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INF7

INFINITY® Rate Meter / Totalizer Clock • Batch Controller

Operator's Manual



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WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

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⚠ This device is marked with the international caution symbol. It is important to read the Setup Guide before installing or commissioning this device as it contains important information relating to safety and EMC.

Table of Contents -

HOW TO USE THIS MANUAL

This manual is organized to follow a sequence of setting up the meter, configuring it, and operating it. The table of contents reflects this sequence. The contents also show that the manual contains a lot of information; we have taken care to answer likely questions and provide all the information you may need. We have purposely included all sections in the contents, to allow you to use it as an index–to easily pinpoint specific information and go directly to it.

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SAFETY CONSIDERATIONS



This device is marked with the international Caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

Unpacking & Inspection



Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

This instrument is a panel mount device protected in accordance with Class I of EN 61010 (115/230 AC power connections). Installation of this instrument should be done by Qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has no power-on switch. An external switch or circuit-breaker shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall not interrupt the Protective Conductor (Earth wire), and it shall meet the relevant requirements of IEC 947–1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the mains supply cord.

Furthermore, to provide protection against excessive energy being drawn from the mains supply in case of a fault in the equipment, an overcurrent protection device shall be installed.



- The **Protective Conductor** must be connected for safety reasons. Check that the power cable has the proper Earth wire, and it is properly connected. It is not safe to operate this unit without the Protective Conductor Terminal connected.



- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

1. Introduction

1.1 DESCRIPTION

The Counter Timer is a multifunctional panel meter that can measure counts, rates, flows, times, totals and batches from pulse and analog input sources over the range of 0.2 to 20,000 Hz.

The meter can function in four different modes and be applied to a wide range of applications, serving functions as simple as displaying incoming pulses–or as complex as detecting out-of-limits conditions, triggering alarms, and channeling communications for a process control system.

The front panel displays values and messages with six, 14-segment LEDs, indicates which mode-associated measurement is being displayed through three Measurement LEDs, and indicates alarm status through four Setpoint LEDs. Five buttons below the LED display allow easy front-panel configuration and access to the meter's many features. These features can also be accessed through digital communications.

The meter can be mounted in a panel or simply placed on a bench top.

1.2 FEATURES

The following list outlines the meter's features.

- Six-digit display
- Microprocessor-based, with nonvolatile memory-no battery backup required
- Configurable via front-panel push buttons and/or through RS-232 or RS-485 ports
- High accuracy
- Large digital offset enabling easy scaling in engineering units
- Five open-collector outputs for RATE, TOTAL, BATCH count, BAT NO (Number of Batches), and TIME
- Programmable decimal point selection
- Read/Display/Output rates up to 25 per second
- Plug-in input and output optional boards

1

Introduction

1.3 METER MODES

The meter can be configured to operate in four different modes. These are Rate Meter/Totalizer (Rate), Rate Meter/Totalizer/ Square Root Extractor (Sq Rt), Batch Controller (Batch), and Clock (C).

1.3.1 RATE METER/TOTALIZER

As a rate meter/totalizer, the meter measures the rate, totalizes and displays pulses in any engineering units required, and provides unregulated sensor excitation. The meter can also provide running averages and process time in HH:MM:SS format in this mode.

With the addition of the Isolated Analog Input Board, analog signals can be received and displayed in the required engineering units.

1.3.2 RATE METER/TOTALIZER/SQUARE ROOT EXTRACTOR

As a rate meter/totalizer/Square Root Extractor, the meter can accept dc signals from any typical differential flow transmitter and extract the square root to provide highly accurate flow values. Digital calculation ensures accurate readings–which can be displayed in any engineering units desired.

This mode requires the Isolated Analog Input Board.

1.3.3 BATCH CONTROLLER

As a batch controller, the meter can count the batch, number of batches completed, and the grand total of pulses received. In addition, it has an internal timer for process time displayed in HH:MM:SS format. Any of the above functions can be displayed during the process without interrupting or stopping the process.

1.3.4 CLOCK

As a clock, the meter can function in real, 24-hour time mode using the HH:MM:SS display format. It can also function as a 99-hour process timer. Time is derived from the power line frequency, 50 or 60 Hz, which ensures accuracy. If power fails and the meter is equipped with a backup battery, the clock function continues working (although the display will not be lit). Refer to Section 2.3.5.2 for information on battery backup.

1.4 OPTIONAL BOARDS OVERVIEW

The meter is designed to accommodate numerous optional boards.

These boards transform the meter into a single instrument that "can do it all." On the input end, they allow the meter to accept signals from a wider variety of sources, and on the output end, to communicate with, or control a wide variety of other devices.

1.4.1 ISOLATED PULSE INPUT BOARD

The Isolated Pulse Input Board is a signal conditioning board that allows the meter to accept low- and high-level input signals from sources whose pulses may be too weak for the Main Board of the meter to handle, or that need selectable hysteresis and/or regulated excitation. This board is used mainly for weak magnetic pick-ups, high-level line voltage sources, and NAMUR sources.

If this board is used, the Isolated Analog Input Board cannot be used.

(See Appendix B for specifications, jumper configuration, wiring, and applications for the Isolated Pulse Input Board.)

1.4.2 ISOLATED ANALOG INPUT BOARD

The Isolated Analog Input Board is a signal conditioning board that converts analog signals to frequency and allows the meter to accept input signals from non-pulsed or direct current sources. This board is often used with differential pressure flow transmitters to provide linear flow values. (First-time installation requires calibration using calibration data on the back of the board.)

If this board is used, the Isolated Pulse Input Board cannot be used.

(See Appendix C for specifications, jumper configuration, wiring, and applications for the Isolated Analog Input Board.)

1.4.3 ISOLATED ANALOG OUTPUT BOARD

The Isolated Analog Output Board converts display readings into voltage or current output. This board is often used as a control board in process applications. (First-time installation requires calibration using calibration data on the back-the solder or out-board side of the board.)
(See Appendix D for specifications, jumper configuration, wiring, calibration, and applications for the Isolated Analog Output Board.)

1.4.4 ISOLATED PARALLEL BCD (BINARY-CODED DECIMAL) OUTPUT BOARD

The Isolated Parallel BCD Output Board produces binary-coded decimal output for direct communication with a printer or with an intelligent device such as a PLC (Programmable Logic Controller).

If this board is used, the Dual Relay Output Board cannot be used.

(See Appendix E for specifications, jumper configuration, wiring, and applications for the Isolated Parallel BCD Output Board.)

1.4.5 DUAL RELAY OUTPUT AND 4 RELAY OUTPUT BOARD

The Dual Relay Output and 4 Relay Output Board enables setpoint-triggered switching to an external device.

If either option board is used, the Isolated Parallel BCD Output Board cannot be used.

(See Appendix F for specifications, jumper configuration, wiring, and applications for the Relay Output Board.)

1.4.6 ISOLATED RS-232 SERIAL COMMUNICATIONS BOARD

The Isolated RS-232 Serial Communications Board provides an isolated digital communications channel between a single meter and a computer, serial printer, or other device.

If this board is used, the RS-485 Serial Communications Board cannot be used.

(See Appendix G for specifications, jumper configuration, wiring, and applications for the Isolated RS-232 Serial Communications Board.)

1.4.7 ISOLATED RS-485 SERIAL COMMUNICATIONS BOARD

The Isolated RS-485 Serial Communications Board provides an isolated digital communications channel where multiple meters (addressed from 0 to 199) can communicate with a single computer.

If this board is used, the RS-232 Serial Communications Board cannot be used.

(See Appendix G for specifications, jumper configuration, wiring, and applications for the Isolated RS-485 Serial Communications Board.)

1.5 AVAILABLE MODELS AND OPTIONS

The following models and options are available. Optional boards are either installed at the time of purchase, or available as separate items and installed by the user after purchase.

BASIC MODELS

MODEL NUMBER	DESCRIPTION
INF7-0	Red LED Display, 115 V ac, 50/60 Hz
INF7-1	Red LED display, 230 V ac, 50/60 Hz
INF7-2	Green LED display, 115 V ac, 50/60 Hz
INF7-3	Green LED display, 230 V ac, 50/60 Hz

INPUT OPTIONS

MODEL NUMBER	DESCRIPTION
0	No optional input board; Basic Meter accepts low level and high level pulses from TTL/CMOS sources, open collector outputs and contact closures; provides 14-20 V unregulated sensor excitation
1 (P7A1)	Isolated Pulse Input Board. Single-input for magnetic pick-ups with low- and high-level signals; direct connection to NPN, PNP, or NAMUR sensors. Includes electrically floating, regulated sensor excitation rated 12.6 V @ 70 mA or 8.2 V or 5 V
2 (P7A5)	Isolated Analog Input Board. Input ranges of 0-1 mA, 4-20 mA, 0-5 V, 1-5 V, and 0-10 V are jumper selectable. Standard factory default calibration: 4-20 mA dc = 0-10000

CONTROL/BCD OUTPUT OPTIONS

MODEL NUMBER	DESCRIPTION
0	No optional output board; standard five open-collector outputs
1 (BCD1)	Isolated Parallel BCD (Binary-Coded Decimal) Output Board
2 (REL1)	Dual Relay Output Board; Two 7-amp, Form-C Relays
3 (REL4)	4 Relay Output Board; Two 7-amp & two 1 amp Form-C Relays.

NOTE: Choose only one Control/BCD output option per meter. A 40-socket plug is included with the BCD option.

ANALOG OUTPUT OPTIONS

MODEL NUMBER	DESCRIPTION
0	No analog output board
1 (ANO2)	Isolated Analog Output Board: Configurable output; 0-20 mA, 4-20 mA, 0-5 V, 0-10 V. Standard factory default calibration: 0-10000 = 4-20 mA dc

DATA COMMUNICATIONS OPTIONS

MODEL NUMBER	DESCRIPTION
0	No serial communications board
1 (RS21)	Isolated RS-232 Serial Communications Board*
2 (RS41)	Isolated RS-485 Serial Communications Board**

NOTE: Choose only one option per meter. Both computer communications come with a 6-foot communications cable with phone plug termination.

* We recommend purchase of 9SC2 or 25SC2 (see OPTIONS below)
** We recommend purchase of 9SC4 or 25SC4 (see OPTIONS below)

OPTIONS

MODEL NUMBER	DESCRIPTION
FS	Custom Factory Calibration/Configuration
BL	Blank Front Panel Lens
9SC2	9-pin Serial Connector for RS-232 port
9SC4	9-pin Serial Connector for RS-485 port
25SC2	25-pin Serial Connector for RS-232 port
25SC4	25-pin Serial Connector for RS-485 port
RP18	19-inch Rack Panel for 1 meter
RP28	19-inch Rack Panel for 2 meters
RP38	19-Inch Rack Panel for 3 meters

2. Setup

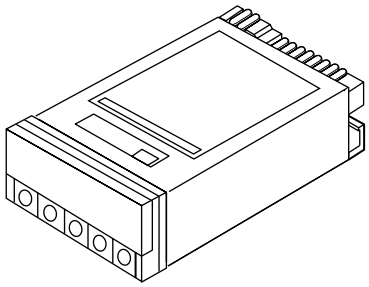
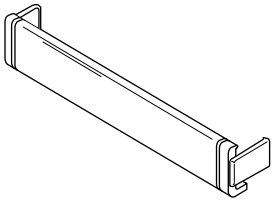
2.1 UNPACKING

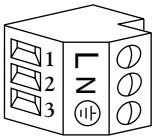
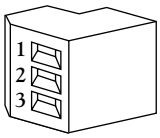
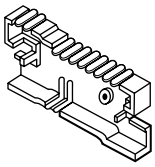
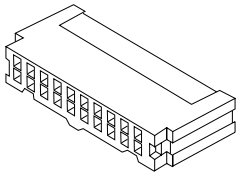
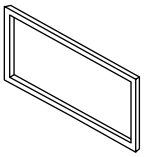
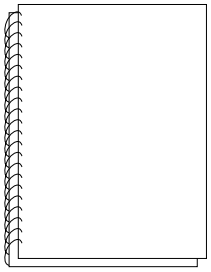
Unpack all items and make sure that every item on the packing list is present. The items you should receive are listed below. If something is missing, use the phone number for the Customer Service Department nearest you.

Also, inspect the shipping container and enclosed equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE: The shipping agent will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save all packing material and containers in the event that reshipment is required.

You should receive the following items :

QTY	DESCRIPTION	ILLUSTRATION
1	Basic meter with main board (and optional boards if ordered by number); in plastic case with sleeve, panel gasket, two thumbnuts	
1	Front-panel button cover available with return of the postcard (see meter box)	

QTY	DESCRIPTION	ILLUSTRATION
1	Orange, 3-socket power connector (P1); for AC input	
1	Gray, 3-socket input connector (P3); for signal input	
1	Rear cover with holddown screw	
1	20-Socket Ribbon Connector (P2)	
2	Panel-mount gasket (1 spare)	
1	Operator's manual	

2.2 SAFETY PRECAUTIONS

The meter is protected in accordance with Class I of EN61010. Refer to Safety Considerations page.

> ***WARNING**: If your meter is to be wired to sensors or to control inputs that could have hazardous potentials, these potentials will be carried to the 20-pin output connector (P2) at the rear. They will also be present on the meter's circuit boards. Follow all instructions carefully, inserting the electronics into the case and installing connectors BEFORE connecting the meter to any source of power.*
>
> *DO NOT contact any exposed metal parts, install optional board(s), change jumpers, or in any way disassemble or assemble the meter while it is connected to AC voltage.*

Note the following information and guidelines for safe operation of your meter:

2.2.1 POWER VOLTAGE

Your power source voltage rating should agree with the voltage under which the meter has been configured to operate. The first thing you should do is verify this.

The meter's operating voltage is shown in the VOLTS: entry of the ID and Serial Number Label. Figure 2-1 shows a copy of this label. It is located on the meter packing box and is clearly visible. (Another label is also affixed to the meter case.)

MODEL:
SERIAL NO.:
PART NO.:
VOLTS: **WATTS:**

Figure 2-1. ID and Serial Number Label showing the Meter's operating voltage.

2.2.2 POWER WIRING

CAUTION: The meter has no power-on switch; it will be ON when power is applied.

Section 2.3.5 shows you how to wire not only the AC power connector, but all other connectors as well.

2.3 ASSEMBLY/DISASSEMBLY

2.3.1 OPENING THE METER

Your meter is fully assembled, but not wired. In most cases, if you have ordered optional boards with the meter, these boards will already be installed.

