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THE 1/16 DIN COUNTERS

MODEL C48C INSTRUCTION MANUAL

INTRODUCTION

The C48 Counters (C48C) are a multi-purpose series of industrial control products that are field-programmable for solving various applications. This series of products is built around the concept that the end user has the capability to program different functions into the unit in order to adapt to different indication and control requirements.

The C48C unit, which you have purchased, has the same high quality workmanship and advanced technological capabilities that have made Red Lion Controls the leader in today's industrial market.

Red Lion Controls has a complete line of industrial indication and control equipment, and we look forward to servicing you now and in the future.

CE

c UL us

UL Recognized Component,
File # E137808

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

CAUTION: Risk of electric shock.

TABLE OF CONTENTS

GENERAL DESCRIPTION

The Model C48 Counter is available as a Standard Counter or a Batch Counter. The Standard Counter is available with single or dual presets. The Batch Counter has a main process counter with dual presets and a secondary counter with a single preset. The secondary counter can be selected to function as a batch or a total counter.

The C48C 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 count value. When preset 3 or output 3 is viewed in the secondary display, the batch/total value is viewed in the main display. The smaller secondary display line is green and can be used to view the prescaler value, preset values, output time values or batch/total count values (Batch model).

The C48C offers a choice of nine programmable counting modes for use in applications requiring bi-directional, anti-coincidence, and quadrature counting. The unit may be programmed to register counts on both edges of the input signal providing frequency doubling capability. DIP switches are used for input configuration set-up and to provide a Program Disable function.

Four front panel push-buttons are used for programming the operating modes and data values, changing the viewed display, and performing user programmable functions, i.e. reset, etc. The C48C can be configured for one of two numeric data entry methods, digit entry or automatic scrolling. The digit entry method allows for the selection and incrementing of digits individually. The automatic scrolling method allows for the progressive change of one through all digit positions by pressing and holding the “up” or “down” button.

The C48 Counter has programmable User Inputs and a programmable front panel function key. The user inputs can be configured as sinking (active low) or sourcing (active high) inputs via a single plug jumper. The following functions are available for user inputs and the front panel function key.

Reset	Print Request
Store and Reset	Change Display
Program Disable	Count Inhibit
Store	Reset Outputs

The Program Disable DIP switch, a user-programmable code value, an external user input (selected for Program Disable), and the Accessible value parameters can all be utilized to provide multi-level protection against unauthorized changes to data values and unit configuration.

The Standard Counter with dual presets is available with solid-state or relay outputs. The single preset model has a solid-state and relay output. The Batch Counter has relay outputs for Output 2 and the Batch/Total Output (3), with Output 1 available as solid-state. The Batch Counter is also available with three solid-state outputs. For all C48 Counters, the 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.

A Prescaler Output model is available as a dual preset, with solid-state outputs. The Prescaler Output is useful for providing a lower frequency scaled pulse train to a PLC or another external totalizing counter. The Prescaler Output provides an output pulse for every count, or every 10 counts registered on the display.

Optional RS485 serial communication capabilities allow for interrogation and modification of the preset, count, and prescaler values.

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 for indoor use, when properly installed. Multiple units can be stacked horizontally or vertically. Modern surface-mount technology, extensive testing, plus high immunity to noise interference makes the C48 Counters extremely reliable in industrial environments.

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.

BLOCK DIAGRAM

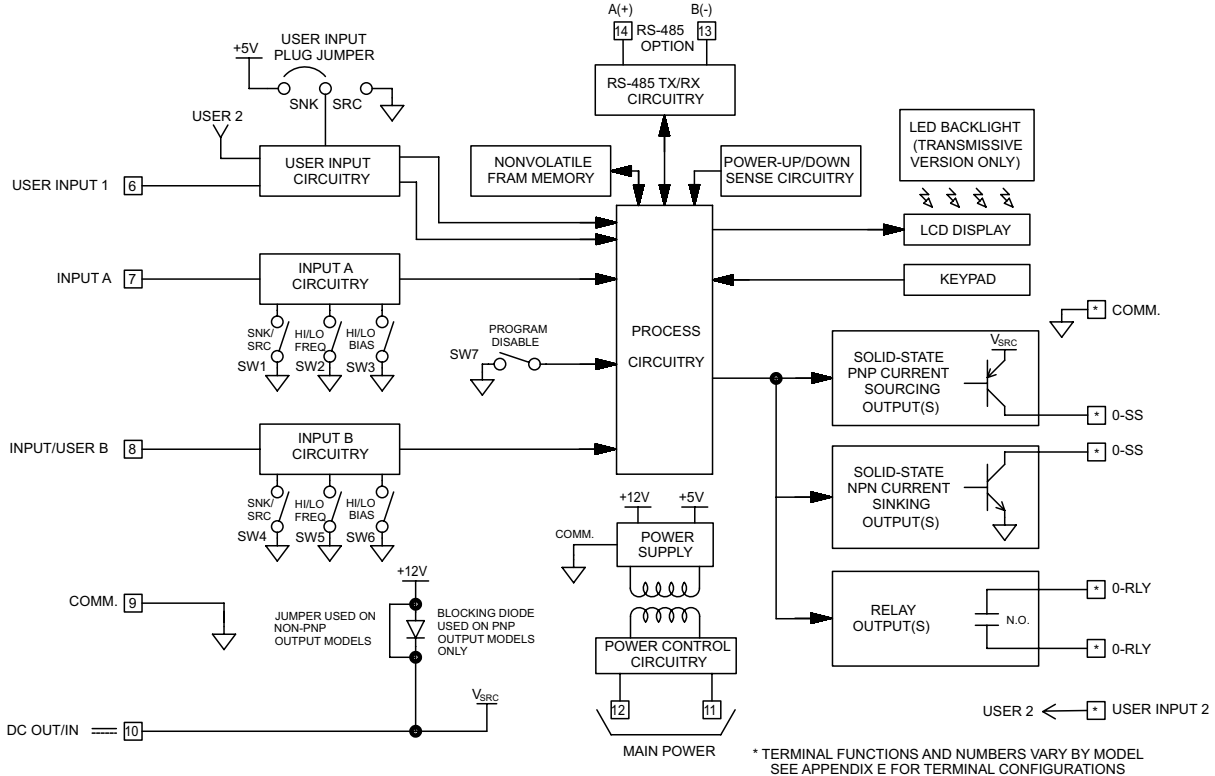


Figure 1, Block Diagram

INSTALLATION & CONNECTIONS

The C48 Counter meets NEMA 4X/IP65 requirements for indoor use to provide a watertight seal in steel panels with a minimum thickness of 0.09 inch, or aluminum panels with a minimum thickness of 0.12 inch. The units are intended to be installed into an enclosed panel. The complete unit assembly (i.e. PC boards and bezel), MUST be in the case when mounting the unit.

