Innovative operator interface, measurement, monitoring and control solutions
## Timer Specifications

### Timer with Output Option Card Capability

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<th>Description</th>
<th>CUB7T</th>
<th>CUB5T</th>
<th>C48T</th>
<th>PAXTM</th>
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<tbody>
<tr>
<td><strong>Dimensions</strong></td>
<td>28 mm (H) x 51 mm (W)</td>
<td>39 mm (H) x 75mm (W)</td>
<td>49 mm (H) x 49 mm (W)</td>
<td>50 mm (H) x 97mm (W)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>8 Digit, .35&quot; (9mm) Reflective, Green and Red Backlight LCD</td>
<td>8 Digit, .46&quot; (12mm) Reflective, Green and Red Backlight LCD</td>
<td>2 x 6 Digit, Main Display 3&quot; (7mm) Sec. Display 2&quot; (5mm) Reflective and Backlight LCD</td>
<td>6 Digit, .56&quot; (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>Single Form C Relay, NPN O. C. or Voltage</td>
<td>Single Form C Relay, NPN O. C. or Voltage</td>
<td>Single or Dual Form A Current Sinking, Min/Sec</td>
<td>Single or Dual Form A Current Sinking, Min/Sec</td>
</tr>
<tr>
<td><strong>Time Ranges</strong></td>
<td>.001, .01, .1 and 1 Second, .01, .1 and 1 Minute, .01, .1 and 1 Hour</td>
<td>.001, .01, .1 and 1 Second, .01, .1 and 1 Minute, .01, .1 and 1 Hour</td>
<td>.001, .01, .1 and 1 Second, Min/Sec</td>
<td>.001, .01, .1 and 1 Second, Min/Sec</td>
</tr>
<tr>
<td><strong>Setpoint Capability</strong></td>
<td>No</td>
<td>Single Form C Relay</td>
<td>Single or Dual Form A Current Sinking</td>
<td>Dual Form C Quad Form A Quad Sinking Quad Sourcing</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>No</td>
<td>RS232, RS485</td>
<td>RS485</td>
<td>RS232, RS485, Modbus, DeviceNet, Profibus, Ethernet w/ICM8</td>
</tr>
<tr>
<td><strong>Other Features/Options</strong></td>
<td>No</td>
<td>Programmable User Inputs</td>
<td>Programmable User Inputs, and Front Buttons</td>
<td>Programmable User Inputs, and Front Buttons, Cycle Counting Capability</td>
</tr>
<tr>
<td><strong>Power Source</strong></td>
<td>3 Volt Lithium Battery, Backlighting 9 - 28 VDC @ 35 mA</td>
<td>9 to 28 VDC</td>
<td>85 to 250 VAC, 11 to 14 VDC, 24 VAC</td>
<td>85 to 250 VAC, 11 to 36 VDC, 24 VAC</td>
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*See website for product information.*

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<th>Description</th>
<th>Timer w/Control</th>
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<tr>
<td>Dimensions (Height)x(Width)</td>
<td>50 mm (H) x 97mm (W)</td>
</tr>
<tr>
<td>Display</td>
<td>6 Digit, .56” (14mm) Standard Green or Sunlight Readable Red LED, Adjustable Intensity</td>
</tr>
<tr>
<td>Input</td>
<td>Switch Contact, NPN O.C., PNP O.C., or VCME through VCMH</td>
</tr>
<tr>
<td>Time Ranges</td>
<td>.001, .01, .1 and 1 Second Minutes/.001, .01, .1, 1 Sec Hours/.001, .01, .1 Min Hours/Minutes/Seconds Seconds/Hours/Minutes</td>
</tr>
<tr>
<td>Reset</td>
<td>Front Panel, Remote, Automatic</td>
</tr>
<tr>
<td>Setpoint Capability</td>
<td>Dual Form C Quad Form A Quad Sinking Quad Sourcing</td>
</tr>
<tr>
<td>Communications</td>
<td>RS232 RS485 Modbus DeviceNet Profibus Ethernet w/ICM8</td>
</tr>
<tr>
<td>Other Features/Options</td>
<td>Programmable User Inputs and Front Buttons, Cycle Counting Capability</td>
</tr>
<tr>
<td>Power Source</td>
<td>85 to 250 VAC 11 to 36 VDC 24 VAC</td>
</tr>
</tbody>
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*See website for product information.*
## REPLACEMENT Guide

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<th>Current Product</th>
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<td><strong>C48T</strong></td>
<td><strong>LIBT</strong></td>
</tr>
</tbody>
</table>

### Features

- **Display:** 2 x 6, Main Display .3” (7 mm) Secondary Display .2” (5 mm) Reflective LCD
- **Power Source:** 85 to 250 VAC, 11 to 36 VDC

### Panel Cut-Out Dimension Differences

- **Display:** 2 x 6, Main Display .3” (7 mm) Secondary Display .2” (5 mm) Reflective LCD
- **Power Source:** 85 to 250 VAC, 11 to 36 VDC

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Note: Refer to the current product literature, as some differences may exist.
MODEL CUB7T0 PROGRAMMABLE GENERAL PURPOSE ELECTRONIC TIMER

DESCRIPTION
The CUB7T0 is an 8-digit miniature programmable timer with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective (CUB7T000), Negative Image Transmissive with yellow/green backlighting (CUB7T010) or red backlighting (CUB7T020). The backlight versions require an external 9 to 28 VDC power supply. The display will wrap around from a full display of "99999999" to "00000000" when an overflow occurs. An annunciator, located in the upper left hand corner of the display, blinks at 2 Hz when the signal input is activated. The CUB7T0 operates from a switch contact or an open collector NPN transistor.

The CUB7T timers 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 CUB7T 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.

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 a NEC Class 2 or SELV rated power supply.
4. ANNUNCIATOR: Annunciator in the upper left corner of the display flashes at a 2 Hz rate when the signal input is activated.
5. SIGNAL INPUT: (LS terminal #4)
   Contact Input (CUB7T0xx): Switch Contact or solid state Transistor Switch to Common. Contact burden 15 \( \mu A \) max. A maintained closed switch to COM will actuate the timer.
6. 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.
7. ACCURACY: 0.025%
8. 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.
   Vibration According to IEC 68-2-6: Operational 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.
   Altitude: Up to 2000 meters
   Wire Strip Length: 0.3" (7.5 mm)
   Wire Gage: 30-14 AWG copper wire
   Torque: 5 inch-lbs (0.565 N-m) max
10. CERTIFICATIONS AND COMPLIANCES:
    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 Indoor Enclosure rating (Face only), UL50

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (53.4) H x 3.00" (140) W.

1-717-767-6511
TIMER RANGE SELECTION

The CUB7T’s timer range can be modified in the Program mode. The Program mode uses the PGM button (refer to photo) to switch between Program and Operate modes. The RESET button (refer to photo) is used to select the desired timer range.

Note: Timer range and accumulated time on the display will be lost if the battery is removed from the unit.

INSTALLATION

The CUB7T meets NEMA 4X/IP65 requirements for indoor use when precisely 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.

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.

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

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.

11. 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.

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

Troubleshooting

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

**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 at right), 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 CUB77 when properly installed.

* - Dispose of properly.

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

**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 connection point for the shield depends somewhat upon the application.

### L.S. INPUT; CONTACT VERSIONS

Connecting the “L.S.” Input to Common with a mechanical or solid-state switch activates the timer. Releasing the connection, deactivates the timer. 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.
**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 timer 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.

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

**APPLICATION**

A bottling company has a preventive maintenance program based on the accumulative running hours. For each bottling line, they added a CUB7T000. When the line is running a contact closure is given to the CUB7T timer allowing the new time to accumulate with the hours of previous operations. At a designated value, the line maintenance is performed and the CUB7T is reset with a key switch to 0.

**BACKLIGHT OPTION**

Optional backlight versions of the CUB7T 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.
DESCRIPTION

The CUB7T1 is an 8-digit miniature programmable timer with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective (CUB7T100), Negative Image Transmissive with yellow/green backlighting (CUB7T110) or red backlighting (CUB7T120). The backlight versions require an external 9 to 28 VDC power supply. The display will wrap around from a full display of “99999999” to “00000000” when an overflow occurs. An annunciator, located in the upper left hand corner of the display, blinks at 2 Hz when the signal input is activated. The CUB7T1 operates from a signal voltage of 10 to 300 V (AC 50/60 Hz or DC).

The CUB7T timers 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 CUB7T 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 bulletin 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: 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.
4. ANNUNCIATOR: Annunciator in the upper left corner of the display flashes at a 2 Hz rate when the signal input is activated.
5. SIGNAL INPUT: (LS terminal #4)
   - Voltage Input (CUB7T1xx): 10 V min. to 300 V max. (AC 50/60 Hz or DC) to Common. 150 V max. for backlight versions. Input current 0.5 mA max. Any off-state leakage current may activate the timer. Constant voltage applied to the input will actuate the timer. Due to the internal digital filtering to this input, up to 30 msec of error may be added per activation of the signal input.
6. 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.
7. ACCURACY: 0.025% (+ up to 30 msec per activation of signal input—CUB7T1xx only)
8. 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.
   - Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g’s.
   - Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
   - Altitude: Up to 2000 meters
9. 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 4 Enclosure rating (Face only).

DIMENSIONS

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.5" (140) W.

| PANEL CUT-OUT | 1.77" (45.0) | 0.04" (0.00) | 0.087" (2.2) |
| 1.56" (39.6) | 0.07 (2.0) |

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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 2, 4 kV contact; Level 3, 10 V rms; Level 3, 10 V/m

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 LFILD000 or equivalent, so as not to impair the function of the backlighting. Refer to EMC Installation Guidelines for additional information.

- Wire Strip Length: 0.3" (7.5 mm)
- Wire Gage: 30-14 AWG copper wire
- Torque: 5 inch-lbs (0.565 N-m) max

10. 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.

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

TIMER RANGE SELECTION

The CUB7T’s timer range can be modified in the Program mode. The Program mode uses the PGM button (refer to photo) to switch between Program and Operate modes. The RESET button (refer to photo) is used to select the desired timer range.

Note: Timer range and accumulated time on the display will be lost if the battery is removed from the unit.

Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front push buttons. Press the PGM button to enter Program Mode, allowing selection of the desired timer range. The display will show 00000.000 (Timer Range 0.001 sec). Repeatedly pressing the RST button will cycle through the available timer ranges as shown in the table. When the desired timer range is displayed, press PGM to load the range and return to operating mode. (The CUB7T will remain in Program Mode until the PGM button is pressed.) Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the timer range. Any new time accumulated will be at the new rate selected.

Note: To avoid incorrect display information, it is recommended that the CUB7T be reset after making programming changes.

DISPLAY DURING PROGRAMMING

<table>
<thead>
<tr>
<th>Time Range</th>
<th>Timer Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000.000</td>
<td>0.001 Sec</td>
</tr>
<tr>
<td>11111.11</td>
<td>0.01 Sec</td>
</tr>
<tr>
<td>222222.2</td>
<td>0.1 Sec</td>
</tr>
<tr>
<td>333333.33</td>
<td>1 Sec</td>
</tr>
<tr>
<td>444444.44</td>
<td>0.1 Min</td>
</tr>
<tr>
<td>55555555</td>
<td>1 Min</td>
</tr>
<tr>
<td>666666.66</td>
<td>0.01 Hr</td>
</tr>
<tr>
<td>777777.77</td>
<td>0.1 Hr</td>
</tr>
<tr>
<td>88888888</td>
<td>1 Hr</td>
</tr>
<tr>
<td>9999.99.99</td>
<td>Factory Use Only</td>
</tr>
</tbody>
</table>

INSTALLATION

The CUB7T 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.

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 push buttons of the unit.

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 CUB7T 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 CUB7T 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% 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.
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.

WARNING: Lithium battery may explode if incinerated.

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.

CAUTION: All leads will be at the same line potential as the input leads.

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 at right), 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 CUB7T when properly installed.

* - Dispose of properly.

WARNING: Lithium battery may explode if incinerated.
L.S. INPUT; VOLTAGE VERSIONS

The CUB7T accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 300 V. The unit times when voltage is applied between the LS input and Common. Any off-state leakage current may activate the timer.

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.

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 timer 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.

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

BACKLIGHT OPTION

Optional backlight versions of the CUB7T 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.

WARNING: When connecting the wiring for a backlit CUB7T 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). The DC supply for the backlighting is connected as shown in the drawing. Three phase AC applications require an isolation transformer.

APPLICATION

A laundromat owner wants to monitor the cost of operating his dryers. He needs to know how many hours each dryer has operated. A CUB7T100 (Voltage Input; Positive Image Reflective) is mounted on the back panel of each dryer. The signal input is connected across the motor of the dryer. The CUB7T will accumulate time while the dryer is running. On a regular basis the owner records the cumulative operating hours for each dryer and calculates if he needs to make any necessary adjustments. The timer can be reset via key switch.

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 NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CUB7T</td>
<td>Timer; Positive Image Reflective</td>
<td>CUB7T100</td>
</tr>
<tr>
<td></td>
<td>Timer, w/Yel-Grn Backlighting</td>
<td>CUB7T110</td>
</tr>
<tr>
<td></td>
<td>Timer, w/Red Backlighting</td>
<td>CUB7T120</td>
</tr>
<tr>
<td>BNL</td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

*Battery is included with unit.
MODEL CUB7T3 PROGRAMMABLE GENERAL PURPOSE ELECTRONIC TIMER

DESCRIPTION
The CUB7T3 is an 8-digit miniature programmable timer with large 0.35 inch (8.90 mm) high digits. It has an LCD read-out available in Positive Image Reflective (CUB7T300), Negative Image Transmissive with yellow/green backlighting (CUB7T310) or red backlighting (CUB7T320). The backlight versions require an external 9 to 28 VDC power supply. The display will wrap around from a full display of “99999999” to “00000000” when an overflow occurs. An annunciator, located in the upper left hand corner of the display, blinks at 2 Hz when the signal input is activated. The CUB7T3 operates from a signal voltage of 10 to 30 V (AC 50/60 Hz or DC).

The CUB7T timers 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 CUB7T 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 bulletin 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: 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 a NEC Class 2 or SELV rated power supply.
4. ANNUNCIATOR: Annunciator in the upper left corner of the display flashes at a 2 Hz rate when the signal input is activated.
5. SIGNAL INPUT: (LS terminal #4) Voltage Input: 10 V min. to 30 V max. (AC 50/60 Hz. or DC) to Common. ANY off-state leakage current may activate the timer. Constant voltage applied to the input will actuate the timer. Due to the internal digital filtering to this input, up to 30 msec of error may be added per activation of the signal input. Must use a NEC or a Class 2 or SELV rated power supply.
6. 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.
7. ACCURACY: 0.025%
8. 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.
   Vibration According to IEC 68-2-6: Operational 5 to 500 Hz, in X, Y, Z direction for 1.5 hours, 5 g’s.
   Shock According to IEC 68-2-27: Operational 30 g, 11 msec in 3 directions.
   Altitude: Up to 2000 meters
9. 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 Indoor Enclosure rating (Face only), UL50

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.

Panel Cut-Out

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
TIMER RANGE SELECTION

The CUB7T’s timer range can be modified in the Program mode. The Program mode uses the PGM button (refer to photo) to switch between Program and Operate modes. The RESET button (refer to photo) is used to select the desired timer range.

Note: Timer range and accumulated time on the display will be lost if the battery is removed from the unit.

Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front push buttons. Press the PGM button to enter Program Mode, allowing selection of the desired timer range. The display will show 00000.000 (Timer Range 0.001 sec). Repeatedly pressing the RST button will cycle through the available timer ranges as shown in the table. When the desired timer range is displayed, press PGM to load the range and return to operating mode. (The CUB7T will remain in Program Mode until the PGM button is pressed.) Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the timer range. Any new time accumulated will be at the new rate selected.

Note: To avoid incorrect display information, it is recommended that the CUB7T be reset after making programming changes.

### TIMER RANGE SELECTION CHART

<table>
<thead>
<tr>
<th>DISPLAY DURING PROGRAMMING</th>
<th>Timer Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000.000</td>
<td>0.001 Sec</td>
</tr>
<tr>
<td>111111.11</td>
<td>0.01 Sec</td>
</tr>
<tr>
<td>222222.2</td>
<td>0.1 Sec</td>
</tr>
<tr>
<td>33333333</td>
<td>1 Sec</td>
</tr>
<tr>
<td>44444444.4</td>
<td>0.1 Min</td>
</tr>
<tr>
<td>55555555</td>
<td>1 Min</td>
</tr>
<tr>
<td>666666.66</td>
<td>0.01 Hr</td>
</tr>
<tr>
<td>7777777.7</td>
<td>0.1 Hr</td>
</tr>
<tr>
<td>88888888</td>
<td>1 Hr</td>
</tr>
<tr>
<td>99999.9999</td>
<td>Factory Use Only</td>
</tr>
</tbody>
</table>

### INSTALLATION

The CUB7T 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.

**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 push buttons of the unit.

Connect wires between RST EN (Reset Enable) and COM. (Common); and between HS (Program Enable) and COM. (Common) to enable front push buttons. Press the PGM button to enter Program Mode, allowing selection of the desired timer range. The display will show 00000.000 (Timer Range 0.001 sec). Repeatedly pressing the RST button will cycle through the available timer ranges as shown in the table. When the desired timer range is displayed, press PGM to load the range and return to operating mode. (The CUB7T will remain in Program Mode until the PGM button is pressed.) Remove the wire from the HS (Program Enable) terminal to prevent accidental changes to the timer range. Any new time accumulated will be at the new rate selected.

Note: To avoid incorrect display information, it is recommended that the CUB7T be reset after making programming changes.

