach Generators, Etc.</th>
<th>Two Wire Proximity, Current Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Magnetic Pickup Diagram" /></td>
<td><img src="image2" alt="AC Inputs Diagram" /></td>
<td><img src="image3" alt="Two Wire Proximity Diagram" /></td>
</tr>
</tbody>
</table>

- **Current Sinking Output**
- **Current Sourcing Output**
- **Interfacing With TTL**
- **Switch or Isolated Transistor; Current Sink**
- **Switch or Isolated Transistor; Current Source**
- **Emitter Follower; Current Source**
- **Current Sink Output; Quad/Direction**
- **Current Sink Output; Quad/Direction**

If using single Counter B, then wire signal to 6, and Quad/Direction to B. Set switch positions 4, 5, and 6 as shown for 1, 2, and 3.

- **User Input Jumper in Sink Position**
- **Shaded areas not recommended for counting applications.**

4.4 SETPOINT (ALARMS) WIRING

<table>
<thead>
<tr>
<th>SETPOINT PLUG-IN CARD TERMINALS</th>
<th>SOURCING OUTPUT LOGIC CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUAD RELAY PAXCD50</td>
<td><img src="image4" alt="Sourcing Output Logic Card Diagram" /></td>
</tr>
<tr>
<td>DUAL RELAY PAXCD50</td>
<td></td>
</tr>
</tbody>
</table>

- **SINKING OUTPUT LOGIC CARD**

- **Quad Sinking PAXCD50**
- **Quad Sourcing PAXCD50**

- **Current Sink Output**
- **Current Sourcing Output**

- **Switch or Isolated Transistor; Current Sink**
- **Switch or Isolated Transistor; Current Source**
- **Emitter Follower; Current Source**

- **Current Sink Output; Quad/Direction**
- **Current Sink Output; Quad/Direction**

- **User Input Jumper in Sink Position**
- **Shaded areas not recommended for counting applications.**
RS232 Communications

RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The PAX emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device.

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function. As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is “busy”. The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the PAX is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

4.5 PAXI SERIAL COMMUNICATION WIRING

4.6 PAXI ANALOG OUTPUT WIRING

4.7 PAXI PRESCALER OUTPUT WIRING

5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

### Counter Readout Legends

- **A**: Setpoint Alarm
- **B**: SP1
- **C**: SP2
- **SP3**: SP3
- **SP4**: SP4
- **DSP**: Disp
- **PAR**: Par
- **F1**: F1
- **F2**: F2
- **RST**: Rst
- **F1A**: Function key 1; hold for 3 seconds for Second Function 1
- **F2V**: Function key 2; hold for 3 seconds for Second Function 2
- **RST**: Reset (Function key)

* Counters B, and C are locked out in Factory Settings (PAXC and PAXI only).
** Factory setting for the F1, and F2 keys is NO mode.
*** Factory setting for the RST key is d5F-5t (Reset Display).

**DISPLAY MODE OPERATION**
- **DSP**: Index display through the selected displays.
- **PAR**: Access Programming Mode
- **F1**: Function key 1; hold for 3 seconds for Second Function 1
- **F2**: Function key 2; hold for 3 seconds for Second Function 2
- **RST**: Reset (Function key)

**PROGRAMMING MODE OPERATION**
- **DSP**: Quit programming and return to Display Mode
- **Par**: Store selected parameter and index to next parameter
- **F1**: Increment selected parameter value or selections
- **F2**: Decrement selected parameter value or selections
- **RST**: Advances digit location in parameter values
6.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

PROGRAMMING MODE ENTRY (PAR KEY)

The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the PAR key. If it is not accessible then it is locked by either a security code, or a hardware lock.

Two types of programming modes are available. Quick Programming Mode permits only certain parameters to be viewed and/or modified. All meter functions continue to operate except the front panel keys change to Programming Mode Operations. Quick Programming Mode is configured in Module 3. Full Programming Mode permits all parameters to be viewed and modified. In this mode, incoming counts may not be recognized correctly, the front panel keys change to Programming Mode Operations and certain user input functions are disabled. Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming.

MODULE ENTRY (ARROW & PAR KEYS)

The Programming Menu is organized into nine modules. These modules group together parameters that are related in function. The display will alternate between the present module and the present module. The arrow keys (F1! and F2") are used to select the desired module. The displayed module is entered by pressing the PAR key.

MODULE MENU (PAR KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Programming Mode and the present module. The arrow keys (F1! and F2") are used to select the desired module. The displayed module is entered by pressing the PAR key.

SELECTION / VALUE ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the present parameter and the selections/values for that parameter. The arrow keys (F1! and F2") are used to move through the selections/values for that parameter. Pressing the PAR key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the RST key may be used to select a specific digit to be changed. Once a digit is selected, the arrow keys are used to increment or decrement that digit to the desired number.

PROGRAMMING MODE EXIT (DSP KEY or at PrA PAR KEY)

The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with PrA ND displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

It is recommended to start with Module 1 for counting and Module 4 for rate. If lost or confused while programming, press the DSP key and start over. When programming is complete, it is recommended to record the parameter programming on the Parameter User Chart and lock out parameter programming with a user input or lock-out code.

FACTORY SETTINGS

Factory Settings may be completely restored in Module 9. This is a good starting point for programming problems. Most parameters can be left at their Factory Settings without affecting basic start-up. These parameters are identified throughout the module explanations.

ALTERNATING SELECTION DISPLAY

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

6.1 MODULE 1 - COUNT A & B INPUT PARAMETERS (1-1NP)

Module 1 is the programming for Counter A, Counter B and the Prescaler Output. Counter B parameters follow the Prescaler parameters. For maximum input frequency, the counters should be set to mode NONE and the Prescaler to NO when they are not in use. When set to NONE or NO, the remaining related parameters are not accessible. A corresponding annunciator indicates the counter being shown in the Display Mode. An Exchange Parameter Lists feature for scale factors and count load values is explained in Module 2.
COUNTER A OPERATING MODE

- **NONE**: Does not count.
- **cnt**: Count X1.
- **cntud**: Count X1.
- **dctud**: Count X1.
- **cnt2**: Count X2.
- **dct2**: Count X2.
- **cntud2**: Count X2.
- **dctud2**: Count X2.

Select the operating mode for Counter A.

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NONE</strong></td>
<td></td>
<td>Does not count.</td>
</tr>
<tr>
<td><strong>cnt</strong></td>
<td></td>
<td>Count X1 Adds Input A falling edge.</td>
</tr>
<tr>
<td><strong>cntud</strong></td>
<td></td>
<td>Count X1 Adds Input A falling edge if Input B is high.</td>
</tr>
<tr>
<td><strong>dctud</strong></td>
<td></td>
<td>Count X1 Adds Input A falling edge if User 1 is high.</td>
</tr>
<tr>
<td><strong>qRad1</strong></td>
<td>Quad</td>
<td>Adds Input A rising edge when Input B is high.</td>
</tr>
<tr>
<td><strong>qRad2</strong></td>
<td>Quad</td>
<td>Adds Input A rising edge when Input B is high and Input A rising edge when Input B is low.</td>
</tr>
<tr>
<td><strong>qRad4</strong></td>
<td>Quad</td>
<td>Adds Input A rising edge when B is high, Input A falling edge when Input B is low, Input B rising edge when Input A is low, and Input B falling edge when Input A is low.</td>
</tr>
<tr>
<td><strong>dqRad1</strong></td>
<td>Quad</td>
<td>Adds Input A rising edge when User 1 is high.</td>
</tr>
<tr>
<td><strong>dqRad2</strong></td>
<td>Quad</td>
<td>Adds Input A rising edge when User 1 is high and Input A rising edge when User 1 is low.</td>
</tr>
<tr>
<td><strong>cnt2</strong></td>
<td>Count</td>
<td>Adds Input A rising and falling edges.</td>
</tr>
<tr>
<td><strong>cntud2</strong></td>
<td>Count</td>
<td>Adds Input A rising and falling edges if Input B is high.</td>
</tr>
<tr>
<td><strong>dctud2</strong></td>
<td>Count</td>
<td>Adds Input A rising and falling edges if User 1 is high.</td>
</tr>
</tbody>
</table>

COUNTER A RESET ACTION

- **R-RESET**: When Counter A is reset, it returns to zero or Counter A count load value.
- **2Er0**: This resets all Counter A resets, except the Setpoint Counter Auto Reset in Module 6.
- **CnLd**: Counter A may be programmed to reset at each meter power-up.

COUNTER A SCALE MULTIPLIER *

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

COUNTER A COUNT LOAD VALUE *

When reset to count load action is selected, Counter A will reset to this value.

COUNTER A RESET POWER-UP *

Counter A may be programmed to reset at each meter power-up.

PAXI: PRESCALER OUTPUT ENABLE *

This enables the prescaler output. The prescaler output is useful for providing a lower frequency scaled pulse train to a PLC or another external counter. On each falling edge of Input A, the prescaler output register increments by the prescaler scale value *(Pr-URL)*. When the register equals or exceeds 1.0000, a pulse is output and the register is lowered by 1.0000. The prescaler register is reset to zero whenever Counter A is reset (except for Setpoint Counter Auto Reset). (See Prescaler Output Figure.)

COUNTER A DECIMAL POSITION

This selects the decimal point position for Counter A and any setpoint value assigned to 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 and the scale multiplier 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.)

* Factory Setting can be used without affecting basic start-up.
**COUNTER B OPERATING MODE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>cnt</td>
<td>Count X1 adds Input B falling edge.</td>
</tr>
<tr>
<td></td>
<td>dcntud</td>
<td>Count X1 w/direction adds Input B falling edge if User 2 is high.</td>
</tr>
<tr>
<td></td>
<td>dqurld</td>
<td>Quad X1 adds Input B rising edge when User 2 is high.</td>
</tr>
<tr>
<td></td>
<td>dqurld2</td>
<td>Quad X2 adds Input B rising edge when User 2 is high and Input B rising edge when User 2 is low.</td>
</tr>
<tr>
<td></td>
<td>cnt2</td>
<td>Count X2 adds Input B rising and falling edges.</td>
</tr>
<tr>
<td></td>
<td>dctud2</td>
<td>Count X2 w/direction adds Input B rising and falling edges if User 2 is low.</td>
</tr>
</tbody>
</table>

Select the operating mode for Counter B.

**SCALING CALCULATIONS**

The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 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 B SCALE MULTIPLIER**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>sccalr</td>
<td>Scale Multiplier (x CM x SM) selection of 1, 0.1 or 0.01.</td>
</tr>
</tbody>
</table>

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

**COUNTER B COUNT LOAD VALUE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>MODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>bcntld</td>
<td>Counter B may be programmed to reset at each meter power-up.</td>
</tr>
</tbody>
</table>

When reset to count load action is selected, Counter B will reset to this value.

**COUNTER B RESET POWER-UP**

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

**8 DIGIT COUNT VALUES**

Any counter display value below -999999 or above 999999 (less decimal point) will consist of a two part display. This display alternates between the least 6 significant digits and the remaining most significant digits beginning with “00” in the display. If the display exceeds ±99999999 the display will roll to zero and continue counting. Outputs cannot be set to counter values above 6 digits. The annunciator, indicating the counter being displayed, will flash when the value is above 6 digits.

**GENERAL RULES ON SCALING**

1. It is recommended that, the scale factor be as close as possible to, but not exceeding 1.00000. This can be accomplished by increasing or decreasing the counter decimal position, using the scale multiplier, or selecting a different count mode.

2. To double the number of pulses per unit, use counter modes direction X2 or Quad X2. To increase it by four times, use counter mode quad X4. Using these modes will decrease the maximum input frequency.

3. A scale factor greater than 1.00000 will cause Counter display rounding. In this case, digit jumps could be caused by the internal count register rounding the display. The precision of a counter application cannot be improved by using a scale factor greater than 1. 00000.

4. The number of pulses per single unit must be greater than or equal to the process (i.e. # of pulses per foot) times factor of the mode 1, 2 or 4.

5. Lowering the scale factor can be accomplished by lowering the counter decimal position. (Example: 100 (Hundredths)/10 pulses = 10.000 lowering to 10 (Tenths)/10 = 1.000.)

6. When reset to count load action is selected, Counter B will reset to this value.
Module 2 is the programming for rear terminal user inputs and front panel function keys.

Three rear terminal user inputs are individually programmable to perform specific meter control functions. While in the Display Mode, the function is executed when the user input transitions to the active state. (Refer to the user input specifications for active state response times.) Certain user input functions are disabled in “full” Programming Mode.

Three front panel function F1, F2 and RST keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed when the key is pressed. Holding the F1 and F2 function keys for three seconds executes a secondary function. It is possible to program a secondary function without a primary function. The front panel key functions are disabled in both Programming Modes.

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

Some of the user functions have a sublist of parameters. The sublist is accessed when PAR is pressed at the listed function. The function will only be performed for the parameters entered as YES. If a user input or function key is configured for a function with a sublist, then that sublist will need to be scrolled through each time to access the following user inputs or function keys parameters.

**NO FUNCTION**

With this selection, NO function is performed. This is the factory setting for all user inputs and function keys except the Reset (RST) Key.

**PROGRAMMING MODE LOCK-OUT**

Programming Mode is locked-out, as long as activated (maintained action). In Module 3, certain parameters can be setup where they are still accessible during Programming Mode Lockout. A security code can be configured to allow complete programming access during user input lockout. Function keys should not be programmed for PLOC.

**ADVANCE DISPLAY**

When activated (momentary action), the display advances to the next display that is not locked out from the Display Mode.

**RESET DISPLAY**

When activated (momentary action), the shown display is reset. This is the factory setting for the Reset (RST) Key.

**EXCHANGE PARAMETER LISTS**

Two lists of values are available for SP-1, SP-2, SP-3, SP-4, MRF-1, MRF-2, ESEFR, ESEF, EFR-M, MFR-E, MFR-EE and MFR-M. The two lists are named L15St-A and L15St-B. If a user input is used to select the list then L15St-A is selected when the user input is not active and L15St-B is selected when the user input is active, (maintained action). If a front panel key is used to select the list then the list will toggle for each key press, (momentary action). The meter will suspend ALL operations for approximately 1 msec. while the new values are loaded. The display will only indicate which list is active when the list is changed or when entering any Programming Mode.

To program the values for L15St-A and L15St-B, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the values for SP-1, SP-2, SP-3, SP-4, MRF-1, MRF-2, ESEFR, ESEF, EFR-M, MFR-E, MFR-EE and MFR-M. If any other parameters are changed then the other list values must be reprogrammed.

Shaded parameters do not apply to the PAXR.

**Note:** When downloading an SFPAX program containing List A/B, make sure that both the software and meter have the same list active. The active list in an SFPAX program is the one being displayed in Input Setup and/or Setpoint Alarms category. To ensure that List A and List B values are transmitted during an upload from the meter, first switch the meter between List A and List B.

**PAXI: PRINT REQUEST**

The meter issues a block print through the serial port when activated. The data transmitted during the print request is configured in Module 7. If the user input is still active after the transmission is complete (about 100 msec.), an additional transmission will occur. Only one transmission will take place with each function key depression. This selection will only function when a serial communications Plug-in card is installed in the meter.

**PAXI: PRINT REQUEST AND RESET DISPLAYS**

The meter issues a block print through the serial port when activated just like the Print Request function. In addition, when activated (momentary action), the meter performs a reset of the displays configured as YES. The print aspect of this action only functions when a serial communication plug-in card is installed. The reset action functions regardless.
### MAINTAINED (LEVEL) RESET AND INHIBIT

![Image of MAINTAINED (LEVEL) RESET AND INHIBIT]

The meter performs a reset and inhibits the displays configured as **YES**, as long as activated (maintained action).

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counter A</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter B</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter C</td>
<td>NO</td>
</tr>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### PAXR: MAINTAINED (LEVEL) RESET AND INHIBIT

![Image of PAXR: MAINTAINED (LEVEL) RESET AND INHIBIT]

The meter performs a reset and inhibits the displays configured as **YES**, as long as activated (maintained action).

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### MOMENTARY (EDGE) RESET

![Image of MOMENTARY (EDGE) RESET]

When activated (momentary action), the meter resets the displays configured as **YES**. (Momentary resets improve max. input frequencies over maintained resets.)

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counter A</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter B</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter C</td>
<td>NO</td>
</tr>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### PAXR: MOMENTARY (EDGE) RESET

![Image of PAXR: MOMENTARY (EDGE) RESET]

When activated (momentary action), the meter resets the displays configured as **YES**. (Momentary resets improve max. input frequencies over maintained resets.)

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### INHIBIT

![Image of INHIBIT]

The meter inhibits the displays configured as **YES**, as long as activated (maintained action).

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counter A</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter B</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter C</td>
<td>NO</td>
</tr>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### STORE DISPLAY

![Image of STORE DISPLAY]

The meter holds (freeze) the displays configured as **YES**, as long as activated (maintained action). Internally the counters and max. and min. values continue to update.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counter A</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter B</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Counter C</td>
<td>NO</td>
</tr>
<tr>
<td>H</td>
<td>Maximum</td>
<td>NO</td>
</tr>
<tr>
<td>L</td>
<td>Minimum</td>
<td>NO</td>
</tr>
</tbody>
</table>

### DEACTIVATE SETPOINT MAINTAINED (LEVEL)

![Image of DEACTIVATE SETPOINT MAINTAINED (LEVEL)]

The meter deactivates the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint card installed.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>Setpoint 1</td>
<td>NO</td>
</tr>
<tr>
<td>SP-2</td>
<td>Setpoint 2</td>
<td>NO</td>
</tr>
<tr>
<td>SP-3</td>
<td>Setpoint 3</td>
<td>NO</td>
</tr>
<tr>
<td>SP-4</td>
<td>Setpoint 4</td>
<td>NO</td>
</tr>
</tbody>
</table>

### DEACTIVATE SETPOINT MOMENTARY (EDGE)

![Image of DEACTIVATE SETPOINT MOMENTARY (EDGE)]

When activated (momentary action), the meter deactivates the setpoints configured as **YES**. This action only functions with a Setpoint card installed.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>Setpoint 1</td>
<td>NO</td>
</tr>
<tr>
<td>SP-2</td>
<td>Setpoint 2</td>
<td>NO</td>
</tr>
<tr>
<td>SP-3</td>
<td>Setpoint 3</td>
<td>NO</td>
</tr>
<tr>
<td>SP-4</td>
<td>Setpoint 4</td>
<td>NO</td>
</tr>
</tbody>
</table>

### HOLD SETPOINT STATE

![Image of HOLD SETPOINT STATE]

The meter holds the state of the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint plug-in card installed.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>Setpoint 1</td>
<td>NO</td>
</tr>
<tr>
<td>SP-2</td>
<td>Setpoint 2</td>
<td>NO</td>
</tr>
<tr>
<td>SP-3</td>
<td>Setpoint 3</td>
<td>NO</td>
</tr>
<tr>
<td>SP-4</td>
<td>Setpoint 4</td>
<td>NO</td>
</tr>
</tbody>
</table>

### ACTIVATE SETPOINT MAINTAINED (LEVEL)

![Image of ACTIVATE SETPOINT MAINTAINED (LEVEL)]

The meter activates the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint card installed.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>Setpoint 1</td>
<td>NO</td>
</tr>
<tr>
<td>SP-2</td>
<td>Setpoint 2</td>
<td>NO</td>
</tr>
<tr>
<td>SP-3</td>
<td>Setpoint 3</td>
<td>NO</td>
</tr>
<tr>
<td>SP-4</td>
<td>Setpoint 4</td>
<td>NO</td>
</tr>
</tbody>
</table>

### ACTIVATE SETPOINT MOMENTARY (EDGE)

![Image of ACTIVATE SETPOINT MOMENTARY (EDGE)]

When activated (momentary action), the meter activates the setpoints configured as **YES**. This action only functions with a Setpoint card installed.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>Setpoint 1</td>
<td>NO</td>
</tr>
<tr>
<td>SP-2</td>
<td>Setpoint 2</td>
<td>NO</td>
</tr>
<tr>
<td>SP-3</td>
<td>Setpoint 3</td>
<td>NO</td>
</tr>
<tr>
<td>SP-4</td>
<td>Setpoint 4</td>
<td>NO</td>
</tr>
</tbody>
</table>

### CHANGE DISPLAY INTENSITY LEVEL

![Image of CHANGE DISPLAY INTENSITY LEVEL]

When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEV) settings of 0, 3, 8 & 15. The intensity level, when changed via the User Input/Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.
Module 3 is the programming for Display lock-out and “Full” and “Quick” Program lock-out.

When in the Display Mode, the available displays can be read consecutively by repeatedly pressing the DSP key. An annunciator indicates the display being shown. These displays can be locked from being visible. It is recommended that the display be set to LOC when the corresponding function is not used.

“Full” Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the PAR key is pressed, the meter enters a Quick Programming Mode. In this mode, setpoint, count load and scale factor values can still be read and/or changed per the selections below. The Display Intensity Level (DIF) parameter also appears whenever Quick Programming Mode is enabled, and the security code is greater than zero.

The setpoint displays can be programmed for LOC, rEd, or EnE. (See the following table). Accessible only with the Setpoint Plug-in card installed.

The Scale Factor values can be programmed for LOC, rEd, or EnE.

Entry of a non-zero value will cause the prompt Code to appear when trying to access the “Full” Programming Mode. Access will only be allowed after entering a matching security code or universal code of 999. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out is overridden by an inactive user input configured for Program Lock-out.

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

Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming (all meter parameters are accessible).
Module 4 is the programming for the Rate parameters. For maximum input frequency, Rate assignment should be set to NO when not in use. When set to NO, the remaining related parameters are not accessible. The Rate value is shown with an annunciator of '<r>' in the Display Mode.

Note: For PAXR, C9 is actually rE IMP on the unit’s display and rDSP is actually rEDSP on the unit’s display.

PAXI: RATE ASSIGNMENT

For measuring the rate (speed) of pulses on Input A, select rRLE-R. For Input B select rRLE-B. This assignment is independent of the counting modes.

LOW UPDATE TIME (DISPLAY UPDATE) *

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. The factory setting of 1.0 will update the display every second minimum.

HIGH UPDATE TIME (DISPLAY ZERO) *

The High Update Time is the maximum amount of time before the Rate display is forced to zero. (For more explanation, refer to Input Frequency 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.

RATE DECIMAL POSITION

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

PAXI: LINEARIZER SEGMENTS

This parameter specifies the number of linear segments used for the Rate Scaling function. Each linear segment has two scaling points which define the upper and lower endpoints of the segment. The number of segments used depends on the linearity of the process and the display accuracy required as described below.

Linear Application – 2 Scaling Points

Linear processes use a single segment (two scaling points) to provide a linear Rate display from 0 up to the maximum input frequency. For typical zero based frequency measurements (0 Hz = 0 on display), leave SE65:0 (factory setting). For non-zero based 2 scaling point applications, set SE65:1, to enter both the zero segment (rIMPl & rDSP 0) and segment 1 (rIMPl & rDSP 1).

Non-linear Application – Up to 10 Scaling Points

Non-linear processes may utilize up to nine segments (ten scaling points) to provide a piece-wise linear approximation representing the non-linear function. The Rate display will be linear throughout each individual segment (i.e. between sequential scaling points). Thus, the greater the number of segments, the greater the conformity accuracy. Several linearization equations are available in the SPPAX software.

About Scaling Points

Each Scaling Point is specified by two programmable parameters: A desired Rate Display Value (rDSP) and a corresponding Rate Input Value (rIMP). Scaling points are entered sequentially in ascending order of Rate Input Value. Two scaling points must be programmed to define the upper and lower endpoints of the first linear segment. Setting SE65:0, automatically factory sets the first scaling point to 0.0 for typical single segment, zero based applications. When multiple segments are used, the upper scaling point for a given segment becomes the lower scaling point for the next sequential segment. Thus, for each additional segment used, only one additional scaling point must be programmed.

The following chart shows the Scaling Points, the corresponding Parameter mnemonics, and the Factory Default Settings for each point.

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>SCALING POINT</th>
<th>DISPLAY PARAMETER</th>
<th>DISPLAY DEFAULT</th>
<th>INPUT PARAMETER</th>
<th>INPUT DEFAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>rDSP 0</td>
<td>00000</td>
<td>rIMP 0</td>
<td>00000.0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>rDSP 1</td>
<td>00100</td>
<td>rIMP 1</td>
<td>01000.0</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>rDSP 2</td>
<td>00200</td>
<td>rIMP 2</td>
<td>02000.0</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>rDSP 3</td>
<td>00300</td>
<td>rIMP 3</td>
<td>03000.0</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>rDSP 4</td>
<td>00400</td>
<td>rIMP 4</td>
<td>04000.0</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>rDSP 5</td>
<td>00500</td>
<td>rIMP 5</td>
<td>05000.0</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>rDSP 6</td>
<td>00600</td>
<td>rIMP 6</td>
<td>06000.0</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>rDSP 7</td>
<td>00700</td>
<td>rIMP 7</td>
<td>07000.0</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>rDSP 8</td>
<td>00800</td>
<td>rIMP 8</td>
<td>08000.0</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>rDSP 9</td>
<td>00900</td>
<td>rIMP 9</td>
<td>09000.0</td>
</tr>
</tbody>
</table>

PAXI: RATE DISPLAY VALUE FOR SCALING POINT 1

Confirm the Rate Display Value for the first Scaling Point is 0.0. This parameter is automatically set to 0 and does not appear when SE65:0. (See Note)

PAXI: RATE INPUT VALUE FOR SCALING POINT 1

Confirm the Rate Input Value for the first Scaling Point is 0.0. (See Note)

Note: For all linear and most non-linear applications, the Scaling Point 1 Factory Setting can be used without affecting basic start-up.
**RATE INPUT VALUE FOR SCALING POINT 2**

Enter the corresponding Rate Input Value for the second Scaling Point by using the arrow keys. Rate Input values for scaling points can be entered by using the Key-in or the Applied method described below.