Multiple Unit Stacking

The C48C is designed for close spacing of multiple units. Units can be stacked either horizontally or vertically. For vertical stacking, install the panel latch with the screws to the sides of the unit. For horizontal stacking, the panel latch screws should be at the top and bottom of the unit. The minimum spacing from center line to center line of 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.

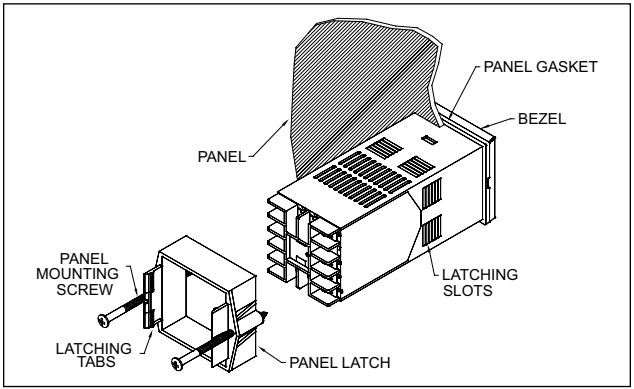


Figure 2, Panel Installation

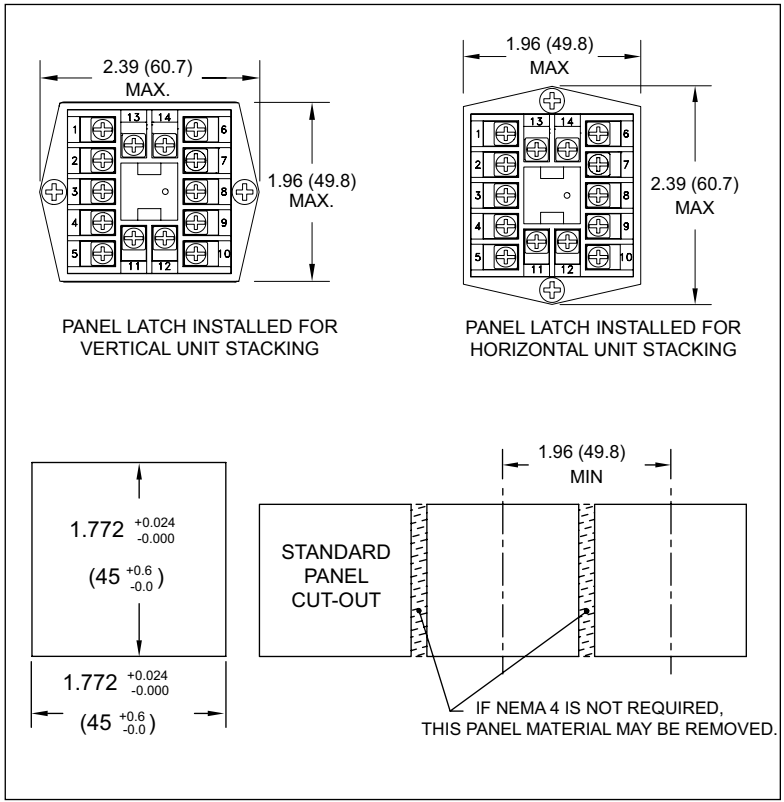


Figure 3, Multiple Unit Stacking

Mounting Instructions

1. Prepare the panel cutout to the dimensions shown in Figure 3, Multiple Unit Stacking.
2. Remove the panel latch from the unit. Discard the cardboard sleeve.
3. Carefully remove the center section of the panel gasket and discard. Slide the panel gasket over the unit from the rear, seating it against the lip at the front of the case.
4. Insert the unit into the panel cutout. While holding the unit in place, push the panel latch over the rear of the unit, engaging the tabs of the panel latch in the farthest forward slot possible.
5. To achieve a proper seal, tighten the panel latch screws evenly until the unit is snug in the panel, torquing the screws to approximately 7 in-lbs. Overtightening can result in distortion of the panel, and reduce the effectiveness of the seal.

Note: The installation location of the counter is important. Be sure to keep it away from heat sources (ovens, furnaces, etc.), and away from direct contact with caustic vapors, oils, steam, or any other process by-products in which exposure may affect proper operation.

Caution: Disconnect power to the unit and to the output control circuits to eliminate the potential shock hazard when removing the entire unit or unit assembly.

Unit Removal Procedure

To remove the entire unit with case from the panel, first loosen the panel latch screws. Insert flat blade screwdrivers between the panel latch and the case on either side of the unit, so that the latches disengage from the grooves in the case. Push the unit through the panel from the rear.

Removing Unit Assembly

The unit assembly, shown in Figure 4, must be removed from the case to change DIP switch settings or to replace the relay output board. To remove the unit assembly, insert a flat blade screwdriver into the pry slot on either side of the unit. Twist the screwdriver handle until the unit is ejected enough to allow removal.

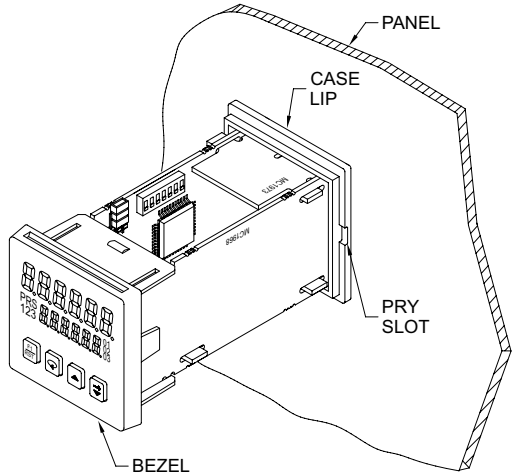


Figure 4, Unit Assembly

Caution: The unit assembly contains electronic circuits that can be damaged by static electricity. Before removing the assembly, discharge static charge on your body by touching an earth ground point. It is also important that the unit assembly be handled only by the bezel. Additionally, if it is necessary to handle a circuit board, be certain that hands are free from dirt, oil, etc., to avoid circuit contamination that may lead to malfunction. If it becomes necessary to ship the unit for repairs, place the unit in its case before shipping it.