You will need to remove only the rear cover to complete wiring, but you will have to open the meter to do one or more of the following:

WARNING: You must disconnect and turn-off the power and connector signals before accessing the unit and installing optional boards. Failure to do so may result in injury!

a. Check or reconfigure the Transformer Jumpers on the Main Board so that they correspond to your line voltage (W1 and W2 for 115 V ac, or W3 for 230 V ac). See Section 2.3.2.1.

b. Access jumpers on the Main and optional boards. See Section 2.3.2.

c. Install optional boards. See Section 2.3.3.

2

Setup

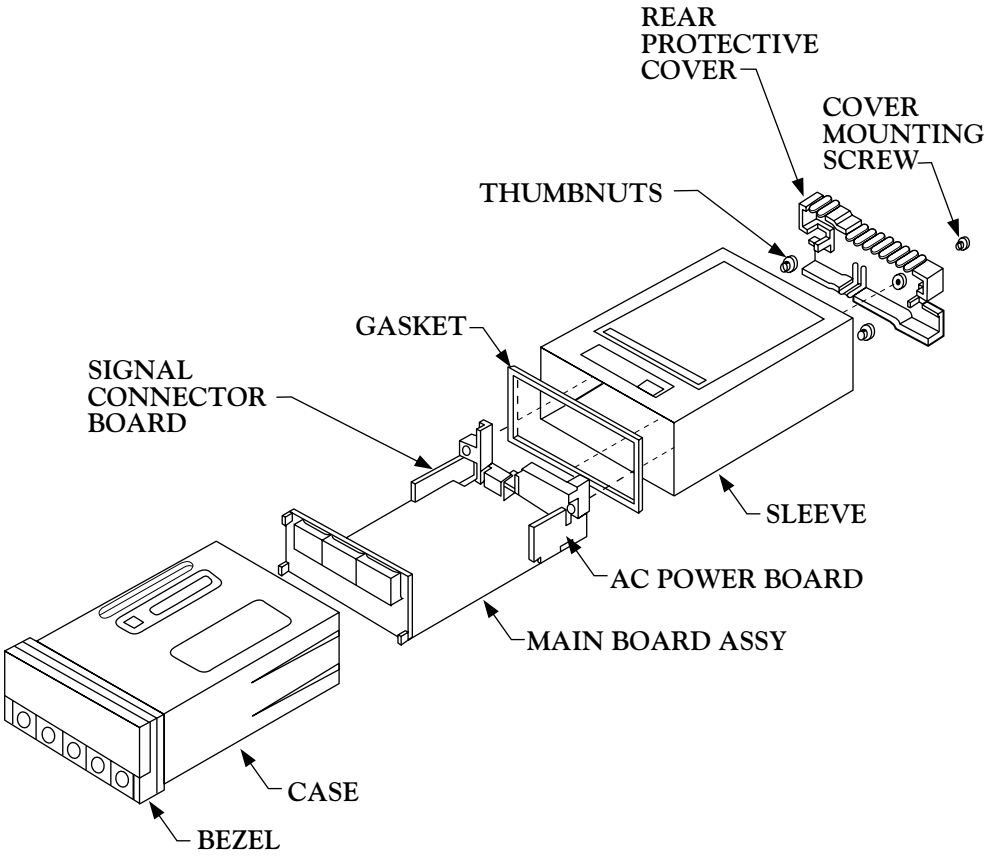


Figure 2-2. Exploded View of the Meter

Using Figures 2-2 as a guide, follow these simple instructions to open the meter:



IMPORTANT: Turn-off the power and input signals from the unit before proceeding. Failure to do so may result in injury!

1. Remove the cover mounting screw that secures the rear protective cover to the meter, and remove the Rear Protective Cover.

   If you are simply wiring the meter–but not checking jumpers or installing or removing boards–this is as far as the meter needs to be disassembled. Go to Section 2.3.5.

2. Remove all wiring connectors from the rear of the meter.

3. Remove the two thumbnuts that secure the case to the sleeve.

4. Remove the sleeve completely by sliding it back from the front bezel.

6. Using Figure 2-4 as a guide, bend the side-panel detents on the case outward and pull the board assembly out of the case by the mounting screw stem.

These six steps are known as "accessing the Main Board assembly."

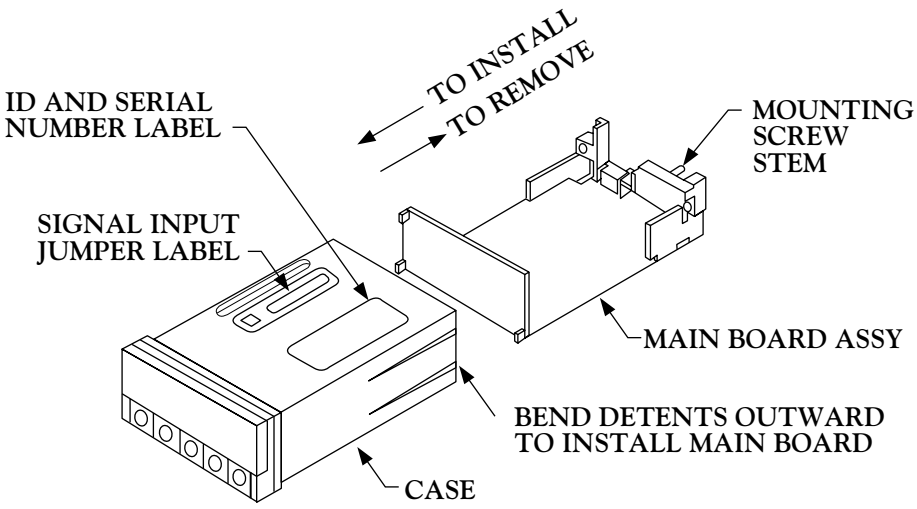


Figure 2-4. Removing the Main Board Assembly from the Case

The meter is now disassembled to the point where you can check and configure jumpers and install boards.

NOTE: When the sleeve is removed from the case in Step 5 above, the Connector Label on the case will be exposed. See Figure 2-5. Use this label for reference when wiring or connecting plugs.

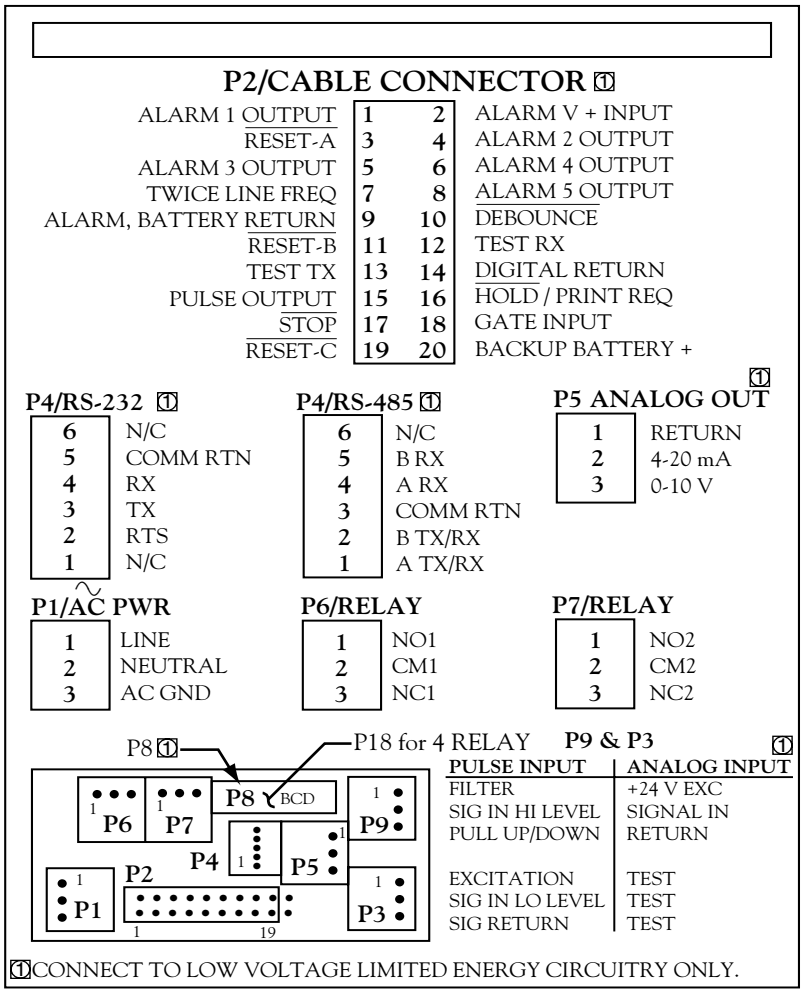


Figure 2-5. Connector Label

2.3.2 CHECKING AND INSTALLING JUMPERS

This section contains figures and instructions for checking and installing jumpers, but it gives full information on the Main Board only. If you have any optional boards, refer to the appropriate appendix for specific jumper information.

NOTE: When referring to jumpers and the corresponding boards, the view is from the REAR of the meter.

2.3.2.1 MAIN BOARD JUMPERS

Using Figure 2-6 and Table 2-1, configure or check Main Board jumpers.

CAUTION: The meter has no power-on switch; it will be in operation as soon as you apply power. To change the factory preset jumpers, disconnect the power from the unit. Failure to do so may result in injury! The jumpers must be changed by specially trained personnel.

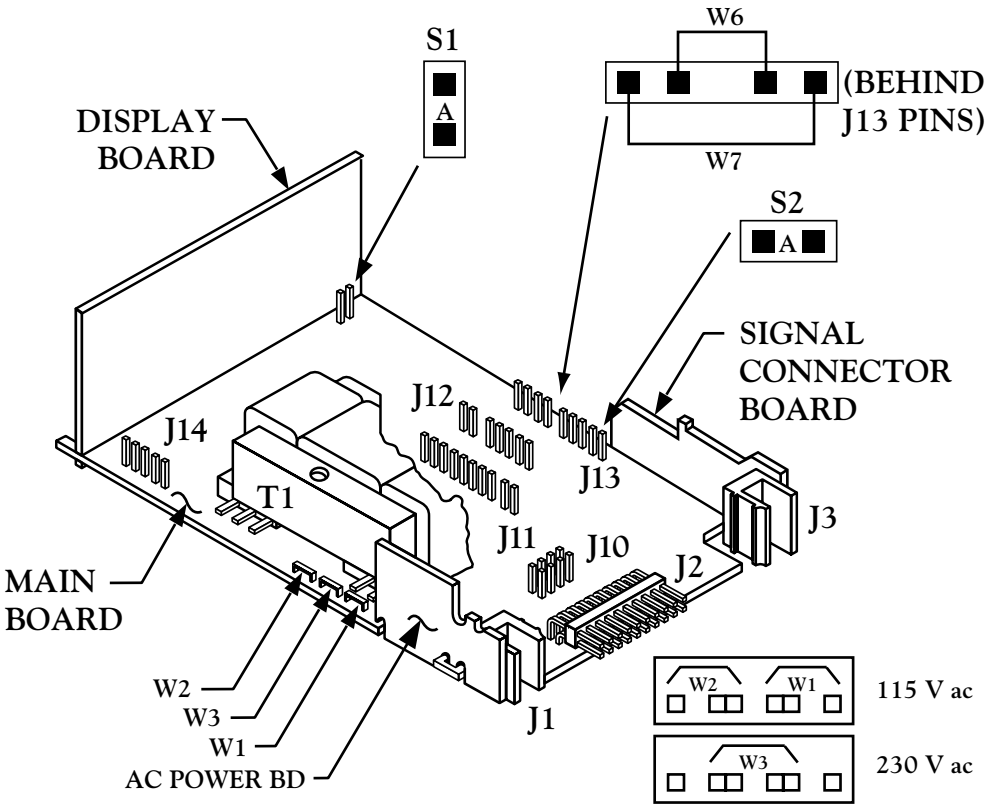


Figure 2-6. Main Board Jumpers

TABLE 2-1. MAIN BOARD JUMPERS

JUMPER	LOCATION, VIEWING THE BOARD FROM THE REAR OF THE METER	FUNCTION
S1-A	On the right, immediately behind the Display board	Enables push buttons to control lockout programming
S2-A	First two pins of J13 on the right side of the Main Board	Channels non-isolated excitation out to P3-1; remove if input board used
W1 and W2	Left side	Enables 115 V operation
W3	Left side	Enables 230 V operation
W6 and W7	Right side of Main Board next to J13	Bypasses isolation circuitry used for option boards; remove if input board used

If your line voltage is 115 V ac, jumpers W1 and W2 (but NOT W3) should be installed.

If your line voltage is 230 V ac, jumper W3 (but NOT W1 or W2) should be installed.

NOTE: When referring to jumpers, the letter S means "switch" and the letter W means "wire." Switch jumpers are caps that bridge two pins; they can easily be moved from one position to another. Wire jumpers are soldered in; they must be cut when "removed" and resoldered if reinstalled.

If no optional input board is used, jumper S2-A should be installed on the first two pins of J13. This jumper brings non-isolated excitation out to the P3-1 connection. Wire jumpers W6 and W7 should also be in place. These jumpers bypass the isolation circuitry used for optional boards. See Figure 2-6.

If one of the optional input boards is used, S2-A should be removed (or be installed on only one pin), and W6 and W7 should be removed.

S1-A allows front-panel control of the three lockouts so that you can lock and unlock meter features. You may want to remove this jumper later to lock in certain settings that you don't want to be changed. (See Section 5.3.) It should be installed when the meter is first configured.

2.3.2.2 OPTIONAL INPUT AND OUTPUT BOARD JUMPER INFORMATION

BOARD TYPE	JUMPER(S) PRESENT	CONFIGURING INFORMATION	NOTES
Isolated pulse input	Yes	Appendix B	–
Isolated analog input	Yes	Appendix C	A one-time calibration is needed when installed the first time.
Isolated analog output	No	Appendix D	A one-time calibration is needed when installed the first time.
Isolated Parallel BCD output	Yes	Appendix E	–
Dual relay output and 4 Relay output	Yes	Appendix F	–
Isolated RS-232 Serial Communications Output	No	Appendix G	–
Isolated RS-485 Serial Communications Output	Yes	Appendix G	–

2.3.3 INSTALLING OPTIONAL BOARDS

NOTE: When referring to installing optional boards, the view is from the REAR of the meter.

Figure 2-7 shows the Main Board and Figure 2-8 shows an exploded view of the meter with the optional board locations. In Figure 2-7, the "front" of the board refers to the side with the Display Board; the back is the side with J1 and J2 connections. Refer to Figures 2-7 and 2-8 as you insert optional boards. All boards must be jumpered before insertion. See Section 2.3.2.