**Applied Method:**
Apply an external rate signal to the appropriate input terminals. At the Rate Input Value (r iNP) press and hold the F1 and F2 keys at the same time. The applied input frequency (in Hz) will appear on the display. To verify correct reading wait for at least the length of the Low Update Time. Then press and hold the F1 and F2 keys at the same time again. The new value should be ± 0.1% of the previous entered value.) Press PAR to enter the displayed frequency as the Rate Input value. To prevent the displayed value from being entered, press DSP. This will take the meter out of Programming Mode and the previous Rate Input value will remain.

**Key-in Method:**
Enter the Rate Input value (r iNP) that corresponds to the entered Rate Display value (r dSP) by pressing the F1 or F2 keys. This value is always in pulses per second (Hz).

**Low Cut Out**
The Low Cut Out feature forces the Rate display to zero when the Rate display falls below the value entered.

**Maximum Capture Delay Time**
When the Rate value is above the present Maximum rate value for the entered amount of time, the meter will capture that Rate value as the new Maximum value. A delay time helps to avoid false captures of sudden short spikes. Maximum detection will only function if Rate is assigned to Input A or B. The Maximum rate value is shown with an annunciator of ‘M’ in the display and will continue to function independent of being displayed.

**Minimum Capture Delay Time**
When the Rate value is below the present Minimum rate value for the entered amount of time, the meter will capture that Rate value as the new Minimum value. A delay time helps to avoid false captures of sudden short spikes. Minimum detection will only function if Rate is assigned to Input A or B. The Minimum rate value is shown with an annunciator of ‘L’ in the display and will continue to function independent of being displayed.

**Rate Display Exceeded**
If the rate of the input signal causes a display that exceeds the capacity of the Rate display (5 digits, 99999), then the display will indicate an overflow condition by showing “% OVL.” During this overflow condition, the Minimum and Maximum rate values will stay at their values even during resets.

* Factory Setting can be used without affecting basic start-up.
Module 5 is the programming for Counter C. For maximum input frequency, the counter operating mode should be set to \textit{NONE} when not in use. When set to \textit{NONE} the remaining related parameters are not accessible. The C annunciator indicates that Counter C is being shown in the Display Mode. An Exchange Parameter List feature for scale factor and count load values is explained in Module 2.

**COUNTER C OPERATING MODE**

- **NONE**
- **Add Ab**
- **Sub Ab**

Select the operating mode for Counter C.

- **NONE**: Does not count.
- **Add Ab**: Counter C counts the incoming pulses from Counter A input as per Counter A mode of operation. The signal is scaled only according to Counter C parameters.
- **Sub Ab**: Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation and subtracts the B counts from the A counts. The result is scaled only according to Counter C parameters.

**Note:** When using Add Ab or Sub Ab, Counter A, B and C must all be reset at the same time for the math to be performed on the display values.

**COUNTER C RESET ACTION**

- **ZERD**
- **CNAld**

When Counter C is reset, it returns to zero or Counter C count load value. This reset action affects all Counter C resets, except the Setpoint Counter Auto Reset Action in Module 6.

**COUNTER C DECIMAL POSITION**

- **ZERD**

This selects the decimal point position for Counter C and any setpoint value assigned to Counter C. The selection will also affect Counter C scale factor calculations.

**COUNTER C SCALE FACTOR**

The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. For \(\text{R} (\text{Numeric transmissions})\) modes of operation, the input signal is scaled directly. For \(\text{Add Ab}\) and \(\text{Sub Ab}\) modes of operation, the math is performed on the input signals and then the result is scaled. To achieve correct results, both Input A and Input B must provide the same amount of pulses per unit of measurement. (Details on scaling calculations are explained at the end of Module 1 section.)

**COUNTER C SCALE MULTIPLIER**

The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1.00000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of Module 1 section.)

**COUNTER C COUNT LOAD VALUE**

When reset to count load action is selected, Counter C will reset to this value.

**COUNTER C RESET POWER-UP**

Counter C may be programmed to reset at each meter power-up.

\* **Factory Setting can be used without affecting basic start-up.**
Module 6 is the programming for the setpoint (alarms) output parameters. To have setpoint outputs, a setpoint Plug-in card needs to be installed into the PAX (see Ordering Information). Depending on the card installed, there will be two or four setpoint outputs available. This section replaces the bulletin that comes with the setpoint plug-in card. Please discard the separate literature when using the Plug-in card with the Digital PAX. For maximum input frequency, unused Setpoints should be configured for +55 action.

The setpoint assignment and the setpoint action determine certain setpoint feature availability. The chart below illustrates this.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>RATE</th>
<th>COUNTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lit-n</td>
<td>Annunciators</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Out-n</td>
<td>Output Logic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sup-n</td>
<td>Power Up State</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sp-n</td>
<td>Setpoint Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Trc-n</td>
<td>Setpoint Tracking</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Typ-n</td>
<td>Boundary Type</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sbb-n</td>
<td>Standby Operation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hys-n</td>
<td>Setpoint Hysteresi</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Loff-n</td>
<td>Setpoint Off Delay</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Lon-n</td>
<td>Setpoint On Delay</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lout-n</td>
<td>Setpoint Time Out</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Auto-n</td>
<td>Counter Auto Reset</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>S5d-n</td>
<td>Reset With Display Reset</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>S5s-n</td>
<td>Reset When SPn+1 Activates</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>S5e-n</td>
<td>Reset When SPn+1 Deactivates</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**SETPOINT SELECT**

Select a setpoint (alarm output) to open the remaining module menu. (The “n” in the following parameters will reflect the chosen setpoint number.) After the chosen setpoint is programmed, the display will default to SPSEL N0. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing PAR at SPSEL N0 will exit Module 6.

**SETPOINT ANNUNCIATORS**

OFF disables the display of the setpoint annunciator. Normal (N0r) displays the corresponding setpoint annunciator of an “on” alarm output. Reverse (rEU) displays the corresponding setpoint annunciator of an “off” alarm output. FLASH flashes the display and the corresponding setpoint annunciator of an “on” alarm output.

**SETPOINT OUTPUT LOGIC**

Normal (N0r) turns the output “on” when activated and “off” when deactivated. Reverse (rEU) turns the output “off” when activated and “on” when deactivated.

**SETPOINT POWER UP STATE**

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

* Factory Setting can be used without affecting basic start-up.
**PAXC & I: SETPOINT ASSIGNMENT**

**Rsp-n**

- **R**: Current display value.
- **sp**: Setpoint value.
- **-n**: Factory Setting can be used without affecting basic start-up.

Select the display that the setpoint is to be assigned.

**SETPOINT VALUE**

- **Sp-n**
- **Sp**: Setpoint value.
- **-n**: Factory Setting can be used without affecting basic start-up.

Enter the desired setpoint value. Setpoint values can also be entered in the Quick Programming Mode when the setpoint is configured as *E* in Module 3. (See Module 2 for Exchange Parameter Lists explanation.)

**SETPOINT TRACKING**

- **Sp-n**
- **Sp**: Setpoint value.
- **-n**: Factory Setting can be used without affecting basic start-up.

If a selection other than NO is chosen, then the value of the setpoint being programmed ("n") will track the entered selection’s value. Tracking means that when the selection’s value is changed (in the Quick Programming Mode), the "n" setpoint value will also change (or follow) by the same amount.

**SETPOINT BOUNDARY TYPE**

- **Sp-n**
- **Sp**: Setpoint value.
- **-n**: Factory Setting can be used without affecting basic start-up.

HI activates the output when the assigned display value (Rsp-n) equals or exceeds the setpoint value. LD activates the setpoint when the assigned display value is less than or equal to the setpoint.
PAXC & I: SETPOINT RESET WHEN SPn+1 DEACTIVATES *

Select **YES**, so the setpoint output will deactivate (reset) when SPn+1 activates and then times out (deactivates). This function may only be used if the SPn+1 is programmed for Setpoint Action of \texttt{'+9'}.

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

---

PAXR & I: SETPOINT (ALARM) FIGURES FOR RATE

(For Reverse Action, The Alarm state is opposite.)
Module 7 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the PAXI with those of the host computer or other serial device, such as a terminal or printer. This programming module can only be accessed if an RS232 or RS485 Serial Communications card is installed.

This section also includes an explanation of the commands and formatting required for communicating with the PAXI. In order to establish serial communications, the user must have host software that can send and receive ASCII characters. Red Lion's SFPAX software can be used for configuring the PAXI (See Ordering Information). For serial hardware and wiring details, refer to section 4.5 Serial Communication Wiring.

This section replaces the bulletin shipped with the RS232 and RS485 serial communications plug-in cards. Discard the separate bulletin when using those serial plug-in cards with the PAXI. Also, this section does NOT apply to the DeviceNet, Modbus, or Profibus-DP communication cards. For details on the operation of the Fieldbus cards, refer to the bulletin shipped with each card.

**BAUD RATE**

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

**DATA BIT**

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

**PARITY BIT**

Set the parity bit to match that of the other serial communications equipment on the serial link. The meter ignores the parity when receiving data and sets the parity bit for outgoing data. If no parity is selected with 7 bit word length, an additional stop bit is used to force the frame size to 10 bits.

**METER UNIT ADDRESS**

Enter the serial meter (node) address. With a single unit, an address is not needed and a value of zero can be used. With multiple units (RS485 applications), a unique 2 digit address number must be assigned to each meter.

**ABBREVIATED PRINTING**

Select **no** for full print or Command T transmissions (meter address, parameter data and mnemonics) or **yes** for abbreviated print transmissions (parameter data only). This will affect all the parameters selected in the print options. (If the meter address is 00, it will not be sent during a full transmission.)

**PRINT OPTIONS**

**YES** - Enters the sub-menu to select the meter parameters to appear during a print request. For each parameter in the sub-menu, select **yes** for that parameter information to be sent during a print request or **no** for that parameter information not to be sent. A print request is sometimes referred to as a block print because more than one parameter information (meter address, parameter data and mnemonics) can be sent to a printer or computer as a block.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>FACTORY</th>
<th>MNEMONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>rCAt</td>
<td>Rate</td>
<td><strong>YES</strong></td>
<td>RTE</td>
</tr>
<tr>
<td>hILo</td>
<td>Max. &amp; Min.</td>
<td><strong>NO</strong></td>
<td>MIN MAX</td>
</tr>
<tr>
<td>SCFrAc</td>
<td>A B C Scale Factors</td>
<td><strong>NO</strong></td>
<td>SFA SFB SFC</td>
</tr>
<tr>
<td>CNtLd</td>
<td>A B C Count Load</td>
<td><strong>NO</strong></td>
<td>LDA LDB LDC</td>
</tr>
<tr>
<td>SPrAt</td>
<td>1 2 3 4 Setpoints *</td>
<td><strong>NO</strong></td>
<td>SP1 SP2 SP3 SP4</td>
</tr>
</tbody>
</table>

*Setpoints are plug-in card dependent.*
SENDING SERIAL COMMANDS AND DATA
When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character * or $. The <CR> is also available as a terminator when Counter C is in the SLAVE mode.

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 two digit node address. Not required when address = 00</td>
</tr>
<tr>
<td>T</td>
<td>Transmit Value (read)</td>
<td>Read a register from the meter. Must be followed by register ID character.</td>
</tr>
<tr>
<td>V</td>
<td>Value change (write)</td>
<td>Write to register of the meter. Must be followed by register ID character and numeric data.</td>
</tr>
<tr>
<td>R</td>
<td>Reset</td>
<td>Reset a register or output. Must be followed by register ID character.</td>
</tr>
<tr>
<td>P</td>
<td>Block Print Request (read)</td>
<td>Initiates a block print output. Registers are defined in programming.</td>
</tr>
</tbody>
</table>

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

1. The first characters consist of the Node Address Specifier (N) followed by a 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the 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 according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters *, $ or when Counter C is set for slave mode <CR>. The meter does not begin processing the command string until this character is received.

See Timing Diagram figure for differences between terminating characters.

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>VALUE DESCRIPTION</th>
<th>REGISTER NAME 1</th>
<th>COMMAND</th>
<th>TRANSMIT DETAILS 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Count A</td>
<td>CTA</td>
<td>T, V, R</td>
<td>6 digit (V), 8 digit (T)</td>
</tr>
<tr>
<td>B</td>
<td>Count B</td>
<td>CBT</td>
<td>T, V, R</td>
<td>6 digit (V), 8 digit (T)</td>
</tr>
<tr>
<td>C</td>
<td>Count C</td>
<td>CTC</td>
<td>T, V, R</td>
<td>6 digit (V), 8 digit (T)</td>
</tr>
<tr>
<td>D</td>
<td>Rate</td>
<td>RTE</td>
<td>T, V</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>E</td>
<td>Min</td>
<td>MIN</td>
<td>T, V, R</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>F</td>
<td>Max</td>
<td>MAX</td>
<td>T, V, R</td>
<td>5 digit, positive only</td>
</tr>
<tr>
<td>G</td>
<td>Scale Factor A</td>
<td>SFA</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>H</td>
<td>Scale Factor B</td>
<td>SFB</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>I</td>
<td>Scale Factor C</td>
<td>SFC</td>
<td>T, V</td>
<td>6 digit, positive only</td>
</tr>
<tr>
<td>J</td>
<td>Count Load A</td>
<td>LDA</td>
<td>T, V</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>K</td>
<td>Count Load B</td>
<td>LDB</td>
<td>T, V</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>L</td>
<td>Count Load C</td>
<td>LDC</td>
<td>T, V</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>M</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, V, R</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>O</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>T, V, R</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>Q</td>
<td>Setpoint 3</td>
<td>SP3</td>
<td>T, V, R</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>S</td>
<td>Setpoint 4</td>
<td>SP4</td>
<td>T, V, R</td>
<td>5 negative / 6 positive</td>
</tr>
<tr>
<td>U</td>
<td>Auto/manual Register</td>
<td>MMR</td>
<td>T, V</td>
<td>0 - auto, 1 - manual</td>
</tr>
<tr>
<td>W</td>
<td>Analog Output Register</td>
<td>AOR</td>
<td>T, V</td>
<td>0 - 4095 normalized</td>
</tr>
<tr>
<td>X</td>
<td>Setpoint Address</td>
<td>SOR</td>
<td>T, V</td>
<td>0 - not active, 1 - active data</td>
</tr>
</tbody>
</table>

1. Register Names are also used as Register Mnemonics during full transmission.
2. The registers associated with the P command are set up in Print Options (Module 7).
3. Unless otherwise specified, the Transmit Details apply to both T and V Commands.

Command String Examples:
1. Address = 17, Write 350 to Setpoint 1
   String: N17VM350S
2. Address = 5, Read Count A value, response time of 50 - 100 msec. min.
   String: N05TA*
3. Address = 0, Reset Setpoint 4 output
   String: RS*

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

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

Transmitting Data From the Meter
Data is transmitted from the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. The meter response is established in Module 7.

Full Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 byte Node (Meter) 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 numeric 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 (bytes 1 and 2) are the unit address. If the address assigned is 00, two spaces are substituted. A space (byte 3) follows the unit address field. The next three characters (bytes 4 to 6) are the register mnemonic. The numeric data is transmitted next.

The numeric field (bytes 7 to 18) is 12 characters long. When the requested value exceeds eight digits for count values or five digits for rate values, an * (used as an overflow character) replaces the space in byte 7. Byte 8 is always a space. The remaining ten positions of this field (bytes 9 to 18) consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with <CR> (byte 19), and <LF> (byte 20). When a block print is finished, an extra <SP> (byte 21), <CR> (byte 22), and <LF> (byte 23) are used to provide separation between the transmissions.

Abbreviated Transmission

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point</td>
</tr>
<tr>
<td>13</td>
<td>&lt;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 address and register mnemonics, leaving only the numeric part of the response.

Meter Response Examples:
1. Address = 17, full field response, Count A = 875
   17 CTA 875 <CR><LF>
2. Address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5<CR><LF><SP><CR><LF>
3. Address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>
Auto/Manual Mode Register (MMR) ID: U

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint and analog output. In Manual Mode (1) the outputs are defined by the registers SOR and AOR. When transferring from auto mode to manual mode, the meter holds the last output value (until the register is changed by a write). Each output may be independently changed to auto or manual. In a write command string (VU), any character besides 0 or 1 in a field will not change the corresponding output mode.

U abcd
\[
\begin{array}{ll}
    c &= \text{Analog Output} \\
    d &= \text{SP4} \\
    c &= \text{SP3} \\
    b &= \text{SP2} \\
    a &= \text{SP1}
\end{array}
\]

Example: VU00011 places SP4 and Analog in manual.

Analog Output Register (AOR) ID: W

This register stores the present signal value of the analog output. The range of values of this register is 0 to 4095, which corresponds to the analog output range per the following chart:

<table>
<thead>
<tr>
<th>Register Value</th>
<th>Output Signal*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.000 4.000 0.000</td>
</tr>
<tr>
<td>1</td>
<td>0.005 4.004 0.0025</td>
</tr>
<tr>
<td>2047</td>
<td>10.000 12.000 5.000</td>
</tr>
<tr>
<td>4094</td>
<td>19.995 19.996 9.9975</td>
</tr>
<tr>
<td>4095</td>
<td>20.000 20.000 10.000</td>
</tr>
</tbody>
</table>

*Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (0-20 mA, 4-20 mA or 0-10 V).

COUNTER C SLAVE COMMUNICATIONS

Counter C may be programmed for $L#UE, to act as a serial slave display. By doing this, the carriage return <CR> is added as a valid command terminator character for all serial command strings. The <CR> as a terminator may be very useful for standard serial commands, even if Counter C is never displayed or sent a slave message. The $ terminator should not be used in the slave mode. If numeric values are not to be saved to EPROM then send the value as a literal transmission with <CR> terminator.

The Counter C slave display is right aligned. It has a capacity of displaying six characters. When less than six characters are received, blank spaces will be placed in front of the characters. If more than six characters are sent, then only the last six are displayed. The meter has a 192 character buffer for the slave display. If more than 192 characters are sent, the additional characters are discarded until a terminator is received. Counter C processes numeric and literal transmissions differently.

Numeric Transmissions

When a string that does not begin with #, T, V, P or R is received, the meter processes it as a Numeric transmission. In this case, only the recognized numbers and punctuation are displayed. All other characters in the string are discarded. If a negative sign appears anywhere in the string the resulting number will be negative. Only the most significant decimal point is retained. If no numerical characters are received, then the numeric value will be zero. The numeric display can be used for setpoint (boundary action only) and analog output functions. When using this display for setpoint and analog output values, the decimal point position must match the programming entered through the front panel. The numeric value is retained in Counter C memory until another Numeric transmission is received.

Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Recognized Punctuation = period, comma, minus

Writing to this register (VW) while the analog output is in the Manual Mode causes the output signal level to update immediately to the value sent. While in the Automatic Mode, this register may be written to, but it has no effect until the analog output is placed in the manual mode. When in the Automatic Mode, the meter controls the analog output signal level. Reading from this register (TW) will show the present value of the analog output signal.

Example: VW2047 will result in an output of 10.000 mA, 12.000 mA or 5.000V depending on the range selected.

Setpoint Output Register (SOR) ID: X

This register stores the states of the setpoint outputs. Reading from this register (TX) will show the present state of all the setpoint outputs. A “0” in the setpoint location means the output is off and a “1” means the output is on.

X abcd
\[
\begin{array}{ll}
    d &= \text{SP4} \\
    c &= \text{SP3} \\
    b &= \text{SP2} \\
    a &= \text{SP1}
\end{array}
\]

In Automatic Mode, the meter controls the setpoint output state. In Manual Mode, writing to this register (VX) will change the output state. Sending any character besides 0 or 1 in a field or if the corresponding output was not first in manual mode, the corresponding output value will not change. (It is not necessary to send least significant 0s.)

Example: VX10 will result in output 1 on and output 2 off.

Literal Transmissions

When a string that begins with # is received, the meter processes it as a Literal transmission. In this case, any unrecognized characters will be replaced with a space. A Literal display will replace a Numeric value in the Counter C display. However, it will not remove a previous Numeric value from Counter C memory or prevent the Counter C outputs from functioning with the Numeric value. Literal transmissions are only possible when using RS232 or RS485 cards.

Recognized Characters = a, b, c, d, e, f, g, h, i, j, l, n, o, p, q, r, s, t, u, y, z (in upper or lower case)
Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Recognized Punctuation = period, comma, minus, blank
COMMUNICATION FORMAT

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

The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

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

* Voltage levels at the Receiver

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

Start bit and Data bits

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

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 PAXI.
Module 8 is the programming for the analog output parameters. To have an analog output signal, an analog output plug-in card needs to be installed (See Ordering Information). This section replaces the bulletin that comes with the analog plug-in card. Please discard the separate literature when using the plug-in card with the PAXI.

**ANALOG TYPE**

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>0 to 20 mA</td>
</tr>
<tr>
<td>4-20</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td>0-10</td>
<td>0 to 10 V</td>
</tr>
</tbody>
</table>

Enter the analog output type. For voltage output use terminals 16 and 17. For current output use terminals 18 and 19. Only one range can be used at a time.

**ANALOG ASSIGNMENT**

Select the display that the analog output is to follow:

- **A CNt** = Counter A Value
- **b CNt** = Counter B Value
- **c CNt** = Counter C Value
- **rAtE** = Rate Value
- **LO** = Minimum Value
- **HI** = Maximum Value

Enter the display value within the selected Analog Assignment that corresponds to the high limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

**ANALOG LOW SCALE VALUE**

Enter the display value within the selected Analog Assignment that corresponds to the low limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

**ANALOG HIGH SCALE VALUE**

Enter the display value within the selected Analog Assignment that corresponds to the high limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

**DISPLAY INTENSITY LEVEL**

Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

**RESTORE FACTORY DEFAULTS**

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

Pressing the **PAR** and **DSP** keys at the same time on power-up will load the factory settings and display **Err**. This allows operation in the event of a memory failure or corrupted data. Immediately press **RST** key and reprogram the meter. If the meter is powered down again before pressing the **RST** key, the existing dynamic data will not be overwritten.
PAXI: CALIBRATION

The only item in the PAXI meter that can be calibrated is the Analog Output. The Count A and B values are scaled using the parameters in Module 1, Counter C value is scaled using Module 5 and the Rate value is scaled using Module 4. If the meter appears to be indicating incorrectly or inaccurately, refer to the Troubleshooting section.

When Analog Out recalibration is required (generally every 2 years), it should be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters.

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

Note: Allow a 30 minute warm-up period before starting calibration.

TROUBLESHOOTING

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

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO DISPLAY</td>
<td>CHECK: Power level, power connections</td>
</tr>
<tr>
<td>PROGRAM LOCKED-OUT</td>
<td>CHECK: Active (lock-out) user input</td>
</tr>
<tr>
<td></td>
<td>ENTER: Security code requested</td>
</tr>
<tr>
<td>CERTAIN DISPLAYS ARE LOCKED OUT</td>
<td>CHECK: Module 3 programming</td>
</tr>
<tr>
<td>INCORRECT DISPLAY VALUE or NOT COUNTING</td>
<td>CHECK: Input wiring, DIP switch setting, input programming, scale factor calculation, input signal level, user input jumper, lower input signal frequency</td>
</tr>
<tr>
<td>USER INPUT NOT WORKING CORRECTLY</td>
<td>CHECK: User input wiring, user input jumper, user input being used for signal, Module 2</td>
</tr>
<tr>
<td>OUTPUT DOES NOT WORK</td>
<td>CHECK: Corresponding plug-in card installation, output configuration, output wiring</td>
</tr>
<tr>
<td>JITTERY DISPLAY</td>
<td>CHECK: Wiring is per EMC installation guidelines, input signal frequency, signal quality, scaling, update time, DIP switch setting</td>
</tr>
<tr>
<td>&quot;r&quot; or &quot;DL&quot; RATE</td>
<td>CHECK: Lower input signal frequency, reduce rate scaling</td>
</tr>
<tr>
<td>MODULES or PARAMETERS NOT ACCESSIBLE</td>
<td>CHECK: Corresponding plug-in card installation, related controlling parameter selected</td>
</tr>
<tr>
<td>ERROR CODE (Err - 4)</td>
<td>PRESS: Reset key (if unable to clear contact factory.)</td>
</tr>
<tr>
<td>SERIAL COMMUNICATIONS</td>
<td>CHECK: Wiring, connections, meter and host settings</td>
</tr>
</tbody>
</table>

Analog Output Card Calibration

Before starting, verify that a precision meter with an accuracy of 0.05% or better (voltmeter for voltage output and/or current meter for current output) is connected and ready. Then perform the following procedure:
1. Use the arrow keys to display Code 48 and press PAR.
2. Error is displayed. Use the arrow keys to select 55 and press PAR.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAXI arrow keys to adjust the output so that the external meter display matches the selection being calibrated. When the external reading matches, or if the range is not being calibrated, press PAR.
4. When Code 50 appears, press PAR twice and remove the external meters.