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<tr>
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<td>1 Sec</td>
</tr>
<tr>
<td>44444444.4</td>
<td>0.1 Min</td>
</tr>
<tr>
<td>55555555</td>
<td>1 Min</td>
</tr>
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<td>0.01 Hr</td>
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<td>0.1 Hr</td>
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<td>88888888</td>
<td>1 Hr</td>
</tr>
<tr>
<td>99999.9999</td>
<td>Factory Use Only</td>
</tr>
</tbody>
</table>

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 CUB7T 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 CUB7T 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.
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 # 044367251 (RLC #FCOR0000)
   - TDK # ZCAT3035-1330A
   - Steward #28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC #LFL0000)
     - 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 at right), 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 CUB7T when properly installed.

* - Dispose of properly.

WARNING: Lithium battery may explode if incinerated.

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### L.S. INPUT; VOLTAGE VERSIONS

The CUB7T3 accepts most machine control voltage signals. The input accepts AC (50/60 Hz) or DC control voltages from 10 to 30 V. The unit times when voltage is applied between the LS input and Common. Any off-state leakage current may activate the timer.

### 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 timer 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.

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

### BACKLIGHT OPTION

Optional backlight versions of the CUB7T 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.

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CUB7T3</td>
<td>VOLTAGE INPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timer; Positive Image Reflective</td>
<td>CUB7T300</td>
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<tr>
<td></td>
<td>Timer, w/Yel-Grn Backlighting</td>
<td>CUB7T310</td>
</tr>
<tr>
<td></td>
<td>Timer, w/Red Backlighting</td>
<td>CUB7T320</td>
</tr>
<tr>
<td>BNL</td>
<td>Replacement 3 V Lithium Battery</td>
<td>BNL10000</td>
</tr>
</tbody>
</table>

*Battery is included with unit.

### TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL CUB5T - MINIATURE ELECTRONIC PRESET TIMER AND CYCLE COUNTER

The CUB5T provides the ultimate in timer flexibility, from its complete user programming to the optional relay output and serial communications capability. The meter functions as an Elapsed Timer or Preset Timer. It also has a built-in Cycle Counter. The display can be toggled either manually or automatically between the Timer and Cycle Counter values. With eight different input operating modes and 18 selectable timer ranges, the meter can be programmed for a wide variety of timing applications.

The CUB5T has an LCD display with 0.46" (11.7 mm) high digits. The LCD is available in two versions, reflective (CUB5TR00) and backlight (CUB5TB00). The backlight version is user selectable for red or green backlighting with variable display intensity.

The Timer has two signal inputs and eight input operating modes. These modes provide level active or edge triggered start/stop operation. A Display Hold mode will display the elapsed time for one cycle, while the next cycle continues timing internally. The Timer Reset modes will automatically reset the timer value when a time start edge is applied to the input. This allows sequential timing cycles without having to manually reset the Timer.

In addition to the Timer inputs, a programmable User Input is available to perform a variety of meter functions. All inputs are current sinking (active low) and accept a variety of logic and open-collector output signal sources. Relay and switch contacts can also be used as signal sources, when the software input debounce filter is enabled.

The capability of the CUB5T can be easily expanded with the addition of a field installable option module. When the CUB5RLY0 relay output module is added, the meter becomes a Preset Timer. The Setpoint Output can be assigned to the Timer or Cycle Counter values, and configured to suit a variety of control and alarm requirements. Serial communications capability for RS232 or RS485 is added with a serial option module (CUB5COM).

The CUB5T can be powered from an optional Red Lion Micro-Line/Sensor Power Supply (MLPS1000), which attaches directly to the back of a CUB5T. The MLPS1 is powered from an 85 to 250 V AC source and provides up to 400 mA to drive the meter and sensors.

SAFETY SUMMARY

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

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

CAUTION: 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 2.15" (54.6) H x 3.00" (76.2) W.

1-717-767-6511
GENERAL METER SPECIFICATIONS

1. DISPLAY: 8 digit LCD 0.46” (11.7 mm) high digits
   - CUB5TR00: Reflective LCD with full viewing angle
   - CUB5TB00: Selectable transmissive red or green backlight LED with viewing angle optimized. Display color change capability at preset when using a relay module.

2. POWER: Input voltage range is +9 to +28 VDC with short circuit and input polarity protection. Must use an RLC model MPLS1 or a Class 2 or SELV rated power supply.

3. TIMER DISPLAY: 7-digits
   - Display Designator: “T” to the left side of the display
   - Display Range: 0 to 99999999
   - Minimum Digit Resolution: 0.001 Sec.
   - Maximum Single Digit Resolution: 1 Hr.
   - Timing Accuracy: ±0.01%

4. CYCLE COUNTER DISPLAY: 6-digits, may be disabled if not used
   - Display Designator: “C” to the left side of the display
   - Display Range: 0 to 9999999
   - Maximum Count Rate: All Count Sources except Input B: 10 Hz
   - Input B Count Source:
     - With Timer Input Filter ON: 10 Hz
     - With Timer Input Filter OFF: 500 Hz

5. TIMER SIGNAL INPUTS (INP A and INP B)
   - Logic Inputs, Current Sinking (active low)
   - Input A: Internal 7.8KΩ pull-up resistor to +9 to 28 VDC
     - Trigger levels: VIL = 1.25 V max; VIH = 2.75 V min; VMAX = 28 VDC
   - Input B: Internal 10KΩ pull-up resistor to +9 to 28 VDC
     - Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
   - Inputs A and B:
     - Timer Input Pulse Width: 1 msec min.
     - Timer Start/Stop Response Time: 1 msec max.
     - Filter: Software filtering provided for relay or switch contact debounce.
     - Filter enabled or disabled through programming. If enabled, results in 50 msec start/stop response time for successive pulses applied to the same input terminal.

6. USER INPUT (USR): Programmable function input
   - Logic Input, Current Sinking (active low)
   - Internal 10KΩ pull-up resistor to +9 to 28 VDC
     - Trigger levels: VIL = 1.0 V max; VIH = 2.4 V min; VMAX = 28 VDC
   - Response Time: 5 msec typ.; 50 msec debounce (activation and release)

7. MEMORY: Nonvolatile E2PROM memory retains all programming parameters and timer/counter values when power is removed.

8. CONNECTIONS: Wire clamping screw terminals
   - Wire Strip Length: 0.3” (7.5 mm)
   - Wire Gage: 30-14 AWG copper wire
   - Torque: 5 inch-lbs (0.565 N-m) max.

9. ENVIRONMENTAL CONDITIONS:
   - Operating Temperature Range for CUB5TR00: -35 to 75°C
   - Storage Temperature: -35 to 85°C
   - Operating and Storage Humidity: 0 to 85% max. relative humidity (non-condensing)

10. CERTIFICATIONS AND COMPLIANCES:
    - SAFETY
      - UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
      - IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
      - Type 4X Indoor 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
      - 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
        - 2 kV power
        - 1 kV signal
        - Surge EN 61000-4-5 Criterion A
        - 1 kV L-L
        - 2 kV L-N-E power
        - RF conducted interference EN 61000-4-6 Criterion A
        - 3 V/rms
        - Power frequency magnetic fields EN 61000-4-8 Criterion A
        - 30 A/m
    - Emissions: EN 55011 Class A
    - Notes:
      2. Refer to EMC Installation Guidelines for additional information.

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

12. WEIGHT: 3.2 oz (100 g)


**OPTIONAL PLUG-IN CARDS**

**ADDING OPTION CARDS**

The CUB5T meters can be fitted with optional relay card and/or serial communications cards. The details for the plug-in cards can be reviewed in the specification section below. The plug-in cards, that are sold separately, can be installed initially or at a later date.

**RELAY CARD**

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

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

**RS485 SERIAL COMMUNICATIONS CARD**

- **Type**: RS485 multi-point balanced interface (non-isolated)
- **Baud Rate**: 300 to 38400
- **Data Format**: 7/8 bits; odd, even, or no parity
- **Bus Address**: 0 to 99; max 32 meters per line
- **Transmit Delay**: Selectable. 2 msec min. or 50 msec min.

**RS232 SERIAL COMMUNICATIONS CARD**

- **Type**: RS232 half duplex (non-isolated)
- **Baud Rate**: 300 to 38400
- **Data Format**: 7/8 bits; odd, even, or no parity

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**1.0 INSTALLING THE METER**

**INSTALLATION**

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

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

**INSTALLATION ENVIRONMENT**

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

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

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

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**2.0 DIP SWITCHES**

The DIP switches on the main circuit board are not used with the CUB5T and must be left in the factory set position (all down). Setting any switch to the up position may cause improper operation of the meter.
3.0 Installing Plug-In Cards

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

WARNING: Disconnect all power to the meter before installing Plug-in Card.

Removing the Rear Cover

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

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

4.0 Wiring the Meter

Wiring Overview

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

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

EMC Installation Guidelines

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

1. The meter should be 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 # 28B2029-0A0
   - Line Filters for input power cables:
     - Schaffner # FN610-1/07 (RLC# LFIL0000)
     - Schaffner # FN670-1.8/07
     - Corcom # 1 VR3
   Note: Reference manufacturer’s instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   - Snubber: RLC# SNUB0000.
4.1 POWER WIRING

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

4.2 USER INPUT WIRING

Sinking Logic
INP COMM
INP COMM
USR
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5.0 Reviewing the Front Buttons and Display

OPERATING MODE DISPLAY DESIGNATORS
- “t” - To the left of the display is the timer value.
- “c” - To the left of the display is the cycle counter value.

If display scroll is enabled, the display will toggle automatically every four seconds between the timer and cycle counter values.

6.0 Programming the Meter

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

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

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

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

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

PROGRAMMING MODE EXIT (SEL KEY)
The Programming Mode is exited by pressing the SEL key with Pr displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

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

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

Pressing the RST key on power-up will load the factory settings and display 1. This allows operation in the event of a memory failure or corrupted data.

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

#### PARAMETER MENU

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANGE</strong></td>
<td>555555</td>
<td>Timer Range Operation</td>
</tr>
<tr>
<td><strong>INPUT OP</strong></td>
<td>LEVEL</td>
<td>Timer Input Operation</td>
</tr>
<tr>
<td><strong>t-d ir</strong></td>
<td>EdGE-1</td>
<td>Edge Triggered Operation - 1 Input</td>
</tr>
<tr>
<td><strong>t-Stt</strong></td>
<td>EdGE-2</td>
<td>Edge Triggered Operation - 2 Input</td>
</tr>
<tr>
<td><strong>t-sLOp</strong></td>
<td>HOLD-2</td>
<td>Edge Triggered Operation - 2 Input, with Display Hold</td>
</tr>
<tr>
<td><strong>t-FLASH</strong></td>
<td>YES</td>
<td>Flash Timer Annunciator</td>
</tr>
<tr>
<td><strong>Run P-UP</strong></td>
<td>SLOp</td>
<td>Timer Run State at Power-up</td>
</tr>
</tbody>
</table>

#### TIMER RANGE

<table>
<thead>
<tr>
<th>Range Selection</th>
<th>Maximum Display</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECONDS</td>
<td>9999999</td>
<td>1 SEC</td>
</tr>
<tr>
<td>5555555</td>
<td>9999999</td>
<td>0.1 SEC</td>
</tr>
<tr>
<td>5555555</td>
<td>9999999</td>
<td>0.01 SEC</td>
</tr>
<tr>
<td>MINUTES</td>
<td>9999999</td>
<td>1 MIN</td>
</tr>
<tr>
<td>9999999</td>
<td>9999999</td>
<td>0.1 MIN</td>
</tr>
<tr>
<td>9999999</td>
<td>9999999</td>
<td>0.01 MIN</td>
</tr>
<tr>
<td>HOURS</td>
<td>9999999</td>
<td>1 HR</td>
</tr>
<tr>
<td>9999999</td>
<td>9999999</td>
<td>0.1 HR</td>
</tr>
<tr>
<td>9999999</td>
<td>9999999</td>
<td>0.01 HR</td>
</tr>
</tbody>
</table>

#### TIMER INPUT FILTER

<table>
<thead>
<tr>
<th>Filter</th>
<th>On</th>
<th>Off</th>
</tr>
</thead>
</table>

Provided a 50 msec software debounce for the Timer Inputs (A and B). Select On when using relays or switch contacts as a signal source.

#### TIMING DIRECTION

<table>
<thead>
<tr>
<th>Direction</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
</table>

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

#### TIMER START VALUE

<table>
<thead>
<tr>
<th>Value</th>
<th>0000000 to 9999999</th>
</tr>
</thead>
</table>

The Timer returns to this value whenever a Timer Reset occurs. The value is entered in the same display format as the Timer Range selected. Non-zero values are normally used for “timing down” applications, but they can also provide an offset value when timing up.

#### TIMER STOP VALUE

<table>
<thead>
<tr>
<th>Value</th>
<th>0000000</th>
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</table>

The Timer stops when this value is reached regardless of the signal levels on the timer inputs. Selecting YES displays a sub-menu where the Stop Value is entered in the same display format as the Timer Range selected. This stop condition is cleared when a Timer Reset occurs or another start edge is applied on the timer input. Select NO if a Stop Value is not desired.

#### FLASH TIMER ANNUNCIATOR

<table>
<thead>
<tr>
<th>Value</th>
<th>YES</th>
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</table>

Select YES to have the timer annunciator (I) flash when the timer is running.

#### TIMER RUN STATE AT POWER-UP

<table>
<thead>
<tr>
<th>Value</th>
<th>SLOp</th>
<th>SRE</th>
</tr>
</thead>
</table>

Determines the Run/Stop state of the Timer at Power-up. This parameter does not apply to LEVEL Input Operation.

SLOp - Timer Stopped at power-up, regardless of prior Run/Stop state
SRE - Timer assumes the Run/Stop state it was in prior to power-down

---

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
### 6.2 MODULE 2 - CYCLE COUNTER PARAMETERS (2-Count)

#### PARAMETER MENU

<table>
<thead>
<tr>
<th>SEL</th>
<th>Cnt Enb</th>
<th>Cnt Src</th>
<th>Cnt dIr</th>
<th>Cnt Strt</th>
<th>RSt P-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEL</td>
<td>Cycle Counter Enable</td>
<td>Cycle Counter Source</td>
<td>Cycle Counter Direction</td>
<td>Cycle Counter Start Value</td>
<td>Cycle Counter Reset At Power-up</td>
</tr>
</tbody>
</table>

#### CYCLE COUNTER ENABLE

<table>
<thead>
<tr>
<th>Cnt Enb</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

#### CYCLE COUNTER COUNT SOURCE

<table>
<thead>
<tr>
<th>Cnt Src</th>
<th>INPUT b</th>
<th>OUT-ON</th>
<th>USR-INV</th>
<th>OUT-OFF</th>
<th>t-rESet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

The Output ON/OFF selections generate a count when the Setpoint output either activates or deactivates. These selections will only generate counts when an optional Setpoint module is installed.

#### CYCLE COUNTER COUNTING DIRECTION

<table>
<thead>
<tr>
<th>Cnt dIr</th>
<th>UP</th>
<th>dn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

#### CYCLE COUNTER START VALUE

<table>
<thead>
<tr>
<th>Cnt Strt</th>
<th>0000000 to 9999999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

#### CYCLE COUNTER RESET AT POWER-UP

<table>
<thead>
<tr>
<th>RSt P-Up</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**PARAMETER MENU**

- **3-DISPLAY**
  - **SEL**
  - **Front Panel Display Select**
    - **Sel Enb**
      - **Yes**
      - **No**
      - **YES**
      - **NO**
      - **Both**
      - **Display**

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

The **YES** selection allows the **SEL** button to toggle between the timer and cycle counter displays.

**FRONT PANEL RESET ENABLE (RST)**

- **RST**
- **Enb**
- **Yes**
- **No**
- **YES**
- **NO**
- **Both**

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

**DISPLAY SCROLL ENABLE**

- **d-Scroll**
- **Yes**
- **No**
- **YES**
- **NO**
- **Both**

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

**DISPLAY COLOR (BACKLIGHT UNIT ONLY)**

- **d-Col**
- **Red**
- **Green**
- **YES**
- **NO**
- **Both**

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

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

- **d-Level**
- **1 to 5**
- **YES**
- **NO**
- **5**

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

**LOAD FACTORY DEFAULT SETTINGS**

- **Face Set**
- **Yes**
- **NO**

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

Pressing the **RST** key on power-up will load the factory settings and display **Res**. This allows operation in the event of a memory failure or corrupted data.

---

**PROGRAMMING SECURITY CODE**

Enter desired Display Color, red or green. This parameter is active for backlight units only.

**USER INPUT FUNCTION**

- **User Input State**
- **Security Code**
- **Mode When 'Sel' Key Is Pressed**
- **Full Programming Mode Access**

<table>
<thead>
<tr>
<th>USER INPUT FUNCTION</th>
<th>USER INPUT STATE</th>
<th>SECURITY CODE</th>
<th>MODE WHEN 'SEL' KEY IS Pressed</th>
<th>FULL PROGRAMMING MODE ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>not Pro Loc</td>
<td></td>
<td></td>
<td>0</td>
<td>Full Programming Immediate Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>After Quick Programming with correct code entry at Pro Cod prompt *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>Pro Cod prompt</td>
<td>With correct code entry at Pro Cod prompt *</td>
</tr>
<tr>
<td>Pro Loc</td>
<td>Active</td>
<td>0</td>
<td>Programming Lock</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-99</td>
<td>Quick Programming</td>
<td>No Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100-999</td>
<td>Pro Cod prompt</td>
<td>With correct code entry at Pro Cod prompt *</td>
</tr>
<tr>
<td></td>
<td>Not Active</td>
<td>0-999</td>
<td>Full Programming</td>
<td>Immediate Access</td>
</tr>
</tbody>
</table>

* Entering Code 222 allows access regardless of security code.
The Setpoint Output Parameters are only active when the optional relay module is installed in the meter. Some parameters will not appear depending on the Setpoint Assignment and Setpoint Output Action selected.