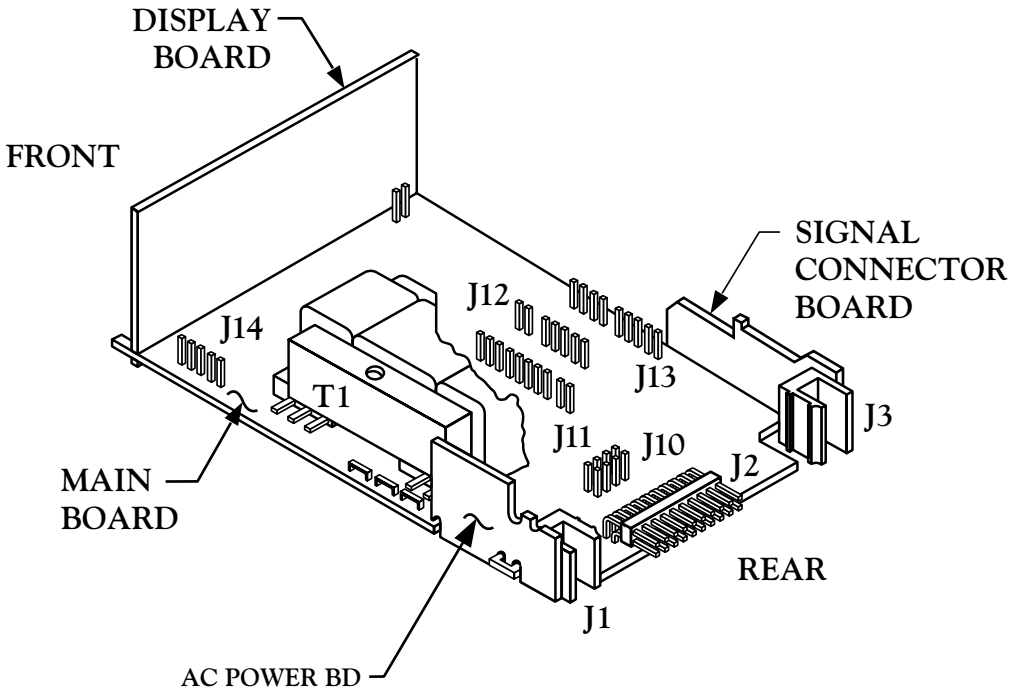


Figure 2-7. Main Board

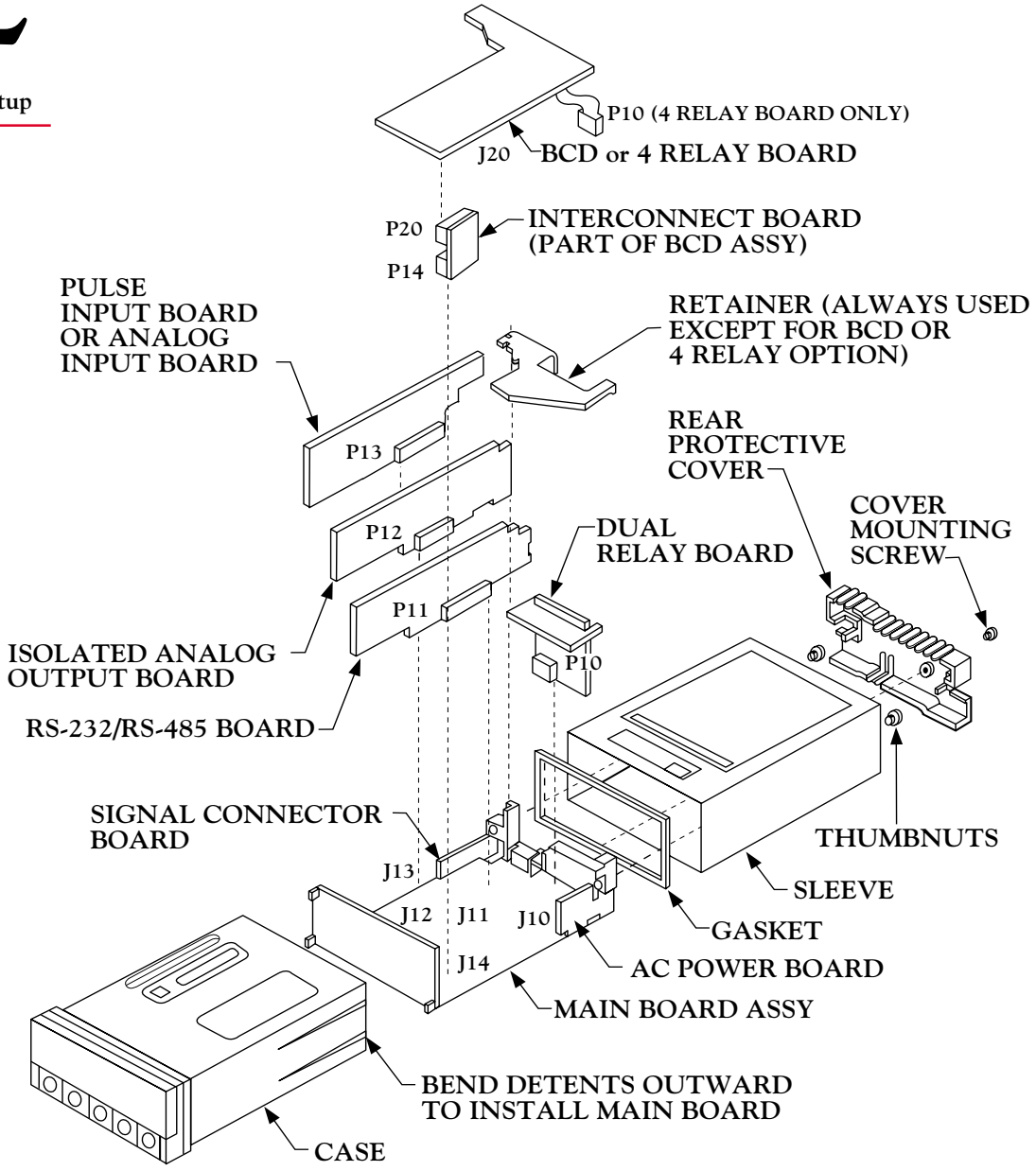


Figure 2-8. Exploded View of Main and Optional Boards

2.3.3.1 ISOLATED PULSE INPUT BOARD

The Isolated Pulse Input Board plugs into J13 on the right side of the Main Board. J13 consists 10-pins with a gap at pin 5.

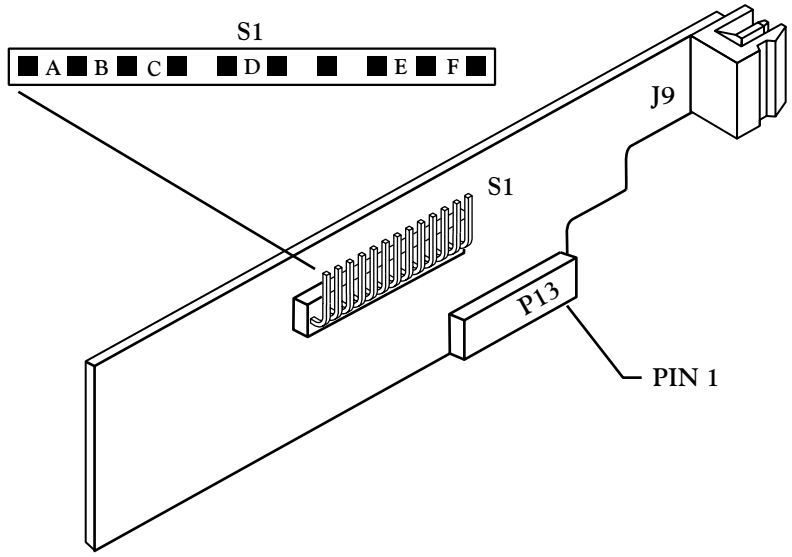


Figure 2-9. Isolated Pulse Input Board

Follow these steps before installing the board:

1. Remove (or connect to a single pin) jumper S2-A, the black jumper clip on the first two pins of J13 on the Main Board.

2. Remove wire jumpers W6 and W7, the two soldered-in connections to the immediate right of J13.

3. Plug the input board onto the J13 jack.

The Pulse Input Board and Analog Input Board can be installed at J13. However, only one can be installed at a time.

Refer to Appendix B to configure this board.

2.3.3.2 ISOLATED ANALOG INPUT BOARD

The solder side of the Isolated Analog Input Board contains calibration data for precisely calibrating the board. Make sure you copy the data before you install the board.
Record them here:

Input 1 @ 4 mA =_____

Input 2 @ 20 mA =_____

Input 1 @ 0 V = _____

Input 2 @ 5 V =_____

The Isolated Analog Input Board plugs into J13 also. See section 2.3.3.1, Steps 1 through 3.

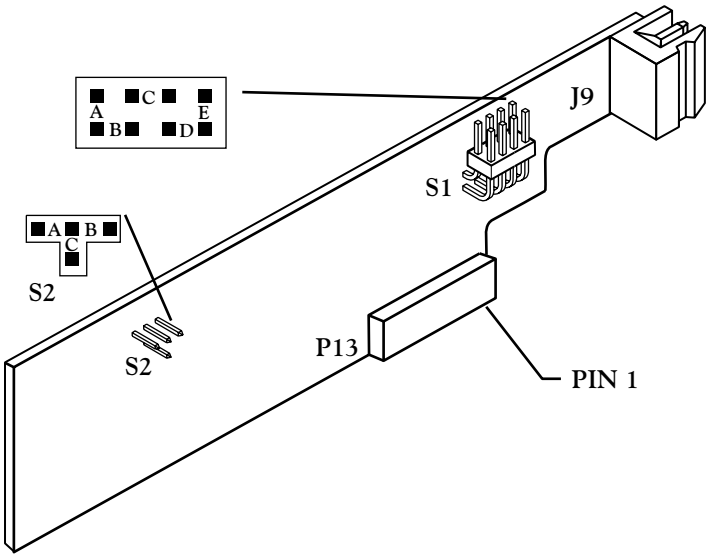


Figure 2-10. Isolated Analog Input Board

The Analog Input Board and Pulse Input Board can be installed at J13. However, only one can be installed at a time.

Refer to Appendix C to configure this board.

2.3.3.3 ISOLATED ANALOG OUTPUT BOARD

The solder side of the Analog Output Board contains calibration data for precisely calibrating the board. Make sure you copy the data readings–CAL VZ (Calibrate Voltage Zero), CAL VS (Calibrate Voltage Span), CALmAZ (Calibrate milliAmp Zero), and CALmAS (Calibrate milliAmp Span)–before you install the board. Record them here:

CAL VZ = _____

CAL VS = _____

CALmAZ = _____

CALmAS = _____

The Analog Output Board plugs into J12, between J13 (on the right edge of the Main Board) and the transformer. J12 consists of 8 pins with a gap at pin 6.

NOTE: Future analog output boards will be supplied with a 10-pin connector for use with a DC powered version of this instrument.

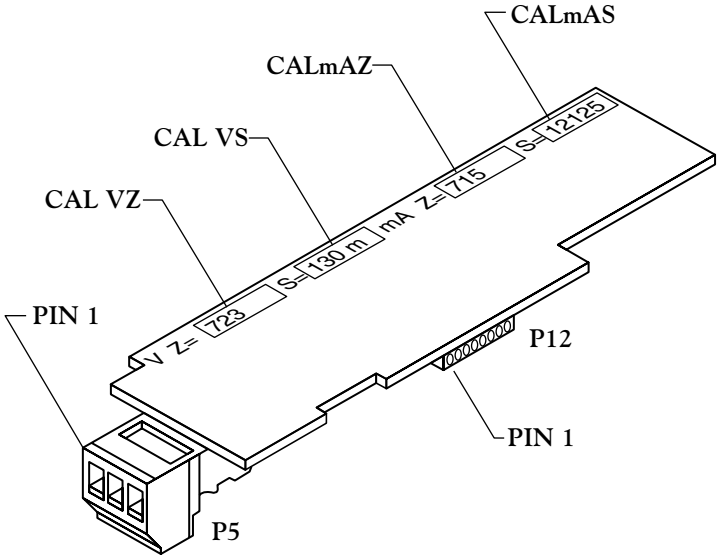


Figure 2-11. Isolated Analog Output Board

Refer to Appendix D to configure this board.

2.3.3.4 ISOLATED PARALLEL BCD (BINARY-CODED DECIMAL) OUTPUT BOARD

The Isolated Parallel BCD Output Board mounts above (and parallel to) the Main Board using the small vertical Interconnector Board as a support. **Note that this board is inserted component-side down.**

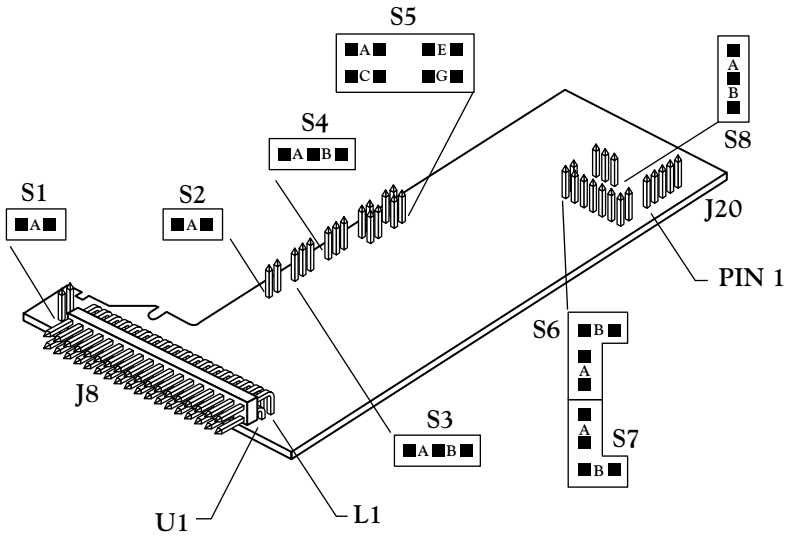


Figure 2-12. Isolated Parallel BCD Output Board

1. Insert the P14 plug of the Interconnect Board onto the J14 pins on the Main Board. J14 consists of 5 vertical pins on the left side of the Main Board, immediately behind the Display Board.

2. Insert the P20 connector of the Interconnect Board onto the J20 pins on the BCD Board. (See Figure 2-8.)

The Dual Relay or 4 Relay Output Option may not be installed at the same time as the Parallel BCD Output Option.

Refer to Appendix E to configure this board.

2.3.3.5 DUAL RELAY AND 4 RELAY OUTPUT BOARDS

The Dual Relay Board is a vertical board and the 4 Relay board is a horizontal board which plugs into J10, the double row of 4 pins each at the rear of the Main Board.