Installing Unit Assembly

To install the unit assembly, insert the assembly into the case until the bezel is fully seated against the lip of the case. Properly installing the unit assembly is necessary for watertight front panel sealing.

Output Board

The C48C is supplied with an output board installed. The output board is preconfigured for the type of output needed, based upon the Model ordered. See Ordering Information, page 48, for available models. All relay output boards are field replaceable.

Replacing Relay Output Board

1. Remove the unit assembly. (See Removing Unit Assembly, page 4).
2. Lift up on the top bezel board latch while gently pulling out on the bezel/display board assembly. Do NOT remove the display board from the bezel.
3. Remove the output board by pulling it away from the other boards. Replace the output board by aligning the board to board connectors. Be certain connectors are fully mated.
4. Connect the bezel/display board assembly by guiding the board ends into the bezel latches. Slide the assembly on evenly until the display board connector is completely engaged and bezel latches are fully seated onto the boards.

Note: When replacing the relay output board, be certain to install a new output board of the same type.

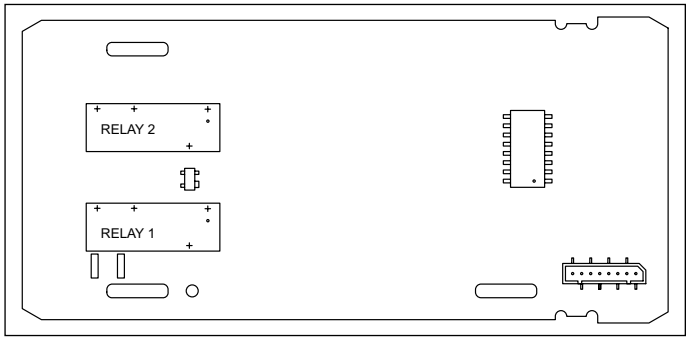


Figure 5, Relay Output Board

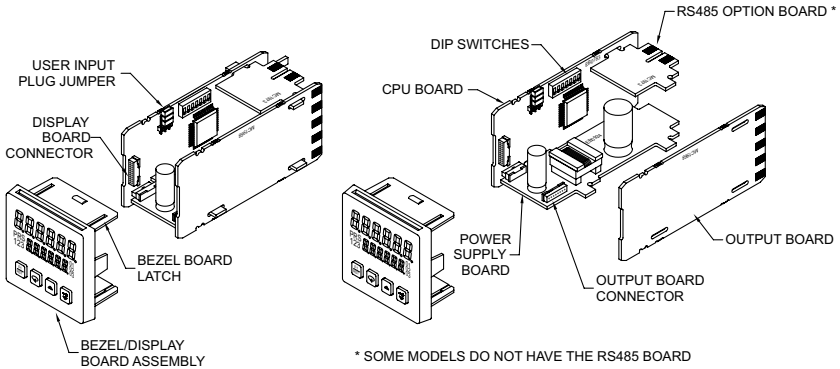


Figure 6, Relay Output Board Replacement

EMC INSTALLATION GUIDELINES

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

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. Long cable runs are more susceptible to EMI pickup than short cable runs.
5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:
   Fair-Rite part number 0443167251 (Red Lion Controls #FCOR0000)
   Line Filters for input power cables:
   Schaffner # FN2010-1/07 (Red Lion Controls #LFIL0000)
6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
   a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
   b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most Red Lion products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.
   Red Lion part numbers: Snubber: SNUB0000
   Varistor: ILS11500 or ILS23000
7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit http://www.redlion.net/emi for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion products.

Wiring Connections

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

After the unit has been mechanically mounted, it is ready to be wired. All wiring connections are made to rear screw terminals. When wiring the unit, use the numbers on the label and those embossed on the back of the case, to identify the position number with the proper function. See page 46 for terminal descriptions. Strip the wire, leaving approximately 1/4" (6 mm) bare wire exposed (stranded wires should be tinned with solder). Insert the wire under the clamping washer and tighten the screw until the wire is clamped tightly.

Caution: Unused terminals are NOT to be used as tie points. Damage to the counter may result if these terminals are used.

POWER WIRING

AC Versions (C48CXX0X)

AC Power Wiring

Primary AC power is connected to terminals 11 and 12, labeled AC. To reduce the chance of noise spikes entering the AC line and affecting the counter, an AC feed separate from that of the load should be used to power the counter. Be certain that the AC power to the counter is relatively "clean" and within the specified range. Connecting power from heavily loaded circuits or circuits that also power loads that cycle on and off, (contacts, relays, motors, etc.) should be avoided.

DC Power Wiring (Non PNP Output models)

The DC power is connected to terminals 9 & 10, marked COMM. and DC OUT/IN. The DC power source must be capable of supplying the unit's rated current (150 mA max.) and be within the specified 11 to 14 VDC range. The C48C has non-volatile memory that stores information on power down, thereby eliminating the need for battery back-up.

Note: AC Versions with PNP outputs cannot be powered from DC.

CAUTION: Observe proper polarity when connecting DC voltages. Damage to the unit will occur if polarity is reversed.

DC Versions (C48CXX1X)

DC power (18 to 36 VDC) or low voltage AC power (24 VAC) is connected to terminals 11 and 12, labeled DC+ (AC) and DC- (AC) respectively.

Output Power

For DC/ Low Voltage AC units that do not have PNP current sourcing outputs, Terminal 10, DC OUT (V_{SRC} IN), 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.

Serial Communications Wiring

It is recommended that shielded (screened) cable be used for serial communications. This unit meets the EMC specifications using Alpha #2404 cable or equivalent. There are higher grades of shielded cable, such as four conductor twisted pair, that offer an even higher degree of noise immunity.

Refer to RS-485 Serial Communications, page 30, for wiring and operational procedures.

User Inputs

The external user inputs are programmable inputs that can be configured as current sinking (active low) or current sourcing (active high) inputs via a single plug jumper. Programmable external user inputs are digital inputs. The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection. The active logic state of ALL user inputs is dictated by the position of the User Input plug jumper. The plug jumper is located on the CPU board to the left of the DIP switches (See Figure 7, User Input Jumper Location). Input/User B can be programmed to be a user input when only unidirectional counting is required (See CNT IN parameter, page 17). When programmed as a User Input, Input B's active logic level is also controlled by the User SNK/SRC plug jumper.