<table>
<thead>
<tr>
<th>SELECTION</th>
<th>EXTERNAL METER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0_A</td>
<td>0.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>4.0_A</td>
<td>4.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>20.0_A</td>
<td>20.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>0.0u</td>
<td>0.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
<tr>
<td>10.0u</td>
<td>10.00</td>
<td>Adjust if necessary, press PAR</td>
</tr>
</tbody>
</table>

Note: Allow a 30 minute warm-up period before starting calibration.

Shaded areas are model dependent.
### 1 - INP Counter A & B Input Parameters - PAXC & I only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A CNa</td>
<td>COUNTER A OPERATING MODE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>R RaEE</td>
<td>COUNTER A RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>AdEEPl</td>
<td>COUNTER A DECIMAL POSITION</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>ASCFAC</td>
<td>COUNTER A SCALE FACTOR (A)</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>R ASCFL</td>
<td>COUNTER A RESET POWER-UP</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>R-UP</td>
<td>PRESCALER OUTPUT ENABLE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>b CNb</td>
<td>COUNTER B OPERATING MODE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>b RaEE</td>
<td>COUNTER B RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>b AdEEPl</td>
<td>COUNTER B DECIMAL POSITION</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>b ASCFAC</td>
<td>COUNTER B SCALE FACTOR (A)</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>b ASCFL</td>
<td>COUNTER B SCALE MULTIPLIER</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>b-UP</td>
<td>COUNTER B RESET POWER-UP</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.

### 2 - FNC User Input and Function Key Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>USr - 1</td>
<td>USER INPUT 1</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>USr - 2</td>
<td>USER INPUT 2</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>USr - 3</td>
<td>USER INPUT 3</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>F 1</td>
<td>FUNCTION KEY 1</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>F 2</td>
<td>FUNCTION KEY 2</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>r S 1</td>
<td>RESET KEY</td>
<td>dSP-5k</td>
<td></td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.

### 3 - LOC Display and Program Lockout Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A CNa</td>
<td>COUNTER A DISPLAY LOCK-OUT</td>
<td>rEd</td>
<td></td>
</tr>
<tr>
<td>b CNa</td>
<td>COUNTER B DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C CNa</td>
<td>COUNTER C DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>r RaE</td>
<td>RATE DISPLAY LOCK-OUT</td>
<td>rEd</td>
<td></td>
</tr>
<tr>
<td>L 1</td>
<td>MIN DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 1</td>
<td>SETPOINT 1 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 2</td>
<td>SETPOINT 2 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 3</td>
<td>SETPOINT 3 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP - 4</td>
<td>SETPOINT 4 ACCESS LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>R CnLa</td>
<td>COUNT LOAD A ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>b CnLa</td>
<td>COUNT LOAD B ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C CnLa</td>
<td>COUNT LOAD C ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>ASCFAC</td>
<td>SCALE FACTOR A ACCESS</td>
<td>Enb</td>
<td></td>
</tr>
<tr>
<td>b ASCFAC</td>
<td>SCALE FACTOR B ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C ASCFAC</td>
<td>SCALE FACTOR C ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C De</td>
<td>SECURITY CODE</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.

### 4 - EE Rate Input Parameters - PAXI & R only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>r RaEE</td>
<td>RATE ASSIGNMENT</td>
<td>rEE-R</td>
<td></td>
</tr>
<tr>
<td>L 1- Ud t</td>
<td>LOW UPDATE TIME</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>H 1- Ud t</td>
<td>HIGH UPDATE TIME</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>r EE dP</td>
<td>RATE DECIMAL POINT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>S EGS</td>
<td>LINEARIZER SEGMENTS</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 1 - DISPLAY VALUE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 1 - INPUT VALUE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 2 - DISPLAY VALUE</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 2 - INPUT VALUE</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 3 - DISPLAY VALUE</td>
<td>20000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 3 - INPUT VALUE</td>
<td>20000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 4 - DISPLAY VALUE</td>
<td>30000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 4 - INPUT VALUE</td>
<td>30000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 5 - DISPLAY VALUE</td>
<td>40000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 5 - INPUT VALUE</td>
<td>40000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 6 - DISPLAY VALUE</td>
<td>50000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 6 - INPUT VALUE</td>
<td>50000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 7 - DISPLAY VALUE</td>
<td>60000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 7 - INPUT VALUE</td>
<td>60000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 8 - DISPLAY VALUE</td>
<td>70000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 8 - INPUT VALUE</td>
<td>70000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 9 - DISPLAY VALUE</td>
<td>80000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 9 - INPUT VALUE</td>
<td>80000</td>
<td></td>
</tr>
<tr>
<td>r dSP</td>
<td>SCALING PT. 10 - DISPLAY VALUE</td>
<td>90000</td>
<td></td>
</tr>
<tr>
<td>r dIP</td>
<td>SCALING PT. 10 - INPUT VALUE</td>
<td>90000</td>
<td></td>
</tr>
<tr>
<td>r rNd</td>
<td>RATE DISPLAY ROUNding</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LOut</td>
<td>MINIMUM LOW CUT OUT</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>H 1- Lt</td>
<td>MAX CAPTURE DELAY TIME</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>LO - Lt</td>
<td>MIN CAPTURE DELAY TIME</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.

### 5 - ECl E Counter C Input Parameters - PAXC & I only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>C CNa</td>
<td>COUNTER C OPERATING MODE</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>r RaEE</td>
<td>COUNTER C RESET ACTION</td>
<td>2E-0</td>
<td></td>
</tr>
<tr>
<td>C AdEEPl</td>
<td>COUNTER C DECIMAL POSITION</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>ASCFAC</td>
<td>COUNTER C SCALE FACTOR (A)</td>
<td>100000</td>
<td></td>
</tr>
<tr>
<td>r ASCFL</td>
<td>COUNTER C SCALE FACTOR (B)</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>C CnLa</td>
<td>COUNTER C SCALE MULTIPLIER</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>b CnLa</td>
<td>COUNTER C COUNT LOAD VALUE (A)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>b CnLa</td>
<td>COUNTER C COUNT LOAD VALUE (B)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>C P-UP</td>
<td>COUNTER C RESET POWER-UP</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.
### 6-SPt Setpoint (Alarm) Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>LI:k-n</td>
<td>SETPOINT ANNUNCIATORS</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Dl:u-n</td>
<td>SETPOINT OUTPUT LOGIC</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SUP:n</td>
<td>SETPOINT POWER UP STATE</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>Rl:u-n</td>
<td>SETPOINT ACTION</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>A$P:n</td>
<td>SETPOINT ASSIGNMENT</td>
<td>R  Cnt</td>
<td></td>
</tr>
<tr>
<td>SP-n</td>
<td>SETPOINT VALUE (A)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>trC-n</td>
<td>SETPOINT TRACKING</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>tYP-n</td>
<td>SETPOINT BOUNDARY TYPE</td>
<td>H  I</td>
<td></td>
</tr>
<tr>
<td>Ste-n</td>
<td>STANDBY OPERATION</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>KY:n</td>
<td>SETPOINT HYSTERESIS (rate)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>lOFF-n</td>
<td>SETPOINT OFF DELAY</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>lON-n</td>
<td>SETPOINT ON DELAY</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>tOut-n</td>
<td>SETPOINT TIME OUT</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>rSd-n</td>
<td>COUNTER AUTO RESET ACTION</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>rSASN-n</td>
<td>RESET WHEN SPn+1 ACTIVATES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>rSRE-n</td>
<td>RESET WHEN SPn+1 DEACTIVATES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>_</td>
<td>Setpoint (Alarm) Parameters</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 7-5rL Serial Communication Parameters - PAXI only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>bAUd</td>
<td>BAUD RATE</td>
<td>9600</td>
<td></td>
</tr>
<tr>
<td>dATR</td>
<td>DATA BIT</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>PRt</td>
<td>PARITY BIT</td>
<td>Odd</td>
<td></td>
</tr>
<tr>
<td>Addr</td>
<td>METER ADDRESS</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>AbTr</td>
<td>ABBREVIATED PRINTING</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>A Cnt</td>
<td>PRINT COUNTER A</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>b Cnt</td>
<td>PRINT COUNTER B</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>C Cnt</td>
<td>PRINT COUNTER C</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>rAtE</td>
<td>PRINT RATE</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>H 1LD</td>
<td>PRINT MAX &amp; MIN</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SCFAC</td>
<td>PRINT SCALE FACTORS</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>CntLD</td>
<td>PRINT COUNT LOAD VALUES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SPnt</td>
<td>PRINT SETPOINT VALUES</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

#### 8-RnR Analog Output Parameters - PAXI only

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>ANALOG TYPE</td>
<td>4-20</td>
<td></td>
</tr>
<tr>
<td>AS IN</td>
<td>ANALOG ASSIGNMENT</td>
<td>-RLE</td>
<td></td>
</tr>
<tr>
<td>AN-LD</td>
<td>ANALOG LOW SCALE VALUE</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AN-HI</td>
<td>ANALOG HIGH SCALE VALUE</td>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>

#### 9-FCS Factory Service Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>d-LEU</td>
<td>DISPLAY INTENSITY LEVEL</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.

---

### LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
Counter parameters apply to the PAXC and PAXI, while the rate parameters apply to the PAXR and PAXI.

**Counter parameters**
- x = Counter A, B, or C
- n = Setpoint number
- # = Scaling Points (0-9)
**MODEL LIBC - LIBRA SERIES COUNTERS (LCD & LED)**

- Ability to lock out front panel functions
- Sealed front panel construction (NEMA 4/IP65)
- One or two preset versions
- 0.5” high liquid crystal display or 0.4” high LED display
- Accepts input count rate up to 2500 CPS
- Bi-directional counting
- Solid-state current sink output(s)
- Form C relay output(s)
- Programmable timed output (0.01 sec to 99.99 sec.)
- Simple front panel for programming ease
- Front panel programmable decimal points
- Meets DIN panel mount specifications
- Remote reset capability
- Non-volatile memory (E2PROM)
- On-line self-test

**DESCRIPTION**

The Libra Series of presettable counters is an economical and reliable solution to one or two preset level requirements. The LIBC1 and LIBC1E are the single preset versions and the LIBC2 and LIBC2E are the dual preset versions. All four units have a solid-state output and a Form C relay output for each preset. These units feature input configuration programmability, a full complement of control inputs, programmable timed outputs, non-volatile memory, and many other features which will satisfy most any single or dual preset level requirement.

The Libra counters have two main counting actions, Reset to Zero (RTZ) and Reset to Preset (RTP). With RTZ, the counter resets to zero and counts up (if UP/DN terminal is at high level) and activates the outputs when the preset value(s) are reached. When RTP is used, the unit starts at the preset value and counts down (if the UP/DN terminal is at low level) and activates the output when zero is reached. For the 2-preset version, the count starts at preset 2 and counts toward zero. Output 1 fires when preset 1 value is reached and output 2 fires when the count reaches zero. There are eight modes of operation for the single preset unit and sixteen modes of operation for the dual preset unit.

The timed output is programmed through the front panel buttons and can be programmed from 0.01 sec. to 99.99 sec. (The unit’s timed output is set at the factory to be 0.1 sec.) The Libra counters have an internal non-volatile memory device which eliminates the need for battery back-up. When input power is removed, this device will maintain all data necessary for system operation. A Program Disable terminal is available, which is used to prevent accidental changes or tampering by unauthorized personnel to the preset(s) or timed output value(s). The front panel reset button can also be enabled or disabled by a rear panel DIP switch. These counters also have an on-line self-test, which checks all display driver and micro-processor hardware. The self-test can be run at any time without losing counts or missing a preset value.

Power, input, and output connections are made via removable terminal strips located at the rear of the unit. These strips can accept one #14 AWG stripped wire. DIP switches at the rear of the unit are used to program the input configuration and to set the desired operating modes.

The Libra Series counters have a metal die-cast front bezel, which is sealed, and meets NEMA 4/IP65 specifications for wash-down and/or dust when properly installed. Mounting clips are provided for easy panel installation.

**SAFETY SUMMARY**

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

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

**DIMENSIONS In inches (mm)**

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.7” (69 mm) H X 4.5” (114 mm) W.
SPECIFICATIONS

1. DISPLAY: 4-digit, 0.5" (12.7 mm) high LCD display.
   4-digit, 0.4" (10.2 mm) high LED display.

2. POWER REQUIREMENTS:
   AC Operation: 115/230 VAC (±10%), 50/60 Hz, 6 VA (LCD)
   or 9 VA (LED).
   DC Operation: 11 to 14 VDC @ 0.2 A max. (LCD) or 0.3 A max. (LED).

3. SENSOR POWER: +10 to 16 VDC @ 150 mA.

4. COUNT INPUT: Switch selectable to accept count pulses from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.
   Current Sourcing - Unit provides 3.9 KΩ pull-down load for sensors with current sourcing outputs. (Max. input voltage 28 VDC @ 7 mA)
   Current Sinking - Unit provides 7.8 KΩ pull-up load for sensors with current sinking outputs. (Max. sensor current, 1.6 mA)
   Debounce - Damping capacitor provided for switch contact debounce.
   Limits count speed to 100 Hz max. and input pulse widths of 5 msec min.
   Lo Bias - Input Trigger levels VIL = 1.5 V, VIH = 3.75 V.
   Hi Bias - Input Trigger levels VIL = 5.5 V, VIH = 7.5 V.
   Note: Bias levels ±10% @ 12 VDC sensor voltage. These levels vary proportionally with the sensor supply voltage.

5. MAXIMUM COUNT RATES:
   High Frequency - 2.5 KHz max. for all electronic sensors under all modes of operation. Signals can be square wave inputs or inputs with negative going pulse widths, as short as 50 µsec, with a total min. period of 400 µsec.
   Low Frequency - 100 Hz for switch contact closures. (Note: These units will operate with VCM [E-H] modules.)

6. CONTROL INPUTS:
   Remote Reset - Active low (VIL = 0.5 V max.), internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA). Response time = 10 msec. A low will reset the unit and deactivate outputs.
   Program Disable - Active low (VIL = 0.5 V max.), internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA). A low will inhibit the changing of presets, decimal point selection, and timed outputs, as well as testing outputs in self-test.
   Up/Dn Control - Active low (VIL = 0.5 V max.), internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA) Response Time = 150 µsec.
   This input determines the direction of the count and is independent of Reset to Zero or Reset to Preset modes of operation. When input is low, count is down.

7. OUTPUTS:
   Solid-State - Current sinking NPN open collector transistors. ISNK = 100 mA max. VOH = 30 VDC max. (Internal Zener diode protection). One solid-state output for each preset level. VIL = 1 VDC max. @ 100 mA.
   Relay(s) - Form C contacts max. rating 5 amps @ 120/240 VAC, 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load). The operate time is 5 msec nominal and the release time is 3 msec nominal.
   Relay Life Expectancy - 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)
   Programmable Timed Output - The timed output can be programmed from 0.01 sec to 99.99 sec, ±0.01% - 10 msec. The timed output is set for 0.1 sec at the factory.

8. MEMORY RETENTION: The Libra counters have a “no power E2PROM” which maintains all information when the input power is removed. The life expectancy of this device is at least 100,000 power down cycles and length of memory retention for a single power down can be as long as 10 years.

9. INPUT, POWER, AND OUTPUT CONNECTIONS:
   There are two plug-in, compression type, barrier strips located at the rear of the unit. These strips can be removed from the rear of the unit for ease of wiring. After wiring is complete, the connector can be plugged back into the unit.

10. CERTIFICATIONS AND COMPLIANCES:
   - SAFETY
     Type 4 Indoor Enclosure rating (Face only). IEC 1010-1. EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
     IP65 Enclosure rating (Face only). IEC 529

   - ELECTROMAGNETIC COMPATIBILITY
     Immunity to EN 50082-2
     Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact1
     Electromagnetic RF fields EN 61000-4-3 Level 3; 8 Kv air
     Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv I/O2
     RF conducted interference EN 61000-4-6 Level 3; 10 V/rms2
     Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m
     Emissions to EN 50081-2
     RF interference EN 55011 Enclosure class B
     Emissions to EN 50082-2
     Power mains class B
     Notes:
     1. Metal bezel of unit connected with ground lead from rear bezel screw to metal mounting panel.
     2. When the unit is DC powered from terminal TBA pin 5 (common) and terminal TBB pin 6 (+12 VDC) a power line filter was installed, RLC filter, #LFIL0000 or equivalent, so as not to impair the function of the unit.
     Refer to the EMC Installation Guidelines for additional information.

11. ENVIRONMENTAL CONDITIONS:
   Operating Temperature: 0 to 50°C
   Storage Temperature: -40 to 70°C
   Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
   Altitude: Up to 2000 meters

12. CONSTRUCTION:
   Metal die-cast bezel with black, high impact plastic insert. Front panel meets NEMA 4/IP65 requirements for indoor use when properly installed. (Panel gasket and mounting clips included with unit.) Installation Category II, Pollution Degree 2.

13. WEIGHT: 1.5 lbs. (0.68 k) [LCD], 1.75 lbs. (0.79 k) [LED]
MODES OF OPERATION

Mode settings of the switches are shown to the right of the text below. The mode number corresponds to a binary code, represented by the DIP switch positions. When the switch is “UP”, it is equivalent to a one. When the switch is “DOWN”, it is equivalent to a zero. The mode switch settings can be easily observed from the panel front by using the self-test. At the end of self-test, the state of these mode switches are displayed.

NOTES:
1. For all the following modes of operation, when the unit is set for a Reset to Zero mode, the UP/DN terminal (count direction) is normally left high (in “UP” position). When the unit is set for a Reset to Preset mode, the UP/DN terminal is normally tied to common (in “DOWN” position). However, even though these are the usual conditions for the UP/DN terminal, it does not have to operate in this fashion. For example: the unit can count down in a Reset to Zero mode or count up in a Reset to Preset mode and still maintain normal operating functions.

2. The timed output must be less than the time required to count from the reset condition to the preset point. Otherwise, the output will appear to be latched-on.

MODES OF OPERATION FOR SINGLE PRESET LIBRA COUNTER

MODE 0 LATCH OUTPUT AT PRESET, MANUAL RESET TO ZERO
In this mode, the unit counts from zero, the output will latch on when the preset is reached. When a manual reset occurs, the unit will Reset to Zero and the output, if latched on, will unlatch. Counts will continue to accumulate after the output has turned on.

MODE 1 TIMED OUTPUT AT PRESET, MANUAL RESET TO ZERO
In this mode, as the unit counts from zero, the output will turn on when the preset is reached. At the same time, the unit will automatically Reset to Zero and the output will turn off after its programmed time value has occurred. When a manual reset occurs, the unit will Reset to Zero. Manual reset will terminate the timed output, if the output is still activated. Counts will continue to accumulate after the preset level has been reached.

MODE 2 & 3

MODE 4 TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AT PRESET
In this mode, as the unit counts from zero, the output will turn on when the preset is reached. During automatic reset, the unit will automatically Reset to Zero and start the cycle over again. The output will turn off after its programmed time value has occurred. Manual reset will turn off the output, if turned on, and reset the count to zero. During automatic reset, no counts will be lost if the count rate does not exceed 2,500 cps.

MODE 5

MODE 6 TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AFTER THE TIMED OUTPUT
In this mode, as the unit counts from zero, the output will turn on when preset 1 is reached. The output will turn off after its programmed time value has occurred. At the end of the timed output, the unit will automatically Reset to Zero and start the cycle over again. During automatic reset, no counts will be lost, as long as the count rate does not exceed 2,500 cps. Manual reset will turn off the output, if turned on, and reset the count to zero.

MODE 7

† Manual reset, either by front panel reset (if enabled) or remote reset, is always active, and will override any condition or state the counter is presently in.

MODE 8 LATCH OUTPUT AT ZERO, MANUAL RESET TO PRESET
In this mode, as the unit counts from preset, the output will turn on when zero is reached. The output will turn off after its programmed time value has occurred. When a manual reset occurs, the unit will Reset to Preset and the output, if latched on, will unlatch. Counts will continue to accumulate after the preset has activated.

MODE 9 TIMED OUTPUT AT ZERO, MANUAL RESET TO PRESET
In this mode, as the unit counts from preset, the output will turn on when zero is reached. The output will turn off after its programmed time value has occurred. When a manual reset occurs, the unit will Reset to Preset. Manual reset will terminate the timed output if the output is still activated. Counts will continue to accumulate after the output has activated.

MODE 10 & 11

MODE 12 TIMED OUTPUT AT ZERO, AUTOMATIC RESET TO PRESET AT ZERO
In this mode, as the unit counts from preset, the output will turn on when zero is reached. At this time, the unit will automatically Reset to Preset. The output will turn off after its programmed time value has occurred. Manual reset will turn off the output, if turned on, and reset the count to preset. During automatic reset, no counts will be lost if the count rate does not exceed 2,500 cps.

MODE 13

MODE 14 TIMED OUTPUT AT ZERO, AUTOMATIC RESET TO PRESET AFTER THE TIMED OUTPUT
In this mode, as the unit counts from preset, the output will turn on when zero is reached. The output will turn off after its programmed time value has occurred. At the end of the timed output, the unit will automatically Reset to Preset and start the cycle over again. During automatic reset, no counts will be lost, as long as the count rate does not exceed 2,500 cps. Manual reset will turn off the output, if turned on, and reset the count to preset.

MODE 15

† When down count is desired, (such as reset to preset modes of operation) the “UP/DN” terminal must be tied to the “COMM.” terminal. ✦ These modes are not applicable to the single preset Libra counter (they are used only for the two preset counter unit).

MODES OF OPERATION FOR DUAL PRESET LIBRA COUNTER

MODE 0 LATCH OUTPUT AT PRESET, MANUAL RESET TO ZERO
In this mode, as the unit counts from zero, output 1 will latch on when preset 1 is reached, and output 2 will latch on when preset 2 is reached. When a manual reset occurs, the unit will Reset to Zero and the outputs, if latched on, will unlatch. Counts will continue to accumulate after the outputs have turned on.

MODE 1 TIMED OUTPUTS AT PRESETS, MANUAL RESET TO ZERO
In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached, and output 2 will turn on when preset 2 is reached. The outputs will turn off after their respective programmed time values have occurred. When a manual reset occurs, the unit will Reset to Zero. Manual reset will terminate the timed outputs, if the outputs are still turned on. Counts will continue to accumulate after the preset levels have been reached.

† Manual reset, either by front panel reset (if enabled) or remote reset, is always active, and will override any condition or state the counter is presently in.

MODE 2 OUTPUT 1 TURN OFF AT PRESET 2, LATCH OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO
In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached. When preset 2 is reached, output 2 will turn off. Output 2 will remain latched on until a manual reset occurs. Manual reset will turn off both outputs and the unit will Reset to Zero. Counts will continue to accumulate after the preset levels have been reached.

MODE 3 OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO
In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached. When preset 2 is reached, output 2 will turn on and output 1 will turn off. Output 2 will turn off after its programmed time value has occurred. When a manual reset occurs, the unit will Reset to Zero. Manual reset will also turn off both outputs if they are still activated. Counts will continue to accumulate after preset levels have been reached.

(Modes Cont’d)
MODES OF OPERATION FOR DUAL PRESET LIBRA COUNTER (Cont’d)

MODE 10 OUTPUT 1 TURN OFF AT ZERO, LATCH OUTPUT 2 AT ZERO, MANUAL RESET TO PRESET 2 †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached. When zero is reached, output 2 will turn on and output 1 will turn off. Output 2 will remain latched on until a manual reset occurs. Counts will continue to accumulate after preset levels have been reached. Manual reset † will turn off all outputs if activated and the unit Resets to Preset 2.

MODE 11 OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, MANUAL RESET TO PRESET 1

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached. When zero is reached, output 2 will turn on and output 1 will turn off. Output 2 will turn off after its programmed time value has occurred. Counts will continue to accumulate after preset levels have been reached. When a manual reset occurs, the unit will Reset to Preset 2. Manual reset will also turn off both outputs, if still activated.

MODE 12 OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, AUTOMATIC RESET TO PRESET 2 AT ZERO †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached. When zero is reached, output 2 will turn on, output 1 will turn off, and the unit will automatically Reset to Preset 2. Output 2 will turn off after its programmed time value has occurred. Manual reset † will turn off both outputs, if turned on, and reset the count to zero. During automatic reset, no counts will be lost, as long as the count rate does not exceed 2,500 cps.

MODE 13 TIMED OUTPUTS AT PRESET 1 AND ZERO, AUTOMATIC RESET TO PRESET 2 AT ZERO †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached and output 2 will turn on when zero is reached. The outputs will turn off after their respective programmed time values have occurred. Also, when zero is reached, the unit will automatically Reset to Zero and start the cycle over again. During automatic reset, no counts will be lost as long as the count rate does not exceed 2,500 cps. Manual reset † will turn off both outputs, if turned on, and reset the count to zero.

MODE 14 OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, AUTOMATIC RESET TO PRESET 2 AFTER TIMED OUTPUT 2 †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached and output 2 will turn on when zero is reached. The outputs will turn off after their respective programmed time values have occurred. Also, when zero is reached, the unit will automatically Reset to Preset 2 and start the cycle over. During automatic reset, no counts will be lost as long as the count rate does not exceed 2,500 cps. Manual reset † will turn off both outputs, if activated, and reset the count to preset 2.

MODE 15 TIMED OUTPUTS AT PRESET 1 AND ZERO, AUTOMATIC RESET TO PRESET 2 AFTER TIMED OUTPUT 2 †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached and output 2 will turn on when zero is reached. The outputs will turn off after their respective programmed time values have occurred. Also, when zero is reached, the unit will automatically Reset to Preset 2 and start the cycle over. During automatic reset, no counts will be lost as long as the count rate does not exceed 2,500 cps. Manual reset † will turn off both outputs, if turned on, and reset the count to preset 2.