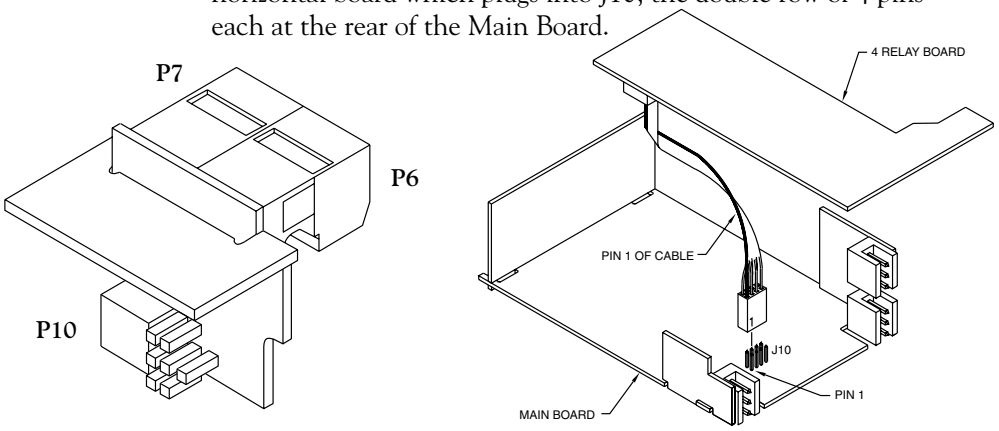


Figure 2-13. The Dual Relay Output Board and the 4 Relay Output Board.

Both the Dual Relay Output Board and the 4 Relay Output Board can be installed at J10. However, only one option board can be installed at a time.

Refer to Appendix F to configure this board.

2.3.3.6 ISOLATED RS-232 SERIAL COMMUNICATIONS BOARD

The Isolated RS-232 Serial Communications Board plugs into J11, to the right of the transformer.

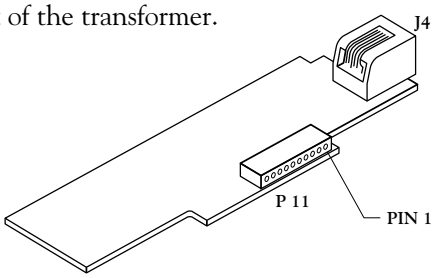


Figure 2-14. Isolated RS-232 Serial Communications Board

J11 consists 11 pins with a gap at pin 9. **(Note that the mating socket of the communications board does not mate with pin 11 of J11; this pin is reserved for future use.)**

The RS485 Board can be installed at J11. However, only one option board can be installed at the same time.

2.3.3.7 ISOLATED RS-485 SERIAL COMMUNICATIONS BOARD

The Isolated RS-485 Serial Communications Board mounts in a manner identical to that of the RS-232 board in the previous section.

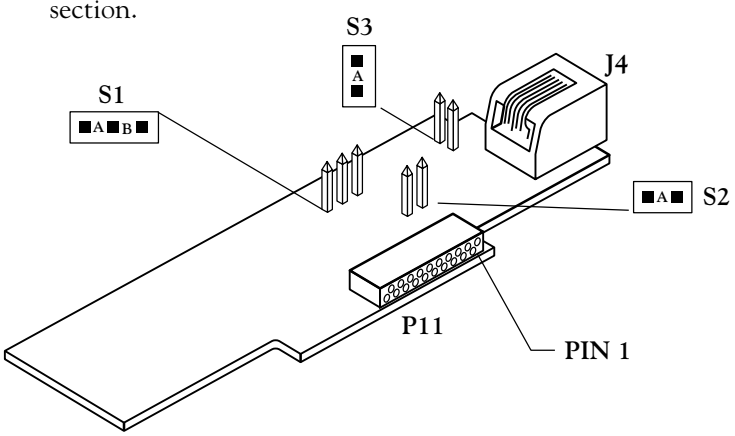


Figure 2-15. Isolated RS-485 Serial Communications Board

The RS232 Board can be installed at J11. However, only one option board can be installed at the same time.

Refer to Appendix G to configure this board.

2.3.4 REINSERTING THE MAIN BOARD ASSEMBLY INTO THE CASE

Reinsert the Main Board into the case once Main Board jumpers have been configured (Section 2.3.2.1) and optional boards have been configured and installed (Sections 2.3.2.2 through 2.3.3).

Spread the side-panel detents of the case, and carefully slide the Main Board all the way in.

You are now ready to wire your meter.

2.3.5 WIRING

The way you connect your input wiring to your meter depends on your pulse or input source, and the types of optional boards you have installed. Therefore, this section contains complete instructions for wiring only the AC Power connector (P1), and guidelines for wiring the input/output control connector (P2). You will be referred to the appropriate appendix for specific wiring instructions based on your optional board configuration.

2.3.5.1 P1 - AC POWER WIRING

CAUTION: As mentioned in Section 2.2.2, the meter has no power ON/OFF switch. The meter will be ON when power is applied.

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications. The meter is factory set to the power specified by the customer at the time of ordering. The voltage is printed on the Label under Input power.

Wire your power (from a wall socket or other source) to P1, the orange, 3-socket connector that plugs into the 3 pins on the left side as you view the meter from the rear. Refer to Figure 2-16 and Table 2-2 below.

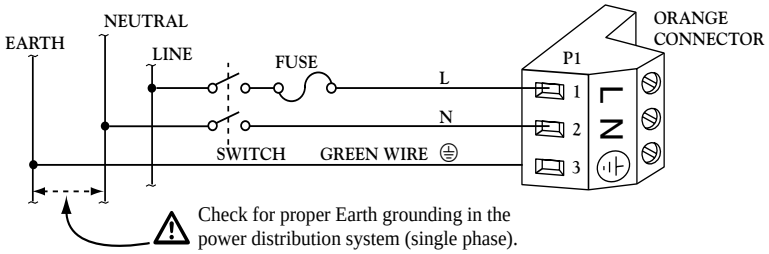


Figure 2-16. P1, ∿AC Power Connector Wiring

TABLE 2-2. P1, AC POWER CONNECTOR WIRING

P1	AC POWER	WIRE COLOR EUROPE	USA
1	∿ac Line	Brown	Black
2	∿ac Neutral	Blue	White
3	∿ac Protective Earth GND	Green/Yellow	Green

2.3.5.2 BATTERY BACKUP CONNECTIONS

The purpose of the battery backup is to allow the internal clock to continue to run when a loss of the AC power is experienced. All other functions will cease to operate until AC power is resumed. The minimum requirements of the battery needed is 7-12 Vdc at 50 mA.

Connect the negative lead of your battery to P2-9 (ALARM, BATTERY RETURN) and the positive lead of your battery to P2-20 (BACKUP BATTERY).

2.3.5.3 P2 - CONTROL INPUT/OUTPUT WIRING

P2, the 20-socket ribbon connector plugs into the center rear of the Main Board, sends out the setpoint transistor collectors and permits remote control of significant meter features. Table 2-3 describes the function of each pin.

TABLE 2-3. P2, INPUT/OUTPUT CONNECTIONS

P2 SOCKET/ PIN NO.	DESCRIPTION/FUNCTION
P2-1	Setpoint 1 transistor open-collector output
P2-2	Input of external V+ used for setpoint transistors so that internal diodes can clamp inductive-load spikes
P2-3	RESET-A: When grounded in Rate or Sq Rt Modes, resets TOTAL to 0, resets TOTAL setpoint latches; in Batch Mode, starts a new BATCH count, increments BAT NO (Number of Batches), resets BATCH-count setpoint latches, and clears any STOP (See Section 4.10)
P2-4	Setpoint 2 transistor open-collector output
P2-5	Setpoint 3 transistor open-collector output
P2-6	Setpoint 4 transistor open-collector output
P2-7	Twice-line-frequency, 5-V pulse output (also used by microcontroller to detect line failure)
P2-8	Setpoint 5 transistor open-collector output
P2-9	Return ground connection: SP-transistor external supply and/or backup battery ground
P2-10	Debounce capacitor for P3-2 signal input (tie to ground for contact input)
P2-11	RESET-B: When grounded in Rate or Sq Rt Modes, starts a new AVG RTE (Average Rate) period, resets RATE setpoint latches; in Batch Mode, resets BAT NO (Number of Batches) to 0 (if count is up) or to Setpoint 4 value (if count is down), and resets BAT NO setpoint latches (if SP4 has been assigned) (See Section 4.10)
P2-12	TTL-level Test RX
P2-13	TTL-level Test TX
P2-14	Meter digital ground (internally connected to P2-9)
P2-15	Programmable Pulse Output (see AL TI, Section 5.4.12)

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P2 SOCKET/ PIN NO.	DESCRIPTION/FUNCTION
P2-16	$\overline{\text{HOLD/PRINT REQUEST}}$: When grounded, if enabled by CF4.3 and CF4.4, freezes displayed value/initiates print out (V01 Command)
P2-17	$\overline{\text{STOP}}$: When grounded in rate or sq rt modes, stops the clock until released; in batch mode, **sets all setpoint outputs to their active states**
P2-18	GATE: Nonisolated input: Can be used as the input signal or to gate P3/P9 inputs
P2-19	$\overline{\text{RESET-C}}$: when grounded in rate or sq rt modes, resets the clock to SET TI (Set Time, see Section 5.4.15), and resets TIME setpoint latches; in Batch, resets the clock to SET TI, resets the grand TOTAL to 0, resets a TOTAL setpoint latch (See Section 4.10)
P2-20	Backup battery +V input

2.3.5.4 BASIC METER INPUT WIRING

If you are going to be operating the meter as a basic meter–with no optional boards–see Appendix A for further wiring instructions.

2.3.5.5 ISOLATED PULSE INPUT BOARD WIRING

If your meter has the isolated pulse input board, see Appendix B for wiring.

2.3.5.6 ISOLATED ANALOG INPUT BOARD WIRING

If your meter has the isolated analog input board, see Appendix C for wiring.

2.3.5.7 ISOLATED ANALOG OUTPUT BOARD WIRING

If your meter has the isolated analog output board, see Appendix D for wiring.

2.3.5.8 ISOLATED PARALLEL BCD OUTPUT BOARD WIRING

If your meter has the isolated parallel BCD output board, see Appendix E for wiring.

2.3.5.9 DUAL RELAY OUTPUT AND 4 RELAY OUTPUT BOARD WIRING

If your meter has the Dual Relay Output Board or the 4 Relay Output Board, see Appendix F for wiring.

2.3.5.10 ISOLATED RS-232 OR RS-485 SERIAL COMMUNICATIONS BOARD WIRING

If your meter has either the Isolated RS-232 or RS-485 Serial Communications Board, see Appendix G for wiring or connections.

2.4 PANEL-MOUNT ASSEMBLY

The meter can be mounted in a panel so that the front of the meter is flush with the vertical panel surface. Panel mounting can be seen as simply "sandwiching" the panel between the inner case and the outer sleeve in the last phases of assembly. **Figure 2-17 shows the panel cutout dimensions, and the dimensions for the panel thickness. It requires that the following already be done**:

1. Your line voltage rating has been checked against the meter rating on the ID and serial number label on the meter case. See Section 2.2.1.

2. You have configured all jumpers–those on the main board as well as those on any optional boards. See Section 2.3.2.1 for main board jumper configuration and Appendices B through G for optional board jumper configuration.

3. You have installed all optional boards and inserted the main board assembly back into the case. See Sections 2.3.3 and 2.3.4.

4. You have wired P1, the AC power connector, and P2 the input/output control connector; connectors are not installed in the meter, but are ready to be. See Sections 2.3.5.1 and 2.3.5.2.

5. You have wired all connectors for optional boards; connectors are not connected to the meter, but are ready to be. See Appendices B through G.



CAUTION: Connectors with the wiring connections will be installed after mounting the unit.

If all of these steps are done, continue here using Figure 2-17 as a guide:

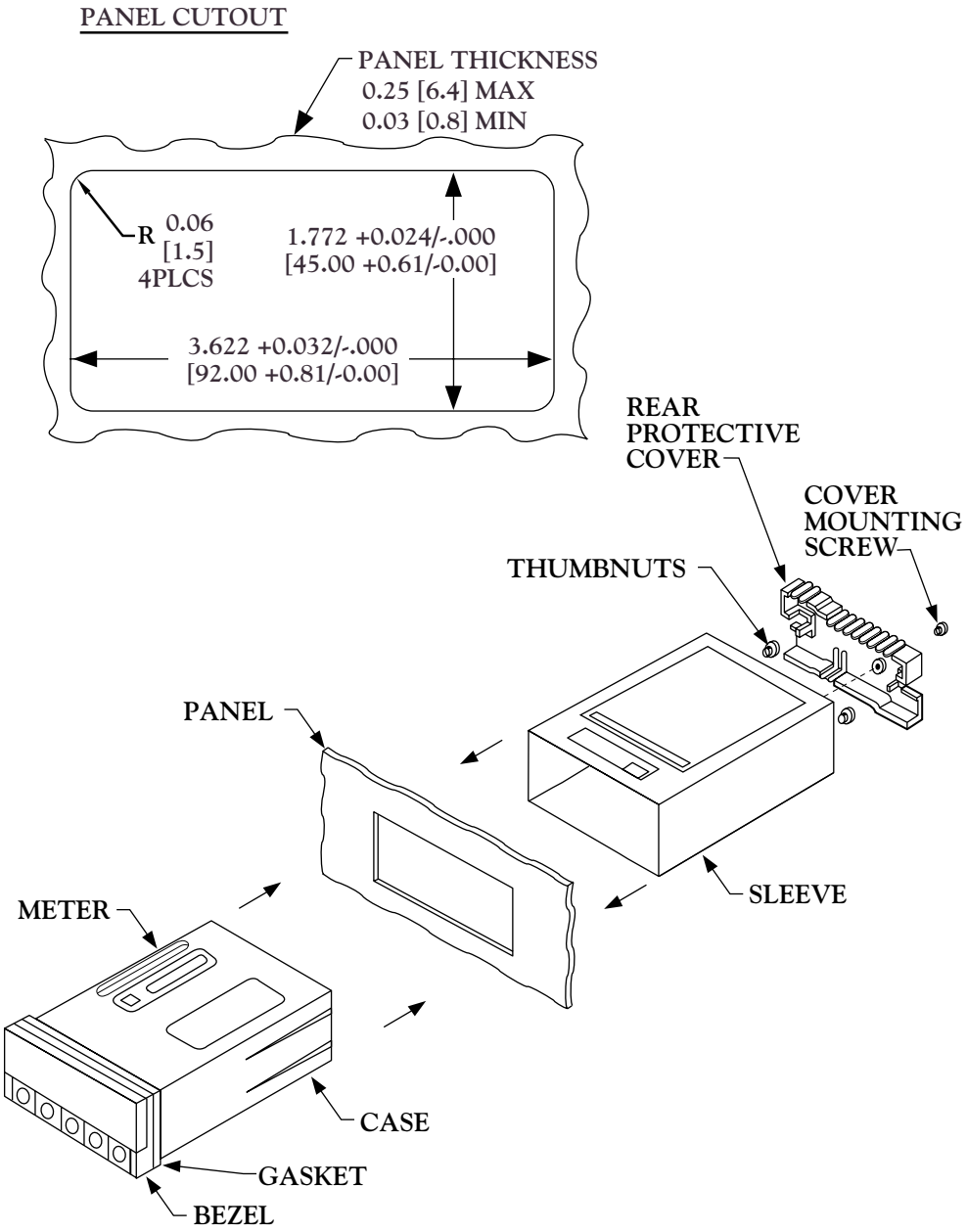


Figure 2-17. Panel-Mount Assembly

6. Punch or cut a hole in the panel using the panel cutout dimensions in Figure 2-17. Remove burrs and paint the panel as required.