**Setpoint Assignment**

- **Setpoint Assignment (SPt ASN)**
  - **t-VALUE**
  - **C-VALUE**
  Select the display for Setpoint assignment.

**Setpoint Output Action**

- **Setpoint Output Action (SPt ACL)**
  - **LATCH**
  - **t-OUT**
  - **OFF**
  This parameter selects the action of the Setpoint output as shown below.

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

**Setpoint On**

- **Setpoint On (SPt ON)**
  - **VALUE**
  - **t-Strt**
  - **t-StOP**
  This parameter determines when the Setpoint output will activate. The output can activate at a programmed Setpoint Value or can be set to activate when the Timer starts (t-Strt) or stops (t-StOP).

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

**Setpoint Off**

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

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

**Setpoint Output Time-Out**

- **Setpoint Output Time-Out (SPt t-Out)**
  - **0000.000** to **99599.999**
  This parameter is only active if the Setpoint Action is set to Timed Output mode (t-Out). Enter the time duration the Setpoint Output will remain ON once it is activated. This value is always entered in minutes, seconds, and hundredths of seconds format. The maximum value is 99 minutes 59.99 seconds.

**Timer/Counter Auto Reset**

- **Auto-Rst (Auto-Rst)**
  - **NO**
  - **OUT-ON**
  - **OUT-OFF**
  Automatically resets the Setpoint Assigned display value when the Setpoint Output activates (OUT-ON) or deactivates (OUT-OFF). Select **NO** if the output should not affect the Timer Run/Stop status. The Timer Stop condition is cleared when a Timer Reset occurs, or a Time Start edge is applied on the Timer input.

**Setpoint Output Reset with Display Reset**

- **Yes/No (SPt rSt)**
  - **YES**
  - **NO**
  Select **YES** to have the Setpoint Output deactivate (reset) when the Setpoint Assigned display resets. Reset can occur by the **RST** button or the User Input, if programmed for that function. Select **NO** if the Setpoint output should not reset when the display resets.

**Change Display Color with Setpoint Output State**

- **Ch-Color (Ch-Color)**
  - **NO**
  - **YES**
  This parameter enables the backlight CUBST to switch the display color when the Setpoint output activates. When the output deactivates, the display color will revert to the normal operating mode color. This parameter is only active for the backlight version.

**Setpoint Output Power-Up State**

- **Setpoint Power-Up (SPt P-UP)**
  - **OFF**
  - **ON**
  Select **OFF** to restore the output to the same state it was at before the meter was powered down. **ON** will activate the output at power up. **OFF** will deactivate the output at power up. This parameter is not active when the Setpoint Action is selected for timed output mode.
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the CUB5T with those of the host computer or other serial device. The Serial Setup Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.

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 CUB5T.

### Parameter Menu

**BAUD RATE**

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

**DATA BIT**

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

**PARITY BIT**

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

**METER ADDRESS**

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

### Abbreviated Printing

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

### Print Options

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

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

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

Note: Inactive parameters will not be sent regardless of the print option setting. For example, the Cycle Counter and Cycle Counter Start values will only be sent when the Cycle Counter is enabled. If disabled, these parameters are inactive and will not be transmitted. Likewise, the Setpoint parameters will not be sent unless an optional setpoint card is installed in the meter.
Sending Serial Commands and Data

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

Command Chart

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

Command String Construction

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

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.

2. After the optional address specifier, the next character is the command character.

3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.

4. If constructing a value change command (writing data), the numeric data is sent next.

5. All command strings must be terminated with the string termination character, * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences in meter response time when using the * and $ terminating characters.

Receiving Data From The Meter

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

Full Field Transmission

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

Abbreviated Transmission

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

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

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

Meter Response Examples:

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

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

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

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint On value
   String: N17VF350S

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

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

4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31P8

Transmitting Data to the Meter

Numeric data sent to the meter must be limited to Transmit Details listed in the Register Identification Chart. Leading zeros are ignored. The meter ignores any decimal point and conforms the number to the appropriate display format. (For example: The Timer range is set for tenths of a second and 25 is written to the Timer Start register. The value of the register is now 2.5 seconds. In this case, write a value of 250 to equal 25.0 seconds).

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

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

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

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

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

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

**Communication Format**

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

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

* Voltage levels at the Receiver

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

**Start Bit and Data Bits**

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

**Parity Bit**

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The CUB5T meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

**Stop Bit**

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.
Press and hold **SEL** key to enter Programming Mode.
C48T SERIES - 1/16 DIN TIMERS
MODEL C48TS - SINGLE PRESET
MODEL C48TD - DUAL PRESET

- LCD, 7 SEGMENT, 2 LINE, 6 DIGIT DISPLAY, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE MODELS WITH RED TOP LINE AND GREEN BOTTOM LINE BACKLIGHTING
- SOLID STATE AND RELAY OUTPUT MODELS
- FIELD REPLACEABLE RELAY OUTPUT BOARDS
- STATUS INDICATORS FOR OUTPUTS
- NEMA 4X/IP65 SEALED FRONT BEZEL
- PROGRAMMABLE USER INPUTS AND FRONT PANEL FUNCTION KEY
- PARAMETER SECURITY VIA PROGRAMMABLE OPERATOR ACCESS PRIVILEGES AND PROTECTED VALUE MENU

DESCRIPTION

The Model C48 Timer is available in Single or Dual Preset models. The C48T features a 7 segment, 2 line by 6 digit reflective or backlit LCD display. For the backlit versions, the main display line is red and shows the timer value. The smaller secondary display line is green, and can be used to view the preset values or output time values.

The C48 timer can be configured for a variety of different operating modes to meet most timing application requirements. Twelve timing ranges are available from thousandths of a second to hours and minutes. Decimal Points are used to separate the time units (hours, minutes, seconds). Timing can be cumulative or can reset and start upon each power cycle. “On Delay” or “Off Delay”, “Single Shot”, “Repetitive auto cycling” modes are all supported.

The Timer can also be configured to Continue or Stop timing upon reaching Preset. The display can be programmed to stop at the preset value (Reset to Zero mode) or zero (Reset to Preset mode), or automatically reset to zero or preset and hold. Once stopped, the timer can be restarted by manually resetting it, or it can be programmed to restart when power is reapplied.

The C48 Timer has a Run/Stop Input, 3 programmable User Inputs, and a programmable front panel function key. The Run/Stop and User Inputs can be configured as sinking (active low) or sourcing (active high) inputs via a single plug jumper. The user inputs and the front panel function key can be configured to provide a variety of functions.

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 C48T 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 through all digit positions by pressing and holding the “up” or “down” button.

The Dual Preset models are available with solid-state or Relay outputs. The Single Preset model has a solid-state and relay output in parallel. All solid-state outputs are available in a choice of NPN current sinking or PNP current sourcing, open-collector transistor outputs. All relay output boards are field replaceable.

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. PC software, SFC48, allows for easy configuration of controller parameters. These settings can be saved to disk for later use or used for multi-controller down loading. On-line help is provided within the software.

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 Timers extremely reliable in industrial environments.

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)

<table>
<thead>
<tr>
<th>PANEL CUT-OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.772 +0.024</td>
</tr>
<tr>
<td>-0.000</td>
</tr>
<tr>
<td>(45 +0.6)</td>
</tr>
<tr>
<td>-0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIMENSIONS In inches (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.95 (49.5)</td>
</tr>
<tr>
<td>0.37 (9.4)</td>
</tr>
<tr>
<td>4.17 (105.9)</td>
</tr>
<tr>
<td>1.76 (44.7)</td>
</tr>
</tbody>
</table>

1-717-767-6511

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
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, and 2
Output: 01 and 02

2. POWER REQUIREMENTS:

AC Versions (C48CXXX0X):
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 (C48CXXX1X):
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.

PEAK (START-UP CURRENT):
AC or DC Power: 500 mA peak start-up current for 10 msec max.

DC OUT (V_{SRC IN}) - Terminal 10
For units which do not have PNP current sourcing outputs, this terminal provides a DC output for sensor power (+12 VDC ±15%). The maximum sensor current is 100 mA.
For units with PNP current sourcing outputs, this terminal serves a dual purpose depending on the application’s PNP output voltage level and current requirements.
1. The terminal may be used as a +12 VDC output for sensor power. In this case, the PNP output voltage level will be +12 VDC (±15%). A maximum of 100 mA is available for the combination of sensor current and PNP output sourcing current.
2. If a higher PNP output voltage level or additional output sourcing current is desired, an external DC supply may be connected between the “DC OUT (V_{SRC IN})” 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 DC supply can also provide the additional output sourcing current required in applications where two or more PNP outputs are “ON” simultaneously. However, the maximum current rating of 100 mA per individual output must not be exceeded, regardless of external supply capacity.

3. MEMORY: Nonvolatile E\textsuperscript{2}PROM retains all programmable parameters and timer values.

4. SENSOR POWER: ±12 VDC (±15%) @ 100 mA max.

5. INPUTS: Run/Stop, Usr In1, Usr In2, and Usr In3.
Configurable as current sinking (active low) or current sourcing (active high) inputs via a single plug jumper.

Current Sinking (active low): V_{IL} = 1.5 VDC max, 22 KΩ pull-up to 5 VDC.
Current Sourcing (active high): V_{IH} = 3.5 VDC min, V_{IN} max = 30 VDC; 22 KΩ pull-down.

Run/Stop Response Time: 250 msec max.

User Input Response Time: 5 msec max.

6. TIME ACCURACY: ±0.01%

7. OUTPUTS: (Output type and quantity are model dependent)

Solid-State:
NPN Open Collector: ISRC = 100 mA max. @ V_{OH} = 1.1 VDC max. @ V_{OL} = 30 VDC max.

PNP Open Collector: ISRC = 100 mA max. (See note); V_{OH} = 12 VDC ±15% (using internal supply); V_{OL} = 13 to 30 VDC (using external supply).
Note: The internal supply of the C48T 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/In” 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 rating of 100 mA per individual output must not be exceeded, regardless of external supply capacity.

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(s): User selectable output time resolution
0.01 Second Resolution: 0.01 to 99.99 seconds, ± 0.01% ± 10 usec max.
0.1 Second Resolution: 0.1 to 999.9 Seconds, ± 0.1% ± 100 msec max.

8. 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)

9. CERTIFICATIONS AND COMPLIANCES:

UL Recognized Component, File #E1378908
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
- 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 K V/I
- Level 3; 2 K power
- RF conducted interference: EN 61000-4-6
- Level 3; 10 V/m
- 150 KHz - 80 MHz
- Simulation of cordless telephone: ENV50204
- Level 3; 10 V/m
- 900 MHz ± 5 MHz
- 200 Hz, 50% duty cycle

Notes:

AC VERSIONS
1. A power line filter, RLC#LFIL0000 or equivalent, was installed when the unit was DC powered.

DC VERSIONS

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.

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 (noncondensing) from 0°C to 50°C.
- Altitude: Up to 2000 meters

11. ELECTRICAL CONNECTION:
- Wire clamping screw terminals.

12. 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. This unit is rated for NEMA 4X/IP65 indoor use. Installation Category II, Pollution Degree 2.

13. WEIGHT: 6.0 oz. (170 g)

SINGLE PRESET MODELS

The C48TS offers a choice of twelve timing ranges with eighteen different operating modes. The unit 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 C48TDT offers a choice of twelve timing ranges with 42 operating modes. The unit is available with solid-state or relay outputs. The solid-state outputs are available as NPN or PNP open collector transistors.
**User Interface/Programming Modes**

The operating modes of the C48T 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

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>Digit or Auto Scrolling Data Entry Mode</td>
</tr>
<tr>
<td>Time Range Modes</td>
<td>(See Table on following page)</td>
</tr>
<tr>
<td>OPer</td>
<td>Timer Operating Modes (See Table on following page)</td>
</tr>
<tr>
<td>rStPwP</td>
<td>Reset at Power up</td>
</tr>
<tr>
<td>Acc PrS</td>
<td>Accessibility of Preset Values</td>
</tr>
<tr>
<td>PresEtt</td>
<td>Preset 1 and 2 Values</td>
</tr>
<tr>
<td>P1rPrC</td>
<td>P1 Track P2 (C48TD only)</td>
</tr>
<tr>
<td>Acc Out</td>
<td>Accessibility of Output Time Values</td>
</tr>
<tr>
<td>OutRes</td>
<td>Output Resolution</td>
</tr>
<tr>
<td>OutPrt</td>
<td>Output 1 and 2 Time Values</td>
</tr>
<tr>
<td>rEUDDt</td>
<td>Reverse Output/Relay Logic</td>
</tr>
<tr>
<td>rEURAnu</td>
<td>Reverse Output Annunciator Logic</td>
</tr>
<tr>
<td>OutPwP</td>
<td>Power up Output State</td>
</tr>
<tr>
<td>USr In1</td>
<td>User Input 1</td>
</tr>
<tr>
<td>USr In2</td>
<td>User Input 2</td>
</tr>
<tr>
<td>USr In3</td>
<td>User Input 3</td>
</tr>
<tr>
<td>USr F1</td>
<td>User F1 Key</td>
</tr>
<tr>
<td>Code</td>
<td>Programming/Protected Parameter Menu Code</td>
</tr>
<tr>
<td>Scroll</td>
<td>Scroll Display</td>
</tr>
<tr>
<td>SerSEtk</td>
<td>Serial Baud Rate and Parity Settings</td>
</tr>
<tr>
<td>SerAdr</td>
<td>Serial Unit Address</td>
</tr>
<tr>
<td>SerAbr</td>
<td>Abbreviate Serial Mnemonics</td>
</tr>
<tr>
<td>PrnOPtk</td>
<td>Print Options</td>
</tr>
<tr>
<td>PrnSrtk</td>
<td>Print and Reset Time Value</td>
</tr>
<tr>
<td>FRA SEtk</td>
<td>Load Factory Default Settings</td>
</tr>
</tbody>
</table>

**Front Panel Keypad**

- Performs user Programmed Function
- Cycles through secondary displays.
- Enters Programming Mode or Protected Value Menu when pushed and held for 2 seconds.
- Scrolls through programming displays.
- Enters Data Values.
- Selects next available mode in programming mode.
- Increments digit in Digit Entry mode.
- Increments value in Auto Scrolling entry mode.
- Selects Data Entry mode for displayed data values.
- Selects Digit to right when in Digit Entry mode.
- Decrement value in Auto Scrolling entry mode.

**Program Security/Operator Accessible Values**

The Program Disable Plug Jumper, Programmable Code Value, User Input (programmed for Program Disable), and the Accessible value parameter settings provide various levels of security against unauthorized programming changes. The accessible value parameters provide individual access or locking of each value.

**Protected Value Menu**

The Protected Value Menu allows access to selected presets 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.

**Timer Range Modes - Time Range Modes**

The timer can be configured to operate in one of 12 time ranges. The table below shows the various ranges available with the time resolution of each range.

<table>
<thead>
<tr>
<th>MODE</th>
<th>RANGE</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEC000</td>
<td>999.999 Seconds</td>
<td>0.001 sec</td>
</tr>
<tr>
<td>SEC000</td>
<td>9999.99 Seconds</td>
<td>0.01 sec</td>
</tr>
<tr>
<td>SEC</td>
<td>9999.99 Seconds</td>
<td>1 sec</td>
</tr>
<tr>
<td>n000</td>
<td>999.999 Minutes</td>
<td>0.001 min</td>
</tr>
<tr>
<td>n00</td>
<td>9999.99 Minutes</td>
<td>0.01 min</td>
</tr>
<tr>
<td>n0</td>
<td>99999.9 Minutes</td>
<td>0.1 min</td>
</tr>
<tr>
<td>n5SEC</td>
<td>9999.59 Minutes.Seconds</td>
<td>1 sec</td>
</tr>
<tr>
<td>nSEC0</td>
<td>9995.90 Minutes.Seconds.0</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>h0SEC</td>
<td>99.59.99 Hours.Seconds.00</td>
<td>0.01 min</td>
</tr>
<tr>
<td>h0</td>
<td>999.59.99 Hours.00</td>
<td>1 sec</td>
</tr>
</tbody>
</table>

**Value Annunciators**

Indicate which value is being viewed or modified.
Programmable Operating Modes - **DP®**
These modes determine the operational characteristics of the timer. In the tables, 01 and 02 refer to Output 1 and Output 2 respectively.