MODE 4 OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, AUTOMATIC RESET TO ZERO AT PRESET 2

In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached. When preset 2 is reached, output 2 will turn on, output 1 will turn off, and the unit will automatically Reset to Zero. Output 2 will turn off after its programmed time value has occurred. Manual reset † will turn off both outputs, if activated, and reset the count to zero. During automatic reset, no counts will be lost as long as the count rate does not exceed 2,500 cps.

MODE 5 TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO ZERO AT PRESET 2

In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached. When preset 2 is reached, output 2 will turn on and output 1 will turn off. Output 2 will turn off after its programmed time value has occurred. At the end of timed output 2, the unit will automatically Reset to Zero and start the cycle over again. During automatic reset, no counts will be lost as long as the count rate does not exceed 2,500 cps. Manual reset † will turn off both outputs, if turned on, and reset the count to zero.

MODE 6 OUTPUT 1 TURN OFF PRESET 2, TIMED OUTPUT 2 AT PRESET 2, AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT 2

In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached and output 2 will turn on when preset 2 is reached. The outputs will turn off after their respective programmed time values have occurred. Also, when preset 2 is reached, the unit will automatically Reset the count to zero and start the cycle over. Output 2 will remain on until its time value has occurred.) Manual reset † will turn off both outputs and reset the count to zero. During automatic reset, no counts will be lost, as long as the count rate does not exceed 2,500 cps.

MODE 7 TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT 2

In this mode, as the unit counts from zero, output 1 will turn on when preset 1 is reached and output 2 will turn on when preset 2 is reached. The outputs will turn off after their respective programmed time values have occurred. At the end of timed output 2, the unit will automatically Reset to Zero and start the cycle over again. During automatic reset, no counts will be lost, as long as the count rate does not exceed 2,500 cps. Manual reset † will turn off both outputs, if turned on, and reset the count to zero.

MODE 8 LATCH OUTPUT AT PRESET 1 AND ZERO, MANUAL RESET TO PRESET 2 †

In this mode, as the unit counts from preset 2, output 1 will latch on when preset 1 is reached and output 2 will latch on when zero is reached. When a manual reset † occurs, the unit will Reset to Preset 2 and the output, if latched on, will unlatch. Counts will continue to register after the outputs have turned on.

MODE 9 TIMED OUTPUT AT PRESET 1 AND ZERO, MANUAL RESET TO PRESET 2 †

In this mode, as the unit counts from preset 2, output 1 will turn on when preset 1 is reached and output 2 will turn on when zero is reached. The outputs will turn off after their respective programmed time values have occurred. When a manual reset † occurs, the unit will Reset to Preset 2. Manual reset will terminate the timed outputs, if the outputs are still activated. Counts will continue to accumulate after the outputs have activated.

† When down count is desired, (such as reset to preset modes of operation) the “UP/DN” terminal must be tied to the “COMM.” terminal.

† Manual reset, either by front panel reset (if enabled) or remote reset, is always active, and will override any condition or state the counter is presently in.

SELECTION OF INPUT SET-UP & MODES OF OPERATION

The selection of Input Set-up and Modes of Operation is accomplished by eight DIP switches, located at the rear of the unit, in the upper right-hand corner. DIP switches 1 to 3 are used to configure the input, and DIP switches 5 to 8 are used to determine the modes of operation. DIP switch 4 is used to enable or disable the front panel reset button. The input set-up and reset enable switches will be discussed first. Refer to the block diagram of the unit for the details of count and control circuitry.

SWITCH SET-UP

S1 - SNK: Provides a 7.8 KΩ pull-up resistor for sensors with sinking outputs.
SRC: Provides a 3.9 KΩ pull-down resistor for sensors with sourcing outputs.
S2 - HI FRQ: Removes damping capacitor and allows operation up to 2.5 KHz. Minimum count OFF times - 50 µsec.
S3 - LO FRQ: Connects damping capacitor for switch contact debounce. Limits count speed to 100 Hz. Minimum count pulses ON/OFF times - 5 msec.
S4 - HI BIAS: Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells, and logic pulses with 0 to +12 V swings. (VHI = 5.5 V, VLO = 7.5 V)
S5 - LO BIAS: Sets input trigger levels to the low range to accept logic pulses with 0 to 5 V swings. (VHI = 1.5 V, VLO = 3.75 V)
S6 - DIS RST: Disables front panel reset.
EN RST: Enables front panel reset.

V swings. (VIL = 1.5 V , VIH = 3.75 V)

Sets input trigger levels to the low range to accept logic pulses with 0 to +12 V swings. (VHI = 5.5 V, VLO = 7.5 V)

Connects damping capacitor for switch contact debounce. Limits count speed to 100 Hz. Minimum count pulses ON/OFF times - 5 msec.
POWER-UP DIAGNOSTICS
The Libra counters have internal diagnostics which will check the stored data during power-up. When the data is saved (power-down), computations are made with these values. The result of these computations is stored in the memory to serve as a check against possible error. Then on power-up, these same computations are repeated on the stored data. If these results do not agree with the stored results, then a “P” will appear on the right side of the display. Normal operation of the unit will continue while this “P” is displayed. To remove the “P” from the display, press the “E” button. Then check programmed values to be certain they are correct.

TO ENTER A DECIMAL POINT INTO THE DISPLAY
FIRST: Press the button located under the right-hand digit. At this time, the display will “freeze”. (The display will remain “frozen” approximately 5 seconds after release of this button). (If no other buttons are pushed.) During the selection of decimal point, the unit will operate normally.
SECOND: Press the button located under the desired decimal point location. (The decimal point will appear to the right of the digit.) (This selection cannot be made when “PGM. DIS.” is activated.) Pressing the button located under the right-hand digit will display no decimal point. (This will turn off any displayed decimal point.) After the second button pushing operation, the unit goes back to normal display mode.

CONNECTIONS
As depicted in the drawing showing the rear view of the Libra Counter, there are two terminal blocks where all wiring connections are made. All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. The blocks can be removed for easy access to the terminal screws. To remove the block, pull from the back of the block until it slides clear of the terminal block shroud.

Caution: The terminal blocks should NOT be removed with power applied to the unit.
All the DC power and input connections are made to the top terminal block labeled TBA. The AC power and output connections are made to the bottom terminal block labeled TBB. The input connections will be discussed first, using the drawing as a guide.

(The input connections are the same for 1 or 2 preset counters.)

EMC INSTALLATION GUIDELINES
Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. It should be noted that the methods listed below may not be necessary for every unit installation. In extremely high EMI environments, additional measures may be needed. The unit becomes more immune to EMI with fewer I/O connections. Cable length, routing and shield termination are very important and can mean the difference between a successful installation or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.

2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended: Ferrite Suppression Cores for signal and control cables:
   - Fair-Rite # 0443167251 (RLC #FCOR0000)
   - TDK # ZCAT3035-1330A
   - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1-07 (RLC #FLFL0000)
     - Schaffner # FN670-1-807
     - Corcom #1VB3
     - Corcom #1VR3

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

DC POWER AND OUTPUT CONNECTIONS
Terminal number 6 on TBA (the first terminal from the left), is the +12 VDC input/output terminal. As an output this terminal is for sensor supply and can provide up to 150 mA of current. As an input, an external 11 to 14 VDC supply can be applied to this terminal to power the unit in the absence of AC power. Terminal 5 is the common terminal which the common line from the sensor and other inputs are connected. (Do NOT connect relay commons or solid-state output commons to this point.) Terminal 4 is the count input terminal. When the signal at this terminal is pulled low (zero volts), a count will be registered. (See Count Input and Count Rates under the Specifications section.) Terminal number 3 is the UP/DOWN terminal (Count Direction Control). When this terminal is at a high level, the count direction is “UP”. When the terminal is grounded, the count direction is “DOWN”. Terminal 2 is the Program Disable (PGM. DIS.) terminal. When this terminal is at a high level, the Preset value(s) and timed output value(s) can be changed using the front panel buttons. (Outputs can also be tested during self-test under this condition. See Self-Test description for further details.) When terminal 2 is at a low level (connected to COMM), changing these values and testing the outputs is no longer possible. Terminal 1 is the Remote Reset terminal. When this terminal is at a low level (connected to COMM), the unit will reset, and the outputs will turn off (if activated). As long as reset is low, the unit is held at reset.

AC POWER AND OUTPUT CONNECTIONS
As mentioned before, AC power and output connections are made to the bottom terminal block, labeled TBB. Primary A.C. power is connected to terminal 1 and 2 (marked A.C. Power, located on the left-hand side of terminal block TBB). For best results, the A.C. Power should be relatively “clean” and within the specified ±10% variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

Terminals 3, 4, and 5 are used to connect to the output relay 1. Terminal 3 is the normally closed contact. Terminal 4 is the normally open contact. Terminal 5 is the output relay common. Terminal 6 is an output common used for the solid-state output(s). This terminal should NOT be used as the common for the output relay(s) or as the common for the input or control terminals. Terminal 7 is current sinking output 1 (labeled 01-SNK.). This internally connects to an NPN Open Collector transistor. The remaining terminals are for the dual preset version of the Libra counter and serve the same functions as those for the single preset unit. Terminal 8 is current sinking output 2 (labeled 02-SNK.). Terminal 9 is the normally closed contact of relay 2. Terminal 10 is the normally open contact. Terminal 11 is the output relay common.
FRONT PANEL FUNCTION DESCRIPTION

These units employ six front panel buttons for control and data entering. The button functions are described below.

RESET “R” - This button resets the counter to either zero or preset, depending on the mode of operation selected. For this button to operate, the enable/disable reset button switch, at the rear of the unit, must be set to the enable (EN) position. This button is also used in conjunction with the two preset buttons (one button on the single preset unit) to view and change the timed output value. (When reset is activated, all processes are stopped or interrupted. I.E. outputs turn off, count stops, display is halted, etc.) This is the case under any mode of operation, in any data entry mode.

PRESET “P1” (“P2”) - The preset buttons are labeled and are the two left-hand buttons of the top row, located on the front of the unit. (For the single preset unit, the left-most button is the preset button.) When the “P1” button is pressed, preset 1 is displayed. When the “P2” (if available) button is pressed, preset 2 is displayed. These values will remain displayed for approximately 10 sec. after release of the button. Also, the preset buttons are used in conjunction with the reset button, to view and change the timed output values. (See “To Enter A New Timed Output Value” section.)

ENTER “E” - This button is used in the “Preset Enter” mode and in the “Timed Output Enter” mode. After the desired value is obtained on the display, this button is pressed which then enters the value into the internal processor. This new value, at that instant, is used in the processing of preset or timed output values. “E” is also used at the end of self-test to exit self-test.

TO ENTER A NEW PRESET VALUE

FIRST: Press “P1” (or “P2”, if a two preset unit). This will display the respective preset value and it will remain displayed for approximately 10 sec. after release of the last button pushed. (At this time, preset display mode can be exited without change, by pressing the “E” button.)

SECOND: Once the preset value is displayed, changing the digit value can be done by pressing the button directly beneath the digit position to be changed. (This value cannot be changed when “PGM. DIS.” is activated.) Each time the button is pressed, the digit will increment by one. Also, pressing and holding the button will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Do this for all the digits to be changed.

THIRD: Press the “E” (Enter) button to enter the value into the unit’s memory. As soon as the “E” button is pressed, this new value is used as the operating data. This means, if the preset value is entered, and the old or new value has not been reached, the new value will be used without process disruption (Preset on the fly). If the “E” button is not pressed within 10 sec. after the last digit has been changed, the value will disappear (go back to normal display mode) and the unit will continue to operate on the previous value. During the displaying, changing, and entering of a new preset value, all functions of the unit are operational, such as, counting, resetting, outputs firing, etc. Note: For RTP modes of operation, “P1” (“P2” for dual preset units) will determine the “Start Count” value of each cycle.

TO ENTER A NEW TIMED OUTPUT VALUE

FIRST: Press and hold the “P1” (or “P2”, for two preset units) button and then press the “R” (Reset) button. At this time, the respective timed output value will be displayed and will remain displayed for approximately 10 sec. after release of the last button pushed. (At this time, the timed output display mode can be exited without change, by pressing the “E” button.)

SECOND: Once the timed output is displayed, changing the digit value can be done by pressing the button directly beneath the digit position to be changed. (This value cannot be changed when “PGM. DIS.” is activated.) Each time the button is pressed, the digit will increment by one. Also, pressing and holding the button will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Do this for all the digits to be changed. (This value can be set between 0.01 sec and 99.99 sec.)

THIRD: Press the “E” (Enter) button to enter the value into the unit’s memory. As soon as the “E” button is pressed, this new value is used as the operating data. If the “E” button is not pressed within 10 sec. after the last digit has been changed, the value will disappear (go back to normal display mode) and the unit will continue to operate on the previous value. During the displaying, changing, and entering of a new timed output value, all functions of the unit can be done, such as counting, resetting, output firing etc. without any interruption.

INITIAL POWER-UP & FACTORY SETTINGS

When the unit is shipped from the factory, the values and the following modes are set as shown.

Preset 1 = 500
Preset 2 = 1,000 (if a dual preset version)
Count value = 0
Timed output value(s) = 0.1 second

DIP SWITCH SETTINGS

All switches are in the “UP” position except for the reset enable switch, which is “DOWN”. With the switches set in these positions, the unit is operating in mode zero (latch-on at preset, manual reset to zero). The input is set for sinking type inputs, high frequency, and high bias operation.

TROUBLESHOOTING

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

SELF-TEST

This unit has a built-in, self-test feature, which can be activated without losing counts, preset values, missing preset points, timed output durations, or interfering with control functions. With this test, all digits are cycled through, then the mode select switch settings are displayed. At this point, the outputs can also be tested. To enter self-test, press the two upper right-hand digit buttons (located on the front panel), simultaneously. At this time, whatever count value was displayed will disappear and be replaced by a string of four zeros. This will be shown for about half a second, then a string of ones will appear for the same time duration. Following these, a string of twos and so on, up to nine will be displayed. After the nines are shown, three decimal points will appear. After this portion, an interface pattern of the same numbers will be shown. First, a combination of 1, 0, 1, 0 then 1, 2, 1, 2 and so on, until all digits from zero to nine have been displayed.

The next portion of self-test will display a group of ones and zeros. These ones and zeros are the settings of the mode select switches (the four right-hand DIP switches only). This pattern directly corresponds to the number representing the mode of operation. If the switches are changed while at this point in the self-test, the settings can be seen to change. These changes will not affect counter operation immediately, but any changes will take effect when self-test is exited. When the switch is “DOWN”, the display will show a one. When the switch is “UP”, the display will show a zero. If no testing of the outputs is required, press the “E” button until the unit exits self-test (the unit will go back to the count display mode). Also, if no activity occurs on the switches or the front panel buttons within 18 sec. after the unit pauses at the mode switch display, the unit will automatically exit the self-test.

During the time the mode switch settings are displayed, the outputs can be tested. To activate the outputs, press the “P1” button (for dual preset version, “P1” or “P2” is pressed). Note: The “PGM. DIS.” terminal must be at a high level for the outputs to be activated. Also, caution should be used when testing the outputs, so as not to cause any undesirable or hazardous conditions in the system. (To turn off the outputs, release the button.)

If the outputs are not tested, the state of the outputs will remain the same as it was prior to self-test. If the outputs are tested in self-test, the outputs will be turned off after exiting self-test. Rapid advance of the self-test routine can be done by pressing and releasing any of the front panel buttons except for the “R” button. (Pressing “R” at any time, except when entering the timed output mode, will reset the unit.)
CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS

1. SENSOR SUPPLY VOLTAGE AND CURRENT
   The +12 V sensor supply voltage on the “+12 VDC” Terminal is nominal with ±25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.

2. HI/LO FRQ. SELECTION
   The HI/LO FRQ Selection switch must be set on LO FRQ when switch contacts are used to generate count input signals. Since the LO FRQ mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used, whenever possible, with electronic sensor outputs, as added insurance. The LO FRQ mode can be used with any type of sensor output, provided the count pulse widths never decrease below 5 milliseconds, and the count rate does not exceed 100 Hz.

3. VIL and VIH levels given are nominal values ±10%, when the counter voltage at the “+12 VDC” Terminal, is +12 VDC. These nominal values will vary in proportion to the variations in “+12 VDC” Terminal voltage, caused by line voltage and load changes.

4. When shielded cable is used, the shield should be connected to COMM. at the counter and left unconnected at sensor end.

NOTES:

INSTALLATION ENVIRONMENT

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

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

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

Installation

The Libra counters meet NEMA 4/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel that is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8” / 3.2 mm.)

After the panel cut-out has been completed and deburred, carefully apply the gasket to the panel. **DO NOT APPLY THE ADHESIVE SIDE OF THE GASKET TO THE COUNTER BEZEL.** Insert the unit into the panel. As depicted in the drawing (at right), install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side. Install each of the two mounting clips by inserting the wide lip of the clips into the front end of the hole, located on either side of the case. Then snap the clip onto the case. Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal.

**Caution:** Only minimum pressure is required to seal panel. Do NOT overtighten mounting screws.
APPLICATION FOR SINGLE PRESET LIBRA COUNTER

**BOX STACKING CONTROL**

A typical application requires the control of a conveyor belt which feeds a mechanical stacker. The stacker can stack 12, 24, 32, or 48 cartons of ceiling tile onto each pallet (depending on pallet size). When the required number of cartons have been stacked, the conveyor is stopped until the loaded pallet is removed and an empty pallet is placed onto the loading area. Also, it is required that only the foreman be allowed to change the number of cartons per pallet.

A single preset Libra counter is used to satisfy all the above requirements. Terminal 3 and terminal 4 of a Model RR Photo-electric sensor (which feeds a count pulse to the Libra after each carton passes by) are respectively connected to the “+12 VDC” and “CNT. IN” terminals of the Libra counter. The normally closed contact of relay 1 is connected to the conveyor belt drive control. A remote reset button is connected to the “REM. RST.” terminal of the Libra counter, which allows the operator to reset the system from the forklift, after an empty pallet is placed onto the loading area. Also, a key switch is connected to the “PGM. DIS.” terminal, which prevents resetting the unit from the front panel. The unit is set for Mode 0 operation, switches 5 through 8 are respectively connected to the terminals of the Libra counter. The normally closed contact of output 2 is connected to the knife actuator so when the knife shears off the paper, the Libra counter is reset and is ready for the next cycle.

The system operation is as follows: as the trailing edge of the box passes the photo-electric, a count is registered on the Libra display. When the preset value is reached, the conveyor belt will turn off. The forklift operator removes the loaded pallet. After the empty pallet is in position, the forklift operator presses the remote reset switch, which then starts the whole cycle over again.

APPLICATION FOR DUAL LEVEL PRESET LIBRA COUNTER

**THE CONTROL OF A PAPER ROLL MANUFACTURING PROCESS**

In a paper production process, the requirement exists to control a solenoid which places a red ink marking at the end of a roll of printing paper (this marking is used to indicate when the end of the roll is near). The unit must also stop the system when the proper amount of paper is wound onto the roll. Then, the cutting knife is manually actuated which shears off the paper. The full roll is taken off the spool and a new roll is loaded on. The system is then started up again. The Libra two preset counter satisfies these requirements.

The Libra set-up is as follows: Preset 1 is set to 30 (30 ft. [9 M] is desired length of red marking at the end of the roll). When the system is started, the ink marker solenoid is activated which starts marking the paper (this is connected to the normally closed contact of relay 1). When 30 is reached, output 1 fires which de-energizes the ink solenoid. Preset 2 is set to 3400 feet. (3400 ft. [1036 M] is the total desired length of paper wound onto the roll). When the unit reaches 3400 feet, preset 2 fires which de-energizes the entire system (the system control is connected to the normally closed contact of output 2). The operator then actuates the knife, which shears off the paper and at the same time, the Libra counter is reset and is ready for the next cycle.

An LSC (length sensor) with a 1 pulse/foot wheel is connected to the Libra counter. The red (+12 V), black (COMM.) and white (COUNT) of the LSC are connected to the Libra “+12 VDC”, “COMM.”, and “CNT. IN” terminals respectively. The “PGM. DIS.” terminal is left unconnected so preset values can be changed (a key switch can be used if desired). “RESET” is connected to the knife actuator so when the knife shears off the paper, the Libra counter is reset. DIP switch 1 is set to current sinking to match the LSC output. DIP switch 2 is set to “LO FRQ.” because the count speed cannot be greater than 100 Hz. DIP switch 3 is set to “HI BIAS”. The front panel reset enable switch (DIP switch 4) is set to “DIS.”. All the mode switches are set “UP”, which is mode 0 (Latch Outputs at Presets and Manual Reset to Zero). The relay contacts are connected as previously discussed.
MODEL LNXCC - LYNX CONTACT INPUT COUNTER

- SINGLE PRESET
- 0.3" (7.6 mm) HIGH, 6 DIGIT DISPLAY
- NON-VOLATILE MEMORY (E2PROM)
- DISPLAY SCROLLING
- FORM (C) RELAY OUTPUT
- SOLID-STATE CURRENT SINKING OUTPUT
- PROGRAMMABLE TIMED OUTPUT
- REMOTE RESET CAPABILITY
- SIMPLIFIED FRONT PANEL PROGRAMMING
- ABILITY TO LOCK OUT FRONT PANEL FUNCTIONS
- ON-LINE SELF-TEST
- AVAILABLE IN AC OR DC VERSIONS
- FRONT PANEL PROGRAMMABLE DECIMAL POINT
- SEALED FRONT PANEL CONSTRUCTION (NEMA 4X/IP65)

DESCRIPTION

The Lynx Contact single preset counter is an economical and reliable solution to single preset level requirements. This unit has a solid-state output and a Form C relay output. It can accept inputs from switch contact closures, NPN Open Collector output sensors, or most any other current sinking output sensor sold by RLC. It also features a full complement of control inputs, programmable timed output, non-volatile memory, and many other features which will satisfy most any single preset application.

The Lynx Contact Counter has two main counting actions, Reset to Zero (RTZ) and Reset to Preset (RTP). There are eight modes of operation for this unit.

All parameters are programmed through the front panel buttons. The unit has an internal non-volatile memory device which eliminates the need for battery back-up. When power is removed, this device maintains all data set-ups necessary for system operation. A Program Disable terminal is provided, which can be used to prevent accidental changes or tampering by unauthorized personnel to the preset or timed output value. The front panel reset button can also be enabled or disabled by a rear panel DIP switch. This counter also has an on-line self-test, which can be run at any time without missing counts or missing a preset value.

Power, input, and output connections are made via removable terminal blocks at the rear of the unit. DIP switches at the rear of the unit are used to set up the desired mode of operation.

The Lynx Contact counter has a sealed high impact plastic bezel which meets NEMA 4X/IP65 specifications for wash-down and/or dust, when properly installed.

SAFETY SUMMARY

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

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

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.7" (68.6) H x 4.0" (101.6) W.
SPECIFICATIONS

1. DISPLAY: 6-digit, 0.3” (7.6 mm) high LCD display.

2. POWER REQUIREMENTS:
   - AC Power Versions: 115 VAC (±10%), 50/60 Hz, 6 VA
   - 230 VAC (±10%), 50/60 Hz, 6 VA
   - DC Power Versions: 11 to 14 VDC @ 180 mA.
   - 21.5 to 30 VDC @ 180 mA.

3. COUNT INPUT: Switch contact closures or NPN Open Collector output sensors. (Current sinking type output sensors)
   - Count threshold levels are \( V_{IL} = 0.5 \text{ V} \), \( V_{IH} = 3.8 \text{ V} \).
   - Current Sinking: Unit provides 10 KΩ pull-up load for sensors with current sinking outputs. (Max. sensor current, 0.5 mA.)

4. MAXIMUM COUNT RATE: 50 Hz under all modes of operation.

5. CONTROL INPUTS: Active low (\( V_{IL} = 0.5 \text{ V max.} \)), internally pulled up to 5 VDC through a 10 KΩ resistor (\( I_{SNK} = 0.5 \text{ mA} \)).
   - Remote Reset: Response time = 10 msec. A low will reset the unit and deactivate the output.
   - Program Disable: A low inhibits the changing of the preset and timed output, as well as testing the output in self-test.

6. OUTPUT:
   - Solid-State: Current sinking NPN Open Collector Transistor. \( I_{SNK} = 100 \text{ mA} \) max., \( V_{OH} = 30 \text{ VDC max.} \), \( V_{OL} = 1 \text{ V} @ 100 \text{ mA} \).
   - Relay: Form C contacts max. rating 5 amps @ 120/240 VAC, 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load). The operate time is 5 msec. nominal and the release time is 3 msec. nominal.
   - Relay Life Expectancy: 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)
   - Programmable Timed Output: The timed output can be programmed from 0.01 sec. to 99.99 sec., ±0.1% + 10 msec. The timed output is set for 0.1 sec. at the factory.

7. MEMORY RETENTION: Non-volatile E-PRoM retains all programmed information when power is removed or interrupted.
   - Power Cycles(ON/OFF): 100,000 min.
   - Data Retention: 10 years min.