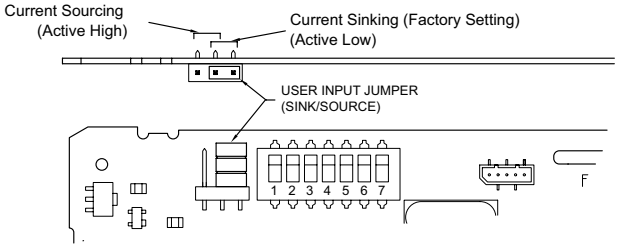


Figure 7, User Input Jumper Location

OUTPUT WIRING

Relay Connections

To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contactor. Follow the manufacturer's instructions for installation.

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

Input A and Input/User B

Input A and Input B have identical circuitry and share the same "COMM." terminal. Each input has separate DIP switches that configure the circuitry to accept various types of sensor outputs.

The input schematic shows the details of the input circuitry. Each input has three DIP switches whose functions are listed below.

To access the DIP switches, the unit assembly must be removed from the case. See Removing The Unit Assembly, page 4, for instructions.

INPUT A

SW1 - SNK: Provides a 7.8 KΩ internal pull-up resistor for sensors with current sinking outputs.

SRC: Provides a 3.9KΩ internal pull-down resistor for sensors with current sourcing outputs.

SW2 - HI FRQ: Removes damping capacitor and allows operation up to the maximum input frequency.

LO FRQ: Connects damping capacitor for switch contact debounce. Limits count speed to 50 Hz maximum and count pulse ON or OFF times to 10 msec. minimum.

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

SW3 - HI BIAS: Sets input trigger levels at mid-range, to accept outputs from 2-wire proximity sensors, resistive photo-cells, and logic pulses with full 0 to +12V swings.

Input trigger levels: V_{IL} = 5.5 V max; V_{IH} = 7.5 V min.

LO BIAS: Sets input trigger levels to low range, to accept logic pulses with 0 to +5 V swings.

Input trigger levels: V_{IL} = 1.5 V max; V_{IH} = 3.75 V min.

Note: V_{IL} and V_{IH} levels given are typical values ±10%, when the counter voltage at the DC OUT/IN terminal, is +12 VDC. These typical values will vary in proportion to the variations in DC OUT/IN terminal voltage, caused by line voltage and load changes.

INPUT B

SW4 - Same as SW1
SW5 - Same as SW2
SW6 - Same as SW3

SW7 - PGM.DIS.: See Front Panel Accessible Functions With Program Disable, page 14, for details.

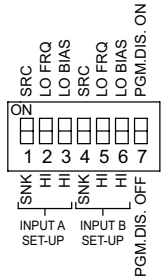


Figure 8, DIP Switches

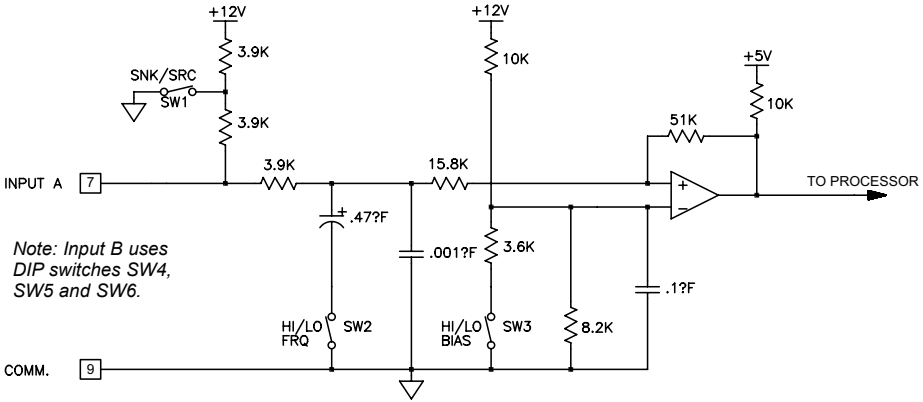
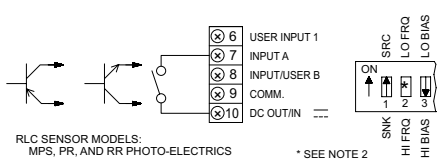


Figure 9, Input Circuit Schematic

Various Sensor Output Connections

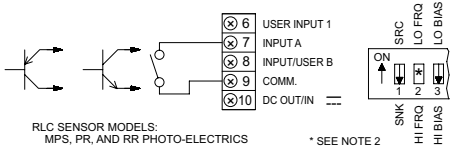
COUNT SWITCH OR ISOLATED TRANSISTOR OUTPUTS
CURRENT SOURCE CONNECTED (COUNT ON OPENING)



RLC SENSOR MODELS:
MPS, PR, AND RR PHOTO-ELECTRICS

* SEE NOTE 2

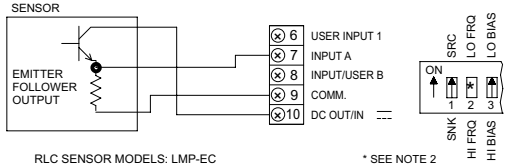
CURRENT SINK CONNECTED (COUNT ON CLOSING)



RLC SENSOR MODELS:
MPS, PR, AND RR PHOTO-ELECTRICS

* SEE NOTE 2

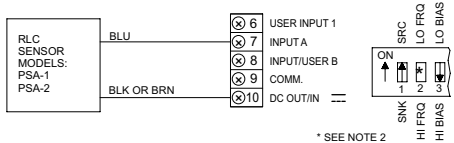
OLDER STYLE SENSORS WITH E-F OUTPUT - CURRENT SOURCE CONNECTED (COUNT ON FALLING EDGE)



RLC SENSOR MODELS: LMP-EC

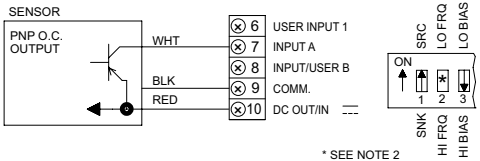
* SEE NOTE 2

2 WIRE PROXIMITY SENSORS - CURRENT SOURCE CONNECTED
(COUNT ON CURRENT FALL)



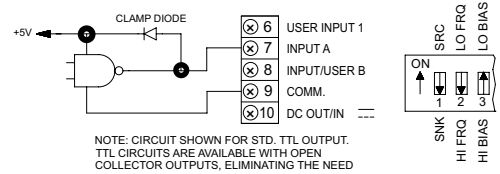
* SEE NOTE 2

SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.)
(COUNT ON TURN-OFF)



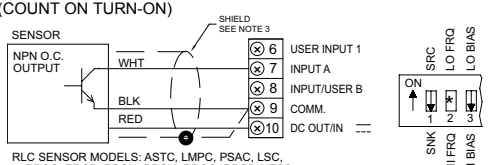
* SEE NOTE 2

INTERFACING WITH TTL



NOTE: CIRCUIT SHOWN FOR STD. TTL OUTPUT.
TTL CIRCUITS ARE AVAILABLE WITH OPEN COLLECTOR OUTPUTS, ELIMINATING THE NEED FOR A CLAMP DIODE.