7. Insert the panel-mount gasket around the rear of the case and slide it forward to the bezel (if it's not already in place).

8. Working from the front of the panel, insert the case assembly, rear end first, all the way into the panel cutout such that the gasket firmly backs the panel surface.

9. Working from the rear of the panel, slide the sleeve forward over the case and up to the panel surface.

The panel should now be sandwiched between the bezel-backed gasket in front and the sleeve in back.

10. Replace the thumbnuts that secure the sleeve tabs to the case.

WARNING: Do not "turn-on" the ac power and input signals until all connections are connected to the meter.

11. Set P1, the AC power connector, aside and connect or reconnect all other connectors to the back of the meter using Figures 3-2 and 3-3 in Section 3.2 as guides.

NOTE: The P1 connector is "keyed"; it is shaped in such a way that it fits only the J1 male pins.

Connect P1 last.

12. Replace the rear protective cover and secure it with the cover mounting screw.

Your meter is now ready for operation and you can turn-on the power.

3. Front and Rear Features

3.1 FRONT-PANEL DISPLAYS AND BUTTONS

Refer to Figure 3-1 as you read about front panel displays and buttons.

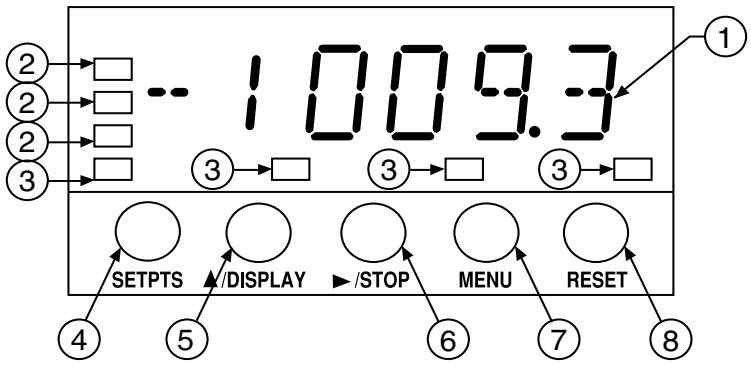


Figure 3-1. Front Panel

TABLE 3-1. FRONT-PANEL DISPLAYS AND BUTTONS

ITEM	FRONT-PANEL BUTTON OR FEATURE	DESCRIPTION/FUNCTION
1	6-Digit Display	6-Digit, 14-segment, 0.54-inch LED display produces alphanumeric readout; programmable decimal point; red with green option
2	Measurement	Green LEDs; designate which measurement is being displayed (See DISPLAY, below)
3	Setpoint LEDs	Red LEDs; designate which setpoints are active; when flashing, designate which setpoint is being viewed and/or set
4	SETPTS Button	In Run mode changes to Setpoint Mode and allows setting of five setpoints; allows value change by pressing the ▲/DISPLAY button and the ►/STOP button

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ITEM	FRONT-PANEL BUTTON OR FEATURE	DESCRIPTION/FUNCTION
5	▲ /DISPLAY Button	Two-Function button: In Run Mode, sequences the display through mode-associated measurements; in Configuration and Setpoint Modes, sequences through possible digit and numerical settings • In Rate-Run Mode, sequences the display through unlocked values of RATE, AVG RT, TOTAL, and TIME • In Sq Rt-Run Mode, sequences the display through unlocked values of SQ RT, AVG RT, TOTAL and TIME • In Batch-Run Mode, sequences the display through unlocked values of BATCH, BAT NO, TOTAL and TIME • In Setpoint and Configuration Modes, sequences through possible alphanumeric settings: For numbers,increments the flashing digit by 1; for alphabetical settings, sequences to the next possible setting
6	▶/STOP Button (STOP enabled by CF4.8=1)	Two-Function button: In run mode, imposes STOP condition; in configuration and setpoint modes, accesses the next digit or choice • In batch-run mode, if CF4.8=1, puts all setpoints in their ACTIVE states and displays STOP. (After 3 seconds, the ▶/STOP button can be pressed again to reset alarms and return to run mode) • Inactive in rate-run or sq rt-run modes • In setpoint mode advances the flashing digit one place to the right, making the new digit accessible for resetting by the ▲/DISPLAY button

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ITEM	FRONT-PANEL BUTTON OR FEATURE	DESCRIPTION/FUNCTION
		• In configuration mode, advances the flashing digit one place to the right, making the new digit accessible for resetting by the ▲/DISPLAY button; advances the displayed choice to the next choice in sequence
7	MENU Button (Enabled by L3C.8=0; disabled by L3C.8=1 and removal of S1)	• In run mode, terminates measurements and switches to Configuration Mode • In configuration mode, stores new values in EEPROM (nonvolatile memory) and advances the display to the next parameter to be programmed
8	RESET Button (Enabled by CF4.7=0)	• In Run Mode, RESETs the value of the measurement on display to zero (or to the reset value designated by configuration) Also RESETs any latched alarms assigned to the dis played measurement • In setpoint mode, switches back to run mode; any new setpoint values entered with the ▶/STOP button and the ▲/DISPLAY button that have not been stored are discarded • In configuration mode, the first press backs up one parameter (Menu item); the second one RESETs the meter and returns to run mode

3.2 REAR CONNECTORS

Figure 3-2 shows the rear of the meter with the Dual Relay Board, and a serial communications board. Figure 3-3 shows it with the Isolated Parallel BCD Output Board, a serial communications board, Isolated Analog Output Board, and Analog or Pulse Input Board. Figure 3-4 shows the connector label with pin assignments.

3

Front and Rear Features

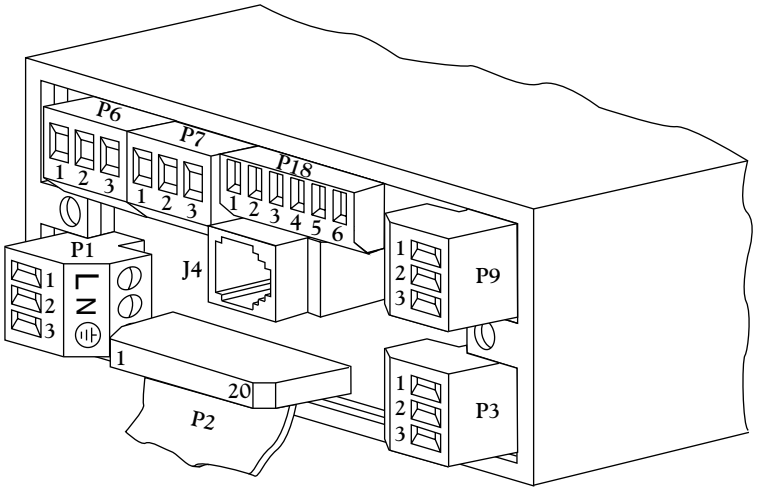


Figure 3-2. Rear View of the Meter with the 4-Relay and Serial Communications Boards

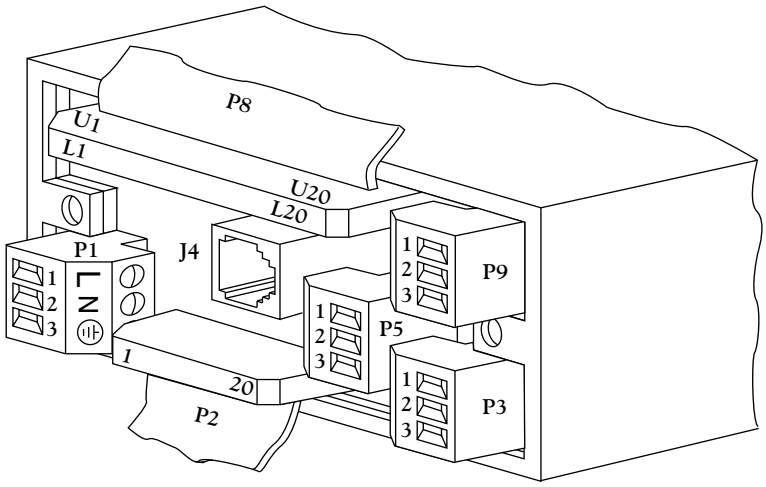


Figure 3-3. Rear View with the BCD, Serial Communications, and Analog Output Boards

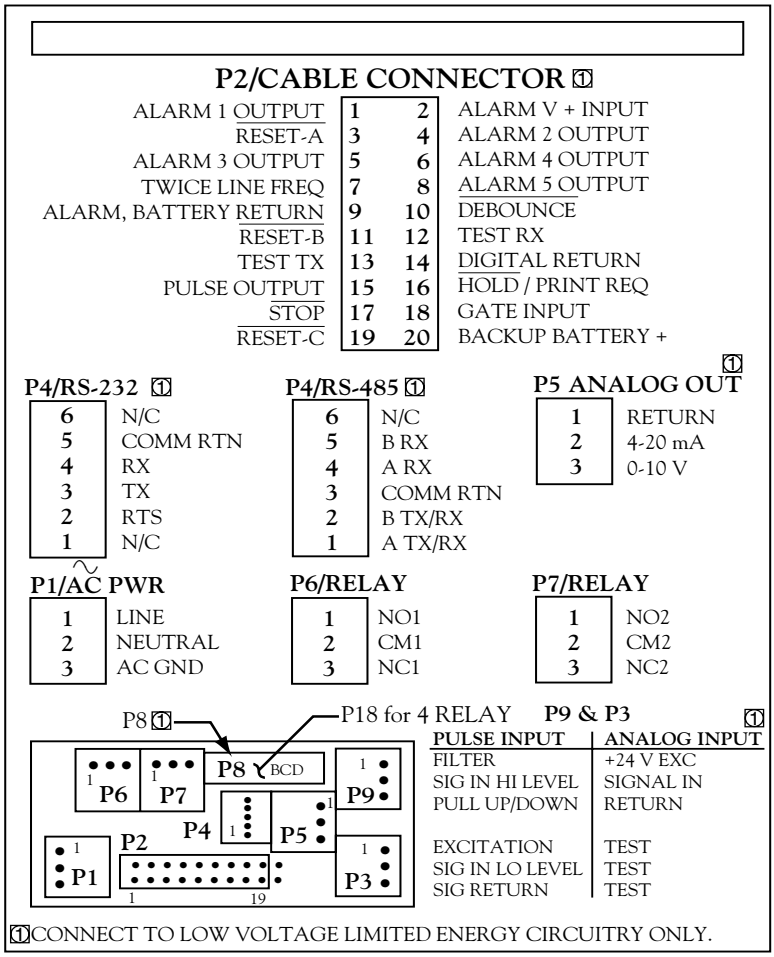


Figure 3-4. Connector Label

TABLE 3-2. REAR CONNECTORS

CONNECTOR NUMBER	DESCRIPTION
P1	AC Power Connector; 3-socket connector for AC power input.
P2	Control Input/Output connector; 20-socket ribbon connector sends out setpoint transistor collectors and allows remote control of certain meter features.

continued next page

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CONNECTOR NUMBER	DESCRIPTION
P3	Input and Excitation connector; 3-socket input plug for unregulated excitation for Basic Meter; low level input and excitation for Isolated Pulse Input Board. **Not used with Analog Input Board (test points for factory use only).**
P4	Isolated RS-232 or RS-485 Serial Communications Board connection for digital communications; 6-spring RJ-12 telephone plug (for 7-foot cable furnished with either board).
P5	Isolated Analog Output connector; 3-socket output plug for optional analog output.
P6 and P7	Dual Relay and 4 Relay connector; 3-socket output plugs for optional 7-amp, Form-C Relays.
P8	Isolated parallel BCD Output Board connector; 40-socket plug for optional BCD output; connects to ribbon cable.
P9	3-Socket optional input board connector; for Isolated Pulse Input Board, high-level input and filter connections; for Isolated Analog Input Board, input, excitation, and common return.
P18	4 Relay connector; 6-socket output plug for optional 1-amp, Form-C relays.

4. Basic Concepts and Approaches to Setup and Configuration

Your application and what you need to accomplish will dictate setup and configuration of the meter. This section shows you how the meter works; it contains information that will help you see how your meter can best be connected to peripheral devices, or to resets and alarms.

4.1 CHOOSING AN OPERATING MODE

One of the first decision you need to make is to determine what MODE you want the meter to run in. There are two rate modes—Rate and Sq Rt—that count per unit time, and one counting mode—Batch.

If you need to measure a simple rate, you should use Rate Mode. If your input signal is proportional to the square of the quantity that you are measuring, you should use Sq Rt mode. Differential pressure transducers produce this type of input and almost always require the use of the isolated analog input board. If you need to count, especially on numerous levels, you should use Batch Mode.

4.2 MODE-ASSOCIATED MEASUREMENTS

Each mode has 4 associated measurements that can be displayed by pressing the ▲/DISPLAY button on the front panel. Table 4-1 shows these measurements for each mode.

TABLE 4-1. MODE-ASSOCIATED MEASUREMENTS

MODE	ASSOCIATED MEASUREMENT			
Rate	RATE	AVG RT	TOTAL	TIME
Sq Rt	SQ RT (Square Root)	AVG RT (Average Rate)	TOTAL	TIME
Batch	BATCH (unit count)	BAT NO (Number of Batches)	TOTAL	TIME

For instance, if the meter is in Rate Mode, you can press the ▲/DISPLAY button to sequence through display readings of RATE, AVG RT (Average Rate), TOTAL, and TIME.