8. INPUT, POWER, AND OUTPUT CONNECTIONS: Removable terminal blocks.

9. ENVIRONMENTAL CONDITIONS:
   - Operating Temperature: 0 to 50°C
   - Storage Temperature: -40 to 70°C
   - Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
   - Altitude: Up to 2000 meters

10. 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
      - Immunity to EN 50082-2
        - Electrostatic discharge: EN 61000-4-2 Level 2; 4 Kv contact
        - Level 3; 8 Kv air
        - Fast transients (burst): EN 61000-4-4 Level 4; 2 Kv I/O2
        - Level 3; 2 Kv power1
        - RF conducted interference: EN 61000-4-6 Level 3; 10 V/m1
        - Level 3; 10 V/2m1
        - 150 KHz - 80 MHz
        - Electromagnetic RF fields
        - EN 61000-4-2 Level 3; 8 Kv air
        - EN 61000-4-2 Level 3; 10 V/m
        - EN 61000-4-2 Level 4; 2 Kv I/O2
        - Level 3; 2 Kv power1
        - EN 61000-4-6 Level 3; 10 V/m1
        - 150 KHz - 80 MHz
    - Notes:
      1. Power lines had an external EMI line filter (RLC #LFIL000 or equivalent) installed.
      2. I/O cables routed in metal conduit connected to earth ground.
      - Refer to the EMC Installation Guidelines section of the bulletin for additional information.
    - 11. CONSTRUCTION: Black plastic front bezel with black plastic insert.
      - Front panel meets NEMA 4X/IP65 requirements for wash-down and dusty environments, when properly installed. Installation Category II, Pollution Degree 2. (Panel gasket, mounting clip, nut fasteners, and screws included with unit.)
      - WEIGHT: 0.8 lbs (0.36 kg).

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNXCC</td>
<td>Lynx Contact Input Counter</td>
<td>LNXCC020  LNXCC030  LNXCC010  LNXCC000</td>
</tr>
<tr>
<td>*LNXC1</td>
<td>Lynx Single Preset Counter</td>
<td>LNXC1020  LNXC1030  LNXC1010  LNXC1000</td>
</tr>
<tr>
<td>*LNXC2</td>
<td>Lynx Dual Preset Counter</td>
<td>LNXC2020  LNXC2030  LNXC2010  LNXC2000</td>
</tr>
</tbody>
</table>

For complete details on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

* For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
**MODES OF OPERATION, DIP SWITCH SET-UP**

Modes of operation and front panel reset enable are selected by five DIP switches located at the rear of the unit. DIP switch 1 is used to enable or disable the front panel reset button. DIP switches 2 through 5 are used to select the desired mode of operation. Mode settings of the switches are shown to the right of the text below.

Note: During automatic reset, no counts will be missed if the count rate does not exceed the maximum count rate specified. A manual reset, either from the front panel reset (if enabled) or remote reset, overrides any condition or state of the counter and begins the cycle again.

**MODES OF OPERATION FOR THE LYNX CONTACT PRESET COUNTER**

**MODE 0 LATCH OUTPUT AT PRESET, MANUAL RESET TO ZERO**

The unit counts from zero; when the preset value is reached, the output turns on and counts continue to accumulate. When a manual reset is performed, the count resets to zero and the output turns off.

**MODE 1 TIMED OUTPUT AT PRESET, MANUAL RESET TO ZERO**

The unit counts from zero; when the preset is reached, the output turns on for the amount of time programmed and counts continue to accumulate. When a manual reset is performed, the unit resets to zero and starts the counting cycle again.

**MODE 2 & 3**

These modes are not applicable.

**MODE 4 TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AT PRESET**

The unit counts from zero; when the preset is reached, the output turns on for the amount of time programmed. At preset, the unit automatically resets to zero and starts the counting cycle again.

**MODE 5**

These modes are not applicable.

**MODE 6 TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AFTER THE TIMED OUTPUT**

The unit counts from zero; when the preset is reached, the output turns on for the amount of time programmed. At the end of the timed output, the unit automatically resets to zero and starts the cycle again.

**MODE 7**

These modes are not applicable.

**POWER-UP DIAGNOSTICS**

Upon applying power, the Lynx contact counter performs an internal self-diagnostic test of all the stored data. If the tests do not agree, a “P” appears on the right side of the display. Normal operation of the unit will continue while the “P” is displayed. Press the “E” button to remove the “P” and check all data set-up values to be certain they are correct.

**EMC INSTALLATION GUIDELINES**

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

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

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

6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.

Snubbers:

RLC # SNUB0000
WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

When wiring the unit, remove the terminal block and use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to one #14 AWG, two #18 AWG or four #20 AWG wire(s). After the terminal block is wired, install it into the proper location on the PC board. Wire each terminal block in this manner.

Caution: Terminal blocks should NOT be removed with power applied to the unit.

INPUT CONNECTIONS

Input connections are made on terminal block TBA, refer to numbers on the label to identify the position number with the proper function. The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection.

Terminal 1 - “REM.RST.” (remote reset) When connected to common a manual reset is performed. The output turns off (if activated) and the count display is reset. As long as this terminal is low, the unit is held at reset.

Terminal 2 - “PGM.DIS.” (program disable) When this terminal is not connected to common, the following values can be programmed using the front panel buttons:

- Preset Value
- Decimal Point Position
- Timed Output Value

Outputs can also be tested during self-test under this condition (See “Self-Test” description for further details). When connected to common, changing these values and testing the output is no longer possible.

Terminal 3 - “CNT.IN” (count input) When the signal is pulled low, a count will be registered. (See Count Input and Count Rates under the Specifications Section.)

Terminal 4 - “COMM.” (common) This is the common line to which the sensor and other input commons are connected. (Do NOT connect relay common or solid-state output common to this point.)

POWER & OUTPUT CONNECTIONS

The input power and relay output connections are made to the bottom terminal block (TBB), and the solid-state output is connected to the polarized three-pin connector.

Relay Connections

To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contactor. Follow the manufacturer’s instructions for installation.

Note: Snubber leakage current can cause some electro-mechanical devices to be held ON.

AC POWER WIRING

Primary AC power is connected to terminals 1 and 2 of TBB (marked VAC 50/60 Hz). To reduce the chance of noise spikes entering the AC line and affecting the unit, the power should be relatively “clean” and within the 10% variation limit. Drawing power from heavily loaded circuits, or from circuits that also power loads that cycle on and off (contactors, relays, motors, machinery, etc.), should be avoided.

DC POWER WIRING

The DC power is connected to terminals 1 and 2 of TBB. The DC plus(+) power is connected to TBB 1 and the minus(-) is connected to TBB 2.

OUTPUT WIRING

Terminals 3, 4, and 5 are used to connect to the output relay. (See Block Diagram)

The solid-state output connector has two wires on top of the connector housing.

Yellow wire - Solid-state output 1 (labeled 01 SNK.) internally connects to an NPN Open Collector transistor.

Black wire - common for the solid-state output. This terminal should NOT be used as the common for the input or control terminals.

FRONT PANEL FUNCTION DESCRIPTION

This unit employs eight front panel buttons for control and data entry. The button functions are as described below:

RESET “R”: Resets the counter to either zero or preset, depending on the mode of operation selected. For this button to operate, the enable/disable reset switch at the rear of the unit must be set to the enable (EN.) position. Also it is used in conjunction with the preset button, to view and change the timed output value. When reset is activated, all processes are stopped or interrupted (i.e. output turns off, display is reset, etc.). This is the case under any mode of operation, in any data entry mode.

PRESET “P1”: The preset value is displayed when the P1 button is pressed, and the Preset Value mode is accessed (See Program Preset Value). The value remains displayed for approximately 10 seconds after release of the button.

The preset button is also used, in conjunction with the reset button, to view and change the timed output value (See Program Timed Output Value section.)

ENTER “E”: Used when programming the Preset Value or the Timed Output Value. After the desired value is obtained on the display, pressing the “E” button enters the value into the unit’s internal memory and takes effect immediately. Also the “E” button can be used to exit self-test.

DISPLAY SCROLLING

To set the display to scroll, press and hold the “E” button and then press the left-most button on the front panel. To stop the scrolling, repeat the above step.

DISPLAY SCROLLING SEQUENCE

<table>
<thead>
<tr>
<th>Single Preset</th>
<th>P1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of P1</td>
<td>Count Value</td>
</tr>
</tbody>
</table>

PROGRAM PRESET VALUE *

The factory default value is set to 500. To enter a different value, the operator must enter the Preset Value Programming Mode by performing the following steps:

Note: During the displaying, changing, and entering of a new preset value, all functions of the unit are operational (i.e. counting, resetting, outputs activating, etc.)

FIRST: Press “P1”. This displays the preset value, which remains displayed for approximately 10 seconds after release of the last button pushed. At this time, the preset display mode can be exited, without change, by pressing the “E” button.

SECOND: Once the preset value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down continuously scrolls the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired preset value is obtained.

THIRD: Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new preset value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

* To enter any new data into the Lynx, the “PGM.DIS.” terminal must be deactivated (open or at +5 VDC maximum).
**PROGRAM TIMED OUTPUT VALUE** *

The factory default Timed Output Value is 0.10 seconds, but can be programmed from 0.01 to 99.99 seconds. To enter a different value, the operator must enter the Timed Output Value Programming Mode by performing the following steps.

*Note: During the displaying, changing, and entering of a new timed output value, all functions of the unit are operational (i.e. counting, resetting, outputs activating, etc.)*

**FIRST:** Set S1 Reset EN./DIS. switch to the Down position (Enable).

**SECOND:** Press and hold the “P1” button and then press the “R” button. The timed output value is displayed and remains displayed for approximately 10 seconds after release of the last button pushed. At this time, the timed output display mode can be exited, without change, by pressing the “E” button.

**THIRD:** Once the timed output value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down continuously scrolls the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired timed output value is obtained.

**FOURTH:** Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new timed output value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

**PROGRAM DECIMAL POINT** *

The Lynx has the capability of displaying a decimal point in one of five positions. The decimal point selection can be done at any time without missing counts or preset outputs. The factory default for the Decimal Point Position is off. To turn a decimal point on, the operator must enter the Decimal Point Position Programming Mode by performing the following steps.

*Note: During the displaying, changing, and entering of a new decimal point value, all functions of the unit are operational (i.e. counting, resetting, outputs activating, etc.)*

**FIRST:** Press and release the left-most digit button on the front panel. This places the Lynx in the decimal point select mode.

**SECOND:** Press the digit button which corresponds to the desired decimal point position. A decimal point will appear to the right of the digit selected. If the right-most digit button (P1) is selected, the decimal point is turned off.

**THIRD:** At the time the decimal point is selected, the unit automatically returns to normal operation. No further action is required by the operator.

* To enter any new data into the Lynx, the “PGM.DIS.” terminal must be deactivated (open or at +5 VDC maximum).

## SELF-TEST

The self-test feature can be activated without affecting the count, missing a preset point, affecting the timed output durations, or interfering with control functions. This test verifies that all digits operate. Also, the DIP switch settings and the relay output can be tested.

If the output is not tested, the state of the output remains the same as it was prior to self-test. If the output is tested in self-test, the output will be off after exiting self-test.

Rapid advance of the self-test routine can be done by pressing and releasing any of the front panel buttons except for the “R” button. (Pressing “R” at any time, except when entering the timed output mode, resets the unit.)

To enter self-test, press the two left-hand digit buttons (on the front panel) simultaneously. At this time, the display will cycle all the digits on the display each for about half a second and in the sequence shown below.

<table>
<thead>
<tr>
<th>DIGITS CYCLED ON THE DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000</td>
</tr>
<tr>
<td>111111</td>
</tr>
<tr>
<td>222222</td>
</tr>
<tr>
<td>333333</td>
</tr>
<tr>
<td>444444</td>
</tr>
<tr>
<td>555555</td>
</tr>
<tr>
<td>666666</td>
</tr>
<tr>
<td>777777</td>
</tr>
<tr>
<td>888888</td>
</tr>
<tr>
<td>999999</td>
</tr>
</tbody>
</table>

**BLANK DISPLAY**

| 101010                        |
| 121212                        |
| 323232                        |
| 434343                        |
| 545454                        |
| 656565                        |
| 767676                        |
| 878787                        |
| 989898                        |

- The next portion of self-test displays a group of four ones and zeros. The first three digits always appear as zeros. The fourth digit represents program disable (PGM.DIS). A zero represents a high at this terminal and a one represents a low. The second set of digits are the settings of the mode select switches. This pattern directly corresponds to the number representing the mode of operation. If the switches are changed while at this point in the self-test, the settings can be seen to change. These changes do not affect counter operation immediately, but any changes will take effect when self-test is exited. When the switch is “DOWN”, the digit shows a one. When the switch is “UP”, the digit shows a zero.

  During the time the mode switch settings are displayed, the output can be tested. To activate the output, press the “P1” button. If no testing of the output is required, press the “E” button until the unit exits self-test (the unit returns to normal display mode). Also, if no activity occurs on the switches or the front panel button within 18 seconds after the unit pauses at the mode switch display, the unit automatically exits self-test.

  *Note: The “PGM.DIS.” terminal must not be connected to common for the outputs to be activated during self-test.*

  **CAUTION:** The operator should use care when testing the outputs, so as not to cause any undesirable or hazardous conditions in the system.

## INITIAL POWER-UP & FACTORY SETTINGS

When the unit is shipped from the factory, the values and the following modes are set as shown.

| Preset 1 | = 500 |
| Count Value | = 0 |
| Timed Output Value(s) | = 0.10 second |

## DIP SWITCH SETTINGS

All switches are set to the “UP” position except for the reset enable switch, which is “DOWN”. With the switches set in these positions, the unit is operating in mode zero (latch-on at preset, manual reset to zero).
**INSTALLATION ENVIRONMENT**

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

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

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

**INSTALLATION**

The Lynx Counters meet NEMA 4X/IP65 requirements for indoor use, when properly installed. These units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal.

One mounting clip and two screws with nuts are provided for easy installation. Consideration should be given to the thickness of the panel. A panel that is too thin, may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 0.125" [3.18 mm].)

After the panel cut-out has been completed and deburred, carefully slide the panel gasket over the rear of the counter body to the back of the bezel. Insert the unit into the panel. As depicted in the drawing, install the two tinnerman nuts and two self-tapping screws onto the mounting clip. To install the mounting clip, hold the mounting clip with both hands so that the top corners rest on the index finger of each hand and the bottom corners rest on the middle finger of each hand. While doing this, place the thumb of each hand over the mounting screws. By pressing on the screws, flex the clip enough to slide it over the back end of the Lynx case until the clip snaps into the groove of the bezel. Tighten the two mounting screws.

Caution: Only minimum pressure is required to seal the panel. Do NOT overtighten mounting screws.

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
APPLICATION FOR LYNX CONTACT COUNTER

COUNTING AND CUTTING BUSINESS FORMS

This application requires that business forms be counted as they are cut to length and then packed in boxes of 100. To assure the proper number of forms are packed in each box, a burst of air is applied to the underside of the last form in each batch causing the form to move slightly out of line with respect to the other forms. The air jet duration required varies for different size forms and should be adjustable. When packing these forms, the packer uses this offset form as a marker to indicate the last form to be packed in each box. The knife controller is used to generate the necessary contact closure pulses.

The system operation is as follows: When the forms machine is running, the knife control circuit signals the knife at the appropriate time to cut each form to length. When this happens, the output of the knife causes the LYNX display to increment. When the counter reaches the desired preset value, the output fires for the predetermined time period, causing the air jet to offset one of the forms. The LYNX immediately resets to zero and is ready for the next cycle.

The following is a list of the DIP switch settings and terminal connections to meet the process requirements.

### FRONT PANEL PROGRAMMING

<table>
<thead>
<tr>
<th>Preset</th>
<th>Value</th>
<th>Mode Dip Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>S1 Up (Disable)</td>
</tr>
<tr>
<td>Timed output</td>
<td>0.50 seconds</td>
<td>S2 Up (Mode 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S3 Down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S4 Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S5 Up</td>
</tr>
</tbody>
</table>

### TBA CONNECTIONS

- **Terminal 1 (REM.RST)**: Unconnected
- **Terminal 2 (PGM.DIS)**: Keyswitch
- **Terminal 3 (CNT.IN)**: Knife Controller Output
- **Terminal 4 (COMM.)**: Knife Controller Output

### TBB CONNECTIONS

- **Terminal 1 & 2**: Primary Power
- **Terminal 4 & 5 (Output)**: Air jet control
- **Terminal 3**: Not used

The preset number and output time duration are locked from further entry when the key switch connects the Program Disable ("PGM. DIS.") terminal to the "COMM." of the LYNX Contact Counter.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at the Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, death, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL LNXC1 SINGLE PRESET COUNTER
MODEL LNXC2 DUAL PRESET COUNTER

- 0.3" (7.6 mm) HIGH, 6 DIGIT DISPLAY
- NON-VOLATILE MEMORY (E²PROM)
- DISPLAY SCROLLING (SELECTABLE)
- BI-DIRECTIONAL COUNTING
- PRESCALE CAPABILITY WITH DISABLE SWITCH (Dual Preset)
- FORM C RELAY OUTPUT(S)
- SOLID-STATE CURRENT SINKING OUTPUT(S)
- PROGRAMMABLE TIMED OUTPUT(S)
- REMOTE RESET CAPABILITY
- ABILITY TO LOCK OUT FRONT PANEL FUNCTIONS
- ACCEPTS INPUT COUNT RATES UP TO 15 Khz (Single preset)
- AVAILABLE IN AC OR DC VERSIONS
- FRONT PANEL PROGRAMMABLE DECIMAL POINT
- SEALED FRONT PANEL CONSTRUCTION (NEMA 4X/IP65)

DESCRIPTION
The Lynx Series of presettable counters is an economical and reliable solution to single or dual preset level requirements. The Model LNXC1 is the single preset version and the Model LNXC2 is the dual preset version. Both units have a solid-state output and a Form C relay output for each preset. These units feature selectable input configurations, a full compliment of control inputs, programmable timed outputs, prescale capability with disable switch (dual preset only), non-volatile memory, and many other features which will satisfy most any single or dual preset application.

The Lynx Counters have two main counting actions, Reset to Zero (RTZ) and Reset to Preset (RTP). There are eight modes of operation for the single preset unit and sixteen for the dual preset unit.

All parameters are programmed through the front panel buttons. The Lynx counters have an internal non-volatile memory device which eliminates the need for battery back-up. When power is removed, this device will maintain all data set-ups necessary for system operation. A Program Disable terminal is provided, which can be used to prevent accidental changes or tampering by unauthorized personnel to the preset(s), prescale or timed output values. The front panel reset button can also be enabled or disabled by a rear panel DIP switch. These counters also have an on-line self-test, which can be run at any time without missing counts or missing a preset value.

Power, input, and output connections are made via removable terminal blocks at the rear of the unit. The Lynx Series of counters have a sealed high impact plastic bezel and meet NEMA 4X/IP65 specifications for wash-down and/or dust, when properly installed.

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

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

SPECIFICATIONS
1. DISPLAY: 6-digit, 0.3" (7.6 mm) high LCD display.
2. POWER REQUIREMENTS:
   AC Power Versions: 115 VAC (±10%), 50/60 Hz, 6 VA
   230 VAC (±10%), 50/60 Hz, 6 VA
   DC Power Versions: 11 to 14 VDC @ 180 mA.
   21.5 to 30 VDC @ 180 mA.
3. SENSOR POWER: +12 VDC (±25%) @ 100 mA.
4. COUNT INPUT: DIP switch selectable to accept count pulses from a variety of sources, including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.
   Current Sourcing: Unit provides 3.9 KΩ pull-down load for sensors with current sourcing outputs. (Max. input voltage, 28 VDC @ 7 mA.)
   Current Sinking: Unit provides 7.8 KΩ pull-up to +12 VDC for sensors with current sinking outputs. (Max. sensor current, 1.6 mA.)
   Debounce: Damping capacitor provided for switch contact debounce. Limits count speed to 100 cps max. with 50% duty cycle.
   Lo Bias: Input Trigger levels VIL = 1.5 V, VIH = 3.75 V
   Hi Bias: Input Trigger levels VIL = 5.5 V, VIH = 7.5 V
   Note: Bias levels ±10% @ 12 VDC sensor voltage. These levels vary proportionally with the sensor supply voltage.
5. PRESCALE VALUE RANGE: 0.00001 to 9.99999 (dual preset unit only).

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.7" (68.6)H x 4.0" (101.6)W.
**SPECIFICATIONS (Cont’d)**

6. **MAXIMUM COUNT RATES:**

   **High Frequency:** For the single preset unit only - 15 KHz max. square wave input for all electronic sensors, under all modes of operation. For dual preset units, the following chart lists the count rates for all the possible prescale values.

<table>
<thead>
<tr>
<th>Prescale Value</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001 to 1</td>
<td>12 KHz</td>
</tr>
<tr>
<td>1.00000 to 2</td>
<td>9 KHz</td>
</tr>
<tr>
<td>2.00000 to 3</td>
<td>7 KHz</td>
</tr>
<tr>
<td>3.00000 to 4</td>
<td>5.5 KHz</td>
</tr>
<tr>
<td>4.00000 to 5</td>
<td>4.5 KHz</td>
</tr>
<tr>
<td>5.00000 to 6</td>
<td>4 KHz</td>
</tr>
<tr>
<td>6.00000 to 7</td>
<td>3.5 KHz</td>
</tr>
<tr>
<td>7.00000 to 8</td>
<td>3 KHz</td>
</tr>
<tr>
<td>8.00000 to 9</td>
<td>3 KHz</td>
</tr>
<tr>
<td>9.00000 to 9.99999</td>
<td>2.5 KHz</td>
</tr>
</tbody>
</table>

   **Low Frequency:** For both single and dual preset units - 100 Hz for switch contact closures. 

   7. **CONTROL INPUTS:** Active low (VIL = 0.5 V max.), internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA).

   **Remote Reset:** Response time = 10 msec. A low will reset the unit and deactivate outputs.

   **Program Disable:** A low will inhibit the changing of presets, prescale, and timed outputs, as well as testing outputs in self-test.

   **Up/Down Control:** Response time = 150 μsec. A low will cause the unit to count down. A high will cause the unit to count up.

   **OUTPUTS:**

   **Solid-State:** Current sinking NPN Open Collector Transistors. ISNK = 100 mA max., VOH = 30 VDC max., VIL = 1 V @ 100 mA.

   **Relay:** Form C contacts. max. rating 5 amps @ 120/240 VAC, 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load). The operate time is 5 msec. nominal and the release time is 3 msec. nominal.

   **Relay Life Expectancy:** 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)

   **Programmable Timed Output:** The timed output can be programmed from 0.01 sec. to 99.99 sec., ±0.1% ± 10 msec. The timed output is set for 0.1 sec. at the factory.

8. **MEMORY RETENTION:** Non-volatile E2PROM retains all programmed information when power is removed or interrupted.

9. **INPUT, POWER, AND OUTPUT CONNECTIONS:** Removable terminal blocks.

10. **ENVIRONMENTAL CONDITIONS:**

    **Operating Temperature:** 0 to 50°C
    **Storage Temperature:** -40 to 70°C
    **Operating and Storage Humidity:** 85% max. relative humidity (non-condensing) from 0°C to 50°C.
    **Altitude:** Up to 2000 meters

11. **ELECTROMAGNETIC COMPATIBILITY**

    **Immunity to EN 50082-2**

    - Electrostatic discharge EN 61000-4-2 Level 2; 4 Kvar contact Level 3; 8 Kvar air
    - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m 80 MHz - 1 GHz
    - Fast transients (burst) EN 61000-4-4 Level 4; 2 Kvar I/O 2
    - RF conducted interference EN 61000-4-6 Level 3; 2 Kvar power 1 150 KHz - 80 MHz
    - Emissions to EN 50081-2

   **Notes:**

   1. Power lines had an external EMI line filter (RLC #LFIL0000 or equivalent) installed.
   2. I/O cables routed in metal conduit connected to earth ground.

   Refer to the EMC Installation Guidelines section of the bulletin for additional information.

12. **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**

   **Immunity to EN 50082-2**

   - Electrostatic discharge EN 61000-4-2 Level 2; 4 Kvar contact Level 3; 8 Kvar air
   - Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m 80 MHz - 1 GHz
   - Fast transients (burst) EN 61000-4-4 Level 4; 2 Kvar I/O 2
   - RF conducted interference EN 61000-4-6 Level 3; 2 Kvar power 1 150 KHz - 80 MHz
   - Emissions to EN 50081-2

   **Notes:**

   1. Power lines had an external EMI line filter (RLC #LFIL0000 or equivalent) installed.
   2. I/O cables routed in metal conduit connected to earth ground.

   Refer to the EMC Installation Guidelines section of the bulletin for additional information.

13. **CONSTRUCTION**

   Black plastic front bezel with black plastic insert. Front panel meets NEMA 4X/IP65 requirements for wash-down and dusty environments, when properly installed. Installation Category II, Pollution Degree 2. (Panel gasket, mounting clip, nut fasteners, and screws included with unit.)

14. **WEIGHT:** 0.8 lbs (0.36 kg).

**FRONT PANEL FUNCTION DESCRIPTION**

The units employ eight front panel buttons for control and data entry. The button functions are as described below:

**RESET “R”**: Resets the counter to either zero or preset, depending on the mode of operation selected. For this button to operate, the enable/disable reset switch at the rear of the unit must be set to the enable (EN) position. The reset button is also used in conjunction with the preset button(s), to view and change the timed output value(s). When reset is activated, all processes are stopped or interrupted (i.e. outputs turn off, display is reset, etc.). This is the case under any mode of operation, in any data entry mode.