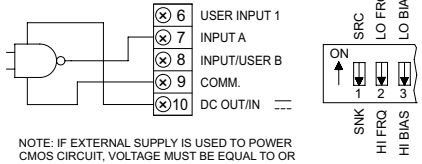
SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.)
(COUNT ON TURN-ON)



RLC SENSOR MODELS: ASTC, LMPC, PSAC, LSC, RPGC, RPGB, RPGH, RPGN, RPGO, RPGP, HESS

* SEE NOTE 2

INTERFACING WITH CMOS CIRCUITRY (B TYPE)



NOTE: IF EXTERNAL SUPPLY IS USED TO POWER CMOS CIRCUIT, VOLTAGE MUST BE EQUAL TO OR GREATER THAN DC OUT VOLTAGE.

NOTES:

1. **SENSOR VOLTAGE AND CURRENT**
   The DC OUT/IN terminal can supply +12 VDC @ 100 mA max. within a ±15% range, due to line and internal load variations. Most RLC sensors will accommodate this range.
2. **HI/LO FRQ SELECTION**
   The HI/LO FRQ selection switch must be set on “LO FRQ” when switch contacts are used to generate count input signals. The “LO FRQ” mode also provides very high immunity against electrical noise pickup. It is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The “LO FRQ” mode can be used with any type of sensor output, provided count pulse widths never decrease below 10 msec, and the count rate does not exceed 50 Hz.
3. When shielded cable is used, connect the shield to “COMM.” at the counter and leave it disconnected at the sensor end.
4. Inputs A and B can accept source pulses from other circuits up to +30 V in amplitude. For voltages above +30 V, a limiting resistor and zener diode should be used to limit the voltage at the input terminal.

FRONT PANEL DESCRIPTION

The front panel bezel material is flame and scratch resistant, textured plastic with clear viewing window that meets NEMA 4X/IP65 requirements, when properly installed. Continuous exposure to direct sunlight might accelerate the aging process of the plastic material used in the bezel. The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

The display is a dual line, 6 digit LCD. On units with backlighting, the upper Main Display is red and the lower Secondary Display is green.

There are up to seven annunciators available in the lower display that illuminate to inform the operator of the counter and output status. See Figure 10, Front Panel, for a description of the annunciators.

Four front panel keys are used to access different modes and parameters. The following is a description of each key.

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

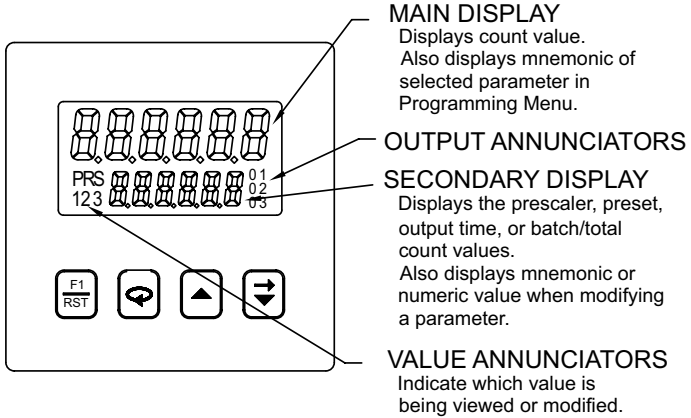


Figure 10 , Front Panel

Keypad Functions

F1/RST - This key is a user programmable key. When the key is pressed, the unit performs the appropriate function as programmed. The RST printing on this key is used as a quick reference for the operator if the function key is selected for a reset function.

- This key is used to access programming, enter changes to data values, and scroll through the available parameters in any mode.

- This key selects the next available mode option during programming. When programming a numerical value in digit entry mode, this key is used to increment the selected digit position. In auto scrolling entry mode, it increments the value. When in the operating mode, this key is pressed to allow changing of the data value viewed in the secondary display.

- When programming a numerical value in digit entry mode, this key accesses the value and selects the digit to the right. In auto scrolling entry mode, it decrements the value. When in the operating mode, this key is pressed to allow changing of the data value viewed in the secondary display.

BASIC OPERATION

Single and Dual Preset Units

The C48CS and C48CD have one counter that keeps track of the input pulse count. On each counter edge, the prescaler value is added to or subtracted from the count value. This results in the desired reading value for the count display.

The counter has two reset action modes; Reset to Zero (up-count modes) and Reset to Preset (down-count modes). A reset can be a manual reset, using a programmable user input, or it can be one of the programmable automatic reset modes.

The counter displays the scaled number of pulses that have been entered. When the count equals either preset 1 or 2, depending on the model, the appropriate output activates. The count can be programmed to automatically reset if desired.

3 Preset Batch Unit

The C48CB contains two counters that keep track of the Process Count, and the Batch or Total Count. On each count edge, the prescaler value is added to or subtracted from the count input value. This results in the desired reading value for the process or total count displays. The batch count registers one count each time the process is completed.

The process counter has two reset action modes; Reset to Zero (up-count modes) and Reset to Preset (down-count modes). A reset can be a manual reset, using a programmable user input, or it can be one of the programmable automatic reset modes.

The batch counter displays the number of process cycles that have been completed.

The total count is the total number of counts that have been received since the total was last reset. It can be used to keep a running total of process units on a desired per shift, per day, per week, etc. basis.

Normal Operating Mode

In the normal operating mode, the count or batch/total value is shown on the main display. By successively pressing the key, the accessible presets, prescaler, output time values, or batch/total count can be viewed in the secondary display.

With the exception of the batch/total count, each of the values can be independently programmed to be viewable only, viewable and changeable, or locked (not viewable) in the normal operating mode. On the batch models, if all values are locked, only the batch/total count value is viewable in the secondary display. On single or dual preset models, the display will be blank. Only from the normal operating mode can access be gained to the Programming Menu or Protected Value Menu.