When any mode-associated measurement (except TIME) is on the display, the corresponding Measurement LED is lit. The first measurement in any mode (RATE, SQ RT, or BATCH) corresponds to the top LED.

The factory preset operating mode of the meter is Rate. The factory preset Rate units are Hertz–cycles per second–which the meter interprets as pulses per second.

4.3 USING SCALE FACTORS

One of the great features of the meter is that the input units can be converted to units other than Hertz (frequency), and the associated TOTAL can also have independent units. This is accomplished by using scale factors.

Input units are converted to other display units by using a rate scale factor (RTE SC) for Rate and Sq Rt Modes, or a Batch scale factor (BAT SC) for the Batch Mode. For instance, you are in Rate Mode, filling barrels of wine; you want to show the rate of filling in gallons per minute, but the total in barrels. You would use the RTE SC parameter to convert the incoming signal from Hertz to gallons per minute, and the TOT SC parameter to convert the total from pulses to barrels. When the meter is running and you press the ▲/DISPLAY button to view readings, the RATE reading will be in gallons per minute, and the TOTAL reading in barrels.

4.4 USING OFFSETS

The meter allows you not only to scale RATE and TOTAL values, but to offset them as well. For instance, you have a dam that is 1000 feet above sea level. You have scaled the incoming signal so that the display reads in feet. Now you want to offset this reading so that it reflects the height above sea level. You would use a Rate Offset (RTE OF) of 1000. When you press the ▲/DISPLAY button to view the RATE reading, it will show the height of the water above sea level.

4.5 AUTOMATIC SCALE AND OFFSET

The Automatic Scale and Offset feature is a function that automatically sets the scale factors of the input signal and the Rate reading to 1, and the offset values of the input signal and Rate

reading to 0. It provides a quick way to "wipe out" scale factors and offsets so that they can be reconfigured easily. This feature is enabled by setting configuration choice CF4.8 to 1. (See Section 5.4.2.)

4.6 OVERFLOW VALUES AND EXPONENTIAL FORMAT

If your source signal units are Hertz, the meter is counting many pulses every second. This means that the TOTAL count can climb very quickly. If you are in this or a similar situation, you will almost always want to convert TOTAL units to other units that scale down the count. When the meter encounters a count too large to show on the 6-digit display, it begins using exponential format like this:

3.23 E8

The E designates the exponent of 10. In this example 3.23 E8 = $3.23 * 10^8 = 323000000$. The exponent power can be seen as the number of places the decimal point should be moved to the right.

4.7 NEGATIVE-TRUE LOGIC

In places throughout this manual, you will see a bar over certain words, like this:

$\overline{\text{RESET-A}}$

This bar indicates Negative-true logic, also referred to as a NOT condition. This means that the indicated function must "go low" to be activated. In the example above, your input voltage to the connector pin that controls a $\overline{\text{RESET-A}}$ must be low in order to activate the reset.

4.8 DIFFERENT METER MODES

Modes are ways in which the meter operates or can be configured.

1. Run Mode is the generic term that defines the operating mode of the meter when it is not being configured or at a STOP. There are four kinds of Run Modes: Rate, Sq Rt, Batch, and Clock. (Since Clock always runs in the background, it is not configurable as a Run Mode.)

Run Mode is accessed under the following conditions:

a. Whenever power is applied to the meter
b. When the RESET button is pressed twice in the middle of the Parameter list, (or three times if the display shows a submenu) in Configuration Mode
c. At the end the Parameter list in Configuration Mode
d. At the end of the setpoint sequence in Setpoint Mode
e. After a 3-second STOP has been initiated (and terminated when the ▶/STOP button is pressed again) in Batch-Run Mode

Whenever the meter starts operating in, or reverts to, Run Mode, the word RUN momentarily shows on the display. If the meter is in Rate, Sq Rt, or Batch Mode, one of the Measurement LEDs is also lit.

2. Configuration Mode is the mode that allows you to configure the meter. It is accessed by pressing the MENU button. Most setpoint assignments can be configured in this mode; the only assignments that cannot be configured are the setpoint values. See Section 5 for more information on configuring the meter.

3. Setpoint Mode. This mode allows you to configure the setpoint values only. It is accessed by pressing the SETPTS button. See the Section 4.9 for more information on setpoints.

4.9 SETPOINTS

One of the most important functions of the meter is to monitor counts and rates, and at certain pre-determined values, initiate appropriate responses. These pre-determined values are called setpoints and the responses they initiate may be alarms, resets, or any other type of action that must be carried out at a certain time.

The meter has a total of 5 setpoints, numbered in sequence—Setpoint 1, Setpoint 2, etc. Each one is associated with a transistor that brings about a response.

4.9.1 SETPOINT ASSIGNMENTS

In a strict sense, setpoints are nothing more than reference points awaiting assignments. Each one must be assigned the following attributes or characteristics:

1. A specific measurement (such as TOTAL) to which it applies

2. A setpoint value: a specific value that when crossed causes the setpoint to become "active"

3. A directional reference indicating whether the setpoint is active ABOVE or BELOW the setpoint value

4. The normal state (open or closed) of the associated transistor

5. The type of output (normal, latched, or pulsed) that is initiated when the setpoint is activated. In Rate and Sq Rt Modes, output can also be hysteretic.

When the Dual Relay Board is used, setpoints are assigned into groups of 3 and 2 each, and one set point in each group is assigned to a specific relay by positioning the S1 jumpers on the relay board. See Appendix F for more information.

Certain setpoints are always associated with certain RESETs. In Batch Mode, when counting down, the Setpoint 3 value is always used when an Autoreset or a $\overline{\text{RESET-A}}$ is initiated.

Table 4-2 shows which setpoints are assigned to which measurement in each mode:

TABLE 4-2. SETPOINT ASSIGNMENTS FOR EACH MODE

	MODE		
SETPOINT	**RATE**	**SQ RT**	**BATCH**
1	TOTAL	TOTAL	BATCH Count
2	TOTAL	TOTAL	BATCH Count
3	RATE	RATE	BATCH Count
4	RATE	RATE	BAT NO or TOTAL
5	TIME	TIME	TIME

For example, if you are in Rate Mode, you can use Setpoints 1 and 2 to trigger appropriate responses based on the TOTAL reading.

4.9.2 CONFIGURING SETPOINTS

All setpoint assignments except for the setpoint value are configured with parameters CNFG 1 through CNFG 3 (see Section 5). They are set to specific values through the SETPTS button on the front panel.

To set any setpoint value from Run Mode, press the SETPTS button. The display will momentarily show STPT 1, then display the current setting. Press the ▶/STOP button to move to any digit, and the ▲/DISPLAY button to set the digit. Press the SETPTS button to store the setting and to move to the next setpoint. The meter will automatically reset and revert to Run Mode at the end of the setpoint sequence.

NOTE: Once you are in the setpoint configuration mode and you do not press any buttons within approximately 30 seconds, the meter will automatically return to the run mode.

Setpoints 1 through 4 have corresponding LEDs that light when they are accessed or activated in Run Mode.

4.10 RESETS AND STOPS

Resets are actions that cause a measurement value to revert to a specific number, or a meter condition to revert to a specific state. They are often used to start a counting cycle over and to deactivate alarms. Resets can be automatic, initiated by setpoints or control devices connected to the meter through the P2 connector; or manual, initiated by the front-panel RESET button, or by an external button connected to P2-2.

4.10.1 POWER-ON (HARD) RESET

A power-on or hard reset occurs when power is restored to the meter. It loads (copies) nonvolatile memory values into operating memory and resets measurement values. The TIME display flashes showing the last time count.

4.10.2 CONFIGURATION (COLD) RESET

A cold reset loads new nonvolatile memory settings into operating memory after the meter has been configured or setpoint values have been changed. (Lockout L3C.7 must be set to 0 to enable storage of new settings in nonvolatile memory.) A cold reset resets all measurement values except TIME, and the meter reverts to Run Mode using the new settings. It is done by pressing the RESET

button two times during configuration. It is also done automatically after the last parameter is viewed and saved in Configuration Mode.

A cold reset can also be done through serial communications. Refer to the Serial Communications Manual for additional information.

4.10.3 SETPOINT-ONLY RESET

A Setpoint-Only Reset returns the meter to Run Mode after writing new setpoint values in operating memory only. New values are prevented from being stored in nonvolatile memory by purposely setting Lockout L3C.7 to 1. This condition is desirable when setpoints are changed very often. Locking out nonvolatile memory storage assures that the EEPROM chip's life isn't shortened by constant setpoint changes. The meter continues to use values set in this way until power is disconnected.

A Setpoint-Only Reset is done by changing setpoints with the SETPT button, then pressing the RESET button. The NOSTOR error message will appear on the display, indicating that setpoint values have not been stored in nonvolatile memory.

4.10.4 RATE AND SQ RT MODE RESETS

> **NOTE:** Access to configuration bits (i.e. CF1.2, CF2.1, CF3.3 and CF4.1) are via the configuration menus CNFG 1, CNFG 2, CNFG 3 and CNFG 4.

4.10.4.1 $\overline{\text{RESET-A}}$

$\overline{\text{RESET-A}}$ is activated through the P2-3 pin on the 20-socket ribbon connector at the rear of the Main Board. It can be configured to act either on the pulse edge (CF4.1=0) or pulse level (CF4.1=1). It does the following:

1. Resets the TOTAL counter to 0; the display will reflect any TOT OF (Total Offset) value.

2. Unlatches a latched alarm (output) assigned to TOTAL (when CF3.3 and CF3.4=1).

3. Terminates a pulsed alarm (output) assigned to TOTAL if the associated setpoint is not designated in the AL TI (Alarm Time) parameter. $\overline{\text{RESET-A}}$ does not terminate a pulsed alarm if the associated setpoint is assigned a pulse duration in the AL TI parameter.

4.10.4.2 RESET-B

RESET-B is activated through P2-11. It does the following:

1. Makes the AVG RT (Average Rate) equal to the latest RATE measurement (starts a new AVG RT period)
2. Unlatches a latched alarm (output) assigned to RATE (Setpoints 3 and 4)
3. Resets the hysteresis action as follows:

   If active BELOW, compares reading with Setpoint 3.

   If active ABOVE, compares reading with Setpoint 4.
4. Terminates a pulsed alarm (output) assigned to RATE if the associated setpoint is not designated in AL TI.

4.10.4.3 RESET-C

RESET-C is activated through P2-19. It sets the TIME to the configured SET TI (Set Time) value.

4.10.4.4 FRONT-PANEL RESET

The front-panel reset is activated by pressing the RESET button. It can be disabled by setting the CF4.7 choice to equal "1". It initiates the actions of RESET-A, RESET-B, or RESET-C, depending upon which measurement is displayed.

Table 4-3 shows the reset function for the measurement displayed in the RATE, AVERAGE RATE, TOTAL or TIME both standard and square-root modes

TABLE 4-3. FRONT-PANEL RESETS IN RATE AND SQ RT MODES

DISPLAYED MEASUREMENT	RESET FUNCTION
RATE	RESET-B (but does not change AVG RT)
AVG RT	Replaces AVG RT with latest RATE
TOTAL	RESET-A
TIME	RESET-C

4.10.5 BATCH MODE RESETS

4.10.5.1 $\overline{\text{RESET-A}}$

$\overline{\text{RESET-A}}$ is activated through the P2-3 pin on the 20-socket ribbon connector at the rear of the Main Board. It can be configured to act either on the pulse edge (CF4.1=0) or pulse level (CF4.1=1). It does the following:

1. Resets the BATCH counter to 0 if the meter is counting up (CF1.8=0); resets to the Setpoint 3 value if the meter is counting down (CF1.8=1)
2. Increments BAT NO (Number of Batches) by 1.
3. Unlatches a latched alarm (output) assigned to BATCH (when CF3.3=1 and CF3.4=1) and removes a STOP condition initiated by either the front-panel ▶/STOP button or P2-17.
4. Terminates a pulsed alarm (output) assigned to BATCH if the associated setpoint is not designated in the AL TI (Alarm Time) parameter.

$\overline{\text{RESET-A}}$ does not terminate a pulsed alarm if the associated setpoint is assigned a pulse duration in the AL TI parameter.

4.10.5.2 $\overline{\text{RESET-B}}$

$\overline{\text{RESET-B}}$ is activated through P2-11. It does the following:

1. Resets the BAT NO (Number of Batches) to 0 if the meter is counting up (CF2.7=0) or to the Setpoint 4 value if the meter is counting down. (When counting down, SP 4 must be assigned to BAT NO).
2. Unlatches a latched alarm (output) assigned to BAT NO.
3. Terminates a pulsed alarm (output) assigned to BAT NO if the associated setpoint is not designated in the AL TI (Alarm Time) parameter.

4.10.5.3 $\overline{\text{RESET-C}}$

$\overline{\text{RESET-C}}$ is activated through P2-19. It does the following:

1. Resets the TOTAL counter to 0; the display will reflect any TOT OF (Total Offset) value.
2. Unlatches a latched alarm (output) assigned to TOTAL.
3. Sets the TIME to the configured SET TI value (if CF4.7=0).

4.10.5.4 FRONT-PANEL RESET

The front-panel reset is activated by pressing the RESET button. It can be disabled by setting the CF4.7 choice to 1. It initiates the actions of RESET-B, or RESET-C, depending upon which measurement is displayed.

Table 4-4 shows the front-panel reset functions for the BATCH mode.

TABLE 4-4. FRONT-PANEL RESETS IN BATCH MODE

DISPLAYED MEASUREMENT	RESET FUNCTION
BATCH	Loads B LOAD Value
BAT NO	RESET-B
TOTAL	Resets the total counter to zero
TIME	Resets time to SET TI value

A front-panel RESET also unlatches a possible latched alarm.

4.10.5.5 AUTORESET

Autoreset is a specific type of automatic reset. It is an internal RESET-A. It uses 0 and the Setpoint 3 value exactly like RESET-A:

Resets the BATCH counter to 0 if the meter is counting up (CF1.8=0); resets to the Setpoint 3 value if the meter is counting down (CF1.8=1).

You must set the CF2.6 choice to 1 to enable the Autoreset function.

4.10.6 STOP

The front-panel ▶/STOP button works only in Batch Mode. If configuration choice CF4.8=1, the button is enabled; pressing it activates all setpoints, which should trigger alarms that halt or safeguard the system. After 3 seconds, pressing the ▶/STOP button again resets all alarms and returns the meter to Run Mode.

4.11 COUNTING UP OR DOWN

Another decision you will have to make when setting up the meter is whether you want to count up or down. Generally, counting up is easier than counting down.