**PRESET “P1” (“P2”)**: Labeled P1 and P2 (single preset units only have the P1 preset button). The preset 1 value is displayed when the P1 button is pressed, and the Preset Value mode is accessed (See Program Preset Value). The value remains displayed for approximately 10 seconds after the button is released. The preset buttons are also used, in conjunction with the reset button, to view and change the timed output values (See Program Timed Output Value section.)

**ENTER “E”**: Used when programming the Preset Value or the Timed Output Value. After the desired value is obtained on the display, pressing the E
button enters the value into the unit’s internal memory and takes effect immediately. Also the “E” button can be used to exit self-test.

**PRESCALE “PS”**: Available only on a dual preset unit. When the “PS” button is pressed, the prescale value can be programmed (See Program PreScale Value). This value remains displayed for approximately 10 seconds after the button is released.

**INPUT CONFIGURATION & FRONT PANEL RESET, DIP SWITCH SET-UP**

The DIP switches are located at the rear of the unit. DIP switches 1 to 3 configure the type of input signal, and DIP switch 4 enables or disables the front panel reset button. Refer to the block diagram of the unit for the details of control and circuitry.

**SWITCH SET-UP**

- **S1 - SNK.** : Provides a 7.8 KΩ pull-up resistor for sensors with sinking outputs.
- **SRC.** : Provides a 3.9 KΩ pull-down resistor for sensors with sourcing outputs.
- **S2 - HI FRQ.** : Removes damping capacitor and allows operation up to the maximum frequency (See max count rates in specifications).
- **LO FRQ.** : Connects damping capacitor for switch contact de-bounce.
- **LO BIAS.** : Sets input trigger levels to the low range, to accept logic pulses with full 0 to +12 V swings. (VIL = 5.5 V, VIH = 7.5 V).
- **HI BIAS.** : Sets input trigger levels at mid-range, to accept outputs from 2-10. Use shielded (screened) cables for all Signal and Control inputs. The shield in an industrial environment.

**POWER-UP DIAGNOSTICS**

Upon applying power, the Lynx counters perform an internal self-diagnostic test of all the stored data. If the tests do not agree, a “P” appears on the right side of the display. Normal operation of the unit will continue while the “P” is displayed. Press the “E” button to remove the “P” and check all data set-up values to be certain they are correct.

**EMC INSTALLATION GUIDELINES**

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

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

5. Use shielded cables for all Signal and Control inputs. The shield (screen) should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

**WIRING CONNECTIONS**

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

When wiring the unit, remove the terminal block and use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to one #14 AWG, two #18 AWG or four #20 AWG wire(s). After the terminal block is wired, install it into the proper location on the PC board. Wire each terminal block in this manner. When wiring the unit, remove the terminal block and use the numbers on the label to identify the position number with the proper function. (The input connections are the same for single or dual preset counters.) The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection.

**INPUT CONNECTIONS**

Input connections are made on terminal block TBA, refer to numbers on the label to identify the position number with the proper function. (The input connections are the same for single or dual preset counters.) The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection.

**Terminal 1 - “REM.RST.” (remote reset)** When connected to common a manual reset is performed. The output(s) turn off (if activated) and the count display is reset. As long as this terminal is low, the unit is held at reset.

**Terminal 2 - “PGM.DIS.” (program disable)** When this terminal is not connected to common, the following values can be programmed using the front panel buttons:

<table>
<thead>
<tr>
<th>Preset Value(s)</th>
<th>PreScale Value (if S9 is UP)</th>
<th>Decimal Point Position</th>
<th>Timed Output Value(s)</th>
</tr>
</thead>
</table>
| Outputs can also be tested during self-test under this condition (See Self-Test description for further details). When connected to common, changing these values and testing the outputs is no longer possible.

**Terminal 3 - “UP/DN” (count direction control)** When this terminal is not connected to common, the count direction is “UP”. When connected to common, the count direction is “DOWN”.

---

**Note:** Reference manufacturer’s instructions when installing a line filter.

**Caution:** Terminal blocks should NOT be removed with power applied to the unit.

---

**S4 - DIS.RST.:** Enables front panel reset.
INPUT CONNECTIONS (Cont’d)
Terminal 4 - “CNT.IN” (count input) When the signal is pulled low, a count
will be registered. (See Count Input and Count Rates under the Specifications
Section.)
Terminal 5 - “COMM.” (common) Is the common line to which the sensor and
other input commons are connected. (Do NOT connect relay commons or
solid-state output commons to this point.)
Terminal 6 - “DC OUT” (+12 V) This is for sensor supply and can provide up
to 100 mA of current.

POWER & OUTPUT CONNECTIONS
The input power and relay output connections are made to the bottom
terminal block (TBB), and the solid-state outputs are connected to the polarized
three-pin connector.

AC POWER WIRING
Primary AC power is connected to terminals 1 and 2 of TBB (marked VAC
50/60 Hz). To reduce the chance of noise spikes entering the AC line and
affecting the unit, the power should be relatively “clean” and within the 10%
variation limit. Drawing power from heavily loaded circuits, or from circuits
that also power loads that cycle on and off (contactors, relays, motors,
machinery, etc.), should be avoided.

DC POWER WIRING
The DC power is connected to terminals 1 and 2 of TBB. The DC plus (+)
power is connected to TBB 1 and the minus (-) is connected to TBB 2.

OUTPUT WIRING
Terminals 3, 4, and 5 of TBB are used to connect to output relay 1. Terminals
6, 7, and 8 of TBB (dual preset only) are used to connect to output relay 2 (Refer
to block diagram).
The solid-state output connector has three wires (two wires for the single
preset unit) for connections.

Yellow wire - Solid-state output 1 (labeled 01 SNK.) internally connects to an
NPN Open Collector transistor.
Black wire - common for the solid-state output(s). This terminal should NOT
be used as the common for the input or control terminals.
Blue wire (dual preset only) - Solid-state output 2 (labeled 02 SNK.)
internally connects to an NPN Open Collector transistor.

Relay Connections
To prolong contact life and suppress electrical noise interference due to the
switching of inductive loads, it is good installation practice to install a snubber
across the contactor. Follow the manufacturer’s instructions for installation.
Note: Snubber leakage current can cause some electro-mechanical devices to be
held ON.

DISPLAY SCROLLING
To set the display to scroll, press and hold the “E” button and then press the
left-most button on the front panel. To stop the scrolling, repeat the above step.

DISPLAY SCROLLING SEQUENCE
Single Preset Dual Preset
P1 P1
Value of P1 Value of P1
Count Value Value of P2

PRESCALE ENABLE/DISABLE SWITCH
(Dual Preset Only)
The Dual Preset Lynx Counter has an extra switch next to the four mode
DIP switches which is labeled “PS. EN./DIS.” (S9). When this switch is in the
enable position (UP), the prescale value can be changed (See Program Prescale
Value). When this switch is in the disable position (DOWN), the prescale value
cannot be changed.
The prescale value cannot be changed if Program Disable is activated even
though the “PS. EN./DIS.” switch is in the Enable position.

PROGRAM PRESCALE VALUE *
The factory default Prescale Value is 1.00000. To enter a different value, the
operator must enter the Prescale Value Programming Mode by performing the
following steps.
Note: During the displaying, changing, and entering of a new prescale value,
all functions of the unit are operational (i.e. counting, resetting,
outputs activating, etc.)
FIRST: Set S9 PRESCALE “EN./DIS.” switch to the “Enable” position.
SECOND: Press and hold the “P1”, or “P2” button if a dual preset unit, and
then press the “R” button. The respective timed output value is displayed and
remains displayed for approximately 10 seconds after release of the button.
At this time, the timed output display mode can be exited, without change,
by pressing the “E” button.
THIRD: Once the timed output value is displayed, a specific digit can be
incremented by pressing the button directly beneath that digit. Pressing and
holding the button down will continuously scroll the digit from 0 through 9,
then back to 0 again. When the desired value for that digit is reached, release
the button. Repeat this step until the desired timed output value is obtained.
FOURTH: Press the “E” button to enter the value into the unit’s memory.
As Soon As the “E” button is pressed, the new timed output value takes effect.
If the “E” button is not pressed within 10 seconds, the unit returns to normal
display operation with the previous value retained.

PROGRAM PRESET VALUE *
The factory default values are set to 500 for preset 1 and 1,000 for preset 2.
To enter a different value, the operator must enter the Preset Value Programming
Mode by performing the following steps.
Note: During the displaying, changing, and entering of a new preset value,
all functions of the unit are operational (i.e. counting, resetting,
outputs activating, etc.)
FIRST: Press “P1”, (or “P2”) if a dual preset unit. This displays the respective
preset value, which remains displayed for approximately 10 seconds after
release of the button. At this time, the preset display mode can be exited,
without change, by pressing the “E” button.
SECOND: Once the preset value is displayed, a specific digit can be
incremented by pressing the button directly beneath that digit. Pressing and
holding the button down will continuously scroll the digit from 0 through 9,
then back to 0 again. When the desired value for that digit is reached, release
the button. Repeat this step until the desired preset value is obtained.
THIRD: Press the “E” button to enter the value into the unit’s memory. As
Soon As the “E” button is pressed, the new preset value takes effect. If the
“E” button is not pressed within 10 seconds, the unit returns to normal
display operation with the previous value retained.

PROGRAM TIMED OUTPUT VALUE *
The factory default Timed Output Value is 0.10 seconds, but can be
programmed from 0.01 to 99.99 seconds. To enter a different value, the operator
must enter the Timed Output Value Programming Mode by performing the
following steps.
Note: During the displaying, changing, and entering of a new timed output
value, all functions of the unit are operational (i.e. counting, resetting,
outputs activating, etc.)
FIRST: Set S4 PRESET “EN./DIS.” switch to the “Enable” position.
SECOND: Press and hold the “P1”, or “P2” button if a dual preset unit, and
then press the “R” button. The respective timed output value is displayed and
remains displayed for approximately 10 seconds after release of the button.
At this time, the timed output display mode can be exited, without change,
by pressing the “E” button.
THIRD: Once the timed output value is displayed, a specific digit can be
incremented by pressing the button directly beneath that digit. Pressing and
holding the button down will continuously scroll the digit from 0 through 9,
then back to 0 again. When the desired value for that digit is reached, release
the button. Repeat this step until the desired timed output value is obtained.
FOURTH: Press the “E” button to enter the value into the unit’s memory.
As Soon As the “E” button is pressed, the new timed output value takes effect.
If the “E” button is not pressed within 10 seconds, the unit returns to normal
display operation with the previous value retained.

PROGRAM DECIMAL POINT *
The Lynx has the capability of displaying a decimal point in one of five
positions. The decimal point selection can be done at any time without missing
counts or preset outputs. The factory default for the Decimal Point Position is
none. To turn a decimal point on, the operator must enter the Decimal Point
Selection Mode by performing the following steps.
Note: During the displaying, changing, and entering of a new decimal point
value, all functions of the unit are operational (i.e. counting, resetting,
outputs activating, etc.)
FIRST: Press and release the left-most button on the front panel. This places
the Lynx in the decimal point select mode.
SECOND: Press the digit button which corresponds to the desired decimal
point position. A decimal point will appear to the right of the digit selected.
If the right-most digit button (P1) is selected, the decimal point is turned off.
THIRD: At the time the decimal point is selected, the unit automatically returns
to normal operation. No further action is required by the operator.

- To enter any new data into the Lynx, the “PGM.DIS.” terminal must
not be connected to common.
The DIP switches for the various operating modes are located on the side of the unit. For Reset to Zero modes, the UP/DN terminal is normally NOT connected to common (count up). For Reset to Preset modes, the UP/DN terminal is normally connected to common (count down). The unit will maintain normal operating functions if the direction is reversed.

**Note:** During automatic reset, no counts will be missed if the count rate does not exceed the maximum count rate specified. A manual reset, either from the front panel reset (if enabled) or remote reset overrides any condition or state of the counter and begins the cycle again.

**Note:** In modes four and twelve (Single preset) and in modes four, five, twelve, and thirteen (Dual preset) the output may appear to be latched if the time delay is longer than the time required to count from the reset condition to the preset point.

---

### MODES OF OPERATION FOR SINGLE PRESET LYNX COUNTER

<table>
<thead>
<tr>
<th>MODE 0</th>
<th>LATCH OUTPUT AT PRESET, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when the preset value is reached, the output turns on and counts continue to accumulate. When a manual reset is performed, the count resets to zero and the output turns off.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 1</th>
<th>TIMED OUTPUT AT PRESET, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when the preset is reached, the output turns on for the amount of time programmed and counts continue to accumulate. When a manual reset is performed, the unit resets to zero and starts the cycle again.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 2 &amp; 3</th>
<th>*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>MODE 4</th>
<th>TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AT PRESET</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when the preset is reached, the output automatically resets to zero and the unit starts the cycle over again.</td>
<td></td>
</tr>
</tbody>
</table>

| MODE 5 | * |

<table>
<thead>
<tr>
<th>MODE 6</th>
<th>TIMED OUTPUT AT PRESET, AUTOMATIC RESET TO ZERO AFTER THE TIMED OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when the preset is reached, the output turns on for the amount of time programmed. At the end of the timed output, the unit automatically resets to zero and starts the cycle over again.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 7</th>
<th>*</th>
</tr>
</thead>
</table>

* - These modes are not applicable to the single preset Lynx counter (they are used only for the dual preset counter unit).

---

### MODES OF OPERATION FOR DUAL PRESET LYNX COUNTER

<table>
<thead>
<tr>
<th>MODE 0</th>
<th>LATCH OUTPUTS AT PRESET, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on and counts continue to accumulate. When preset 2 is reached, output 2 turns on and counts continue to accumulate. When a manual reset is performed, the count resets to zero and the outputs turn off.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 1</th>
<th>TIMED OUTPUTS AT PRESET, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on. Counts continue to accumulate after the preset levels have been reached. The outputs turn off after their respective programmed time values. When a manual reset is performed, the unit resets to zero and starts the cycle again.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 2</th>
<th>OUTPUT 1 TURN OFF AT PRESET 2, LATCH OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns off. Counts continue to accumulate after the preset levels have been reached. Output 2 remains on until a manual reset occurs. Manual reset turns off both outputs and the count resets to zero.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 3</th>
<th>OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on for the amount of time programmed and output 1 turns off. Counts continue to accumulate after the preset levels have been reached. When a manual reset is performed, the count resets to zero.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 4</th>
<th>OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, AUTOMATIC RESET TO ZERO AT PRESET 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on for the amount of time programmed. At the beginning of timed output 2, output 1 turns off and the unit automatically resets to zero.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 5</th>
<th>TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO ZERO AT PRESET 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on, and when preset 2 is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. At preset 2, the count automatically resets to zero and starts the cycle again.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 6</th>
<th>OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on for the amount of time programmed and output 1 turns off. At the end of timed output 2, the count automatically resets to zero and starts the cycle again.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODE 7</th>
<th>TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unit counts from zero, when preset 1 is reached, output 1 turns on, and when preset 2 is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. At the end of timed output 2, the unit automatically resets to zero and starts the cycle again.</td>
<td></td>
</tr>
</tbody>
</table>

* - Prescale EN/DIS. Switch.
M O D E S  O F  O P E R A T I O N  F O R  D U A L  P R E S E T  L Y N X  C O U N T E R  ( C o n t ’ d )

MODE 8  L A T C H  O U T P U T  A T  P R E S E T  1  A N D  Z E R O ,  M A N U A L  R E S E T  T O  P R E S E T  2  †

The unit counts from preset 2, when preset 1 is reached, output 1 turns on, and when zero is reached, output 2 turns on. Counts continue to register after the outputs have turned on. When a manual reset is performed, the count resets to preset 2 and the outputs turn off.

MODE 9  T I M E D  O U T P U T  A T  P R E S E T  1  A N D  Z E R O ,  M A N U A L  R E S E T  T O  P R E S E T  2  †

The unit counts from preset 2, when preset 1 is reached, output 1 turns on, and when zero is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. Counts continue to accumulate after the outputs have activated. When a manual reset is performed, the count resets to preset 2 and the cycle starts over.

MODE 10  O U T P U T  1  T U R N  O F F  A T  Z E R O ,  L A T C H  O U T P U T  2  A T  Z E R O ,  M A N U A L  R E S E T  T O  P R E S E T  2  †

The unit counts from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 2 turns on and output 1 turns off. Output 2 remains on until a manual reset is performed. Counts continue to accumulate after preset levels have been reached. Manual reset turns off all outputs, if activated, and the count resets to preset 2.

MODE 11  O U T P U T  1  T U R N  O F F  A T  Z E R O ,  T I M E D  O U T P U T  2  A T  Z E R O ,  M A N U A L  R E S E T  T O  P R E S E T  2  †

The unit counts from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 2 turns on for the amount of time programmed and output 1 turns off. Counts continue to accumulate after preset levels have been reached. When a manual reset is performed, the unit resets to preset 2.

† - Prescale EN/DIS. Switch.

S E L F - T E S T

The self-test feature can be activated without affecting the count, missing a preset point, affecting the timed output durations, or interfering with control functions. This test verifies that all digits operate. Also, the DIP switch settings and the relay outputs can be tested.

If the outputs are not tested, the state(s) of the output(s) remain the same as they were prior to self-test. If the outputs are tested in self-test, the outputs will be off after exiting self-test.

Rapid advance of the self-test routine can be done by pressing and releasing any of the front panel buttons except for the “R” button. (Pressing “R” at any time, except when entering the timed output mode, resets the unit.)

To enter self-test, press the two left-hand digit buttons (on the front panel) simultaneously. At this time, the display will cycle all the digits on the display each for about half a second and in the sequence shown below.

DIGITS CYCLED ON THE DISPLAY

000000
111111
222222
333333
444444
555555
666666
777777
888888
999999
BLANK DISPLAY

101010
121212
323232
343434
545454
565656
767676
787878
989898

The next portion of self-test displays a group of four ones and zeros. The two left-most digits always appear as zeros. The third digit represents the prescale enable/disable DIP switch setting. With prescale enabled, the digit shows a zero, and with it disabled the digit shows a one. The fourth digit represents program disable (PGM.DIS). A zero represents a high at this terminal and a one represents a low. A second set of digits are the settings of the mode select switches (the four DIP switches located along the side of the unit). This pattern directly corresponds to the number representing the mode of operation. If the switches are changed while at this point in the self-test, the settings can be seen to change. These changes do not affect counter operation immediately, but any changes will take effect when self-test is exited. When the switch is “DOWN”, the digit shows a one. When the switch is “UP”, the digit shows a zero.

During the time the mode switch settings are displayed, the outputs can be tested. To activate the output(s), press “P1” for output 1 or “P2” for output 2. If no testing of the output(s) is required, press the “E” button until the unit exits self-test (the unit returns to normal display mode). Also, if no activity occurs on the switches or the front panel button within 18 seconds after the unit pauses at self-test (the unit returns to normal display mode). Also, if no activity occurs on the switches or the front panel button within 18 seconds after the unit pauses at the mode switch display, the unit automatically exits self-test.

Note: The “PGM.DIS.” terminal must not be connected to common for the outputs to be activated.

C a u t i o n :  T h e  o p e r a t o r  s h o u l d  u s e  c a r e  w h e n  t e s t i n g  t h e  o u t p u t s ,  s o  a s  n o t  t o  c a u s e  a n y  u n d e s i r a b l e  o r  h a z a r d o u s  c o n d i t i o n s  i n  t h e  s y s t e m.

I N I T I A L  P O W E R - U P  &  F A C T O R Y  S E T T I N G S

When the unit is shipped from the factory, the values and the following modes are set as shown.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preset 1</td>
<td>500</td>
</tr>
<tr>
<td>Preset 2</td>
<td>1,000 (if a dual preset version)</td>
</tr>
<tr>
<td>Prescale Value</td>
<td>1.000000 (if a dual preset version)</td>
</tr>
<tr>
<td>Count Value</td>
<td>0</td>
</tr>
<tr>
<td>Timed Output Value(s)</td>
<td>0.10 second</td>
</tr>
</tbody>
</table>

D I P  S W I T C H  S E T T I N G S

All switches are moved to the “UP” position except for the reset enable switch, which is moved “DOWN”. With the switches set in these positions, the unit is operating in mode zero (latch-on at preset, manual reset to zero). The input is set for sinking type inputs, high frequency, and high bias operation.
CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS

1. SENSOR SUPPLY VOLTAGE AND CURRENT
   The +12 V sensor supply voltage on the “DC OUT” Terminal is nominal with ±25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.

2. HI/LO FRQ. SELECTION
   The “HI/LO FRQ.” Selection switch must be set on “LO FRQ.” when switch contacts are used to generate count input signals. The “LO FRQ.” mode also provides very high immunity against electrical noise pickup. It is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The “LO FRQ.” mode can be used with any type of sensor output, provided count pulse widths never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. VIL and VIH levels given are nominal values ±10% when counter voltage on “DC OUT” Terminal is +12 VDC. These nominal values vary in proportion to the variations in “DC OUT” Terminal voltage, caused by line voltage and load changes.

4. When shielded cable is used, the shield should be connected to “COMM.” at the counter and left unconnected at sensor end.

NOTES:

1. SENSOR SUPPLY VOLTAGE AND CURRENT
   The +12 V sensor supply voltage on the “DC OUT” Terminal is nominal with ±25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.

2. HI/LO FRQ. SELECTION
   The “HI/LO FRQ.” Selection switch must be set on “LO FRQ.” when switch contacts are used to generate count input signals. The “LO FRQ.” mode also provides very high immunity against electrical noise pickup. It is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The “LO FRQ.” mode can be used with any type of sensor output, provided count pulse widths never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. VIL and VIH levels given are nominal values ±10% when counter voltage on “DC OUT” Terminal is +12 VDC. These nominal values vary in proportion to the variations in “DC OUT” Terminal voltage, caused by line voltage and load changes.

4. When shielded cable is used, the shield should be connected to “COMM.” at the counter and left unconnected at sensor end.

INSTALLATION ENVIRONMENT

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

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

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

INSTALLATION

The Lynx Counters meet NEMA 4X/IP65 requirements for indoor use, when properly installed. These units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. One mounting clip and two screws with tinnerman nuts are provided for easy installation. Consideration should be given to the thickness of the panel. Too thin of a panel may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 0.125” [3.18 mm].)

After the panel cut-out has been completed and deburred, carefully slide the panel gasket over the rear of the counter body to the back of the bezel. Insert the unit into the panel. As depicted in the drawing, install the two tinnerman nuts and two self-tapping screws onto the mounting clip. To install the mounting clip, hold the mounting clip with both hands so that the top corners rest on the index finger of each hand and the bottom corners rest on the middle finger of each hand. While doing this, place the thumb of each hand over the mounting screws. By pressing on the screws, flex the clip enough to slide it over the back end of the Lynx case until the clip snaps into the groove of the bezel. Tighten the two mounting screws.

NOTE: IF EXTERNAL SUPPLY IS USED TO POWER CMOS CIRCUIT, VOLTAGE MUST BE EQUAL TO OR GREATER THAN DC OUT VOLTAGE.

NOTE: CIRCUIT SHOWN FOR STD. TTL OUTPUT. TTL CIRCUITS ARE AVAILABLE WITH OPEN COLLECTOR OUTPUTS ELIMINATING NEED FOR DIODE CLAMP.

Caution: Only minimum pressure is required to seal the panel. Do NOT overtighten mounting screws.
CALCULATING THE PRESCALER (Dual Preset Only)

The LYNX is factory set to provide 1 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. In these applications it will be necessary for the LYNX to scale or multiply the input pulses by a prescaler to achieve the proper display units (feet, meters, gallons, widgets, etc.).

The “Prescale”, denoted as “K”, is simply the total amount of scaling required. It is obtained by dividing the “Display Units” by the “Number of Pulses” as shown in the Formula below.

\[ K = \frac{\text{Display Units}}{\text{Number of Pulses}} \]

WHERE:

- **DISPLAY UNITS** - The number of units (revolutions, feet, 10ths of feet, meters, etc.) that would be acquired after the “Number of Pulses” has occurred.
- **NUMBER OF PULSES** - The number of pulses required to achieve the number of “Display Units”.

APPLICATION FOR DUAL LEVEL PRESET LYNX COUNTER

CARPET ROLL MEASURING & CUTTING OPERATION

This application requires the control of a motor which winds carpet onto a roll. An early warning signal is required to slow the motor 10 yards before it is to be stopped. The roll length setting should be protected against unauthorized changes and the system must be restarted from a remote location.

A dual preset LYNX counter is used to satisfy all of the above requirements. The measurement of the carpet is done by using a double wheeled version of the LSC sensor. The LSCDY20F was chosen for its 10 pulses per yard output and its durable polyurethane wheels. As the carpet is wound onto the roll, the LYNX starts counting down from its preset value of 300 yards. With a prescale value of 0.00000, the counter decrements once for every 10 pulses and indicates the number of whole yards remaining. Relay 1 turns on when the counter reaches 10, signaling the motor controller to start the slowdown process. Relay 2 turns on when the counter reaches “0”, stopping the motor completely. The operator manually cuts the carpet and removes the full roll, replacing it with an empty one. The “REMOTE RESET” button and the “MOTOR START” button are pushed to start the sequence over again. Any roll length can be programmed into Preset 2 without changing Preset 1. Preset 1 will always turn on 10 yards from the end of the roll.

The following is a list of the DIP switch settings and terminal connections to meet the process requirements.