### SINGLE PRESET OPERATING MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual Reset to Zero, Latched Output</td>
</tr>
<tr>
<td>2</td>
<td>Manual Reset to Zero, Timed Output</td>
</tr>
<tr>
<td>3</td>
<td>Manual Reset to Zero, 01 and 02 Timed</td>
</tr>
<tr>
<td>4</td>
<td>Manual Reset to Zero, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>5</td>
<td>Manual Reset to Preset, Preset 02, 01 and 02 Timed</td>
</tr>
<tr>
<td>6</td>
<td>Auto Reset to Preset, Timed Output</td>
</tr>
<tr>
<td>7</td>
<td>Auto Reset to Zero at 01 End, Timed Output</td>
</tr>
<tr>
<td>8</td>
<td>Auto Reset to Preset at 01 End, Timed Output</td>
</tr>
<tr>
<td>9</td>
<td>Stop Timer at 01, Manual Reset to Zero, Latched Output</td>
</tr>
<tr>
<td>10</td>
<td>Stop Timer at 01, Manual Reset to Zero, Timed Output</td>
</tr>
<tr>
<td>11</td>
<td>Stop Timer at 01, Manual Reset to Preset, Latched Output</td>
</tr>
<tr>
<td>12</td>
<td>Stop Timer at 01, Manual Reset to Preset 2, Latched Outputs</td>
</tr>
<tr>
<td>13</td>
<td>Stop Timer at 01, Auto Reset to Zero, Latched Output</td>
</tr>
<tr>
<td>14</td>
<td>Stop Timer at 01, Auto Reset to Zero, Timed Output</td>
</tr>
<tr>
<td>15</td>
<td>Stop Timer at 01, Auto Reset to Preset, Latched Output</td>
</tr>
<tr>
<td>16</td>
<td>Stop Timer at 01, Auto Reset to Preset, Timed Output</td>
</tr>
<tr>
<td>17</td>
<td>Stop Timer at 01, Auto Reset to Zero at 01 End, Timed Output</td>
</tr>
</tbody>
</table>

### DUAL PRESET OPERATING MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual Reset to Zero, Latched Outputs</td>
</tr>
<tr>
<td>2</td>
<td>Manual Reset to Zero, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>3</td>
<td>Manual Reset to Zero, 01 and 02 Timed</td>
</tr>
<tr>
<td>4</td>
<td>Manual Reset to Zero, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>5</td>
<td>Manual Reset to Zero, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>6</td>
<td>Manual Reset to Preset 2, Latched Outputs</td>
</tr>
<tr>
<td>7</td>
<td>Manual Reset to Preset 2, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>8</td>
<td>Manual Reset to Preset 2, 01 and 02 Timed</td>
</tr>
<tr>
<td>9</td>
<td>Manual Reset to Preset 2, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>10</td>
<td>Manual Reset to Preset 2, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>11</td>
<td>Manual Reset to Zero, 01 and 02 Timed</td>
</tr>
<tr>
<td>12</td>
<td>Auto Reset to Zero, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>13</td>
<td>Auto Reset to Preset 2, 01 and 02 Timed</td>
</tr>
<tr>
<td>14</td>
<td>Auto Reset to Preset 2, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>15</td>
<td>Auto Reset to Zero at 02 End, 01 and 02 Timed</td>
</tr>
<tr>
<td>16</td>
<td>Auto Reset to Zero at 02 End, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>17</td>
<td>Auto Reset to Preset 2 at 02 End, 01 and 02 Timed</td>
</tr>
<tr>
<td>18</td>
<td>Auto Reset to Preset 2 at 02 End, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>19</td>
<td>Stop Timer at 02, Manual Reset to Zero, Latched Outputs</td>
</tr>
<tr>
<td>20</td>
<td>Stop Timer at 02, Manual Reset to Zero, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>21</td>
<td>Stop Timer at 02, Manual Reset to Zero, 01 and 02 Timed</td>
</tr>
<tr>
<td>22</td>
<td>Stop Timer at 02, Manual Reset to Zero, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>23</td>
<td>Stop Timer at 02, Manual Reset to Zero, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>24</td>
<td>Stop Timer at 02, Manual Reset to Preset 2, Latched Outputs</td>
</tr>
<tr>
<td>25</td>
<td>Stop Timer at 02, Manual Reset to Preset 2, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>26</td>
<td>Stop Timer at 02, Manual Reset to Preset 2, 01 and 02 Timed</td>
</tr>
<tr>
<td>27</td>
<td>Stop Timer at 02, Manual Reset to Preset 2, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>28</td>
<td>Stop Timer at 02, Manual Reset to Preset 2, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>29</td>
<td>Stop Timer at 02, Auto Reset to Zero, Latched Outputs</td>
</tr>
<tr>
<td>30</td>
<td>Stop Timer at 02, Auto Reset to Zero, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>31</td>
<td>Stop Timer at 02, Auto Reset to Zero, 01 and 02 Timed</td>
</tr>
<tr>
<td>32</td>
<td>Stop Timer at 02, Auto Reset to Zero, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>33</td>
<td>Stop Timer at 02, Auto Reset to Zero, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>34</td>
<td>Stop Timer at 02, Auto Reset to Preset 2, Latched Outputs</td>
</tr>
<tr>
<td>35</td>
<td>Stop Timer at 02, Auto Reset to Preset 2, 01 Timed, 02 Latched</td>
</tr>
<tr>
<td>36</td>
<td>Stop Timer at 02, Auto Reset to Preset 2, 01 and 02 Timed</td>
</tr>
<tr>
<td>37</td>
<td>Stop Timer at 02, Auto Reset to Preset 2, 01 off at 02, 02 Latched</td>
</tr>
<tr>
<td>38</td>
<td>Stop Timer at 02, Auto Reset to Preset 2, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>39</td>
<td>Stop Timer at 02, Auto Reset to Zero at 02 End, 01 and 02 Timed</td>
</tr>
<tr>
<td>40</td>
<td>Stop Timer at 02, Auto Reset to Zero at 02 End, 01 off at 02, 02 Timed</td>
</tr>
<tr>
<td>41</td>
<td>Stop Timer at 02, Auto Reset to Preset 2 at 02 End, 01 and 02 Timed</td>
</tr>
<tr>
<td>42</td>
<td>Stop Timer at 02, Auto Reset to Preset 2 at 02 End, 01 off at 02, 02 Timed</td>
</tr>
</tbody>
</table>

### PANEL CUT-OUT SPACING FOR MULTIPLE UNIT STACKING.

**HORIZONTAL ARRANGEMENT SHOWN.**

**Panel Ventilation:**
- The C48T is designed for close spacing of multiple units. Units can be stacked either horizontally or vertically. For vertical stacking, install the panel latches 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.
**APPLICATION**

**ONE SHOT TIMING CYCLE**

Proper wash down mixture for a food processing plant is an important factor in maintaining the clean environment required. A disinfectant solution is added to the mixing/holding tank used for the wash down cycle. When the holding tank is near empty, a level transducer activates the filler pump. A C48TS is used to turn on the disinfectant solution pump for a preprogrammed amount of time during the filling process of the holding tank.

When the filler pump starts, a momentary contact closure activates User Input 1, resetting the C48 Timer. The timer begins the timing cycle since the run terminal is connected to common. The normally open relay contacts close at the timer reset signal activating the disinfectant solution pump. When the programmed preset is reached, timing stops and the relay deactivates, turning off the pump controlling the disinfectant solution. The C48 Timer’s preset cycle time may be changed according to the manufacturer’s concentration level of the disinfectant.

**PROGRAMMING**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Auto Sc</th>
<th>trAnSE</th>
<th>nSEC (min &amp; sec)</th>
<th>DPEv</th>
<th>D9</th>
</tr>
</thead>
<tbody>
<tr>
<td>rStPv</td>
<td>P</td>
<td>n</td>
<td>yes</td>
<td>rEOut</td>
<td>n</td>
</tr>
<tr>
<td>Ac PrS</td>
<td>rEUnu</td>
<td>n</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rEOut</td>
<td>n</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OutPv</td>
<td>rSk-E</td>
<td></td>
<td></td>
<td></td>
<td></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)</th>
<th>RS485</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>C48T</td>
<td>1 Preset Timer, Reflective LCD</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>C48TS013 C48TS003</td>
</tr>
<tr>
<td></td>
<td>1 Preset Timer, Backlit LCD</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>C48TS113 C48TS103</td>
</tr>
<tr>
<td></td>
<td>2 Preset Timer, Reflective LCD</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>C48TD012 C48TD002</td>
</tr>
<tr>
<td></td>
<td>2 Preset Timer, Reflective LCD</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>C48TD017 C48TD007</td>
</tr>
<tr>
<td></td>
<td>2 Preset Timer, Backlit LCD</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>C48TD112 C48TD102</td>
</tr>
<tr>
<td></td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>C48TD117 C48TD107</td>
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* PNP O.C. output(s) versions are available, contact the factory.

**RELAY OUTPUT BOARDS**

<table>
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<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>NPN O.C. OUTPUT</th>
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<th>RELAY OUTPUT(S)</th>
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**ACCESSORIES**

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<td>SFC48</td>
<td>PC Configuration Software for Windows 3.x and 95 (3.5*disk) (for RS-485 Models)</td>
<td>SFC48</td>
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MODEL PAX-1/8 DIN PRESET TIMER (PAXTM) &
REAL-TIME CLOCK (PAXCK)

- 6-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY
- 4 SEPARATE DISPLAYS (Timer, Counter, Real-Time Clock, and Date)
- CYCLE COUNTING CAPABILITY
- PROGRAMMABLE FUNCTION KEYS/USER INPUTS
- FOUR SETPOINT ALARM OUTPUTS (W/Plug-in card)
- COMMUNICATIONS AND BUS CAPABILITIES (W/Plug-in card)
- BUS CAPABILITIES: DEVICE NET, MODBUS and PROFIBUS-DP
- CRIMSON® PROGRAMMING SOFTWARE
- NEMA 4X/IP65 SEALED FRONT BEZEL

GENERAL DESCRIPTION
The PAXTM (PAX® Timer) and PAXCK (PAX® Clock/Timer) offer many features and performance capabilities to suit a wide range of industrial applications. Both can function as an Elapsed Time Timer or Preset Timer, while the PAXCK also offers Real-Time Clock with Date capability. The Plug-in option cards allow the opportunity to configure the meter for the present application, while providing easy upgrades for future needs.

Both units can function as an Elapsed Time Clock. By using two separate signal inputs and 23 selectable timer ranges, the meters can be programmed to meet most any timing application. With the addition of a Plug-in Setpoint card, they can easily become a dual or quad output preset timer.

The PAXCK can also operate as a Real-Time Clock (RTC), with the Real-Time Clock Card already installed. The meter is capable of displaying time in 12 or 24-hour time formats. The 12-hour format can be displayed in hours and minutes, with or without an AM/PM indication or in hours, minutes, and seconds. The 24-hour format can be displayed in hours and minutes or in hours, minutes, and seconds. The PAXCK is also capable of a calendar display in which the day, month and/or year can be displayed. The meter will recognize leap years, and can automatically adjust for Daylight Savings Time. The Real-Time Clock has the ability to externally synchronize with other PAXCK meters and to provide a uniform display network throughout the plant.

The application calls for both a Preset Timer and a Real-Time Clock at the same time, the PAXCK can handle this requirement as well. The meter provides up to four different displays, accessed via front panel push buttons or external inputs. The displays are Timer (TMR), which displays the current time value; Count (CNT), which displays the current cycle counter value; Date (DAT), which displays the current programmed date; and Real-Time Clock, which displays the current time. A battery-backed Real-Time Clock plug-in card is provided with the PAXCK. This card, which includes a lithium coin-cell battery, will maintain the time and date when main power is removed.

The meters accept inputs from a variety of sources including switch contacts and outputs from CMOS or TTL circuits. The input can be configured to trigger on the edge or level of the incoming pulse. Internal jumpers are available to allow the selection for sinking inputs (active low) or sourcing inputs (active high).

The front panel keys and three user inputs are programmable to perform various meter functions. One of the functions includes exchanging parameter lists, allowing for two separate listings of setpoint values, timer start/stop values, counter start/stop values and RTC daily on and off values.

The meters can have up to four setpoint outputs, determined by the optional plug-in cards. The setpoint plug-in cards provide dual FORM-C relays (5A), quad FORM-A relays (3A) or either quad sinking or quad sourcing open collector logic outputs. The outputs can be assigned to the timer, counter, RTC date, and RTC time. The outputs can also be independently configured to suit a variety of control and alarm requirements.

Plug-in cards can also provide serial communications. These include RS232, RS485, Modbus, DeviceNet, and Profibus-DP. Display values, setpoint alarm values and setpoint states can be controlled through serial communications. With the RS232 or RS485 communication card installed, it is possible to configure the meter using a Windows® based program. The meter configuration data can be saved to a file for later recall.

Once the meters have been initially configured, the parameter list may be locked out from further modification entirely, or the setpoint, timer start/stop values, counter start/stop values, RTC time SET, and Display Intensity can be locked out from further modification entirely, or the setpoint, timer start/stop values, counter start/stop values, RTC time SET, and Display Intensity can be made accessible. This lockout is possible through a security code or user input.

The meters have 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 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 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: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

SAFETY SUMMARY

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.
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ORDERING INFORMATION

Meter Part Numbers

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
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<tbody>
<tr>
<td>PAXCDS</td>
<td>PAXCDS10</td>
<td>Dual Setpoint Relay Output Card</td>
<td>PAXCDS10</td>
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<td>PAXCDS20</td>
<td>Quad Setpoint Relay Output Card</td>
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</tr>
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<td>PAXCDS30</td>
<td>Quad Setpoint Sourcing Open Collector Output Card</td>
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<td>PAXCDS40</td>
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Optional Plug-In Cards

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<tr>
<td></td>
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<td>RS485 Serial Communications Output Card with Terminal Block</td>
<td>PAXCDS10</td>
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<td></td>
<td>Extended RS485 Serial Communications Output Card with Dual RJ11 Connector</td>
<td>PAXCDS1C</td>
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<td>DeviceNet Communications Card (Terminal Block)</td>
<td>PAXCDS30</td>
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<td>Modbus Communications Card</td>
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<td>Profibus-DP Communications Card</td>
<td>PAXCDS50</td>
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<td>PAXRTC</td>
<td>PAXRTC00</td>
<td>Real-Time Clock Card (Replacement Only)</td>
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<tr>
<td></td>
<td></td>
<td>Crimson® 2 PC Configuration Software for Windows 98, ME, 2000 and XP</td>
<td>SFCRD200</td>
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</table>

*Crimson® software is available for download from http://www.redlion.net*/
GENERAL METER SPECIFICATIONS

1. DISPLAY: 6 digit, 0.56” (14.2 mm) red sunlight readable or standard green LED

2. POWER:
   AC Versions (PAXCK000, PAXTM000):
   - AC Power: 85 to 250 VAC, 50/60 Hz, 18 VA
   - Isolation: 2300 Vrms for 1 min. to all inputs and outputs. (300 V working)
   DC Versions (PAXCK010, PAXTM010):
   - DC Power: 11 to 36 VDC, 14 W
     - (Derate operating temperature to 40°C if operating <15 VDC and three plug-in 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. ANNUNCIATORS:
   - TMR - Timer Display
   - CNT - Cycle Counter Display
   - DAT - Real-Time Clock Date Display
     - - Real-Time Clock Time Display
   - SP1 - Setpoint 1 Output
   - SP2 - Setpoint 2 Output
   - SP3 - Setpoint 3 Output
   - SP4 - Setpoint 4 Output

5. KEYPAD: 3 programmable function keys, 5 keys total.

6. TIMER DISPLAY:
   - Timer Range: 23 Selectable Ranges
   - Timing Accuracy: ± 0.01%
   - Minimum Digit Resolution: 0.001 Sec.
   - Maximum Least Significant Digit Resolution: 1 Hr.
   - Maximum Display: 999999

7. CYCLE COUNTER DISPLAY:
   - Counter Range: 0 to 999999
   - Digit Resolution: 1 cycle
   - Maximum Count Rate: 50 Hz

8. REAL-TIME/DATA DISPLAY (PAXCK):
   - Real-Time Display: 5 display formats
     - Hour/Min/Sec (12 or 24 Hr. format); Hour/Min (24 Hr.); Hour/Min (12 Hr. with or without AM/PM indication)
   - Date Display: 7 display formats
     - Month/Day or Day/Month (numeric or 3-letter Month format); Month/Day/Year or Day/Month/Year (all numeric); Day of Week/Day (3-letter Day of Week format)
   - Time Accuracy: ± 5 sec./Month (1 min./year) with end-user calibration
   - Battery: Lithium 2025 coin cell
   - Battery Life Expectancy: 10 yrs. typical
   - Synchronization Interface: Two-wire multi-drop network (RS485 hardware), 32 units max., operates up to 4000 ft.
   - Isolation To Timer & User Input Commons: 500 Vrms for 1 min.
   - Working Voltage: 50 V. Not isolated from all other commons.

9. REAL-TIME CLOCK CARD:
   - Field replaceable plug-in card
   - Time Accuracy: ± 5 secs./Month (1 min/year) with end-user calibration
   - Battery Life: 10 years
   - Synchronization Interface: Two-wire multi-drop network (RS485 hardware), 32 units max., operates up to 4000 ft.
   - Isolation To Timer & User Input Commons: 500 Vrms for 1 min.

10. TIMER INPUTS A and B:
    - Logic inputs configurable as Current Sinking (active low) or Current Sourcing (active high) via a single plug jumper.
    - Current Sinking (active low): $V_{IL} = 0.9$ V max., 22KΩ pull-up to +12 VDC
    - Current Sourcing (active high): $V_{IH} = 3.6$ V min., 22KΩ pull-down, Max.
    - Continuous Input: 30 VDC
    - Timer Input Pulse Width: 1 msec min.
    - Timer Start/Stop Response Time: 1 msec max.
    - Filter: Software filtering provided for switch contact debounce. Filter enabled or disabled through programming.
    - If enabled, filter results in 50 msec start/stop response time for successive pulses on the same input terminal.