For instance, you're baking a batch of pies and you know that the pies must be in the oven for 45 minutes. You have two options: You can count up from 0, and at 45 minutes perform a reset that sets the time back to 0; or you can count down from 45, and at 0 perform a reset that sets the time back to 45.

If you are using the Rate Mode or Sq Rt Mode, counting up and down applies to the TOTAL count only. In Batch mode, counting up and down applies to all counts, BATCH, BAT NO, and TOTAL.

Note that most counting routines involve interdependent reset, setpoint, and configuration settings.

4.11.1 COUNTING UP

For TOTAL counts, the meter counts UP by using the following equation:

Display Count = (count * TOT SC) + TOT OF

In order to make the count positive and go up, you must make TOT SC (the TOTAL scale factor) positive. (See Section 5.4.11.) TOT OF represents the number from which you are counting up.

To make BATCH count up, you must set configuration choice CF1.8 to 0. To make BAT NO count up, you must set configuration choice CF2.7 to 0. (See Section 5.4.2.)

The following table shows you interdependent settings for counting up from 0 to 50. The setpoint number in the third column shows which setpoint must be assigned to the associated measurement (BATCH, BAT NO, or TOTAL).

For example, Setpoint 1, 2 or 3 is assigned to the BATCH count with the setpoint at 50. When the BATCH reading goes ABOVE 50, a RESET-A resets the BATCH count to 0, increments the BAT NO by 1, and the cycle starts over. Configuration choice CF1.8 must be set to 0 to count the BATCH up.

Table 4-5. Interdependent Settings for Counting UP

MODE	QTY	SP	SP VALUE	ACTIVE ABOVE OR BELOW	RESET	CONFIG-URATION SETTINGS
Batch	BATCH	1, 2 or 3	50	Above	$\overline{\text{RESET-A}}$ (Resets BATCH to 0) Increments BAT NO	CF1.8=0, meter counts UP
Batch	BAT NO	4	50	Above	$\overline{\text{RESET-B}}$ (Resets BAT NO to 0)	CF2.7=0, meter counts UP
Batch	TOTAL	4	50	Above	$\overline{\text{RESET-C}}$ (Resets TOTAL to TOT OF Value)	TOT OF=0
Rate or Sq Rt	TOTAL	1 or 2	50	Above	$\overline{\text{RESET-A}}$ (Resets TOTAL to TOT OF Value)	TOT OF=0

4.11.2 COUNTING DOWN

For TOTAL counts, the meter counts DOWN by using the same equation it uses to count up:

Display Count = (count ❊ TOT SC) + TOT OF

In order to make the count positive but go down, you must make TOT SC (the TOTAL scale factor) negative. TOT OF represents the number from which you are counting down.

To make BATCH count down, you must set configuration choice CF1.8 to equal "1". To make BAT NO count down, you must set configuration choice CF2.7 to equal "1".

The following table shows you interdependent settings for counting down from 50 to 0. The setpoint number in the third column shows which setpoint must be assigned to the associated measurement (BATCH, BAT NO, or TOTAL).

In this example, Setpoint 1, 2, or 3 is assigned to the BATCH count. The setpoint is still 50, but it is not activated until the reading hits 0. At that point, a $\overline{\text{RESET-A}}$ resets the BATCH count to the Setpoint 3 value, which must be set to 50, and the cycle starts over. Configuration choice CF1.8 must be set to 1 to count the BATCH down.

Table 4-6. Interdependent Settings for Counting DOWN

MODE	QTY	SP	SP VALUE	ACTIVE ABOVE OR BELOW	RESET	CONFIG-URATION SETTINGS
Batch	BATCH	1, 2 or 3	50, but not active until 0	Below	$\overline{\text{RESET-A}}$ (Resets to SP 3 Value)	CF1.8=1, meter counts down SP 3=50
Batch	BAT NO	4	50, but not active until 0	Below	$\overline{\text{RESET-B}}$ (Resets to SP 4 Value)	CF1.7=1, assigns SP 4 to BAT NO CF1.8=1, meter counts down SP 4=50
Batch	TOTAL	4	50, but not active until 0	Below	$\overline{\text{RESET-C}}$ (Resets to 50 using TOT OF Value)	CF1.7=0, assigns SP 4 to TOTAL SP 4=50 TOT OF=50
Rate or Sq Rt	TOTAL	1 or 2	50, but not active until 0	Below	$\overline{\text{RESET-A}}$ (Resets TOTAL to 50 using TOT OF Value)	TOT OF=50

4.12 AN EXAMPLE SHOWING SETPOINT AND RESET CONTROL

Figure 4-1 shows a setup where setpoints and resets control filling of barrels on a conveyor belt. The signal source is a flow meter with a 4-20-mA signal. The flow is directed toward two valves, a "fast" valve that delivers a large quantity of liquid quickly, and a "slow" valve that delivers a much smaller quantity slowly.

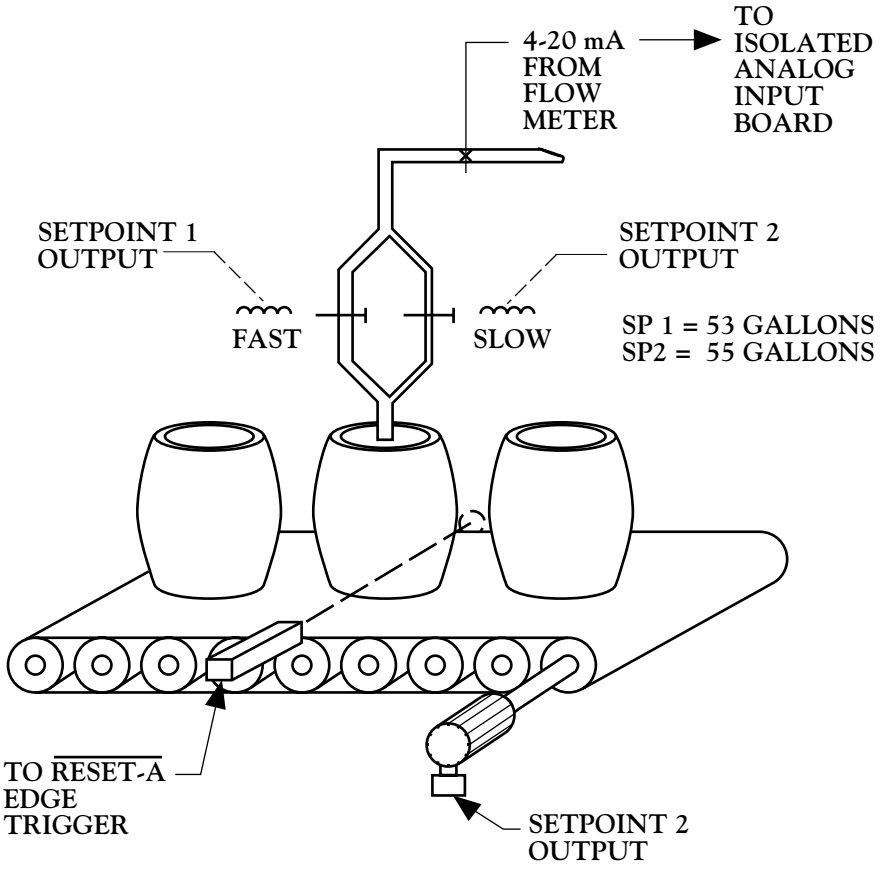


Figure 4-1. Setup using Setpoints and Resets

Here are the system connections and settings:

Mode:	Rate
Setpoint 1:	Value, 53; assigned to TOTAL, active ABOVE; enables closing of fast valve
Setpoint 2:	Value, 55: assigned to TOTAL, active ABOVE; enables closing of slow valve and moving of conveyor belt
$\overline{\text{RESET-A}}$:	Edge-triggered by barrel position sensor; resets TOTAL (as configured by TOT OF), enables opening of fast and slow valves and stopping of conveyor belt
TOT OF:	0; TOTAL count resets to 0
TOT SC:	As required to convert display units to gallons; the meter counts up

When the system is in action, barrels move from left to right. Just after a barrel has been completely filled, the conveyor belt moves forward and an empty barrel hits the sensor that triggers a $\overline{\text{RESET-A}}$. This stops the conveyor belt, positioning the empty barrel beneath the flow output, and opens the fast and slow filling valves. The edge-triggered reset also deactivates Setpoints 1 and 2, and resets the TOTAL count to 0, but allows it to climb immediately as the barrel is filled. When the TOTAL (the volume of the barrel) reaches 53 gallons, Setpoint 1 is activated and the fast valve closes. The slow valve continues to deliver a very low flow that can easily be shut off at exactly 55 gallons. When TOTAL reaches 55 gallons, Setpoint 2 is activated and the slow valve also closes. The conveyor belt simultaneously moves forward and the next empty barrel triggers a $\overline{\text{RESET-A}}$, deactivating Setpoints 1 and 2, setting the TOTAL count to 0, and starting the filling process all over again.

5. Configuring the Meter

Configuration is the process of telling the meter exactly how you would like it to operate.

The meter must be ON to configure it. When power is applied, the meter starts to function immediately in Run Mode. To access Configuration Mode, simply press the MENU button. The display will show L1 CNF (explained below), and configuration can start.

5.1 PARAMETERS, CHOICES, AND SETTINGS

Your meter always operates within certain guidelines called parameters. When power is applied, the meter "consults" these parameters and operates accordingly. The parameter list is accessed by repeated pressing of the MENU button. The parameters that appear on the display after the appearance of the MODE parameter depend on the MODE setting.

Each parameter has a number of possible choices. Choices are accessed by pressing the ▶/STOP button, and set by pressing the ▲/DISPLAY button. For example, the MODE parameter, has three choices: Rate, Sq Rt (Square Root), and Batch. If you set the MODE to Rate, the meter functions as a Rate Meter/Totalizer; if you set it Sq Rt, it functions as a Rate Meter/Totalizer/Square Root Extractor; and if you set it to Batch, it functions as a Batch Controller.

Settings are stored by pressing the MENU button which also brings up the next parameter on the display.

While in the Configuration Mode, pressing the RESET button once displays the previous parameter. Pressing the RESET button two times resets the meter; all changes are stored in nonvolatile memory (EEPROM), and the meter reverts to Run Mode. The meter also resets and reverts to Run Mode at the end of the parameter sequence.

5.2 THE BASICS OF CONFIGURATION

The following is a brief outline for configuring the meter:

1. To access any parameter, press the MENU button repeatedly until the desired parameter appears.

2. Press the ▶/STOP button repeatedly until the desired choice appears. A flashing digit or word indicates that that choice is current and can be changed.

3. Press the ▲/DISPLAY button repeatedly until the desired setting appears.

4. Press the ▶/STOP button to advance to a new choice; press the MENU button to save the new settings and to advance to the next parameter. The display will show STORED when changed settings are saved.

The configuration of some parameters varies slightly from these general instructions; specific instructions for each parameter are detailed in Section 5.4.

Table 5-1 shows you the parameter list for each meter mode.

TABLE 5-1. PARAMETERS FOR EACH MODE

PARA-METER	RATE MODE	SQ RT MODE	BATCH MODE
1	L1 CNF	L1 CNF	L1 CNF
2	L2 CNF	L2 CNF	L2 CNF
3	L3 CNF	L3 CNF	L3 CNF
4	MODE	MODE	MODE
5	CNFG 1	CNFG 1	CNFG 1
6	CNFG 2	CNFG 2	CNFG 2
7	CNFG 3	CNFG 3	CNFG 3
8	CNFG 4	CNFG 4	CNFG 4
9	AVG.CNF	AVG.CNF	IN.SC.OF
10	IN.SC.OF	IN.SC.OF	OT.SC.OF
11	OT.SC.OF	OT.SC.OF	BAT DP
12	RTE DP	RTE DP	B LOAD
13	RTE OF	RTE OF	BAT SC
14	RTE SC	RTE SC	TOT DP
15	TOT DP	TOT DP	TOT OF

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PARA-METER	RATE MODE	SQ RT MODE	BATCH MODE
16	TOT OF	TOT OF	TOT SC
17	TOT SC	TOT SC	AL TI
18	AL TI	AL TI	BAUD
19	GATE T	BAUD	SER.CNF
20	BAUD	SER.CNF	DAT FT
21	SER.CNF	DAT FT	BUS FT
22	DAT FT	BUS FT	ADDRES
23	BUS FT	ADDRES	SER TI
24	ADDRES	SER TI	SET TI
25	SER TI	SET TI	CAL VZ
26	SET TI	CAL VZ	CAL VS
27	CAL VZ	CAL VS	CALmAZ
28	CAL VS	CALmAZ	CALmAS
29	CALmAZ	CALmAS	
30	CALmAS		

5.3 LOCKOUTS

The first three parameters in each meter mode, L1 CNF, L2 CNF, and L3 CNF, are called Lockouts because their sole function is to control access to **other** parameters. When you initially configure your meter, all choices of each Lockout should be set to 0 (this is the factory preset value). This ensures that all meter parameters are displayed, and are therefore accessible for change during configuration. After configuration, you may want to return to the Lockouts and set certain ones to equal "1". This locks out the corresponding parameters so that they don't appear on the display in future programming attempts, and therefore cannot be altered.

For example, you have completely configured your meter, and it is particularly important that your settings for BAUD and SER.CNF (Serial Configuration) parameters not be altered. Using Table 5-2 as a guide, you would look for the Lockout choice controlling display of BAUD and SER.CNF. L2C.6=1 would then be programmed into the meter.