### Set-Up DIP Switches

<table>
<thead>
<tr>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNK</td>
<td>HI FRQ</td>
<td>HI BIAS</td>
<td>DIS RST</td>
<td>Down</td>
<td>Up</td>
<td>Up</td>
<td>Up (enable)</td>
<td></td>
</tr>
</tbody>
</table>

### Mode DIP Switches

<table>
<thead>
<tr>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNK</td>
<td>HI FRQ</td>
<td>HI BIAS</td>
<td>DIS RST</td>
<td>Down</td>
</tr>
</tbody>
</table>

### TBA Connections

- **Terminal 1 (REM.RST)**: Pushbutton switch
- **Terminal 2 (PGM.DIS)**: Keyswitch
- **Terminal 3 (UP/DN)**: Terminal 5 (COMM.)
- **Terminal 4 (CNT.IN)**: Output of LSC
- **Terminal 5 (COMM.)**: Common of LSC
- **Terminal 6 (DC OUT)**: +12V of LSC

### TBB Connections

- **Terminal 1 & 2**: Primary Power
- **Terminal 4 & 5 (Relay 1)**: Slow motor
- **Terminal 7 & 8 (Relay 2)**: Stop motor
- **Terminal 3 & 6**: Not Used

### Front Panel Programming

- **Preset 1**: 10
- **Preset 2**: 300
- **Prescale**: 0.00000

After programming is complete, activating the key switch connects Program Disable, “PGM.DIS.” to “COMM.” and prevents accidental changes to programmed values. “REMOTE RESET” is accomplished by connecting the contacts of a pushbutton switch to the “REM.RST.” and “COMM.” terminals of the LYNX.

### TROUBLESHOOTING

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

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNXC1</td>
<td>Lynx Single Preset Counter</td>
</tr>
<tr>
<td>LNXC2</td>
<td>Lynx Dual Preset Counter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 VDC</td>
</tr>
<tr>
<td>LNXC1020</td>
</tr>
<tr>
<td>LNXC2020</td>
</tr>
<tr>
<td>LNXC020</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.

* For complete details on this version of the Lynx counter, refer to Bulletin No. LNXCC.
**DESCRIPTION**

The LNXNT presettable Timer is an economical and reliable solution to dual preset level timing requirements. This unit features current sinking input configurations, programmable timed outputs, non-volatile memory, and many other features that satisfy most dual preset timing applications.

The LNXNT Timer has two main timing actions, Reset to Zero (RTZ) and Reset to Preset (RTP). There are sixteen modes of operation.

All parameters are programmed through the front panel buttons. The LNXNT Timer has an internal non-volatile memory device which eliminates the need for battery back-up. When power is removed or interrupted, this device maintains all data-set-ups necessary for system operation. A Program Disable terminal is provided, which prevents accidental changes or tampering by unauthorized personnel to the presets or timed output values. The front panel reset button can be enabled or disabled by a rear panel DIP switch. This timer has an on-line self-test, which can be run at any time without losing time or missing a preset value.

Power, input, and output connections are made via fixed terminal blocks at the rear of the unit. DIP switches at the rear of the unit are used to set the input configuration and the desired mode of operation.

The LNXNT Timer has a sealed high impact plastic bezel and meets NEMA 4X/IP65 specifications for wash-down and/or dust, when properly installed.

**SAFETY SUMMARY**

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

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

**SPECIFICATIONS**

1. **DISPLAY**: 6-digit, 0.3" (7.6 mm) high LCD display.

2. **POWER REQUIREMENTS**: 25 mA @ 5 VDC (±5%) or 25 mA @ 10 to 30 VDC.

   Power supplies must be Class 2 or SELV rated.

3. **RUN INPUT**: Accepts switch contact closures and NPN Open Collector outputs and similar types of current sinking sensors. VIL = 0.5 V max., internally pulled up to 5 VDC through a 10 KΩ resistor (ISNK = 0.5 mA). Response time = 1 msec. (This unit operates with VCM E through H modules)

4. **TIME ACCURACY**: ±0.01%

5. **TIME RANGES**:
   - 0.01 SECONDS
   - 0.01 MINUTES
   - 0.001 SECONDS
   - 0.001 MINUTES

6. **CONTROL INPUTS**: Activate low (VIL = 0.5 V max.), internally pulled up to 5 VDC through a 10 KΩ resistor (IN = 0.5 mA). Remote Reset: Response time = 10 msec. A low resets the unit and deactivates outputs.

   Program Disable: A low inhibits the changing of presets and timed outputs, as well as testing outputs in self-test.

---

**DIMENSIONS In inches (mm)**

- Recommended minimum clearance (behind the panel) for mounting clip installation is 2.7" (68.6) x 4.0" (101.6) W.

---
SPECIFICATIONS (Cont’d)

7. OUTPUTS:
Solid-State: Current sinking NPN open collector transistors. 
\[ I_{\text{NK}} = 100 \text{ mA max.}, \quad V_{\text{OH}} = 30 \text{ VDC max.}, \quad V_{\text{OL}} = 1 \text{ V @ 100 mA}. \]
Programmable Timed Output: The timed output can be programmed from 0.01 sec. to 99.99 sec., ±0.1% + 10 msec. max. The timed output is set for 0.10 second at the factory.

8. MEMORY RETENTION:
Non-volatile E²PROM retains all programmed information when power is removed or interrupted.

Power Cycles(ON/OFF): 100,000 min.
Data Retention: 10 years min.

9. INPUT, POWER, AND OUTPUT CONNECTIONS:
Fixed terminal block.

10. ENVIRONMENTAL CONDITIONS:
Operating Temperature: 0 to 50°C
Storage Temperature: -40 to 70°C
Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
Altitude: Up to 2000 meters

11. 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:
Immunity to EN 50022-2
Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
Level 3; 8 Kv air

Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m
80 MHz - 1 GHz
Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv I/O
Level 3; 2 Kv power ²
RF conducted interference EN 61000-4-6 Level 3; 10 V/rms ²
150 KHz - 80 MHz

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

Notes:
1. Power lines had an external EMI filter, (RLC #LFIL0000 or equivalent) installed.

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

12. CONSTRUCTION: High impact plastic case with clear viewing window.
Front panel meets NEMA 4X/IP65 requirements for indoor use, when properly installed. (Panel gasket, mounting clip, nut fasteners, and screws included with unit.) Installation Category II, Pollution Degree 2.

13. WEIGHT: 0.2 lbs (91 g).

SWITCH SET-UP
S1 - DIS.RST.: Disables front panel reset.
EN. RST.: Enables front panel reset.
S2 to S5: These are the mode select DIP switches.
S6 - 0.00: Sets the timer to display two decimal places.
0.000: Sets the timer to display three decimal places.
S7 - Sec.: Sets the timer to display in seconds.
Min.: Sets the timer to display in minutes.

MODES OF OPERATION, DIP SWITCH SET-UP
The DIP switches for the various operating modes are accessible from the rear of the unit.

Notes
1. A manual reset, either from the front panel reset (if enabled) or remote reset overrides any condition or state of the timer and begins the cycle again.
2. In modes four, five, twelve, and thirteen, the output may appear to be latched if the time delay is longer than the time required for the timer to reach the preset point or zero.

MODES OF OPERATION FOR DUAL PRESET LNXNT TIMER

MODE 0 LATCHED OUTPUTS AT PRESET, MANUAL RESET TO ZERO
The unit times from zero, when preset 1 is reached, output 1 turns on and time continues to accumulate. When preset 2 is reached, output 2 turns on and time continues to accumulate. When a manual reset is performed, the time resets to zero, the outputs turn off, and the cycle starts again.
MODE 1  TIMED OUTPUTS AT PRESET, MANUAL RESET TO ZERO
The unit times from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on. Time continues to accumulate after the preset levels have been reached. The outputs turn off after their respective programmed time values. When a manual reset is performed, the time resets to zero and the cycle starts again.

MODE 2  OUTPUT 1 TURN OFF AT PRESET 2, LATCH OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO
The unit times from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 1 turns off, and output 2 turns on. Time continues to accumulate after the preset levels have been reached. Output 2 remains on until a manual reset occurs. Manual reset turns off both outputs, the time resets to zero, and the cycle starts again.

MODE 3  OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, MANUAL RESET TO ZERO
The unit times from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 1 turns off and output 2 turns on for the amount of time programmed. Time continues to accumulate after the preset levels have been reached. When a manual reset is performed, the time resets to zero, and the cycle starts again.

MODE 4  OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2 AT PRESET 2, AUTOMATIC RESET TO ZERO AT PRESET 2
The unit times from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on for the amount of time programmed. At the beginning of timed output 2, output 1 turns off, the time automatically resets to zero, and the cycle starts again.

MODE 5  TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO ZERO AT PRESET 2
The unit times from zero, when preset 1 is reached, output 1 turns on. When preset 2 is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. At preset 2, the time automatically resets to zero and starts the cycle again.
MODE 6  OUTPUT 1 TURN OFF AT PRESET 2, TIMED OUTPUT 2
AT PRESET 2, AUTOMATIC RESET TO ZERO AFTER
TIMED OUTPUT 2

The unit times from zero, when preset 1 is reached,
output 1 turns on. When preset 2 is reached, output 1
turns off and output 2 turns on for the amount of time
programmed. At the end of timed output 2, the time automatically
resets to zero and starts the cycle again.

MODE 7  TIMED OUTPUTS AT PRESETS, AUTOMATIC RESET TO
ZERO AFTER TIMED OUTPUT 2

The unit times from zero, when preset 1 is reached,
output 1 turns on. When preset 2 is reached, output 2
turns on. The outputs turn off at the end of their respective programmed time values. At the end of timed output 2, the
time automatically resets to zero, and starts the cycle again.

MODE 8  LATCH OUTPUT AT PRESET 1 AND ZERO, MANUAL
RESET TO PRESET 2

The unit times down from preset 2, when preset 1 is
reached, output 1 turns on, when zero is reached, output
2 turns on. Time continues to decrement after the preset
levels have been reached. When a manual reset is performed, the time
resets to preset 2, the outputs turn off, and the cycle starts again.

MODE 9  TIMED OUTPUTS AT PRESET 1 AND ZERO, MANUAL
RESET TO PRESET 2

The unit times down from preset 2, when preset 1 is
reached, output 1 turns on. When zero is reached, output
2 turns on. The outputs turn off when their respective
programmed time values end. Time continues to decrement after
the preset levels have been reached. When a manual reset is performed, the time resets to preset 2, and the cycle starts again.

MODE 10  OUTPUT 1 TURN OFF AT ZERO, LATCH OUTPUT 2 AT
ZERO, MANUAL RESET TO PRESET 2

The unit times down from preset 2, when preset 1 is
reached, output 1 turns on. When zero is reached, output
2 turns on and output 1 turns off. Output 2 remains on
until a manual reset is performed. Time continues to decrement after
preset levels are reached. Manual reset turns off both outputs, if
activated, the time resets to preset 2, and the cycle starts again.
MODES OF OPERATION FOR DUAL PRESET LNXTNT TIMER (Cont’d)

MODE 11  OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, MANUAL RESET TO PRESET 2

The unit times down from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 1 turns off and output 2 turns on for the amount of time programmed. Time continues to decrement after the preset levels have been reached. When a manual reset is performed, the time resets to preset 2, and the cycle starts again.

MODE 12  OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, AUTOMATIC RESET TO PRESET 2 AT ZERO

The unit times down from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 2 turns on for the amount of time programmed, output 1 turns off, and the time automatically resets to preset 2.

MODE 13  TIMED OUTPUTS AT PRESET 1 AND ZERO, AUTOMATIC RESET TO PRESET 2 AT ZERO

The unit times down from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. At zero, the time automatically resets to preset 2 and the cycle starts again.

MODE 14  OUTPUT 1 TURN OFF AT ZERO, TIMED OUTPUT 2 AT ZERO, AUTOMATIC RESET TO PRESET 2 AFTER TIMED OUTPUT 2

The unit times down from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 1 turns off and output 2 turns on for the amount of time programmed. At the end of timed output 2, the time automatically resets to preset 2, and the cycle starts again.

MODE 15  TIMED OUTPUTS AT PRESET 1 AND ZERO, AUTOMATIC RESET TO PRESET 2 AFTER TIMED OUTPUT 2

The unit times down from preset 2, when preset 1 is reached, output 1 turns on. When zero is reached, output 2 turns on. The outputs turn off at the end of their respective programmed time values. At the end of timed output 2, the time automatically resets to preset 2 and the cycle starts again.
POWER-UP DIAGNOSTICS

Upon applying power, the LNXNT Timer performs an internal self-diagnostic test of all the stored data. If the tests do not agree, a “P” appears on the right side of the display. Normal operation of the unit will continue while the “P” is displayed. Press the “E” button to remove the “P” and check all data set-up values to be certain they are correct.

EMC INSTALLATION GUIDELINES

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

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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

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

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   - Ferrite Suppression Cores for signal and control cables:
     - Fair-Rite # 0443167251 (RLC #FCOR0000)
     - TDK # ZCAT3035-1330A
     - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC #LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom #1VB3
     - Corcom #1VR3
   - Note: Reference manufacturer’s instructions when installing a line filter.

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

6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubbers:
     - RLC #SNUB0000

WIRING CONNECTIONS

When wiring the unit, use the numbers on the label to identify the position number with the proper function. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Strip the wire, leaving approximately 1/4” bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to one 14-gauge, two 18-gauge or four 20-gauge wire(s). Wire each terminal block in this manner.

INPUT CONNECTIONS

Input connections are made on the terminal block at the rear of the unit, refer to numbers on the label to identify the position number with the proper function.

POWER & OUTPUT CONNECTIONS

Power and output connections are made to the terminal block located at the rear of the unit.

The DC power is connected to terminals 1 and 2. The DC plus (+) power is connected to terminal 1 and the minus (-) is connected to terminal 2.

Terminals 4 & 5 are used to connect to the solid-state outputs. Terminal 2 is used as common for the solid-state outputs. When switching an inductive load with solid state outputs, it is recommended that an EMI device such as a snubber (RLC #SNUB0000) be installed at the load.

Note: Snubber leakage current can cause some electro-mechanical devices to be held on.

FRONT PANEL FUNCTION DESCRIPTION

These units employ eight front panel buttons for control and data entering. The button functions are as described below:

- **RESET “R”:** Resets the timer to either zero or preset, depending on the mode of operation selected. For this button to operate, the enable/disable reset DIP switch at the rear of the unit must be set to the enable (EN.) position. The preset button is also used in conjunction with the preset buttons, to view and change the timed output values. When reset is activated, all processes are stopped or interrupted (i.e. outputs turn off, display is reset). This is the case under any mode of operation, in any data entry mode.

- **P1** and **P2:** The preset 1 value is displayed when the P1 button is pressed, and the Preset Value mode is accessed (See Program Preset Value). The value remains displayed for approximately 10 seconds after the button is released.

**DISPLAY SCROLLING**

To set the display to scroll, press and hold the “E” button and then press the left-most button on the front panel. To stop the scrolling, repeat the above step.
**PROGRAM PRESET VALUE**

The factory default values are set to 5.00 for preset 1 and 10.00 for preset 2. To enter a different value, the operator must enter the Preset Value Programming Mode by performing the following steps.

Note: During the displaying, changing, and entering of a new preset value, all functions of the unit are operational (i.e. timing, resetting, outputs activating, etc.)

**FIRST:** Press “P1” or “P2”. This displays the respective preset value, which remains displayed for approximately 10 seconds after release of the last button pushed. At this time, the preset display mode can be exited, without change, by pressing the “E” button.

**SECOND:** Once the preset value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired preset value is obtained.

**THIRD:** Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new preset value takes effect. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

**PROGRAM TIMED OUTPUT VALUE**

The factory default Timed Output Value is 0.10 seconds, but can be programmed from 0.01 to 99.99 seconds. To enter a different value, the operator must enter the Timed Output Value Programming Mode by performing the following steps.

Note: During the displaying, changing, and entering of a new timed output value, all functions of the unit are operational (i.e. timing, resetting, outputs activating, etc.)

**FIRST:** Set S1 Reset EN/DIS. switch to the UP position (Enable).

**SECOND:** Press and hold the “P1” or “P2” button and then press the “R” button. The respective timed output value is displayed and remains displayed for approximately 10 seconds after release of the last button pushed. At this time, the timed output display mode can be exited, without change, by pressing the “E” button.

**THIRD:** Once the timed output value is displayed, a specific digit can be incremented by pressing the button directly beneath that digit. Pressing and holding the button down will continuously scroll the digit from 0 through 9, then back to 0 again. When the desired value for that digit is reached, release the button. Repeat this step until the desired timed output value is obtained.

**FOURTH:** Press the “E” button to enter the value into the unit’s memory. As Soon As the “E” button is pressed, the new timed output value takes effect, if the output is not active at that time. If the output is active at the time of the change, the new value will take effect the next time the output is activated. If the “E” button is not pressed within 10 seconds, the unit returns to normal display operation with the previous value retained.

To enter any new data into the LNXNT, the “PGM.DIS.” terminal must be open or at 5 VDC maximum.

**SELF-TEST**

The self-test feature can be activated without affecting the time, missing a preset point, affecting the timed output durations, or interfering with control functions. This test verifies that all digits operate. Also, the DIP switch settings and the outputs can be tested.

If the outputs are not tested, the state of the outputs remain the same as they were prior to self-test. If the outputs are tested in self-test, the outputs will be off after exiting self-test.

Rapid advance of the self-test routine can be done by pressing and releasing any of the front panel buttons except for the “R” button.

To enter self-test, press the two left-hand digit buttons (on the front panel) simultaneously. At this time, the display will cycle all the digits each for about half a second in the sequence shown below.

**DIGITS CYCLED ON THE DISPLAY**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000</td>
</tr>
<tr>
<td>111111</td>
</tr>
<tr>
<td>222222</td>
</tr>
<tr>
<td>333333</td>
</tr>
<tr>
<td>444444</td>
</tr>
<tr>
<td>555555</td>
</tr>
<tr>
<td>666666</td>
</tr>
<tr>
<td>777777</td>
</tr>
<tr>
<td>888888</td>
</tr>
<tr>
<td>999999</td>
</tr>
</tbody>
</table>

**BLANK DISPLAY**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>101010</td>
</tr>
<tr>
<td>121212</td>
</tr>
<tr>
<td>323232</td>
</tr>
<tr>
<td>343434</td>
</tr>
<tr>
<td>545454</td>
</tr>
<tr>
<td>565656</td>
</tr>
<tr>
<td>767676</td>
</tr>
<tr>
<td>787878</td>
</tr>
<tr>
<td>989898</td>
</tr>
</tbody>
</table>

The next portion of self-test displays a group of four ones and zeros. The two left-most digits represent the setting of the timer mode DIP switches, with the first being min/sec and the second being 0.000T/0.00T. When the switch is “DOWN”, the digit shows a zero. When the switch is “UP”, the digit shows a one. The third digit always shows a zero. The fourth digit represents program disable (PGM.DIS). A zero represents a high at this terminal and a one represents a low. The second set of digits are the settings of the mode select DIP switches (S2 to S5 at the rear of the unit). This pattern directly corresponds to the number representing the mode of operation. If the switches are changed while at this point in the self-test, the settings can be seen to change. These changes do not affect timer operation immediately, but any changes take effect when the self-test is exited. When the switch is “DOWN”, the digit shows a zero. When the switch is “UP”, the digit shows a one.

When the mode switch settings are displayed, the outputs can be tested. To activate the outputs, press “P1” for output 1 or “P2” for output 2. If no testing of the outputs is required, press the “E” button until the unit exits self-test (the unit returns to normal display mode). Also, if no activity occurs on the switches or the front panel button within 18 seconds after the unit pauses at the mode switch display, the unit automatically exits self-test.

**Note:** The “PGM.DIS.” terminal must be open or at 5 VDC for the outputs to be activated.

**Caution:** The operator should use care when testing the outputs, so as not to cause any undesirable or hazardous conditions in the system.

**INITIAL POWER-UP & FACTORY SETTINGS**

The following are the values set when shipped from the factory.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preset 1</td>
<td>5.00</td>
</tr>
<tr>
<td>Preset 2</td>
<td>10.00</td>
</tr>
<tr>
<td>Time Value</td>
<td>0</td>
</tr>
<tr>
<td>Timed Output Value</td>
<td>0.10 second</td>
</tr>
</tbody>
</table>

**DIP Switch Settings**

All switches are moved to the “DOWN” position except for the reset enable switch, which is moved “UP”. With the switches set in these positions, the unit is operating in mode zero (latch-on at preset, manual reset to zero). Timing is selected for seconds with two decimal places.

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
A candy manufacturer has a requirement to automatically shrink wrap their packaged candy. The boxed candy is loaded onto a conveyor belt and sent to the automatic shrink wrap machine. The conveyor speed and position is controlled by a PLC. However, an external time adjustment is required to allow for different size boxes to be processed. Timing accuracy is very important to insure that the shrink wrap is sealed without melting the candy. The Dual Preset LNXNT Timer is chosen due to its accuracy and the ability to easily change the presets. Changing of the presets will meet the time requirements for different size packages.

As the package is moved into the shrink wrap machine, the PLC receives a signal that the package is in position. At this time, the PLC sends a signal to close the Run Input switch of the LNXNT Timer. It takes 1.5 seconds for the machine to wrap the package. At the end of this time, Output 1 of the LNXNT Timer signals the PLC to move the package to the shrink oven.

As soon as the PLC receives the signal from the LNXNT, it opens the Run input switch stopping timer operation while the package is being placed in the oven. When the package is in position, the PLC closes the Run Input switch. This will restart the timer from 1.5 seconds. The time required in the oven is 3 seconds, so Preset 2 is set for 4.5. When the timer reaches Preset 2, output 2 signals the PLC to move the package out of the oven. At the end of the cycle, the PLC performs a reset via the Remote Reset terminal. This action resets the timer to zero in preparation for the next package.

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.

**Installation**

The unit meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. One mounting clip and two screws with tinnerman nuts are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin, may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 0.125” [3.18 mm].)

After the panel cut-out has been completed and deburred, carefully slide the panel gasket over the rear of the unit to the back of the bezel.

Insert the unit into the panel. As depicted in the drawing, install the two tinnerman nuts and two self-tapping screws onto the mounting clip. To install the mounting clip, hold the mounting clip with both hands so that the top corners rest on the index finger of each hand and the bottom corners rest on the middle finger of each hand. While doing this, place the thumb of each hand over the mounting screws. By pressing on the screws, flex the clip enough to slide it over the back end of the case until the clip snaps into the groove of the bezel. Tighten the two mounting screws.

**Caution:** Only minimum pressure is required to seal panel. Do **NOT** overtighten mounting screws.

**Ordering Information**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNXNT</td>
<td>NPN Input/Output Dual Preset Timer</td>
<td>5 VDC LNXXN2T40 10-30 VDC LNXXN2T50</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures, & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.
The Model C48 Counter is available as a Standard Counter or a Batch Counter. The Standard Counter has a main process counter with dual presets and a secondary counter with a single preset. The secondary counter can be selected to function as a batch or a total counter.

The C48C offers a choice of nine programmable counting modes for use in applications requiring bi-directional, anti-coincidence, and quadrature counting. The unit may be programmed to register counts on both edges of the input signal providing frequency doubling capability. DIP switches are used for input configuration set-up and to provide a Program Disable function.

Four front panel push-buttons are used for programming the operating modes and data values, changing the viewed display, and performing user programmable functions, e.g. reset, etc. The C48C can be configured for one of two numeric data entry methods, digit entry or automatic scrolling. The digit entry method allows for the selection and incrementing of digits individually. The automatic scrolling method allows for the progressive change of one entry at a time.

The Program Disable DIP switch, a user-programmable code value, and an optional Program Disable code are used for input configuration set-up and to provide a Program Disable function.

A Prescaler Output model is available as a Dual Preset, with solid-state or relay outputs. The Prescaler Output is useful for providing a lower frequency scaled pulse train to a PLC or another external totalizing counter. The Prescaler Output provides a programmable width output pulse for every count or every 10 counts registered on the display.

The optional RS-485 serial communication interface provides two-way communication between a C48 and other compatible equipment such as a printer, PLC, HMI, or a host computer. In multipoint applications (up to thirty-two), the address number of each C48 on the line can be programmed from 0 to 99. Data from the C48 can be interrogated or changed, and alarm output(s) may be reset by sending the proper command code via serial communications. The software, SFC48, allows for easy configuration of controller parameters. These settings can be saved to disk for later use or used for multi-controller download. On-line help is provided within the software.

Optional programming software (SFC48) is available to program all unit configuration parameters. The software allows unit configurations to be created, uploaded, downloaded, and saved to a file for later use or multi-unit programming.

The unit is constructed of a lightweight, high impact plastic case with a textured front panel and a clear display window. The front panel meets NEMA 4X/IP65 specifications when properly installed. Multiple units can be stacked horizontally or vertically. Modern surface-mount technology, extensive testing, plus high immunity to noise interference makes the C48 Counters extremely reliable in industrial environments.

**DIMENSIONS “In inches (mm)”**

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>1.95 (49.5)</th>
<th>0.37 (9.4)</th>
<th>1.76 (44.7)</th>
</tr>
</thead>
</table>

**PANEL CUT-OUT**

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>1.772 (45)</th>
<th>0.024 (0.6)</th>
</tr>
</thead>
</table>
**SPECIFICATIONS**

1. DISPLAY: 2 Line by 6 digit LCD display. Positive image reflective or negative image transmissive with red (top line) and green (bottom line) backlighting.