11. USER INPUTS:
    - Three programmable user inputs
      - Logic inputs configurable as Current Sinking (active low) or Current Sourcing (active high) through a single plug jumper.
      - Current Sinking (active low): $V_{IL} = 0.9$ V max., 22KΩ pull-up to +12 VDC
      - Current Sourcing (active high): $V_{IH} = 3.6$ V min., 22KΩ pull-down, Max.
      - Continuous Input: 30 VDC
      - Isolation To Timer Input Common: Not isolated
      - Response Time: 10 msec

12. MEMORY: Non-volatile EEPROM retains all programming parameters and display values.

13. 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. RH non-condensing
    - Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g’s.
    - Shock According to IEC 68-2-27: Operational 25 g (10g relay), 11 msec in 3 directions.
    - Altitude: Up to 2000 meters

14. CERTIFICATIONS AND COMPLIANCE:
    - SAFETY
      - UL Recognized Component, File # E179259, UL61010A-1, CSA C22.2 No. 61010-1
      - 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
      - CB Scheme Test Certificate # US/8843A/UL
      - CB Scheme Test Report # 04ME11209-20041018
      - Issued by Underwriters Laboratories, Inc.
      - IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
      - IP65 Enclosure rating (face only), IEC 529
      - IP20 Enclosure rating (rear of unit), IEC 529

    - ELECTROMAGNETIC COMPATIBILITY
      - Immunity to EN 50082-2
        - Electrostatic discharge EN 61000-4-2 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

      - Emissions to EN 50081-1
        - RF interference EN 55022 Class B
        - Power mains class B

    - Note: Refer to the EMC Installation Guidelines section for more information.

15. CONNECTIONS:
    - High compression, cage-clip 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)

16. CONSTRUCTION:
    - This meter is rated for NEMA 4X/IP65 outdoor use.

17. WEIGHT: 10.1 oz. (286 g)
OPTIONAL PLUG-IN CARDS AND ACCESSORIES

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

Adding Option Cards
The PAX and MPAX series meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time.

COMMUNICATION CARDS (PAXCDS)
A variety of communication protocols are available for the PAX and MPAX series.

The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Real-Time Clock Card (PAXRTC). The plug-in cards can be installed initially or at a later date.

SERIAL COMMUNICATIONS CARD
Type: RS485 or RS232
Isolation To Sensor & User Input Commons: 500 Vrms for 1 minute.
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
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I 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 38,400.
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 ASIC
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rate: 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.

SETPOINT CARDS (PAXCDS)
The PAX and MPAX series has 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:
- PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
- PAXCDS20 - Quad Relay, FORM-A, Normally open only
- PAXCDS30 - Isolated quad sinking NPN open collector
- PAXCDS40 - Isolated quad sourcing PNP open collector

DUAL RELAY CARD
Type: Two FORM-C relays
Isolation To Timer & User Input Commons: 2300 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
Timed Output Accuracy: ±0.01% -10 msec.

QUAD RELAY CARD
Type: Four FORM-A relays
Isolation To Timer & 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
Timed Output Accuracy: ±0.01% -10 msec.

QUAD SINKING OPEN COLLECTOR CARD
Type: Four isolated sinking NPN transistors.
Isolation To Timer & 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: 400 usec. nominal with 2 msec. nominal turnoff
Timed Output Accuracy: ±0.01% -10 msec.

QUAD SOURCING OPEN COLLECTOR CARD
Type: Four isolated sourcing PNP transistors.
Isolation To Timer & 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: 400 usec. nominal with 2 msec. nominal turnoff
Timed Output Accuracy: ±0.01% -10 msec.

PROGRAMMING SOFTWARE
The Crimson® software is a Windows® based program that allows configuration of the PAX® meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter’s program can then be saved in a PC file for future use. A PAX® serial plug-in card is required to program the meter using the software.
1.0 Installing the Meter

Installation

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

While holding the meter in place, push the panel latch over the rear of the meter 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 meter is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

Installation Environment

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

2.0 Setting the Jumppers

To access the jumpers, 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.

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

Timer Input Logic Jumper

One jumper is used for the logic state of both timer inputs. Select the proper position to match the input being used.

User Input Logic Jumper

One jumper is used for the logic state of all user inputs. If the user inputs are not used, it is not necessary to check or move this jumper.

JUMPER SELECTIONS

The  indicates factory setting.
3.0 Installing Plug-In Cards

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 meters.

**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. 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. Apply the label to the area designated by the large case label.

**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.

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4.0 Wiring the Meter

**Wiring Overview**

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

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) wire, 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. The shield unconnected and insulated from earth ground. Listed below are some EMC guidelines for successful installation in an industrial environment.

   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 # 28B2029-04A

   - Ferrite Suppression Cores for power cables:
     - Schaffner # FN610-1/07 (RLC# LFI0000)
     - 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.
### 4.1 POWER WIRING

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

**DC Power**
- Terminal 1: +VDC
- Terminal 2: -VDC

### 4.2 TIMER INPUT WIRING

Before connecting the wires, the Timer Input logic jumper should be verified for proper position.

**Two Wire Proximity, Current Source**

**Current Sinking Output**

**Current Sourcing Output**

**Switch or Isolated Transistor; Current Sink**

**Switch or Isolated Transistor; Current Source**

**Interfacing With TTL**

**Emitter Follower; Current Source**

---

**CAUTION:** Timer Input common is NOT isolated from User Input common. In order to preserve the safety of the meter application, the timer 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.

### 4.3 USER INPUT WIRING

Before connecting the wires, the Timer Input logic jumper should be verified for proper position. When the user input is configured for cycle count, in module 4, the count input should be wired between terminals 7 & 10.

**Sinking Logic**
- Terminals 7-9: Connect external switching device between the appropriate User Input terminal and User Comm.
- Terminal 10: Connect external switching device between the User Inputs and the User Common.
- The user inputs of the meter are internally pulled up to +12 V with 22 KΩ 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 22 KΩ resistance.
- The input is active when a voltage greater than 3.6 VDC is applied.
### 4.4 SETPOINT (ALARMS) WIRING

<table>
<thead>
<tr>
<th>SETPOINT PLUG-IN CARD TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DUAL RELAY PAXCD10</strong></td>
</tr>
<tr>
<td>20 - COMMON</td>
</tr>
<tr>
<td>21 - 01 SNK.</td>
</tr>
<tr>
<td>22 - 02 SNK.</td>
</tr>
<tr>
<td>23 - 03 SNK.</td>
</tr>
<tr>
<td>24 - 04 SNK.</td>
</tr>
<tr>
<td>25 - COMMON</td>
</tr>
<tr>
<td><strong>QUAD RELAY PAXCD20</strong></td>
</tr>
<tr>
<td>20 - RLY1</td>
</tr>
<tr>
<td>21 - COMM</td>
</tr>
<tr>
<td>22 - RLY2</td>
</tr>
<tr>
<td>23 - RLY3</td>
</tr>
<tr>
<td>24 - COMM</td>
</tr>
<tr>
<td>25 - RLY4</td>
</tr>
<tr>
<td><strong>QUAD SINKING PAXCD30</strong></td>
</tr>
<tr>
<td>20 - COMMON</td>
</tr>
<tr>
<td>21 - 01 SNK.</td>
</tr>
<tr>
<td>22 - 02 SNK.</td>
</tr>
<tr>
<td>23 - 03 SNK.</td>
</tr>
<tr>
<td>24 - 04 SNK.</td>
</tr>
<tr>
<td>25 - COMMON</td>
</tr>
<tr>
<td><strong>QUAD SOURCING PAXCD40</strong></td>
</tr>
<tr>
<td>20 - EXTERNAL SUPPLY</td>
</tr>
<tr>
<td>21 - 01 SRC.</td>
</tr>
<tr>
<td>22 - 02 SRC.</td>
</tr>
<tr>
<td>23 - 03 SRC.</td>
</tr>
<tr>
<td>24 - 04 SRC.</td>
</tr>
<tr>
<td>25 - COMMON</td>
</tr>
</tbody>
</table>

### 4.5 SERIAL COMMUNICATION WIRING

#### RS232 Communications

**PAX METER (DTE)**

- TXD: Transmit Data
- RXD: Receive Data
- COMM: Common

**RECEIVING DEVICE**

- DB25: 2 3 6 7 8
- DB26: 2 3 4 5 6
- DB9: 2 3 4 5 6

[Terminal Block Connection Figure]

**FEMALE**

- PIN 2: TX
- PIN 3: RX
- PIN 5: COMMON

[Extended Comms Connection Figure]

**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.

[Terminal Block Connection Figure]

[Extended Comms Connection Figure]
### 4.6 REAL-TIME CLOCK WIRING (PAXCK)

Time synchronization between multiple PAXCK meters can be accomplished through a hardware interface on the Real-Time Clock option card. This RS485 type interface allows connection of up to 32 PAXCK meters in a two-wire multidrop network, at distances up to 4000 ft.

In a synchronization network, one PAXCK meter is programmed as the Host, while all other meters are programmed as Slaves. Once every hour, the Host meter outputs a time synchronization pulse onto the network. Upon receiving the synchronization pulse, each Slave meter automatically adjusts the minutes and seconds of its RTC Time setting to synchronize with the Host.

### 5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

#### KEY

- **DSP**: Index display through Timer, Cycle Counter, Date, and Time
- **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) ***

* Cycle counter and Real-Time Clock displays are locked out in Factory Settings.
** Factory setting for the F1 and F2 keys is NO mode.
*** Factory setting for the RST key is dr 5t - £ (Reset Display)

#### DISPLAY MODE OPERATION

- Exit programming and return to Display Mode
- Store selected parameter and index to next parameter
- Increment selected parameter value or selections
- Decrement selected parameter value or selections
- Selects digit location in parameter values

#### PROGRAMMING MODE OPERATION

- Exit programming and return to Display Mode
- Store selected parameter and index to next parameter
- Increment selected parameter value or selections
- Decrement selected parameter value or selections
- Selects digit location in parameter values
6.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU

DISPLAY MODE

The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown: Timer (TMR), Cycle Counter (CNT), or Date (DAT). The Time Display for the Real-Time Clock is shown with no annunciator. Any of these displays can be locked from view through programming. (See Module 3.)

PROGRAMMING MODE

Two programming modes are available.

Full Programming Mode permits all parameters to be viewed and modified. Upon entering this mode, the front panel keys change to Programming Mode operations. This mode should not be entered while a process is running, since the meter timing functions and User Input response may not operate properly while in Full Programming Mode.

Quick Programming Mode permits only certain parameters to be viewed and/or modified. When entering this mode, the front panel keys change to Programming Mode operations, and all meter functions continue to operate properly. Quick Programming Mode is configured in Module 3. The Display Intensity Level “*set*” parameter is only available in the Quick Programming Mode when the security code is non-zero. For a description, see Module 9—Factory Service Operations. Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming Mode.

PROGRAMMING TIPS

The Programming Menu is organized into nine modules. (See above.) These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. Note that Modules 5 through 8 are only accessible when the appropriate plug-in option card is installed. If lost or confused while programming, press the DSP key to exit programming mode and start over. When programming is complete, it is recommended to record the meter settings on the Parameter Value Chart and lock-out parameter programming with a User Input or lock-out code. (See Modules 2 and 3 for lock-out details.)

FACTORY SETTINGS

Factory Settings may be completely restored in Module 9. This is a good starting point if encountering programming problems. Throughout the module description sections which follow, the factory setting for each parameter is shown below the parameter display. In addition, all factory settings are listed on the Parameter Value Chart following the programming section.

ALTERNATING SELECTION DISPLAY

In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternation between the parameter (top display) and the parameter’s Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.

STEP BY STEP PROGRAMMING INSTRUCTIONS:

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at 1SP/0)

The Programming Mode is exited by pressing the DSP key. For a description, see Module 3 for programming lock-out details.)

PROGRAMMING MODE ENTRY (PAR KEY)

The Programming Mode is entered by pressing the PAR key. If this mode is not accessible, then programming programming is locked by either a security code or a hardware lock. (See Modules 2 and 3 for programming lock-out details.)

MODULE ENTRY (ARROW & PAR KEYS)

Upon entering the Programming Mode, the display alternates between Pr and the present module (initially Pr). The arrow keys (F1, F2, F3, F4) are used to select the desired module, which is then entered by pressing the PAR key.

PARAMETER (MODULE) MENU (PAR KEY)

Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pr. From this point, programming may continue by selecting and entering additional modules. (See MODULE ENTRY above.)

PARAMETER SELECTION ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1, F2, F3, F4) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)

For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

In addition, the RST key can be used in combination with the arrow keys to enter numerical values. The RST key is pressed to select a specific digit to be changed, which blinks when selected. Once a digit is selected, the arrow keys are used to increment or decrement that digit to the desired number. The RST key is then pressed again to select the next digit to be changed. This “select and set” sequence is repeated until each digit is displaying the proper number. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pr)

The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pr 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.)
Module 1 is the programming module for the Timer Input Parameters. In the Display Mode, the TMR annunciator indicates the Timer display is currently being shown. An EXCHANGE PARAMETER LISTS feature, which includes the Timer Start and Timer Stop Values, is explained in Module 2.

**TIMER RANGE**

23 TIMER RANGE SELECTIONS
(S = SEC; M = MIN; H = HR; D = DAY)

<table>
<thead>
<tr>
<th>RANGE SELECTION</th>
<th>MAXIMUM DISPLAY</th>
<th>DISPLAY RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECONDS</td>
<td>999999</td>
<td>1 SEC</td>
</tr>
<tr>
<td>999999</td>
<td>0.1 SEC</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>0.01 SEC</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>0.001 SEC</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
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<td>H</td>
</tr>
<tr>
<td>999999</td>
<td>0.1 MIN</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>0.01 MIN</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>0.001 MIN</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>1 HR</td>
<td>H</td>
</tr>
<tr>
<td>999999</td>
<td>0.1 HR</td>
<td>H</td>
</tr>
<tr>
<td>999999</td>
<td>0.01 HR</td>
<td>M</td>
</tr>
<tr>
<td>999999</td>
<td>0.001 HR</td>
<td>H</td>
</tr>
<tr>
<td>999999</td>
<td>1 DAY</td>
<td>D</td>
</tr>
<tr>
<td>999999</td>
<td>0.1 DAY</td>
<td>D</td>
</tr>
<tr>
<td>999999</td>
<td>0.01 DAY</td>
<td>D</td>
</tr>
<tr>
<td>999999</td>
<td>0.001 DAY</td>
<td>D</td>
</tr>
</tbody>
</table>

**TIMER INPUT OPERATION**

This parameter determines how the Timer Input Signals affect the “Run/Stop” status of the Timer. The timing diagrams below reflect a Sinking input setup (active low). A Sourcing input setup (active high) is available through plug jumper selection (see Section 2.0). In this case, the logic levels of the timing diagrams would be inverted.

For **LEVEL** and **Edge** - 1 operation, Input B provides a level active Timer Inhibit function. This function is also available through a User Input (see Module 2). Timing diagrams are shown below for “**LEVEL**” through “**Hold**” modes. The “**Hold**” through “**HR-St._2**” modes are identical except the timer display value is also reset at “Time Start” edges. In the “**Hold**” and “**HR-St._2**” modes, the timer display value remains held and only updates when a Timer Start (Input A) or Timer Stop (Input B) edge occurs.

For **Edge** - 1, “**Edr** - 1” and **Hold** - 2, “**Edr** - 2” operation, the TMR annunciator indicates the Timer display is currently being shown. An EXCHANGE PARAMETER LISTS feature, which includes the Timer Start and Timer Stop Values, is explained in Module 2.

**TIMER START VALUE**

The Timer returns to this value whenever a Timer Reset occurs. The value is entered in the same display format as the Timer Range selected. Non-zero values are normally used for “timing down” applications, but they can also provide an “offset” value when timing up.

**TIMER STOP VALUE**

The Timer stops when this value is reached, regardless of the signal levels on the Timer Inputs. Selecting **YES** will display the **VALUE** sub-menu where the Stop Value can be set or changed. The Stop Value is entered in the same display format as the Timer Range selected. This Stop Condition is cleared when a Timer Reset occurs. Select **NO** if a Stop Value is not being used.
**6.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FAC)**

Module 2 is the programming module for the 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. User Inputs should be programmed while in the inactive state.

Three front panel Function Keys, F1, F2 and RST, 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 or 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 active) functions will be performed while at least one of those User Inputs or Function Keys are activated. The momentary (edge triggered) functions are performed every time any of those User Inputs or Function Keys transition to the active state.

Some functions have a sublist of parameters, which appears when PAR is pressed at the listed function. A sublist provides yes/no selection for Display Values or Setpoints which pertain to the programmed function. The function will only be performed on the parameters entered as YES in the sublist. 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, in order to access any parameters for the User Inputs or Function Keys which follow.

**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.

**FLASH TIMER ANNUNCiator**

- **FLASH**
- **NO**

This parameter allows the Timer annunciator (TMR) to flash when the Timer is running or stopped/inhibited. Select NO if a flashing indicator is not desired.

**TIMER RESET AT POWER-UP**

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

The Timer can be programmed to Reset at each meter power-up.

**TIMER INPUT STATE AT POWER-UP**

- **IN-UP**
- **STOP**
- **SAFE**

Determines the “Run/Stop” State of the Timer at Power-up. This parameter does not apply to Level timer input operation.

- **STOP** - Timer Stopped at power-up, regardless of prior run/stop state
- **SAFE** - Timer assumes the same run/stop state it was in prior to power-down

**PROGRAMMING MODE LOCK-OUT**

- **USER-1**
- **PLOC**

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 Lock-out. A security code can be configured to allow complete programming access during User Input lock-out. This parameter does not apply to the function keys. Program only one user input for this function.

**EXCHANGE PARAMETER LISTS**

- **USER-1**
- **L ISK**

Two lists of parameter entries are available for the Timer/Counter Start and Stop Values; Setpoint On/Off and Time-Out Values, and Setpoint Daily On/Off Occurrence (for Real-Time Clock option). The two lists are named L ISK-1 and L ISK-2. If a User Input is used to select the list, then L ISK-1 is selected when the User Input is in the inactive state and L ISK-2 is selected when the User Input is in the active state (maintained action). If a front panel Function Key is used to select the list, then the list will toggle for each key press (momentary action). 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 L ISK-1 and L ISK-2, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the Timer/Counter Start and Stop Values (t Start, t Stop,)* t Start, t Stop, (t Start, t Stop), and if applicable, the Setpoint On/Off and Time-Out Values (SP-1, SP-2, SP-3, SP-4, SP-5, SP-6, SP-7, SP-8, SP-9, SP-10, SP-11, SP-12), and the Setpoint Daily On/Off Occurrence (d ON-1, d ON-2, do ON-3, do ON-4, doff-1, doff-2, doff-3, doff-4). If any other parameters are changed, the other list values must be reprogrammed. Program only one user input for this function.