Modifying A Secondary Display Parameter From the Front Panel

Secondary display parameters can be modified from the normal operating mode if the Operator Access privileges allow it.

To modify a parameter, it must be viewed in the secondary display. When the parameter to be modified is viewed, press the or key. Leading zeros appear and the least significant digit blinks. The value can now be modified as described in Programming Numeric Data Values, page 15.

Protected Value Menu

The Protected Value Menu allows access to selected presets, prescaler, and output time values without having them viewable or changeable from the main display. To enter the protected menu, the ⟲ key is pressed and held, and a code value is entered. The Protected Value Menu and the Programming Menu are not available at the same time. See Front Panel Accessible Functions With Program Disable, page 14, for available options.

Access value parameters that are programmed for “P” or “n” are accessible in the Protected Value Menu. Parameters selected as “n” (no) are viewable from the main display, but can only be changed in the protected menu. Parameters selected as “P” (protected) are not viewable from the main display, but can be viewed and changed in the protected menu.

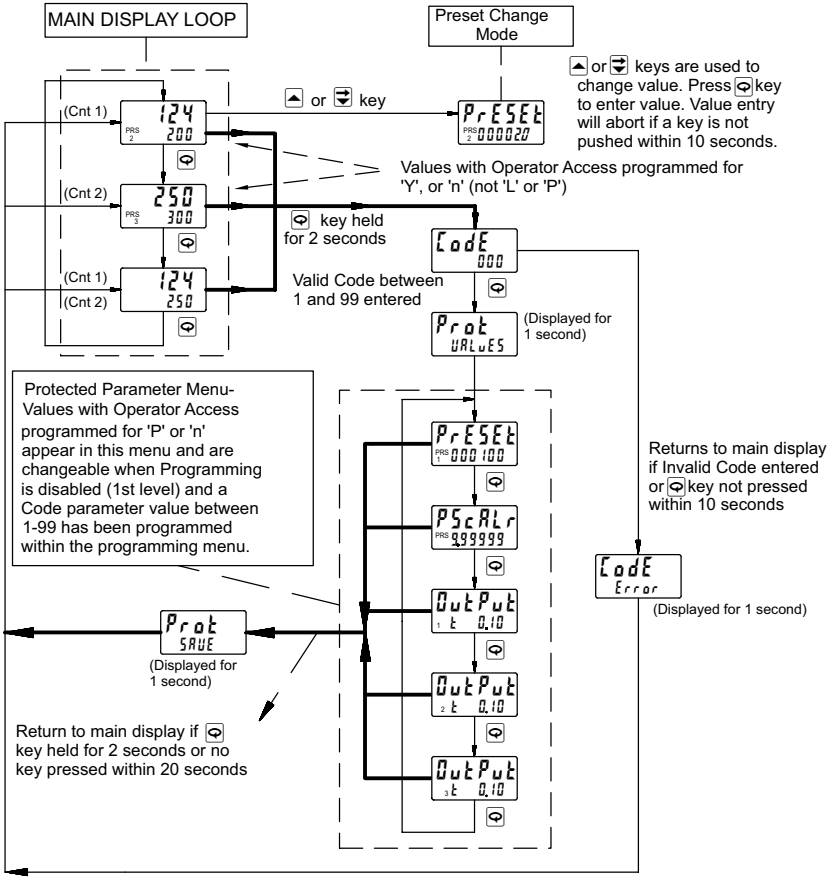


Figure 11, Protected Value Menu

Front Panel Accessible Functions With Program Disable

There are several ways to limit the programming of parameters from the front panel keypad. The Accessible Value parameters are used with the Program Disable DIP switch and an external programmable User Input selected for **Prod.5** to limit programming. To enter the programming mode, a code number may need to be entered, depending on the Program Disable Setting. Front Panel Function Key F1 cannot be selected for program disable. The following table describes the possible program disabling functions.

PGM.DIS. SWITCH	USER INPUT TERMINAL	PROGRAM CODE NUMBER	PROTECTED VALUE MENU	OPERATOR ACCESS AT MAIN DISPLAY	PROGRAMMING ENABLED	PROGRAM DISABLE LEVEL
OFF	INACTIVE or Not Programmed for Pro.dis	ALL	No	All displayed values changeable	Yes	None
OFF	ACTIVE	0	No	Per Access Privileges programmed	No	Level 1
OFF	ACTIVE	1 to 99	Yes W/code	Per Access Privileges programmed	No	Level 1
OFF	ACTIVE	100 to 199	No	Per Access Privileges programmed	Yes W/code	Level 1
ON	INACTIVE or Not Programmed for Pro.dis	0	No	Per Access Privileges programmed	No	Level 1
ON	INACTIVE or Not Programmed for Pro.dis	1 to 99	Yes W/code	Per Access Privileges programmed	No	Level 1
ON	INACTIVE or Not Programmed for Pro.dis	100 to 199	No	Per Access Privileges programmed	Yes W/code	Level 1
ON	ACTIVE	ALL	No	Viewable only	No	Level 2

PROGRAMMING GENERAL DESCRIPTION

Programming of the C48 Counter is done through the front panel keypad. English language prompts, flashing parameter values, and the front panel keypad aid the operator during programming.

Although the unit has been programmed at the factory, the parameters generally have to be changed to suit the desired application. In order to access the Programming Menu, the Program Disable DIP switch and/or any User Input programmed for **Prod IS** may need to be turned off or deactivated. When shipped from the factory, all programming is enabled. See Front Panel Accessible Functions With Program Disable, page 14, for program disabling options. With programming enabled, to enter the programming menu, the ⟲ key is pressed and held for two seconds. Once in the programming menu, the ⟲ key is used to sequence through the list of programming parameters. To loop backwards one item in the Programming Menu, press and hold the ⟲ key, then quickly press and hold the ⇉ key while releasing the ⟲ key. Repeatedly pressing the ⟲ key with the ⇉ key held will continue the backwards sequencing.

Programming Option Values

The operator can scroll through the available options for a selected parameter by pressing the ▲ or ⇉ keys to enter parameter change mode, and then pressing the ▲ key repeatedly until the desired option is viewed. The option is entered by pressing the ⟲ key, which returns the operator to the Programming Menu.

Programming Numeric Data Values

The presets, prescaler, and output time values may be accessible when the unit is in the normal operating mode (not programming mode), providing that the Program Disable input is not activated. Pressing the ⟲ key will sequence the secondary display through the available presets, prescaler, and output time values.