   Main Display: 0.3” (7.62 mm) high digits
   Secondary Display: 0.2” (5.08 mm) high digits

   Annunciators:
   Value: PRS, 1, 2, and 3
   Output: 01, 02, and 03.

2. POWER REQUIREMENTS:

   **AC Versions:**
   AC Power: 85 to 250 VAC, 50/60 Hz, 9 VA max.
   DC Power: 11 to 14 VDC @ 150 mA max. (Non PNP output models)
   Note: Models with PNP current sourcing outputs must be powered from AC.

   **DC Versions (C48XXX):**
   CONTINUOUS:
   DC Power: 18 to 36 VDC; 5.5 W max.
   AC Power: 24 VAC ±10%; 50/60 Hz; 7 VA max.
   Note: The +10% tolerance range on AC input voltage must be strictly adhered to. DO NOT EXCEED 26.4 VAC.

3. MEMORY: Nonvolatile E2PROM retains all programmable parameters and count values.

4. SENSOR POWER: +12 VDC (±15%) @ 100 mA max.

5. COUNT INPUTS A & B: Accepts count pulses from a variety of sources, DIP switch selectable.

   Current Sourcing: 3.9KΩ pull-down, VIN max = 30 VDC
   Current Sinking: 7.8KΩ pull-up to 12 VDC; ZSNK = 1.8 mA max.

6. DEBOUNCE: 50 Hz max.

   Lo Bias: VIL = 1.5 VDC max., VIH = 3.75 VDC min.
   Hi Bias: VIL = 5.5 VDC max., VIH = 7.5 VDC min.

7. MAX. COUNT RATE: Model dependent. All listed values are in KHz.

   Note: Max. count rates for X2 & X4 modes are given for 50% duty cycle signals and quad signals with 90° phase shift.

**Single Preset Model C48CS**

<table>
<thead>
<tr>
<th>PRESCALER VALUE</th>
<th>C1-Usr C1-Ud</th>
<th>C2-Usr C2-Ud</th>
<th>*Ad-Sub Ad-Ad</th>
<th>QUAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001-0.99999</td>
<td>6.4</td>
<td>4.1</td>
<td>9.4</td>
<td>5.4</td>
</tr>
<tr>
<td>0.00000</td>
<td>12</td>
<td>5.9</td>
<td>12.4</td>
<td>6.5</td>
</tr>
<tr>
<td>1.00001-2</td>
<td>6.6</td>
<td>3.2</td>
<td>6.8</td>
<td>4.3</td>
</tr>
<tr>
<td>2.00001-3</td>
<td>5.3</td>
<td>2.6</td>
<td>5.6</td>
<td>3.7</td>
</tr>
<tr>
<td>3.00001-4</td>
<td>4.3</td>
<td>2.1</td>
<td>4.6</td>
<td>3.2</td>
</tr>
<tr>
<td>4.00001-5</td>
<td>3.6</td>
<td>1.8</td>
<td>3.8</td>
<td>2.7</td>
</tr>
<tr>
<td>5.00001-6</td>
<td>3.1</td>
<td>1.5</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>6.00001-7</td>
<td>2.8</td>
<td>1.4</td>
<td>3.2</td>
<td>2.1</td>
</tr>
<tr>
<td>7.00001-8</td>
<td>2.6</td>
<td>2.8</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>8.00001-9</td>
<td>2.3</td>
<td>1.1</td>
<td>2.4</td>
<td>1.8</td>
</tr>
<tr>
<td>9.00001-9.99999</td>
<td>2.1</td>
<td>1.2</td>
<td>2.3</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**Dual Preset Model C48CD**

- Prescaler Output Model C48CP

<table>
<thead>
<tr>
<th>PRESCALER VALUE</th>
<th>C1-Usr C1-Ud</th>
<th>C2-Usr C2-Ud</th>
<th>*Ad-Sub Ad-Ad</th>
<th>QUAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001-0.99999</td>
<td>8.3</td>
<td>4.1</td>
<td>8.6</td>
<td>4.5</td>
</tr>
<tr>
<td>1.00000</td>
<td>11.5</td>
<td>5.7</td>
<td>11.6</td>
<td>6.5</td>
</tr>
<tr>
<td>1.00001-2</td>
<td>6.5</td>
<td>3.2</td>
<td>6.6</td>
<td>4.3</td>
</tr>
<tr>
<td>2.00001-3</td>
<td>5.2</td>
<td>2.4</td>
<td>5.3</td>
<td>3.4</td>
</tr>
<tr>
<td>3.00001-4</td>
<td>4.1</td>
<td>2.4</td>
<td>4.4</td>
<td>2.8</td>
</tr>
<tr>
<td>4.00001-5</td>
<td>3.4</td>
<td>1.7</td>
<td>3.8</td>
<td>2.5</td>
</tr>
<tr>
<td>5.00001-6</td>
<td>2.9</td>
<td>1.4</td>
<td>3.2</td>
<td>2.2</td>
</tr>
<tr>
<td>6.00001-7</td>
<td>2.7</td>
<td>1.3</td>
<td>2.8</td>
<td>1.3</td>
</tr>
<tr>
<td>7.00001-8</td>
<td>2.2</td>
<td>1.1</td>
<td>2.4</td>
<td>1.8</td>
</tr>
<tr>
<td>8.00001-9</td>
<td>2.2</td>
<td>0.9</td>
<td>2.3</td>
<td>1.6</td>
</tr>
<tr>
<td>9.00001-9.99999</td>
<td>1.9</td>
<td>0.9</td>
<td>2.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**Batch Model C48CB**

- With Counter 2 configured as a Batch Counter (C2 = R5n = bHz/ch)

<table>
<thead>
<tr>
<th>PRESCALER VALUE</th>
<th>C1-Usr C1-Ud</th>
<th>C2-Usr C2-Ud</th>
<th>*Ad-Sub Ad-Ad</th>
<th>QUAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001-0.99999</td>
<td>8.3</td>
<td>4.1</td>
<td>8.4</td>
<td>3.7</td>
</tr>
<tr>
<td>1.00000</td>
<td>11.4</td>
<td>5.5</td>
<td>11.8</td>
<td>4.3</td>
</tr>
<tr>
<td>1.00001-2</td>
<td>6.5</td>
<td>3.2</td>
<td>6.6</td>
<td>3.2</td>
</tr>
<tr>
<td>2.00001-3</td>
<td>5.2</td>
<td>2.4</td>
<td>5.4</td>
<td>2.8</td>
</tr>
<tr>
<td>3.00001-4</td>
<td>4.1</td>
<td>2.4</td>
<td>4.2</td>
<td>2.4</td>
</tr>
<tr>
<td>4.00001-5</td>
<td>3.4</td>
<td>1.7</td>
<td>3.8</td>
<td>2.1</td>
</tr>
<tr>
<td>5.00001-6</td>
<td>2.9</td>
<td>1.4</td>
<td>3.2</td>
<td>2.2</td>
</tr>
<tr>
<td>6.00001-7</td>
<td>2.7</td>
<td>1.3</td>
<td>2.8</td>
<td>1.3</td>
</tr>
<tr>
<td>7.00001-8</td>
<td>2.4</td>
<td>1.1</td>
<td>2.6</td>
<td>1.6</td>
</tr>
<tr>
<td>8.00001-9</td>
<td>2.2</td>
<td>1.1</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>9.00001-9.99999</td>
<td>1.9</td>
<td>0.9</td>
<td>2.2</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**Batch Model C48CB**

- With Counter 2 configured as a Total Counter (C2 = R5n + bHz/RL)

<table>
<thead>
<tr>
<th>PRESCALER VALUE</th>
<th>C1-Usr C1-Ud</th>
<th>C2-Usr C2-Ud</th>
<th>*Ad-Sub Ad-Ad</th>
<th>QUAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001-0.99999</td>
<td>6.5</td>
<td>3.3</td>
<td>6.6</td>
<td>3.5</td>
</tr>
<tr>
<td>1.00000</td>
<td>8.5</td>
<td>3.6</td>
<td>8.6</td>
<td>4.4</td>
</tr>
</tbody>
</table>

* - Inputs A & B rates summed.

**Outputs:**

- Output type and quantity, model dependent

**Solid-State:**

- NPN Open Collector: ISNK = 100 mA max. @ VOL = 1.1 VDC max.; VOH = 30 VDC max.

- PNP Open Collector: I = 100 mA max.(See note); VOH = 12 VDC ±15% (using internal supply); VOH = 13 to 30 VDC (using external supply).

   Note: The internal supply of the C48C can provide a total of 100 mA for the combination of sensor current and PNP output sourcing current. The supply voltage is +12 VDC (±15%), which will be the PNP output voltage level when using only the internal supply.

   If additional PNP output sourcing current or a higher output voltage level is desired, an external DC supply may be connected between the “DC Out” and “Comm.” terminals. This supply will determine the PNP output voltage level, and must be in the range of +13 to +30 VDC.

   An external supply can provide the additional output sourcing current required in applications where two or more outputs are “ON” simultaneously. However, the maximum current rating of 100 mA per individual output must not be exceeded, regardless of external supply capacity.
8. **OUTPUTS**: (Output type and quantity, model dependent) Cont’d  
   Relay: Form A contact, Rating = 5 A @ 250 VAC, 30 VDC (resistive load),  
   1/10 HP @ 120 VAC (inductive load)  
   Relay Life Expectancy: 100,000 cycles min. at max. load rating  
   Programmable Timed Output: User selectable output time resolution.  
   0.01 Second Resolution: 0.01 to 99.99 sec, ± 0.01% +/− 20 msec max.  
   (Prescalers less than 2)  
   0.1 Second Resolution: 0.1 to 999.9 sec, ± 0.01% +/− 100 msec (Prescalers less than 2)  
   Note: For Prescaler values above 2, the timed delay output is affected by the count speed (rate).  

9. **RS485 SERIAL COMMUNICATIONS (Optional)**: Up to 32 units can be connected.  
   Baud Rate: Programmable from 1200 to 9600 baud  
   Address: Programmable from 0 to 99  
   Data Format: 10 Bit Frame, 1 start bit, 7 or 8 data bits, 1 or No Parity bit, and 1 stop bit  
   Parity: Programmable for Odd (7 data bits), Even (7 data bits), or None (8 data bits)  

10. **CERTIFICATIONS AND COMPLIANCES**:  
    - UL Recognized Component, File #E137808  
    - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.  

**ELECTROMAGNETIC COMPATIBILITY**  
Immunity to EN 50082-2  
- Electrostatic discharge: EN 61000-4-2 Level 2; 4 Kv contact  
- Electromagnetic RF fields: EN 61000-4-3 Level 3; 10 V/m  
- Fast transients (burst): EN 61000-4-4 Level 4; 2 Kv I/O  
- RF conducted interference: EN 61000-4-6 Level 3; 10 V/rms  
- Simulation of cordless telephone: ENV 50204 Level 3; 10 V/m  
- Emissions to EN 50081-2:  
  - RF interference: EN 55011 Enclosure class A  

**Notes:**  
- AC VERSIONS  
  1. A power line filter, RLC#LFIL0000 or equivalent, was installed when the unit was DC powered.  
  2. To insure compliance with the EMC standards listed above, do not connect any wires from the terminal(s) labeled “COMM.” to the “DC-” supply terminal (12), when powering the unit from a DC supply.  

Refer to EMC Installation Guidelines section of the manual for additional information.  

11. **ENVIRONMENTAL CONDITIONS**:  
    - Operating Temperature: 0°C to 50°C  
    - Storage Temperature: -40°C to 70°C  
    - Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C  
    - Altitude: Up to 2000 meters  

12. **ELECTRICAL CONNECTIONS**: Wire clamping screw terminals.  

13. **CONSTRUCTION**: Black plastic case with collar style panel latch. The panel latch can be installed for horizontal or vertical stacking. Black plastic textured bezel with clear display viewing window. Unit assembly with circuit boards can be removed from the case without removing the case from the panel or disconnecting the wiring. Front panel meets NEMA 4X/IP65 requirements for indoor use, when properly installed. Installation Category II, Pollution Degree 2.  

14. **WEIGHT**: 6.0 oz (170 g)

**SINGLE PRESET MODELS**  
- The C48CS has a solid-state output that operates in parallel with a relay output. The solid-state output is available as an NPN or PNP open collector transistor.  

**DUAL PRESET MODELS**  
- The C48CD has two outputs that are activated from presets 1 and 2 respectively. These outputs can be relay outputs, or solid-state outputs. The solid-state outputs are available as NPN or PNP open-collector transistors. Units with solid-state outputs can be ordered with an optional prescaler output (C48CP).  

**3 PRESET BATCH MODELS**  
- The C48CB has a secondary counter that can be used for batch counting, or to keep a total count. This second counter can be programmed to operate in one of eight operating modes. Outputs 1 and 2 are assigned to the primary process counter (C1). Output 3 is assigned to the secondary Batch/Total counter (C2). The three preset batch unit can be ordered with solid-state or relay outputs. Units with solid-state outputs have a User Input 2 terminal available. The relay model has a relay output for Output 2 and Output 3 (Batch/Total). Output 1 is available only as solid-state.  

**PRESCALER OUTPUT MODELS**  
- The C48CP is a dual preset counter with solid-state outputs. These models have an additional output configured as a prescaler output. Each time the least significant digit of the display increments, the Prescaler output provides a pulse. The width of this pulse is variable in that the output will turn off after a programmed number of count input pulses has occurred (1-9). The Prescaler output can also be programmed to activate when the 10’s digit of the display increments, rather than the least significant digit.  

**Notes**: Prescaler Output models are limited to two programmable count modes and prescaler values of 1.00000 or less. See Count Input Modes for available modes.  

**FRONT PANEL FEATURES**  
- The C48 Counters feature a dual line display. In the normal operating mode (main display), the count or batch/total value is shown on the top line and presets, prescaler, or output time values are shown on the bottom line. The bottom line values can be programmable to be viewable only, viewable and changeable, or locked (not viewable) from the main display.  

In the operating mode, the presets, prescaler, and output time values are accessible providing that these values are not programmed for ‘L’ocked. Values that are accessible (changeable) can be changed immediately when viewed in the secondary display.  

**FRONT PANEL KEYPAD**  
- Performs user Programmed Function  
- Cycles through secondary displays.  
- Enters Protected Value Menu or Programming Mode when pushed and held for 2 seconds.  
- Scrolls through programming parameters.  
- Enters Data Values.  
- Selects next available mode in programming mode.  
- Increments digit in Digit Entry mode.  
- Increments value in Auto Scrolling entry mode.  
- Selects Digit to right when in Digit Entry mode.  
- Decrements value in Auto Scrolling entry mode.
USER INTERFACE/PROGRAMMING MODES

The operating modes of the C48C are programmed using the front panel keypad. To enter the programming menu, the 
key is pushed and held for 2 seconds. Within the programming menu, the 
key is used to sequence through the list of programming parameters.

PROGRAMMING MENU

- Digit or Auto Scrolling Data Entry Mode
- Accessibility of Prescaler Value
- Prescaler Value
- Decimal Point Position
- Count Input Modes
- Counter 1 Operating Mode
- Counter 2 Assignment (C48CB only)
- Accessibility of Prescaler Value
- Power Up Output State
- User Input 1
- User Input 2 (Not available on Batch Relay Models)
- User Input b
- User Input F1 Key
- Programming/Protected Parameter menu Code
- Scroll Display
- Serial Baud Rate & Parity Settings
- Serial Unit Address
- Abbreviate Serial Memonics
- Print Options
- Print & Reset Count Value
- Prescaler Output Pulse (C48CP only)
- Prescaler Output Pulse Length (Width) (C48CP only)
- Load Factory Default Settings

Program Security/Operator Accessible Values

The Program Disable DIP switch, programmable code value, User Input (programmed for Program Disable), and the Accessible Value parameters provide various levels of security against unauthorized programming changes. The accessible values parameters provide individual access or locking of each value.

Protected Value Menu

The Protected Value Menu allows access to selected presets, prescaler and timed output values without having them viewable or changeable from the main display. To enter the protected menu, the 
key is pressed and held, and a programmed code value is entered.

Programming Numeric Data Values

The Presets may be accessible when the unit is in its operating mode. Pressing the 
key will sequence the secondary display through the available preset, prescaler and Batch/Total count values.

To change a data value it must be visible on the secondary display. Pressing the 
key will allow changing of the value. If the data entry method has been set to “digit entry”, pressing the 
key multiple times will select other digits. Pressing the 
key will increment the selected digit. If the data entry method is set to “Auto scrolling”, the data value can be changed by pressing and holding the 
keys to change one or all digits of the display.

The data value will be entered when the 
key is pushed, or the old value will be retained if no key activity is detected for 10 seconds.

Count Input Modes - Cnt In

This parameter controls the count/control function of Inputs A and B. It also allows Input B to be used as a User Input with the same programmable functions as the dedicated User Inputs.

<table>
<thead>
<tr>
<th>MODE</th>
<th>INPUT A</th>
<th>INPUT B</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-Usr</td>
<td>Count</td>
<td>User Input</td>
</tr>
<tr>
<td>C2-Usr</td>
<td>Count (X2)</td>
<td>User Input</td>
</tr>
<tr>
<td>C1-Up</td>
<td>Up/Dn Control</td>
<td>User Input</td>
</tr>
<tr>
<td>C2-Up</td>
<td>Up/Dn Control</td>
<td>User Input</td>
</tr>
<tr>
<td>Ad-Sub</td>
<td>Add Count</td>
<td>Subtract Count</td>
</tr>
<tr>
<td>Ad-Rd</td>
<td>Add Count</td>
<td>Add Count</td>
</tr>
</tbody>
</table>

* These are the only input count modes available on the Prescaler Output Model.

Programmable Operating Modes - DPEr

These modes determine the operational characteristics of the counter. In the tables, 01, 02, and 03, refer to Outputs 1, 2, and 3 respectively.

SINGLE PRESET OPERATING MODES

1 - Manual Reset to Zero, Latched Output
2 - Manual Reset to Zero, Timed Output
3 - Manual Reset to Preset, Latched Output
4 - Manual Reset to Preset, Timed Output
5 - Auto Reset to Zero, Timed Output
6 - Auto Reset to Preset, Timed Output
7 - Auto Reset to Zero at Timed Output End
8 - Auto Reset to Preset at Timed Output End

DUAL PRESET AND BATCH COUNTER 1 OPERATING MODES

1 - Manual Reset to Zero, Latched Outputs
2 - Manual Reset to Zero, 01 Timed, 02 Latched
3 - Manual Reset to Zero, 01 and 02 Timed
4 - Manual Reset to Zero, 01 off at 02, 02 Latched
5 - Manual Reset to Zero, 01 off at 02, 02 Timed
6 - Manual Reset to Preset 2, Latched Outputs
7 - Manual Reset to Preset 2, 01 Timed, 02 Latched
8 - Manual Reset to Preset 2, 01 and 02 Timed
9 - Manual Reset to Preset 2, 01 off at 02, 02 Latched
10 - Manual Reset to Preset 2, 01 off at 02, 02 Timed
11 - Auto Reset to Zero, 01 and 02 Timed
12 - Auto Reset to Zero, 01 off at 02, 02 Timed
13 - Auto Reset to Preset 2, 01 and 02 Timed
14 - Auto Reset to Preset 2, 01 off at 02, 02 Timed
15 - Auto Reset to Zero at 02 End, 01 and 02 Timed
16 - Auto Reset to Zero at 02 End, 01 off at 02, 02 Timed
17 - Auto Reset to Preset 2 at 02 End, 01 and 02 Timed
18 - Auto Reset to Preset 2 at 02 End, 01 off at 02, 02 Timed

COUNTER 2 OPERATING MODES (C48CB Only)

1 - Manual Reset to Zero, 03 Latched
2 - Manual Reset to Zero, 03 Timed
3 - Manual Reset to Preset 3, 03 Latched
4 - Manual Reset to Preset 3, 03 Timed
5 - Auto Reset to Zero, 03 Timed
6 - Auto Reset to Zero at 03 Timed Output End
7 - Auto Reset to Preset 3, 03 Timed
8 - Auto Reset to Preset 3 at 03 Timed Output End
MULTIPLE UNIT STACKING

The C48C is designed for close spacing of multiple units. Units can be stacked either horizontally or vertically. For vertical stacking, install the panel latch with the screws to the sides of the unit. For horizontal stacking, the panel latch screws should be at the top and bottom of the unit. The minimum spacing from center line to center line of the units is 1.96" (49.8 mm). This spacing is the same for vertical or horizontal stacking.

Note: When stacking units, provide adequate panel ventilation to ensure that the maximum operating temperature range is not exceeded.

SLOW DOWN & CUT TO LENGTH WITH TOTAL FOOTAGE

To improve production efficiency, a wallpaper manufacturing plant is installing cut to length counters on the roll form machines. Currently, electromechanical counters are used for length measurements. The operator slows the machine down upon arriving at the desired length, stops and then cuts. The addition of the C48CB batch counters eliminates the operator’s manual observation and control.

The operator programs the required cut length as Preset 2. Preset 1 is preprogrammed for tracking and will automatically follow Preset 2. Preset 1 is used as the slow down, and is set for a value 0.25 yards less than Preset 2. The process count is programmed to automatically reset at the Preset 2 cut length of 11.00 yards, and begin counting for the next roll. Counter 2 is programmed as a totalizer and is recorded and reset (via key switch) at the end of the operator’s shift. The C48CB was ordered with the RS-485 serial communication option. Future plans include a data acquisition program to interrogate the C48CB’s. A 100 ppr rotary pulse generator is shaft coupled to a 4" pinch roller for length measurement. Display units desired is 0.01 yards.

Program Security features are set to allow access to Preset 2 only. This allows the operator to change the required cut length, but prevents accidental changes to other programming parameters that may adversely affect process operation. After all programming is complete, the Program Disable DIP switch is moved to the up position to enable the Program Security function.

Circumference Of Pinch Roller:

\[
\text{circumference} = \pi \times \text{diameter}
\]

\[
12.56636 = 3.14159 \times 4.00
\]

Pulses Per Yard:

\[
\text{Pulses Per Yard} = \frac{\text{36 inches}}{1 \text{ yard}} \times \frac{1 \text{ rev}}{12.56636} = 2.86\text{47913 rev/yard}
\]

\[
2.86\text{47913 rev/yard} \times 100 \text{ ppr/rev} = 286.47913 \text{ pulses/yard}
\]

Prescaler:

\[
\text{Prescaler} = \frac{\text{Display units}}{\text{number of pulses}} = \frac{100}{286.47913} = 0.34907
\]

Products:

C48CB108
RPGQ0100
## ACCESSORIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFC48</td>
<td>PC Configuration Software for Windows 3.x and 95 (3.5&quot; disk) (for RS-485 Models)</td>
<td>SFC48</td>
</tr>
</tbody>
</table>

## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>*NPN O.C. OUTPUT(S)</th>
<th>RELAY OUTPUT(S) (Note)</th>
<th>RS485</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>C48CS</td>
<td>1 Preset Counter, Reflective LCD</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>C48CS013 C48CS003</td>
</tr>
<tr>
<td></td>
<td>1 Preset Counter, Backlit LCD</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>C48CS113 C48CS103</td>
</tr>
<tr>
<td>C48CD</td>
<td>2 Preset Counter, Reflective LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CD015 C48CD005</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Reflective LCD</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>C48CD012 C48CD002</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CD017 C48CD007</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Backlit LCD</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>C48CD110 C48CD100</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CD115 C48CD105</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Backlit LCD</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>C48CD112 C48CD102</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter, Backlit LCD</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>C48CD117 C48CD107</td>
</tr>
<tr>
<td>C48CP</td>
<td>2 Preset Counter w/Prescaler Output, Reflective LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CP015 C48CP005</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter w/Prescaler Output, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>C48CP110 C48CP100</td>
</tr>
<tr>
<td></td>
<td>2 Preset Counter w/Prescaler Output, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CP115 C48CP105</td>
</tr>
<tr>
<td>C48CB</td>
<td>3 Preset Batch Counter, Reflective LCD</td>
<td>Yes (O1)</td>
<td>Yes</td>
<td>No</td>
<td>C48CB003</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Reflective LCD</td>
<td>Yes (O1)</td>
<td>Yes</td>
<td>Yes</td>
<td>C48CB008</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Reflective LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CB005</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Backlit LCD</td>
<td>Yes (O1)</td>
<td>Yes</td>
<td>No</td>
<td>C48CB103</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Backlit LCD</td>
<td>Yes (O1)</td>
<td>Yes</td>
<td>Yes</td>
<td>C48CB108</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>C48CB110</td>
</tr>
<tr>
<td></td>
<td>3 Preset Batch Counter, Backlit LCD</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>C48CB105</td>
</tr>
</tbody>
</table>

*Note: On Batch Relay Models, Outputs 2 and 3 are Relays, and Output 1 (O1) is a solid-state output.

*PNP O.C. output(s) versions available, contact the factory.

## RELAY OUTPUT BOARDS

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NPN O.C. OUTPUT(S)</th>
<th>PNP O.C. OUTPUT(S)</th>
<th>RELAY OUTPUT(S)</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC48</td>
<td>Single Preset</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>RBC48001</td>
</tr>
<tr>
<td></td>
<td>Dual Preset</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>RBC48002</td>
</tr>
<tr>
<td></td>
<td>Batch</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>RBC48003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>RBC48004</td>
</tr>
</tbody>
</table>

---

*[NPN O.C.]

[1] 270x704 N/A

**18-36 VDC/24 VAC**

**85 to 250 VAC**