**Note:** When downloading the Crimson® program containing List A/B, make sure that both the software and meter have the same list active. The active list in the Crimson® program is the one being displayed in Input Setup and/or Setpoint Alarms category.
DISPLAY SELECT (Level Active)

When active (maintained action), the meter continuously scrolls through all displays that are not “locked-out” in the Display mode. (See Module 3 for Display Lock-out details.) A sub-menu provides Scrolling Speed selection.

Scrolling Speed

- 25 sec
- 1 sec

DISPLAY SELECT (Edge Triggered)

When activated (momentary action), the meter advances to the next display that is not “locked-out” in the Display mode. (See Module 3 for Display Lock-out details.)

DISPLAY RESET (Level Active)

When active (maintained action), the meter continually resets only the currently shown display. If the RTC Time or Date is displayed, this function applies to the Outputs assigned to the RTC, and does not Reset the actual RTC Time or Date display. (See Module 6 for details on Output Assignment and Output Reset with Display Reset.)

DISPLAY RESET (Edge Triggered)

When activated (momentary action), the meter resets only the currently shown display. This is the factory setting for the Reset (RST) key. If the RTC Time or Date is displayed, this function applies to the Outputs assigned to the RTC, and does not Reset the actual RTC Time or Date display. (See Module 6 for details on Output Assignment and Output Reset with Display Reset.)

MAINTAINED RESET (Level Active)

When active (maintained action), the meter continually resets the displays entered as YES in the sublist. The sublist appears when the PAR key is pressed. This function does not apply to the RTC Time or Date displays.

DISPLAY HOLD (Level Active)

When active (maintained action), the meter “freezes” the display values entered as YES in the sublist, while normal meter operation continues internally. Program only one user input for this function.

DISPLAY HOLD and RESET (Level Active Reset)

When activated, the meter “freezes” the display values entered as YES in the sublist, before performing an internal Maintained Reset on the selected displays. This function does not apply to the RTC Time or Date displays.

DISPLAY HOLD and RESET (Edge Triggered Reset)

When activated, the meter “freezes” the display values entered as YES in the sublist, before performing an internal Momentary Reset on the selected displays. This function does not apply to the RTC Time or Date displays. Program only one user input for this function.

INHIBIT (Level Active)

When active (maintained action), timing and counting ceases for the displays entered as YES in the sublist. The inhibit function is not a Stop or Start event in Setpoint programming. This function does not apply to RTC Time or Date displays. Program only one user input for this function.

CHANGE DIRECTION (Level Active)

When active (maintained action), the timing or counting direction for the display entered as YES in the sublist, will be reversed from the direction set by the Timing Direction (Ch-dir) parameters in Modules 1 and 4. (Program only one User Input per display for this function.) This function does not apply to RTC Time or Date displays.
When active (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEU) 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 unit will power-up at the last saved intensity level.

**Note:** The next two parameters only appear when an RS232 or RS485 Serial Communications Card is installed in the meter.

### PRINT REQUEST

When activated, the meter issues a block print through the serial port. The specific values transmitted during a print request are selected with the Print Options parameter in Module 7. For User Inputs (level active), the meter transmits blocks repeatedly as long as the input is active. For Function Keys, (edge triggered) only one block is transmitted per key press.

### PRINT REQUEST and RESET (Edge Triggered)

When activated (momentary action), the meter first issues a block print through the serial port, and then performs a Momentary Reset on the displays entered as Yes in the sublist. The specific values transmitted in the print block are selected with the Print Options parameter in Module 7. Only one transmit and reset occurs per User Input activation or Function Key press.

**Note:** The remaining parameters only appear when a Setpoint Card is installed in the meter.

### OUTPUT HOLD (Level Active)

When active (maintained action), the meter “holds” (maintains) the present output state for all Setpoints entered as Yes in the sublist. Does not apply to Output Set and Reset User Inputs. Program only one user input for this function.

### OUTPUT SET (Level Active)

When activated (maintained action), the meter continually activates the output for all Setpoints entered as Yes in the sublist.

<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>

### OUTPUT SET (Edge Triggered)

When activated (momentary action), the meter activates the output for all Setpoints entered as Yes in the sublist.

<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>

### OUTPUT RESET (Level Active)

When activated (maintained action), the meter continually deactivates the output for all Setpoints entered as Yes in the sublist.

<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>

### OUTPUT RESET (Edge Triggered)

When activated (momentary action), the meter deactivates the output for all Setpoints entered as Yes in the sublist.

<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

**Note:** The next two parameters only appear when an RS232 or RS485 Serial Communications Card is installed in the meter.
Module 3 is the programming module for setting the Display Lock-out Parameters and the "Quick Programming Mode" Value Access Parameters. In the Quick Programming mode, after the PROGRAM LOCKOUT PARAMETERS and before the Security Code (@Code), a Display Intensity Level (@DISPLAY-I) parameter is available when the security code is non-zero. It allows the display intensity to be set to 1 of 16 levels (0-15).

DISPLAY LOCK-OUT PARAMETERS

When operating in the Display Mode, the meter displays can be viewed consecutively by repeatedly pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown. Timer (TMR), Cycle Counter (CNT), or Date (DAT). The Time Display for the Real-Time Clock is shown with no annunciator. Any of these displays can be locked from view with the DISPLAY LOCK-OUT parameters. Using these parameters, each display can be programmed for "Read" or "Lock" defined as follows:

PROGRAM LOCK-OUT PARAMETERS (VALUE ACCESS)

"Full" Programming Mode permits all parameters to be viewed and modified. This programming mode can be locked with a Security Code and/or a User Input. When locked, and the PAR key is pressed, the meter enters a Quick Programming Mode. In this mode, access to Setpoint Values, Timer & Cycle Counter Start/Stop Values, and Time Setting for the Real-Time Clock can be programmed for "Read", "Enter", or "Lock" defined as follows:

SETPOINT 1 to 4 VALUE ACCESS ** (n = 1 thru 4)

- ** These parameters only appear if a Setpoint option card is installed.

** SECURITY CODE

Entry of a non-zero value will cause the @Code prompt to appear when trying to access the “Full” Programming Mode. Access will only be allowed after entering a matching security code or the universal unlock code of 255. With this lock-out, a User Input would not have to be used for the Program Lock-out function. Note however, the Security Code lock-out is overridden when an User Input, configured for Program Lock-out (PLOC), is not active (See Chart.)

** PROGRAMMING MODE ACCESS

Throughout this bulletin, Programming Mode (without Quick in front) always refers to “Full” Programming.

** TIMER & CYCLE COUNTER START/STOP VALUE ACCESS

** PAXCK: REAL-TIME CLOCK TIME SETTING ACCESS

This parameter can be programmed for Ent or LOC. Selecting Ent allows setting or changing the RTC Time in Quick Programming mode.
Module 4 is the programming module for the Cycle Counter Parameters. In the Display Mode, the CNT annunciator indicates the Cycle Counter display is currently being shown. An Exchange Parameter Lists feature, which includes the Cycle Counter Start and Stop Values, is explained in Module 2.

### Cycle Counter Count Source

- **None**
- **User 1**
- **User 2**
- **User 3**
- **User 4**
- **User 5**
- **Timer Reset**
- **Output ON/OFF**

This parameter selects the source from which a count is added to or subtracted from the Cycle Counter. Select **None** if the Cycle Counter is not being used, which will exit the module and bypass the remaining parameters.

When **User 1** is selected, a count is generated each time the User 1 Input is activated. When selected as the count source, User Input 1 can still be programmed to perform a User Function described in Module 2, if desired. In this case, the Cycle Counter would be counting the number of times the particular User Function occurred.

The Timer Reset (**Timer Reset**) selection generates a count when either a manual or automatic reset occurs. (See Module 6 for programming Automatic Resets.)

The Output ON/OFF selections generate a count when the chosen output either activates or deactivates. These selections only appear when a Setpoint Card is installed. O3 and O4 selections only appear for Quad Setpoint cards.

### Cycle Counter Counting Direction

This parameter can be reversed through a User Input. (See Module 2.)

### Cycle Counter Start Value

- **00000** to **99999**

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

### Cycle Counter Stop Value

- **00000** to **99999**

The Cycle Counter stops counting when this value is reached, regardless of the operation of the Timer. Selecting **Yes** will display the Value sub-menu where the Stop Value can be set or changed. The Stop condition is cleared when a Cycle Counter Reset occurs. Select **No** if a Stop Value is not used.

### Cycle Counter Reset at Power-up

- **No**
- **Yes**

The Cycle Counter can be programmed to Reset at each meter power-up.

### Predefined Timer Operating Mode

This parameter is used to select Predefined Operating Modes for the Timer. These modes cover a variety of timing applications frequently encountered in industrial control processes. When using a Predefined mode, the operator needs only to set the actual Setpoint On/Off or Time-out values for the particular application. However, each programming parameter will still be accessible, in order to make modifications to the predefined settings if desired.

The Predefined modes control the activation and deactivation of Output 1, in relation to Start and Reset signals applied to the Timer inputs. (See timing diagrams which follow.) When a selection other than **No** is chosen, the parameters for Setpoint 1 (**SP 1**) in Module 6 are automatically configured to implement the selected operating mode. For some modes, parameters in Modules 1 and 2 are also automatically configured to properly implement the predefined mode. Refer to the chart shown with the timing diagrams for the specific parameters loaded for each predefined mode. Also, note the specific external wiring or plug jumper settings required for some modes.

The Setpoint On/Off or Time-out values for the specific application should be entered directly in Module 5 after selecting the operating mode. Only the value parameters which apply to the selected mode are displayed. These values can also be entered through Module 6, Setpoint (Alarm) Parameters, if desired.

Select **No** if not using a Predefined Operating Mode, in which case Setpoint parameters must all be individually programmed for the particular application.
Timing Diagrams for Predefined Timer Operating Modes

NOTE: Input A is shown as a Sourcing input (active high). If a Sinking input (active low) is used, the logic levels for Input A would be inverted.

The input signal must be wired to both the Input A and User Input 1 terminals. The Timer Input plug jumper and the User Input plug jumper must both be set to the same position (either both SNK or both SRC).

On-Delay Timing

On-Delay / Interval Timing

Off-Delay Timing

Interval Timing (Level triggered)

Repeat Cycle Timing

Interval Timing (Edge triggered)

Parameter Settings for Predefined Timer Operating Modes

**MODULE 1 - Timer Input Parameters (1 - INP)**

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>ON-dLY</th>
<th>OFF-dLY</th>
<th>rEPERk</th>
<th>dLY INh</th>
<th>INh - L</th>
<th>INh - E</th>
</tr>
</thead>
<tbody>
<tr>
<td>INP DP</td>
<td>Timer Input Operation</td>
<td>EdrS-2</td>
<td>EdrS-2</td>
<td>EdrS-2</td>
<td>EdrS-2</td>
<td>LEUrSk</td>
<td>EdrS-2</td>
</tr>
</tbody>
</table>

**MODULE 2 - User Input Parameters (2-FAC)**

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>ON-dLY</th>
<th>OFF-dLY</th>
<th>rEPERk</th>
<th>dLY INh</th>
<th>INh - L</th>
<th>INh - E</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER - 1</td>
<td>User Input 1</td>
<td>N/A</td>
<td>rSk - L</td>
<td>N/A</td>
<td>N/A</td>
<td>O-Sk - E</td>
<td>N/A</td>
</tr>
<tr>
<td>rSk</td>
<td>Reset Key</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

**MODULE 6 - Setpoint Parameters (6-SPL)**

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>ON-dLY</th>
<th>OFF-dLY</th>
<th>rEPERk</th>
<th>dLY INh</th>
<th>INh - L</th>
<th>INh - E</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPSEL</td>
<td>Setpoint Select</td>
<td>SP - 1</td>
<td>SP - 1</td>
<td>SP - 1</td>
<td>SP - 1</td>
<td>SP - 1</td>
<td>SP - 1</td>
</tr>
<tr>
<td>A5N - 1</td>
<td>Setpoint Assignment</td>
<td>k - dSP</td>
<td>k - dSP</td>
<td>k - dSP</td>
<td>k - dSP</td>
<td>k - dSP</td>
<td>k - dSP</td>
</tr>
<tr>
<td>ACL - 1</td>
<td>Setpoint Action</td>
<td>LACKh</td>
<td>ON-OFF</td>
<td>ON-OFF</td>
<td>OUt - k</td>
<td>ON-OFF</td>
<td>ON-OFF</td>
</tr>
<tr>
<td>OUT - 1</td>
<td>Output Logic</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
</tr>
<tr>
<td>ON - 1</td>
<td>Setpoint On</td>
<td>VALUE</td>
<td>k - Skrb</td>
<td>VALUE</td>
<td>VALUE</td>
<td>k - Skrb</td>
<td>k - Skrb</td>
</tr>
<tr>
<td>SP - 1</td>
<td>Setpoint On Value</td>
<td>T*</td>
<td>N/A</td>
<td>T1*</td>
<td>T1*</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>OFF - 1</td>
<td>Setpoint Off</td>
<td>N/A</td>
<td>VALUE</td>
<td>N/A</td>
<td>VALUE</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SPOF - 1</td>
<td>Setpoint Off Value</td>
<td>N/A</td>
<td>T*</td>
<td>N/A</td>
<td>T2*</td>
<td>N/A</td>
<td>T*</td>
</tr>
<tr>
<td>TDUL - 1</td>
<td>Time-out Value</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>T*</td>
</tr>
<tr>
<td>TSUP - 1</td>
<td>Timer Stop</td>
<td>NO</td>
<td>0 -OFF</td>
<td>NO</td>
<td>0 -OFF</td>
<td>0 -OFF</td>
<td>0 -OFF</td>
</tr>
<tr>
<td>RUCO - 1</td>
<td>Timer/Counter Auto Reset</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>QSRd - 1</td>
<td>Output Reset wide display Reset</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>L &amp; T - 1</td>
<td>Setpoint Annunciator</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
<td>NOr</td>
</tr>
<tr>
<td>P - UP</td>
<td>Power-up State</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

* Refer to timing diagrams. These parameters are the actual Setpoint On/Off or Time-Out values set by the user for the specific application.
Module 6 is the programming module for the Setpoint (Alarm) Output Parameters. This programming module can only be accessed if a Setpoint card is installed. Depending on the card installed, there will be two or four Setpoint outputs available. The Setpoint Assignment and Setpoint Action parameters determine the applicable Setpoint features, and dictate which subsequent parameters will appear for the Setpoint being programmed.

This section of the bulletin replaces the bulletin shipped with the Dual and Quad Setpoint plug-in cards. Discard the separate bulletin when using Setpoint plug-in cards with the PAXCK and PAXTM.

**SETPOINT SELECT**

Select the Setpoint (alarm) output to be programmed. This provides access to the parameters for that particular Setpoint. The "n" in the following parameter displays, reflects the chosen Setpoint number (1 thru 4). After the chosen Setpoint is programmed, the display returns to SPSEL NO. Select the next Setpoint to be programmed and continue this sequence for each Setpoint. Select NO to exit the module. SP-3 and SP-4 apply to Quad Setpoint cards only.

**SETPOINT ASSIGNMENT**

Select the meter display to which the Setpoint is assigned: Timer (t-dSP), Cycle Counter (C-dSP), Real-Time Clock Date display (rE-d) or Real-Time Clock Time display (rE-t). (The rE-d and rE-t selections only appear if a Real-Time Clock option card is installed.)

By selecting NONE, the Setpoint is not assigned to a specific display. However, the output can still be activated (set) and deactivated (reset) by various "events". Such events include the Timer starting or stopping, or another Setpoint output turning On or Off. The output can also be set and reset through a User Input function or through serial communications.

**SETPOINT ACTION**

This parameter determines the mode for output deactivation as shown below. Output activation is controlled by the SETPOINT ON parameter setting.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
<th>OUTPUT DEACTIVATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCHED</td>
<td>Latched Mode</td>
<td>At Reset (Manual or Automatic)</td>
</tr>
<tr>
<td>TIMEOUT</td>
<td>Timed Mode</td>
<td>After &quot;Time-Out Value&quot; Elapses</td>
</tr>
<tr>
<td>ON-OFF</td>
<td>On-Off Mode</td>
<td>Based on &quot;Setpoint Off&quot; Setting</td>
</tr>
</tbody>
</table>

The t-DISP and ON-OFF selections are not available when Setpoint is assigned to rE-d. 

**OUTPUT LOGIC**

Normal Output Logic (NO) turns the output "on" when activated and "off" when deactivated. Reverse Output Logic (RO) turns the output "off" when activated and "on" when deactivated.

**SETPOINT ON**

This parameter determines when the Setpoint output will activate. Output activation can occur at a specific Setpoint Value (VALUE) or can be triggered by various "events", as shown in the parameter list. Such events include the Timer starting (t-STRT) or stopping (t-STOP), or by the action (event) that causes another Setpoint output to turn On or Off. When programmed for an event, the Setpoint must not be used as the Setpoint On event for another Setpoint.