To change a numeric data value it must be visible on the secondary display. Pressing the ▲ or ⇉ key will allow changing of the value. The two methods for changing numeric data values are “digit entry” and “auto scrolling”.

Digit Entry

If the data entry method has been set to “digit entry”, the least significant digit will blink. Pressing the ⇉ key multiple times will select other digits. Pressing the ▲ key will increment the selected digit. The data value will be entered when the ⟲ key is pushed, or the old value will be retained if no key activity is detected for 10 seconds.

Short-Cut - Decrementing Value

To decrement a digit value, press and hold the ▲ key and then press the ⇉ key. This will decrement the selected digit to zero if held.

Auto Scrolling

If the data entry method is set to “auto scrolling”, the data value can be progressively changed by pressing and holding the ▲ or ⇉ keys. If one of the keys is pushed and held, the value will scroll automatically. After 5 counts, the unit enters fast scroll mode. If a key remains pushed, a digit shift occurs every one hundred counts until the maximum value or zero is reached. When the digit shift occurs, the previously scrolling digit goes to zero. When scrolling at the higher order digit locations, you can switch directions by quickly pressing the other key (▲ or ⇉) within a second following the release of previous direction key.

Short-Cut - Quick Digit Shift

To quickly select higher order digits while incrementing or decrementing numeric values (with ▲ or ⇉ held), press and hold the ⟲ key. This sequences the selected digit from the least to the most significant digit. As each digit is passed, it changes to zero. When the desired digit is reached, release the ⟲ key to increment or decrement from the new digit location.

Saving Program

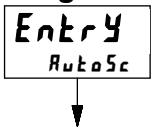
All parameter values changed in programming mode are saved when exiting. To exit programming mode, press and hold the ⟲ key for two seconds. The display will momentarily display **Prog SAVE** while the parameter values are saved in non-volatile memory. The unit then returns to the indication display that was last viewed.

USER INTERFACE/PROGRAMMING MODES

The operating modes of the C48 Counter are programmed using the front panel keypad. Accessibility to the Programming Menu depends on the Program Disable Function setting (See Front Panel Accessible Functions With Program Disable, page 14, for available settings).

Note: Before attempting to program the C48C, read the section Programming General Description, page 15, for detailed information on using the front panel keypad to navigate through the Programming Menu.

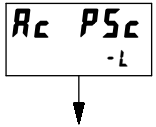
Programming Menu



Numeric Value entry method

Configures push button response for entering numeric data values such as Presets, Prescaler, and Output Times.

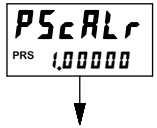
MODE	DESCRIPTION
AutoSc	The auto scrolling method allows pressing and holding the “up” or “down” keys to progressively change all digits of the data value, similar to incrementing or decrementing a counter.
digit	The digit entry method allows the selecting and incrementing of each numeric digit on an individual digit-by-digit basis.



Access Prescaler Value

This parameter configures the type of access given to the Prescaler Value when in normal operating mode with Programming disabled. For more information on Program Disable, see page 14.

MODE	DESCRIPTION
-L	**Locked**; Prescaler is not viewable at main display or in Protected Value Menu. The Prescaler can only be viewed or changed in the Programming Menu.
-P	**Protected Value**; Prescaler value is viewable and changeable in Protected Value Menu only. It is not viewable at Main Display.
-n	**No**; Prescaler value is viewable only and not changeable from main display when Programming is Disabled. Value is viewable and changeable in Protected Value Menu.
-Y	**Yes**; Prescaler value is viewable and changeable at main display when at 1st level program disable. Value is not shown in Protected Value Menu.

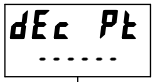


Prescaler (0.00001 - 9.99999*)

The Prescaler is used to convert a pulse input signal to the desired units of indication. For each pulse input, the Prescaler value is added to or subtracted from the internal count value. A prescaler of 1.00000, provides unity scaling, i.e., for every pulse input, the display changes by 1. The prescaler value selected will affect the maximum count rate (See Appendix B - Specifications, page 39).

It is important to note that the precision of a counter application cannot be improved by using a prescaler greater than 1.

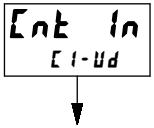
**Limited to 1.00000 or less on Prescaler Output Model or when Counter 2 is assigned to total on the Batch Counter.*



Decimal Point Position

Programmable for display of 0 to 5 digits right of decimal point.

MODE	DESCRIPTION
------	No decimal Point
-----.-	Decimal point for 10ths
----.--	Decimal point for 100ths
---.---	Decimal point for 1000ths
--.----	Decimal point for 10,000ths
-.-----	Decimal point for 100,000ths



Count Input Mode

This parameter controls the Count / Control function of Inputs A and B. It also allows Input B to be used as a User Input when only uni-directional counting is required.

MODE	Input A	Input B
C1-USr*	Count X1; Count on falling edge	User Input B (See UsrInb parameter)
C2-USr	Count X2; Counts on both edges	User Input B (See UsrInb parameter)
C1-Ud*	Count X1; Counts on falling edge	Up/Down control; Input B high = Up Input B Low = Down
C2-Ud	Count X2; Counts on both edges	Up/Down control; Input B high = Up Input B Low = Down
Ad-Sub	Add count; Counts on falling edge	Subtract count; Counts on falling edge
Ad-Ad	Add count; Counts on falling edge	Add count; Counts on falling edge
QUAd 1	Quadrature X1 Input	Quadrature X1 Input
QUAd 2	Quadrature X2 Input	Quadrature X2 Input
QUAd 4	Quadrature X4 Input	Quadrature X4 Input

**- These are the only count input modes available on the Prescaler Output model.*

Count Modes

Input A signal is used for the count input. Input B is used in combination with Input A for Count Direction Control, Quadrature counting, Anti-coincidence Add/Subtract, or Anti-coincidence Add/Add counting applications.

C1-USR - The unit counts one count on every negative edge of the input signal at Input A. In this mode, Input B acts as a user input and has no effect on the count function.

C2-USR - The unit counts one count on every negative edge of the input signal and one count on every positive edge of the input signal at Input A. In this mode, the input signal is effectively doubled. Input B acts as a user input and has no effect on the count function.

C1-UD - The unit counts one count on every negative edge of the input signal at Input A. The direction of the count is determined by the logic state of Input B. A high level at Input B causes the unit to count in a positive direction. A low level causes the unit to count in a negative direction.