Selecting VALUE displays a sub-menu where the Setpoint value is entered. The Setpoint value is based on the meter display to which the Setpoint is assigned (nSP-n). When assigned to the Timer or Cycle Counter, the Setpoint value is entered in the same format as the assigned display. When assigned to the Real-Time Clock Date Display (rE-d), the date value is entered in month.day.year format (nDDDDDD). When assigned to the Real-Time Clock Time Display (rE-t), the Setpoint value is always entered in HH-MM format (Hours-Minutes with AM/PM selection). In Setpoint One-shot mode (See Daily On Occurrence), the One-shot Setpoint is enabled (armed) by scrolling the AM/PM digit until the 2nd digit decimal point is lit.

**SETPOINT OFF**

The Setpoint Off parameter only appears when the Setpoint Action (C-DISP) is programmed for On-Off Output mode (ON-OFF). In this mode, this parameter determines when the Setpoint output will deactivate. Output deactivation can occur at a specific Setpoint Off Value (VALUE) or can be triggered by various "events", as shown in the parameter list. Such events include the Timer starting (t-STRT) or stopping (t-STOP), or by the action (event) that causes another Setpoint output to turn On or Off. When programmed for an event, the Setpoint must not be used as the Setpoint Off event for another Setpoint.

Selecting VALUE will display a sub-menu where the Setpoint Off value is entered. The Setpoint Off value is based on the meter display to which the Setpoint is assigned (nSP-n). When assigned to the Timer or Cycle Counter, the value is entered in the same format as the assigned display. When assigned to the Real-Time Clock Date Display (rE-d), the date value is entered in month.day.year format (nDDDDDD). When assigned to the Real-Time Clock Time Display (rE-t), the value is always entered in HH-MM format (Hours-Minutes with AM/PM selection).
The Time-Out Value only appears when the Setpoint Action (\texttt{Setp-\texttt{n}}) is programmed for Timed Output mode (\texttt{t-Out}). In this mode, the Time-Out Value is the Setpoint Output time duration, from activation to deactivation. This value is always entered in minutes, seconds, and hundredths of seconds format. The maximum Time-Out Value is 99 minutes 59.99 seconds.

**PAXCK: DAILY ON OCCURRENCE**

This parameter only appears when the Setpoint is assigned (\texttt{Setp-\texttt{n}}) to the Real-Time Clock Time display (\texttt{rTClk}). This parameter determines the days of the week when the Setpoint output will activate.

Selecting \texttt{Yes} displays a sublist for choosing the days of the week. On all days entered as \texttt{Yes} in the sublist, the output will activate. On all days entered as \texttt{No}, the output will not activate. The output activation is repetitive, and will occur every week on the chosen day(s).

**Setpoint One-Shot Mode**

If all days are set to \texttt{No}, the Setpoint will operate in “One-shot” mode. When a One-shot setpoint is enabled (armed), the setpoint output will activate at the set time and disable itself from activating again. To enable or re-enable a one-shot alarm, go to the Setpoint value entry display and press the Up or Down key repeatedly while the AM/PM digit is selected (flashing). When the 2nd digit decimal point is lit, the Setpoint is enabled. The Setpoint enable status is saved at power-down. The enable state of the Setpoint is not affected or changed when the Parameter List is exchanged.

The setpoint will turn off (de-activate) as programmed per the Setpoint Action selected. If \texttt{On-Off} mode is selected, program all the Daily Off days to \texttt{Yes} to have the Setpoint turn off at the next Daily Off Occurrence. The One-shot status can also be viewed or set from the Setpoint Off value entry display.

**PAXCK: DAILY OFF OCCURRENCE**

This parameter only appears when the Setpoint is assigned (\texttt{Setp-\texttt{n}}) to the Real-Time Clock Time display (\texttt{rTClk}) and when the Setpoint Action (\texttt{Setp-\texttt{n}}) is programmed for On-Off Output mode (\texttt{On-Off}). In this mode, this parameter determines the days of the week when the Setpoint output will deactivate.

Selecting \texttt{Yes} displays a sublist for choosing the days of the week. On all days entered as \texttt{Yes} in the sublist, the output will deactivate. On all days entered as \texttt{No}, the output will not deactivate. The output deactivation is repetitive, and will occur every week on the chosen day(s).

**TIMER STOP**

Timer stops when the Setpoint output activates (\texttt{On}) or deactivates (\texttt{Off}). Select \texttt{No} if the output should not affect the Timer Run/Stop status.

Stopping the Timer as a result of this parameter does not constitute a \texttt{Stop} condition (event) for the Setpoint On or Setpoint Off parameters.

**SETPOINT ANNUNCIATOR**

This parameter controls the illumination of the LED annunciator for the corresponding Setpoint output (\texttt{Setp-\texttt{n}}) as follows:

- Normal (\texttt{No}) – Annunciator displayed when output is “on” (activated)
- Reverse (\texttt{rEv}) – Annunciator displayed when output is “off” (deactivated)
- Flash (\texttt{Flash}) – Annunciator and display flashes when output is “on” (activated)
- Off (\texttt{Off}) – Annunciator disabled

**SETPOINT POWER-UP STATE**

Determines the on/off state of the Setpoint output at power-up. Regardless of output logic setting (normal or reverse).

- Off – Deactivates the Setpoint output at power-up
- On – Activates the Setpoint output at power-up
- Saved – Restores the output to the state it was in prior to power-down
Module 7 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the PAX 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 PAX. In order to establish serial communications, the user must have host software that can send and receive ASCII characters. Red Lion’s Crimson software can be used for configuring the PAX. (See ordering information.) For serial hardware and wiring details, refer to section 4.5 Serial Communication Wiring.

This section of the PAX/CK bulletin 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 PAX/CK. 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.

### Parameter Menu

<table>
<thead>
<tr>
<th>Parameter</th>
<th>mnemonic</th>
<th>Parameter Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>bR Ud</td>
<td>300, 600, 1200, 2400, 4800, 9600, 19200</td>
</tr>
<tr>
<td>Data Bits</td>
<td>dR A</td>
<td>7, 8</td>
</tr>
<tr>
<td>Parity Bit</td>
<td>P r</td>
<td>Odd, Even</td>
</tr>
<tr>
<td>Meter Address</td>
<td>Addr</td>
<td>00 to 99</td>
</tr>
<tr>
<td>Abbreviated Printing</td>
<td>Abbr</td>
<td>no, yes</td>
</tr>
<tr>
<td>Real-Time Clock Print Formatting</td>
<td>rC Ft</td>
<td>yes, no</td>
</tr>
<tr>
<td>Print Options</td>
<td>rP</td>
<td>no</td>
</tr>
</tbody>
</table>

### 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 at which all the serial equipment are capable of transmitting and receiving data.

### Data Bits

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

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

### Meter Address

Enter the serial meter (node) address. With a single meter, an address is not needed and a value of zero can be used. With multiple meters (RS485 applications), a unique 2-digit address number must be assigned to each meter.

Addresses 98 and 99 are reserved to configure a unit as a serial real-time clock master. See Serial Real-time Clock Master Addressing.

### Abbreviated Printing

This parameter determines the formatting of data transmitted from the meter in response to a Print Value (T) command or a Block Print Request (P) command. Select no for a Full print transmission, which consists of the meter address, mnemonics, and parameter data. Select yes for abbreviated print transmissions, consisting of the parameter data only. This setting affects all the parameters selected in the print options. (Note: If the meter address is 00, the address will not be sent during a Full transmission.)

### Real-Time Clock Print Formatting

This parameter determines the formatting of the Real-Time Clock (RTC) values transmitted from the meter in response to a Transmit Value (T) command or a Block Print Request (P) command. This parameter appears only when a Real-Time Clock plug-in option card is installed.

When yes is selected, RTC values are formatted as per the RTC Time and Date Display Formats programmed in Module 8. The Day of Week value is sent as a single number as shown below:

**TIME** - Hours (24-Hr. format), Minutes, Seconds (HHMMSS)
**DATE** - Month, Day, Year (mmddyy)
**DAY** - 1 = Sunday thru 7 = Saturday

### Print Options

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

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

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY</th>
<th>MNEONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>t DSP</td>
<td>Timer</td>
<td>yes</td>
<td>TMR</td>
</tr>
<tr>
<td>c DSP</td>
<td>Cycle Counter</td>
<td>no</td>
<td>CNT</td>
</tr>
<tr>
<td>rC d</td>
<td>RTC Date*</td>
<td>no</td>
<td>DAT</td>
</tr>
<tr>
<td>rC t</td>
<td>RTC Time*</td>
<td>no</td>
<td>TIM</td>
</tr>
<tr>
<td>S Pn</td>
<td>Setpoint Values*</td>
<td>no</td>
<td>SP1 SP2 SP3 SP4</td>
</tr>
<tr>
<td>S Pnt</td>
<td>Setpoint Off/Time-Out Values*</td>
<td>no</td>
<td>SO1 SO2 SO3 SO4</td>
</tr>
<tr>
<td>S t</td>
<td>Timer/Cnt Start &amp; Stop Values</td>
<td>no</td>
<td>TST TSP CST CSP</td>
</tr>
</tbody>
</table>

* These values are plug-in card dependent.
SERIAL RTC MASTER ADDRESSING

A meter, having software code version 2.3 or greater, with a Real Time Clock Card and an RS485 Serial Communication Card installed, can act as a Serial RTC Master, when programmed with meter address 98 or 99. This feature, whenever the Master meter’s time, date or day is changed, through quick or main programming, it will transmit and make the same change to the other PAXCKs on the RS485 bus. Only one meter should be configured as Master. This Master, with address 98 or 99, should also be programmed as the “Host” in module 9 under Clock Synchronization. With it programmed as Host, the other PAXCK Slaves will update hours, minutes and seconds to the Host once an hour and the Real-Time Clock Wiring (terminals 16-18) will not be necessary.

Meter addresses 98 and 99 are distinguished as follows: With address 98, the meter will transmit the change to all meters on the RS485 bus addressed as “0”. This is useful when using both newer or older software code versions, or when another master (computer, operator interface) is not being used.

With address 99, the meter will transmit the change to all, software code version 2.3 or greater, meters on the RS485 bus using a global broadcast address suffix. This is useful when it is necessary to have unique or other than 0 serial meter addresses or when having a computer or operator interface connected.

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 the command terminator character * or $.

Command Chart

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Node (Meter) Address Specifier</td>
<td>Address a specific meter. Must be followed by 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 1 or 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. The address suffix “?” is the global broadcast address specifier. A command string that is sent with N? prefix will be accepted by all PAXCKs on the RS485 network (software code version 2.3 or greater). This is useful for setting all meters to the current time, date or day that may have unique meter addresses on a bus. It is important not to send (P)rint or (T)ransmit commands using N? prefix, as it will result in multiple meters responding at the same time. 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 the options. If constructing a value change command (writing data), the numeric data is sent next.
4. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See Timing Diagram figure for differences between terminating characters.

Note: On a change value command (V), if the command string is terminated with the * character, all values are stored in E2PROM memory. Values are not stored if the $ terminator is used.

Register Identification Chart

<table>
<thead>
<tr>
<th>ID</th>
<th>VALUE DESCRIPTION</th>
<th>REGISTER NAME 1</th>
<th>COMMAND 2</th>
<th>TRANSMIT DETAILS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Timer Value</td>
<td>TMR</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>B</td>
<td>Cycle Counter Value</td>
<td>CNT</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>C</td>
<td>RTC Time Value</td>
<td>TIM</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>D</td>
<td>RTC Date Value</td>
<td>DAT</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>E</td>
<td>Setpoint 1</td>
<td>SP1</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>F</td>
<td>Setpoint 2</td>
<td>SP2</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>G</td>
<td>Setpoint 3</td>
<td>SP3</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>H</td>
<td>Setpoint 4</td>
<td>SP4</td>
<td>T, V, R</td>
<td>6 digit</td>
</tr>
<tr>
<td>I</td>
<td>Setpoint 1 Off Value</td>
<td>SO1</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>J</td>
<td>Setpoint 2 Off Value</td>
<td>SO2</td>
<td>T, V</td>
<td>5 digit</td>
</tr>
<tr>
<td>K</td>
<td>Setpoint 3 Off Value</td>
<td>SO3</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>L</td>
<td>Setpoint 4 Off Value</td>
<td>SO4</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>M</td>
<td>Timer Start Value</td>
<td>TST</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>O</td>
<td>Cycle Counter Start Value</td>
<td>CST</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>Q</td>
<td>Timer Stop Value</td>
<td>TSP</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>S</td>
<td>Cycle Counter Stop Value</td>
<td>CSP</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>U</td>
<td>Auto/Man Register</td>
<td>MMR</td>
<td>T, V</td>
<td>0 - auto, 1 - manual</td>
</tr>
<tr>
<td>W</td>
<td>Day of Week Value</td>
<td>DAY</td>
<td>T, V</td>
<td>6 digit</td>
</tr>
<tr>
<td>X</td>
<td>Setpoint Register</td>
<td>SOR</td>
<td>T, V</td>
<td>0 - not active, 1 - active</td>
</tr>
</tbody>
</table>

1. Register Names are also used as Register Mnemonics during full transmission.
2. The registers associated with the Pcommand 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: N17VE350$
2. Address = 5, Cycle Counter value, response time of 50 to 100 msec. min.
   String: N05TB$
3. Address = 0, Reset Timer value
   String: RA$

Transmitting Data To the Meter

Numeric data sent to the meter must be limited to Transmit Details listed in the Register Identification Chart. Leading zeros are ignored. The meter ignores any decimal point and conforms the number to the scaled resolution. (ie. The meter’s decimal 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).

For RTC Time [C] and Date [D] Value:

- Time - 24 Hours, Minutes, Seconds (HHMMSS)
  - Ex: 083000 = 8:30 AM, 144500 = 2:45 PM
- Date - Month, Day, Year (mmddyy)
  - Ex: 123101 = December 31, 2001
- Day - 1 = Sunday through 7 = Saturday
  - Ex: 3 = Tuesday

Notes:
1. Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.
2. The date and date must be set separately.

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 (\text{Rbb}r = \text{ND})

<table>
<thead>
<tr>
<th>BYTE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</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: 6 bytes for number, up to 3 for decimal points.</td>
</tr>
<tr>
<td>19</td>
<td>&lt;CR&gt; (Carriage return)</td>
</tr>
<tr>
<td>20</td>
<td>&lt;LF&gt; (Line feed)</td>
</tr>
<tr>
<td>21</td>
<td>&lt;SP&gt; (Space)³</td>
</tr>
<tr>
<td>22</td>
<td>&lt;CR&gt; (Carriage return)³</td>
</tr>
<tr>
<td>23</td>
<td>&lt;LF&gt; (Line feed)³</td>
</tr>
</tbody>
</table>

³ These characters only appear in the last line of a block print.

The first two characters transmitted are the unit address. If the address assigned is 0, two spaces are substituted. A space follows the unit address field. The next three characters are the register mnemonic.

The numeric data is transmitted next. The numeric field is 12 characters long (decimal points are loaded depending on timer range selected). The data is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with <CR> and <LF>. When a block print is finished, an extra <SP>, <CR>, and <LF> are used to provide separation between the transmissions.

Abbreviated Transmission (\text{Rbb}r = \text{YE5})

<table>
<thead>
<tr>
<th>BYTE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>12 byte data field, 6 bytes for number, up to 3 bytes for decimal points.</td>
</tr>
<tr>
<td>13</td>
<td>&lt;CR&gt; (Carriage return)</td>
</tr>
<tr>
<td>14</td>
<td>&lt;LF&gt; (Line feed)</td>
</tr>
<tr>
<td>15</td>
<td>&lt;SP&gt; (Space)³</td>
</tr>
<tr>
<td>16</td>
<td>&lt;CR&gt; (Carriage return)³</td>
</tr>
<tr>
<td>17</td>
<td>&lt;LF&gt; (Line feed)³</td>
</tr>
</tbody>
</table>

³ 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.

Note: Transmissions are formatted to match the way the parameter is displayed. This includes setpoints.

Example: SP1 assigned to RTC. RTC format = 12:00 P. SP1 printout = 12:00 P.

Note: When communicating with a Red Lion Controls HMI unit, set \text{eE} Fx in programming module 7 (serial) to \text{#F}. This formats the RTC parameters to:

- Time - 24 Hours, Minutes, Seconds
- Date - Month, Day, Year
- Day - 1 = Sunday through 7 = Saturday
- Decimal points are substituted for all punctuation.

**COMMAND RESPONSE TIME**

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

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

\[
t_1 = \left(\frac{10 \times \text{# of characters}}{\text{baud rate}}\right)
\]

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

If the meter is to reply with data, the time interval \( t_2 \) is controlled by the use of the command terminating character. The * \( \text{terminating character results in a response time window of 50 msec. minimum and 100 msec. maximum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with ‘S’ results in a response time window (t2) of 2 msec. minimum and 50 msec. maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received. At the beginning of time interval \( t_1 \), the meter responds with the first character of the reply. As with \( t_1 \), the duration of \( t_3 \) is dependent on the number of characters and baud rate of the channel. At the end of \( t_3 \), the meter is ready to receive the next command.

\[
t_3 = \left(\frac{10 \times \text{# of characters}}{\text{baud rate}}\right)
\]

**SERIAL TIMING**

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>COMMENT</th>
<th>PROCESS TIME (( t_d ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Reset</td>
<td>2-50 msec.</td>
</tr>
<tr>
<td>V</td>
<td>Write</td>
<td>100-200 msec.</td>
</tr>
<tr>
<td>T</td>
<td>Transmit</td>
<td>2-50 msec. for $</td>
</tr>
<tr>
<td>P</td>
<td>Print</td>
<td>50-100 msec. for $</td>
</tr>
</tbody>
</table>

**Timing Diagrams**

**NO REPLY FROM METER**

**RESPONSE FROM METER**

**Setpoint Output Register (SOR) ID: X**

This register is used to view or change 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 inactive and a “1” means the output is active. The output logic parameter in Module 6 will affect the active logic state.

Example: VX10* will result in output 1 active and output 2 inactive.
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 -25 V</td>
<td>a-b &lt; -200 mV</td>
</tr>
<tr>
<td>0</td>
<td>space (active)</td>
<td>TXD, RXD: +3 to +25 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. 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.

![Character Frame Figure](image)

Start Bit and Data Bits

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

Parity Bit

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

Stop Bit

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

6.8 MODULE 8 - REAL-TIME CLOCK PARAMETERS (B=rtc) - PAXCK

Module 8 is the programming module for the Real-Time Clock (RTC) Date and Time Parameters. In the Display Mode, the DAT annunciator indicates the RTC Date is currently being shown. The RTC Time display is shown with no annunciator. This programming module can only be accessed if a Real-Time Clock card is installed.

**PARAMETER MENU**

- **Par**
- **Set Time**
- **Set Date**
- **dRY**
- **dSP**
- **Ch-DSB**
- **Sync**
- **CalR**

**SET DATE**

This parameter sets the Date for the Real-Time Clock. Selecting YES will display the sub-menu where the Date can be set or changed. The RTC Date is entered in “Month.Day.Year” format (two-digit values). When the PAR key is pressed, the new Date is entered. Select NO to advance to the next parameter without changing the Date.

**SET TIME**

This parameter sets the Time for the Real-Time Clock. Selecting YES will display the sub-menu where the Time can be set or changed. The RTC Time is entered in “Hours-Minutes”, 12-hour format, with AM/PM indication. When the PAR key is pressed, the new Time is entered and begins running. The “Seconds” always start from 00 when the Time is entered. Select NO to advance to the next parameter without changing the Time.

**SET DAY**

Set the Day of the week for the Real-Time Clock.
The Real-Time Clock circuit uses a crystal controlled oscillator for high accuracy timekeeping. The oscillator is factory calibrated* and optimized for 25°C ambient temperature operation. Since the PAXCK is designed to operate over a wide temperature range, and since the accuracy of a crystal oscillator varies with ambient temperature, some drift in the RTC time may be observed over an extended period. This is primarily seen in high or low temperature installations. To compensate for the wide operating temperature range, a calibration or “Offset” value can be entered, which effectively slows down or speeds up the clock to maintain accurate timekeeping.

To calibrate the RTC, install the meter in its normal operating environment, and set the time based on a known accurate reference (such as the WWV broadcast or the Atomic Clock reference which is available via the internet). After 30 days of normal operation, compare the RTC time to the reference, and note the amount of time gained or lost. Refer to the tables on the next page for the proper Offset value to enter, given the amount of time drift observed.

Selecting YES for the CRF parameter displays the OFFSET sub-menu where the present Offset value can be viewed or changed. The tables below show the value to enter, given the amount of time gained or lost in a 30-day period.

Values 00 and 32 provide no Offset, and are not shown in the tables.

<table>
<thead>
<tr>
<th>SECONDS GAINED IN 30 DAYS</th>
<th>ENTER THIS OFFSET VALUE</th>
<th>SECONDS LOST IN 30 DAYS</th>
<th>ENTER THIS OFFSET VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>01</td>
<td>90</td>
<td>17</td>
</tr>
<tr>
<td>11</td>
<td>02</td>
<td>95</td>
<td>18</td>
</tr>
<tr>
<td>16</td>
<td>03</td>
<td>100</td>
<td>19</td>
</tr>
<tr>
<td>21</td>
<td>04</td>
<td>105</td>
<td>20</td>
</tr>
<tr>
<td>26</td>
<td>05</td>
<td>111</td>
<td>21</td>
</tr>
<tr>
<td>32</td>
<td>06</td>
<td>116</td>
<td>22</td>
</tr>
<tr>
<td>37</td>
<td>07</td>
<td>121</td>
<td>23</td>
</tr>
<tr>
<td>42</td>
<td>08</td>
<td>127</td>
<td>24</td>
</tr>
<tr>
<td>47</td>
<td>09</td>
<td>132</td>
<td>25</td>
</tr>
<tr>
<td>53</td>
<td>10</td>
<td>137</td>
<td>26</td>
</tr>
<tr>
<td>58</td>
<td>11</td>
<td>142</td>
<td>27</td>
</tr>
<tr>
<td>63</td>
<td>12</td>
<td>148</td>
<td>28</td>
</tr>
<tr>
<td>69</td>
<td>13</td>
<td>153</td>
<td>29</td>
</tr>
<tr>
<td>74</td>
<td>14</td>
<td>158</td>
<td>30</td>
</tr>
<tr>
<td>79</td>
<td>15</td>
<td>163</td>
<td>31</td>
</tr>
<tr>
<td>84</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECONDS LOST IN 30 DAYS</th>
<th>ENTER THIS OFFSET VALUE</th>
<th>SECONDS GAINED IN 30 DAYS</th>
<th>ENTER THIS OFFSET VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>33</td>
<td>179</td>
<td>49</td>
</tr>
<tr>
<td>21</td>
<td>34</td>
<td>190</td>
<td>50</td>
</tr>
<tr>
<td>32</td>
<td>35</td>
<td>200</td>
<td>51</td>
</tr>
<tr>
<td>42</td>
<td>36</td>
<td>211</td>
<td>52</td>
</tr>
<tr>
<td>53</td>
<td>37</td>
<td>221</td>
<td>53</td>
</tr>
<tr>
<td>63</td>
<td>38</td>
<td>232</td>
<td>54</td>
</tr>
<tr>
<td>74</td>
<td>39</td>
<td>243</td>
<td>55</td>
</tr>
<tr>
<td>84</td>
<td>40</td>
<td>253</td>
<td>56</td>
</tr>
<tr>
<td>95</td>
<td>41</td>
<td>264</td>
<td>57</td>
</tr>
<tr>
<td>105</td>
<td>42</td>
<td>274</td>
<td>58</td>
</tr>
<tr>
<td>116</td>
<td>43</td>
<td>285</td>
<td>59</td>
</tr>
<tr>
<td>127</td>
<td>44</td>
<td>295</td>
<td>60</td>
</tr>
<tr>
<td>137</td>
<td>45</td>
<td>306</td>
<td>61</td>
</tr>
<tr>
<td>148</td>
<td>46</td>
<td>316</td>
<td>62</td>
</tr>
<tr>
<td>158</td>
<td>47</td>
<td>327</td>
<td>63</td>
</tr>
<tr>
<td>169</td>
<td>48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FCS)

PARAMETER MENU

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 RST and/or arrow keys to display Code 056 and press PAR. The meter will display ESEEEEE and then returns to Code 050. Press DSP key to return to the Display Mode. This will overwrite all programmed user settings with the Factory Default Settings shown in the Parameter Value Chart. For the PAXCK, the Time and Date stored in the Real-Time Clock, as well as the RTC Calibration Offset value, are NOT overwritten by this parameter. However, the Time and Date Display Formats will revert back to the Factory Default Settings.

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>PROGRAMMING LOCKED-OUT</td>
<td>CHECK: User input set for program lock-out function is in Active state</td>
</tr>
<tr>
<td></td>
<td>ENTER: Security code requested</td>
</tr>
<tr>
<td>CERTAIN DISPLAYS ARE LOCKED-OUT</td>
<td>CHECK: Display Lock-out programming in Module 3</td>
</tr>
<tr>
<td>MODULES or PARAMETERS NOT ACCESSIBLE</td>
<td>CHECK: Corresponding plug-in card installation, Program Lock-out/ Value Access parameter programming in Module 3</td>
</tr>
<tr>
<td>TIMER NOT RUNNING</td>
<td>CHECK: Input wiring, Timer plug jumper setting, Timer input programming in Module 1, input signal level, Timer Inhibited by Input B or a user input</td>
</tr>
<tr>
<td>USER INPUT NOT WORKING PROPERLY</td>
<td>CHECK: User input wiring, user input plug jumper setting, user input signal level, user input programming in Module 2</td>
</tr>
<tr>
<td>OUTPUTS NOT WORKING PROPERLY</td>
<td>CHECK: Setpoint plug-in card installation, wiring, Setpoint programming in Module 6</td>
</tr>
<tr>
<td>REAL-TIME CLOCK NOT WORKING PROPERLY</td>
<td>CHECK: RTC plug-in card installation, RTC programming in Module 8, check for proper battery installation, replace battery. <strong>DO NOT ADJUST TRIM CAP ON RTC CARD!</strong></td>
</tr>
<tr>
<td>SERIAL COMMUNICATIONS NOT WORKING</td>
<td>CHECK: Serial plug-in card installation, Serial wiring, Serial settings in Module 7, host settings</td>
</tr>
<tr>
<td>ERROR CODE (Err 1-4)</td>
<td>PRESS: Reset key (If unable to clear, contact factory.)</td>
</tr>
</tbody>
</table>

Shaded areas are model dependent.
### Timer Operating Modes

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>t OPF</td>
<td>PREDEFINED TIMER OPER. MODE</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SP-1</td>
<td>SETPOINT 1 ON VALUE</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>SPDF-1</td>
<td>SETPOINT 1 OFF VALUE</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>tOUT-1</td>
<td>SETPOINT 1 TIME-OUT VALUE</td>
<td>00000000</td>
<td></td>
</tr>
</tbody>
</table>

### 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>USER-1</td>
<td>USER INPUT 1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>USER-2</td>
<td>USER INPUT 2</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>USER-3</td>
<td>USER INPUT 3</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>FUNCTION KEY 1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>FUNCTION KEY 2</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>rSt</td>
<td>RESET KEY</td>
<td>drSt-E</td>
<td></td>
</tr>
<tr>
<td>SEC-F1</td>
<td>SECONDARY FUNCTION KEY F1</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>SEC-F2</td>
<td>SECONDARY FUNCTION KEY F2</td>
<td>NO</td>
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</tr>
</tbody>
</table>

### Timer Input Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>rRANG</td>
<td>TIMER RANGE</td>
<td>LEVEL</td>
<td></td>
</tr>
<tr>
<td>INP OP</td>
<td>TIMER INPUT OPERATION</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>t dir</td>
<td>TIMING DIRECTION</td>
<td>UP</td>
<td></td>
</tr>
<tr>
<td>t St r</td>
<td>TIMER START VALUE (A)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>t St OP</td>
<td>TIMER STOP (A &amp; B)</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>t St OP</td>
<td>TIMER STOP VALUE (A)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>t St OP</td>
<td>TIMER STOP VALUE (B)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>FLASH</td>
<td>FLASH TIMER ANNUNCIATOR</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>InP-UP</td>
<td>TIMER INPUT STATE AT POWER-UP</td>
<td>StOP</td>
<td></td>
</tr>
<tr>
<td>t P-UP</td>
<td>TIMER RESET AT POWER-UP</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

### Cycle Counter Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Src</td>
<td>CYCLE COUNTER COUNT SOURCE</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>C dir</td>
<td>CYC. CNTR. COUNTING DIRECTION</td>
<td>UP</td>
<td></td>
</tr>
<tr>
<td>C St r</td>
<td>CYCLE COUNTER START VALUE (A)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>C St r</td>
<td>CYCLE COUNTER START VALUE (B)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>C StOP</td>
<td>CYCLE COUNTER STOP (A &amp; B)</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>VALUE</td>
<td>CYCLE COUNTER STOP VALUE (A)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>VALUE</td>
<td>CYCLE COUNTER STOP VALUE (B)</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>C P-UP</td>
<td>CYC. CNTR. RESET AT POWER-UP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Display and Program Lock-out Parameters

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>PARAMETER</th>
<th>FACTORY SETTING</th>
<th>USER SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>t dSP</td>
<td>TIMER DISPLAY LOCK-OUT</td>
<td>rEd</td>
<td></td>
</tr>
<tr>
<td>C dSP</td>
<td>CYCLE COUNT DISPLAY LOCK-OUT</td>
<td>EF</td>
<td></td>
</tr>
<tr>
<td>rEE-d</td>
<td>RTC DATE DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>rEE-t</td>
<td>RTC TIME DISPLAY LOCK-OUT</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP-1</td>
<td>SP1 ON VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SPDF-1</td>
<td>SP1 OFF VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>tOut-1</td>
<td>SP1 TIME-OUT VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP-2</td>
<td>SP2 ON VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SPDF-2</td>
<td>SP2 OFF VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>tOut-2</td>
<td>SP2 TIME-OUT VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP-3</td>
<td>SP3 ON VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SPDF-3</td>
<td>SP3 OFF VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>tOut-3</td>
<td>SP3 TIME-OUT VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SP-4</td>
<td>SP4 ON VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SPDF-4</td>
<td>SP4 OFF VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>tOut-4</td>
<td>SP4 TIME-OUT VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C St r</td>
<td>TIMER START VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>t StOP</td>
<td>TIMER STOP ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C St r</td>
<td>COUNTER START VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>C StOP</td>
<td>COUNTER STOP VALUE ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>SEE-t</td>
<td>RTC TIME SETTING ACCESS</td>
<td>LOC</td>
<td></td>
</tr>
<tr>
<td>CODE</td>
<td>SECURITY CODE</td>
<td>0000</td>
<td></td>
</tr>
</tbody>
</table>

* See Module 2, Exchanging Parameter Lists, for details on programming this value.

### Shaded areas are model dependent.
**PAXCK Application**

A big application request has always been for Real-Time Clocks to display time throughout the plant. The challenge has been to keep all the various clock locations synchronized with the right time. With the new PAXCK Timer/Real-Time Clock this problem is history. The clocks can be provided in three different sizes, the PAXCK (0.56 inch LEDs), the LPAXCK (1.5 inch LEDs), or the EPAX (4 inch LEDs). You can mix and match any number of the two versions, up to a maximum of 32 units. Simply select one of the units in the system as the host and the balance are programmed as slaves. The host will send out a synchronization pulse every hour to correct the time on any clock unit wired in the system.

---

**Real-Time Clock Synchronization Network**

This document provided by Barr-Thorp Electric Co., Inc. 800-473-9123 www.barr-thorp.com
Real-Time Clock parameters apply to the PAXCK only.

1- INP
   PAR
   Timer Range

2- FNC
   USER-1
   USER-2
   USER-3

3- LOC
   t-dSP
   C-dSP
   rTC-d
   rTC-b
   SP-n
   SPDF-n
   tOUT-n
   tStrt

4- CNk
   C Src
   C dir
   C Strt
   C STOP
   C P-UP

5- OPER
   t OPER
   SP-1
   SPDF-1
   tOUT-1

6- SPk
   SPSEL
   RST-n
   RCT-n
   OUT-n
   ON-n
   OFF-n
   tOUT-n
   d ON-n

7- SLR
   bAUD
   dArt
   PR
   Addr
   Addrbr
   rTC Flt
   OPT

8- rEC
   SET-k
   SET-d
   dAY
   dSP-k
   dSP-d
   Ch-dStk
   SYNC
   P-UP-n

9- FCS
   d-LEU
   COdE
   n = Setpoint number

Baud Rate
Data Bit
Parity Bit
Meter Address
Abbreviated Printing
Real-Time Clock Print Formatting
Print Options

Set Time
Set Date
Set Day
Time Display Format
Date Display Format
Auto Change for Daylight Savings Time
Meter Type for Clock Synchronization
Calibrate Real-Time Clock

Display Intensity Level
Factory Service Code

Security Code

Power-up State

Timer Stop
Timer/Counter Auto Reset
Output Reset w/Display Reset
Setpoint Annunciator

Daily Off Occurrence
Timer Stop
Timer/Counter State at Power-up
Timer Reset at Power-up

Security Code

Factory Service Code
MODEL PAXCK - 1/8 DIN REAL-TIME CLOCK

This is a brief overview of the PAXCK. For complete specifications and programming information, see the PAX 1/8 DIN Preset Timer (PAXTM) & Real-time Clock (PAXCK) Bulletin starting on page 268.

PAXCK SPECIFICATIONS

4. ANNUNCIATORS:

- TMR - Timer Display  SP1 - Setpoint 1 Output
- CNT - Cycle Counter Display  SP2 - Setpoint 2 Output
- DAT - Real-Time Clock Date Display  SP3 - Setpoint 3 Output
  - Real-Time Clock Time Display  SP4 - Setpoint 4 Output

REAL-TIME/DATE DISPLAY (PAXCK):

Real-Time Display: 5 display formats
  - Hr/Min/Sec (12 or 24 Hr. format); Hr/Min (24 Hr.); Hr/Min (12 Hr. with or without AM/PM indication)
Date Display: 7 display formats
  - Month/Day or Day/Month (numeric or 3-letter Month format);
  - Month/Day/Year or Day/Month/Year (all numeric);
  - Day of Week/Day (3-letter Day of Week format)

REAL-TIME CLOCK CARD: Field replaceable plug-in card

Time Accuracy: ± 5 secs./Month (1 min./year) with end-user calibration
Battery: Lithium 2025 coin cell
Battery Life Expectancy: 10 yrs. typical
Synchronization Interface: Two-wire multi-drop network (RS485 hardware), 32 units max., operates up to 4000 ft.
Isolation To Timer & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not isolated from all other commons.

TIMER INPUTS A and B:

Logic inputs configurable as Current Sinking (active low) or Current Sourcing (active high) via a single plug jumper.
Current Sinking (active low): \( V_{IL} = 0.9 \, V \) max., \( 22\Omega \) pull-up to +12 VDC.
Current Sourcing (active high): \( V_{IH} = 3.6 \, V \) min., \( 22\Omega \) pull-down, Max.
Continuous Input: 30 VDC.
Timer Input Pulse Width: 1 msec min.
Timer Start/Stop Response Time: 1 msec max.
Filter: Software filtering provided for switch contact debounce. Filter enabled or disabled through programming.
If enabled, filter results in 50 msec start/stop response time for successive pulses on the same input terminal.