C2-UD - The unit counts one count on every negative edge of the input signal and one count on every positive edge of the input signal at Input A. In this mode, the input signal is effectively doubled. The direction of the count is determined by the logic state of Input B. A high level at Input B causes the unit to count in a positive direction. A low level causes the unit to count in a negative direction.

AD-SUB - This mode effectively separates count pulses that may simultaneously appear at the two inputs. The C48C processes the count pulses into a string of time separated pulses, so the internal counter does not miss any count pulses. Input A serves as the add input (count increments) and Input B serves as the subtract input (count decrements).

AD-AD - This mode effectively sums count pulses that may simultaneously appear at the two inputs. The C48C processes the count pulses into a string of time-separated pulses so the internal counter does not miss any count pulses. Input A serves as an add input (count increments) and Input B serves as an additional add input (count increments).

QUAD 1 - Quadrature counting modes are primarily used in positioning and anti-jitter applications. This mode works due to the manner in which the two incoming pulses are positioned relative to each other. The pulse signal on Input B is shifted 90° away from the pulse signal at Input A. These two signals are processed by the C48C as follows:

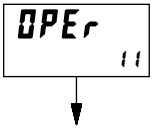
Input A serves as the count input, while Input B serves as the quadrature input. For quadrature with single edge counting, the counter counts in a positive direction when Input A is a negative going edge and Input B is at a low level. The counter counts in a negative direction when Input A is a positive going edge and Input B is at a low level. All transitions on Input A are ignored when Input B is at a high level. These logic rules provide the basis for anti-jitter operation which prevents false counts from occurring due to back-lash, vibration, chatter, etc.

QUAD 2 - When two edge counting is used, the quadrature mode works the same as with single edge counting when Input B is low. But, when Input B is a high level, counts at Input A are no longer ignored. Instead, the logic rules for Input A are complemented, allowing both edges of Input A to be counted. This doubles the effective resolution of the encoded input.

QUAD 4 - This takes the quadrature mode, with two edge counting, one step further. In quadrature times 4, both Input A and Input B serve as the count or quadrature input, depending on their state. In one instance, Input A serves as the count input and Input B serves as the quadrature input. In another instance, Input A is the quadrature input and Input B is the count input. This enables each edge, positive and negative going , of both inputs, A and B, to be counted. This results in a resolution four times greater than in the basic quadrature X1 mode.

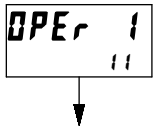
Counter (1) Operating Mode

Single or Dual Preset Model



The charts on the following pages show operating modes for single preset and the dual preset / Batch Counter Models. In the descriptions below the "Main Preset or Output" refers to "Preset or Output 1" on the single preset Model. On the dual preset or Batch Models it refers to "Preset or Output 2".

Batch Model



Reset Type:

Auto - unit automatically resets when count triggers main preset's output or at its timed output end, as programmed.

Manual - unit does not reset when count triggers main presets output or at its timed output end. The counter can be manually reset by a User Input or by a Serial Communications command.

Reset to:

Zero - When reset (manually or automatically) counter goes to zero. The Main Preset Output is triggered when count value reaches main Preset Value

Preset - When reset (manually or automatically), the main Preset value is loaded into the counter. The main Preset Output is triggered when count reaches zero.

At Timed Output End:

When this mode is selected, Auto Reset occurs when the main preset's Output time elapses and the main output deactivates. If not selected, Auto reset occurs when the main output is triggered.

Output 1: (Main Output for Single Preset Model)

Latched - When Output 1 activates, it stays activated or latched until it is manually reset.

Timed - When Output 1 is activated it stays activated for the time specified by the Output 1 Time Value. Output 1 deactivates after the Output 1 time elapses.

O1 Off at O2: (dual preset / Batch Model only)

Output 1 activates at Preset 1. It deactivates when Output 2 is activated. Does not apply when activating Output 2 using Serial Communications command.

Output 2: (dual preset / Batch Model only; Main Output)

Operates similarly to Output 1 Latched and Timed modes.

SINGLE PRESET OPERATING MODES

Use either of the two charts below for more information on specific operating modes.

SINGLE PRESET OPERATING MODES
1 - Manual Reset to Zero, Latched Output
2 - Manual Reset to Zero, Timed Output
3 - Manual Reset to Preset, Latched Output
4 - Manual Reset to Preset, Timed Output
5 - Auto Reset to Zero, Timed Output
6 - Auto Reset to Preset, Timed Output
7 - Auto Reset to Zero at Timed Output End
8 - Auto Reset to Preset at Timed Output End

MODE#	RESET TYPE		RESET			OUTPUT 1	
	Manual	Auto	To Zero	To Preset	at Timed Output End	Latched	Timed
1	√		√			√	
2	√		√				√
3	√			√		√	
4	√			√			√
5		√	√				√
6		√		√			√
7		√	√		√		√
8		√		√	√		√

DUAL PRESET/ BATCH COUNTER 1 OPERATING MODES

Use either of the two charts below for more information on specific operating modes.

DUAL PRESET AND BATCH COUNTER 1 OPERATING MODES
1 - Manual Reset to Zero, Latched Outputs
2 - Manual Reset to Zero, 01 Timed, 02 Latched
3 - Manual Reset to Zero, 01 and 02 Timed
4 - Manual Reset to Zero, 01 off at 02, 02 Latched
5 - Manual Reset to Zero, 01 off at 02, 02 Timed
6 - Manual Reset to Preset 2, Latched Outputs
7 - Manual Reset to Preset 2, 01 Timed, 02 Latched
8 - Manual Reset to Preset 2, 01 and 02 Timed
9 - Manual Reset to Preset 2, 01 off at 02, 02 Latched
10 - Manual Reset to Preset 2, 01 off at 02, 02 Timed
11 - Auto Reset to Zero, 01 and 02 Timed
12 - Auto Reset to Zero, 01 off at 02, 02 Timed
13 - Auto Reset to Preset 2, 01 and 02 Timed
14 - Auto Reset to Preset 2, 01 off at 02, 02 Timed
15 - Auto Reset to Zero at 02 End, 01 and 02 Timed
16 - Auto Reset to Zero at 02 End, 01 off at 02, 02 Timed
17 - Auto Reset to Preset 2 at 02 End, 01 and 02 Timed
18 - Auto Reset to Preset 2 at 02 End, 01 off at 02, 02 Timed