5.3.1 LOCKOUTS AND CORRESPONDING ACTIONS

Table 5-2 shows you each Lockout and the parameters or functions it controls. The factory preset for all Lockouts is 0. **Factory presets are asterisked.**

TABLE 5-2. LOCKOUTS AND CORRESPONDING ACTIONS

PARA-METER	CHOICE	SETTING	ENABLES/ DISABLES	METER FUNCTION
L1 CNF	L1C.1	0* 1	Enables Disables	Display and setting of Setpoints 1 and 2 using the SETPTS button
	L1C.2	0* 1	Enables Disables	Display and setting of Setpoints 3 and 4 using the SETPTS button
	L1C.3	0* 1	Enables Disables	Display and setting of Setpoint 5 using the SETPTS button
	L1C.4	0* 1	Enables Disables	Display and setting of CNFG 1 parameter (Setpoint and display brightness configuration)
	L1C.5	0* 1	Enables Disables	Display and setting of CNFG 2 parameter (Setpoint and line frequency configuration)
	L1C.6	0* 1	Enables Disables	Display and setting of CNFG 3 parameter (Setpoint and input/ output configuration)
	L1C.7	0* 1	Enables Disables	Display and setting of CNFG 4 parameter (Input/output and reset configuration)

continued next page

Table 5-2 (cont'd)

PARA-METER	CHOICE	SETTING	ENABLES/ DISABLES	METER FUNCTION
	L1C.8	0* 1	Enables Disables	Display and setting of AVG.CNF parameter (Filter configuration) in Rate and Sq Rt Modes
L2 CNF	L2C.1	0* 1	Enables Disables	Display and setting of IN.SC.OF parameter (Input Scale and Offset configuration)
	L2C.2	0* 1	Enables Disables	Display and setting of OT.SC.OF parameter (Output Scale and Offset configuration)
	L2C.3	0* 1	Enables Disables	Display and setting of RTE DP, RTE OF, and RTE SC parameters (RATE decimal point, offset, and scale configuration)
	L2C.4	0* 1	Enables Disables	Display and setting of TOT DP, TOT OF, and TOT SC parameters (TOTAL decimal point, offset, and scale configuration)
	L2C.5	0* 1	Enables Disables	Display and setting of AL TI parameter (Alarm pulse time configuration)
	L2C.6	0* 1	Enables Disables	Display and setting of BAUD, SER.CNF, DAT FT, BUS FT, ADDRES, and SER TI parameters (Serial communications configuration)
	L2C.7	0* 1	Enables Disables	Display and setting of SET TI parameter (TIME configuration)

continued next page

Table 5-2 (cont'd)

PARA-METER	CHOICE	SETTING	ENABLES/ DISABLES	METER FUNCTION
	L2C.8	0* 1	Enables Disables	Display and setting of GATE T parameter (Gate Time configuration) in Rate Mode only
L3 CNF	L3C.1	0* 1	Enables Disables	Display of RATE, SQ RT, and BATCH using the ▲DISPLAY button in Run Mode
	L3C.2	0* 1	Enables Disables	Display of AVG RT, and BAT NO using the ▲DISPLAY button in Run Mode
	L3C.3	0* 1	Enables Disables	Display of TOTAL using the ▲DISPLAY button in Run Mode
	L3C.4	0* 1	Enables Disables	Display of TIME using the ▲DISPLAY button in Run Mode
	L3C.5	0* 1	Enables Disables	Display and setting of MODE parameter (Operating mode configuration)
	L3C.6	0* 1	Enables Disables	Display and setting of CAL VZ,CAL VS, CALmAZ, and CALmAS parameters (Analog output configuration)
	L3C.7	0* 1	Enables Disables	EEPROM (nonvola-tile) storage of changed settings
	L3C.8	0* 1	Enables Disables	the MENU button (Disabled only with removal of S1-A)

5.3.2 SETTING LOCKOUTS

The following instructions show you how to set the Lockouts.

1. Press the MENU button repeatedly until L1 CNF appears on the display. (If you are in Run Mode you will need to press the MENU button only once.)

NOTE: If L1 CNF, L2 CNF, and L3 CNF do not appear on the display, the S1-A jumper has been removed from the Main Board. If this is a first-time configuration, you must open the meter as described in Section 2.3.1 and install the jumper as described in Section 2.3.2.1. **If this is not a first-time configuration, the jumper may have been removed intentionally to ensure that certain operating parameters are not changed.**

2. Press the ▶/STOP button. The display will show either L1C.1=0 or L1C.1=1.

3. Press the ▲/DISPLAY button one or two times to toggle the setting to equal to 0 (to enable the corresponding parameter) or 1 (to disable the corresponding parameter). Refer to Table 5-2 for the definitions of each submenu as you continue on.

4. Press the ▶/STOP button to advance to L1C.2, then press the ▲/DISPLAY button to set it. Advance to, and set all 8 choices in L1 CNF in turn.

5. Press the MENU button to save the settings of L1 CNF and advance to the next Lockout, L2 CNF. Set all choices as you did those of the L1 CNF, then press the MENU button to save the settings and advance to L3 CNF. Set and save all choices.

6. Press the RESET button two times to exit Configuration Mode. The meter will reset and revert to Run Mode.

For on-line production measurement and control, you may want to lock out all programming choices that won't be changed from one run to another. Locking out all but frequently adjusted parameters will shorten the MENU parameter list considerably.

If you have locked out certain features as a security measure, there is no guarantee that a knowledgeable person won't access the Lockouts, unlock the choices, and reconfigure the corresponding parameters. How do you remove the Lockouts completely so that settings cannot be changed at all? See the next section.

5.3.3 REMOVING THE S1-A JUMPER FOR ADDED SECURITY

As an added measure of security after configuration and setting certain lockouts, you may also remove the S1-A jumper on the Main Board. This prevents the Lockouts themselves from appearing during configuration and gives you the utmost security in safeguarding settings.

Open the meter as described in Section 2.3.1 and remove the S1-A jumper as described in Section 2.3.2.1.

5.4 OTHER METER PARAMETERS

This section explains the function of all parameters following the Lockouts.

5.4.1 MODE

MODE refers to the mode in which the meter operates. There are three choices: Rate, Sq Rt, and Batch. The factory preset mode is Rate.

Press the MENU button repeatedly until the display shows MODE. Press the ▶/STOP button. The display will show the current mode. Press the ▲/DISPLAY button to set the desired mode, then press the MENU button to store the setting.

If you change the MODE to a new setting, the meter will automatically RESET and revert to RUN. To continue configuring the meter, press the MENU button 5 times to sequence past the first 4 parameters and bring up the fifth one, CNFG 1.

5.4.2 CNFG 1 THROUGH CNFG 4 (Rate, Sq Rt, Batch)

CNFG 1 through CNFG 4 are configuration parameters that assign attributes to setpoints (Section 4.9.1), control the display, and configure input/output.

Press the ▶/STOP button to advance to L1C.2, then press the ▲/DISPLAY button to set it. Continue on by pressing the ▶/STOP button and the ▲/DISPLAY button until all 8 submenus of L1 CNF have been set. Press the MENU button to save your selections and the display will show L2 CNF. You may now proceed to set all of the parameters in this menu just as you did in L1 CNF. L3 CNF and L4 CNF are configured the same way.

Table 5-3 shows configuration parameters CNFG 1 through CNFG 4. Factory preset values are asterisked.

TABLE 5-3. CONFIGURATION PARAMETERS CNFG 1 THROUGH CNFG 4

PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
CNFG 1	CF1.1	0*	SP 1 output is normally CLOSED; SP 1 is assigned to TOTAL		SP 1 output is normally CLOSED; SP 1 is assigned to BATCH count
		1	SP 1 output is normally OPEN; SP 1 is assigned to TOTAL		SP 1 output is normally OPEN; SP 1 is assigned to BATCH count
	CF1.2	0*	SP 2 output is normally CLOSED; SP 2 is assigned to TOTAL		SP 2 is normally CLOSED; SP 2 is assigned to BATCH count
		1	SP 2 output is normally OPEN; SP 2 is assigned to TOTAL		SP 2 output is normally OPEN; SP 2 is assigned to BATCH count
	CF1.3	0*	SP 3 output is normally CLOSED; SP 3 is assigned to RATE if CF1.7=0; SP 3 used for AVG RT if CF1.7=1		SP 3 output is normally CLOSED; SP 3 is assigned to BATCH count
		1	SP 3 is normally OPEN; SP3 is assigned to RATE if CF1.7=0; SP 3 used for AVG RT if CF1.7=1		SP 3 is normally OPEN; SP 3 is assigned to BATCH count
	CF1.4	0*	SP 4 is normally CLOSED; SP 4 is assigned to RATE if CF1.8=0; SP 4 used for AVG RT if CF1.8=1		SP 4 is normally CLOSED; SP 4 is assigned to TOTAL if CF1.7=0; for BAT NO if CF1.7=1

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
	CF1.4	1	SP 4 is normally OPEN; SP4 is assigned to RATE if CF1.8=0; SP 4 used for AVG RT if CF1.8=1		SP 4 is normally OPEN; SP 4 is assigned to TOTAL if CF1.7=0; for BAT NO if CF1.7=1
	CF1.5	0*	SP 5 is normally CLOSED; SP 5 is assigned to TIME		
		1	SP 5 is normally OPEN; SP 5 is assigned to TIME		
	CF1.6	0*	Meter display is bright		
		1	Meter display is dimmed 50%		
	CF1.7	0*	SP 3 is assigned to RATE		SP 4 is assigned to TOTAL
		1	SP 3 is assigned to AVG RT		SP 4 is assigned to BAT NO
	CF1.8	0*	SP 4 is assigned to RATE		BATCH counts up
		1	SP 4 is assigned to AVGRT		BATCH counts down
CNFG 2	CF2.1	0*	SP 1 output is active ABOVE SP 1 value		
		1	SP 1 output is active BELOW SP 1 value		
	CF2.2	0*	SP 2 output is active ABOVE SP 2 value		
		1	SP 2 output is active BELOW SP 2 value		
	CF2.3	0*	SP 3 output is active ABOVE SP 3 value		
		1	SP 3 output is active BELOW SP 3 value		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
	CF2.4	0*	SP 4 output is active ABOVE SP 4 value		
		1	SP 4 output is active BELOW SP 4 value		
	CF2.5	0*	SP 5 output is active ABOVE SP 5 value		
		1	SP 5 output is active BELOW SP 5 value		
	CF2.6	0*	SP 3 action is not delayed		RESET action is normal (manual by the front-panel RESET button or external P2-2 reset)
		1	SP 3 action is delayed for 4 alarm readings		At SP 3 value, meter Autoresets to 0; or at 0, meter Autoresets to SP3 value
	CF2.7	0*	SP 4 action is not delayed		BAT NO counts up
		1	SP 4 action is delayed for 4 alarm readings		BAT NO counts down from SP 4 value if CF1.7=1
	CF2.8	0	Meter is set for 60 Hz power		
	(See Appendix J for factory setting)	1	Meter is set for 50 Hz power		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
CNFG 3	CF3.1 (Analog Output)	0	Analog output = disabled		
		1*	RATE is sent		BATCH count is sent
		2	AVG RT is sent		BAT NO is sent
		3	TOTAL is sent		
		4	Output is ramped (See Appendix K for Ramp Specs)		
	CF3.2 (BCD Output)	0	BCD output = disabled		
		1*	RATE is sent		BATCH count is sent
		2	AVG RT is sent		BAT NO is sent
		3	TOTAL is sent		
		4	TIME is sent		
	CF3.3 (SP 1)	0*	SP 1 output is normal (unlatched)		
		1	SP 1 output is latched		
		2	SP 1 output is pulsed with 70 to 140 ms duration unless SP 1 is the designated setpoint in the AL TI parameter, in which case pulse duration is set by AL TI		
	CF3.4 (SP 2)	0*	SP 2 output is normal (unlatched)		
		1	SP 2 output is latched		
		2	SP 2 output is pulsed with 70 to 140 ms duration unless SP 2 is the designated setpoint in the AL TI parameter, in which case pulse duration is set by AL TI		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
	CF3.5 (SP 3)	0*	SP 3 output is normal (unlatched)		
		1	SP 3 output is latched		
		2	SP 3 output is pulsed with 70 to 140 ms duration unless SP 3 is the designated setpoint in the AL TI parameter, in which case pulse duration is set by AL TI		
		3	Setpoints 3 and 4 act as low and high thresholds, respectively, for SP 4 hysteretic action (CF3.6=3)		
	CF3.6 (SP 4)	0*	SP 4 output is normal (unlatched)		
		1	SP 4 output is latched		
		2	SP 4 output is pulsed with 70 to 140 ms duration unless SP 4 is the designated setpoint in the AL TI parameter, in which case pulse duration is set by AL TI		
		3	SP 4 output is hysteretic		
	CF3.7 (SP 5)	0*	SP 5 output is normal (unlatched)		
		1	SP 5 output is latched		
		2	SP 5 output is pulsed with 70 to 140 ms duration unless SP 5 is the designated setpoint in the AL TI parameter, in which case pulse duration is set by AL TI		
	CF3.8	0*	No input rate cutoff; all positive and negative rates are counted		
		1	0 input rate cutoff; only positive input rates are counted		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
		2	100 Hz input rate cutoff; only input rates >100 Hz are counted	5% of display full scale cutoff; only input rates reading ≥5% of display full scale are counted	
		3	300 Hz input rate cutoff; only input rates >300 Hz are counted	10% of display full scale cutoff; only input rates reading 10% of display full scale are counted	
	CF3.9	0	Meter waits up to 11 s for final pulse before computing RATE		
		1*	Meter waits up to 2 s for final pulse before computing RATE		
		2	Meter waits up to 0.5 s for final pulse before computing RATE		
		3	Meter waits up to 0.15 s for final pulse before computing RATE		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
CNFG 4	CF4.1	0*	External $\overline{\text{RESET}}$ A (P2-3) triggered on pulse edge		
		1	External $\overline{\text{RESET}}$ A (P2-3) triggered on pulse level		
	CF4.2	0	Calibrated Analog Output = Voltage		
		1*	Calibrated Analog Output = Current		
	CF4.3	0*	Display HOLD (P2-16) = disabled		
		1	Display HOLD (P2-16) = enabled		
	CF4.4	0*	Print Request (P2-16) = disabled		
		1	Print Request (P2-16) via V01 communications = enabled (Appendix G)		
	CF4.5	0*	10-ms output pulse on P2-15 at the end of each RATE measurement		Pulse output on P2-15 is low when input rate is cut off, high if rate is not cut off
		1	Output pulse on P2-15 is low for 100 ± 40 ms: repeat rate is configured by SER TI (Serial Time)		
	CF4.6	0*	BCD binary address decimal point is right justified (See Appendix E)		
		1	BCD binary address decimal point is left justified (See Appendix E)		
	CF4.7	0*	Front-panel RESET = enabled		
		1	Front-panel RESET = disabled		

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PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
	CF4.8	0*	Automatic Scale and Offset = disabled (See below)		Front-panel STOP =disabled
		1	Automatic Scale and Offset = enabled. (Sets the scale factors of IN.SC.OF and RTE SC to 1.00000, and the offset factors of IN.SC.OF and RTE OF to 0.00000		Front-panel STOP =enabled

5.4.3 AVG.CNF (Rate, Sq Rt)

AVG.CNF (Running Average Configuration) selects the type and amount of average rate filtering for Rate and Sq Rt Modes. Follow the steps 1 through 4 in Section 5.2 to configure this parameter.

There are 5 choices. The first four, AVG.1 through AVG.4, set the number of values averaged into AVG RT.

Table 5-4 shows you the settings of the first 4 choices. Factory preset settings are asterisked and correspond to 256 total values in the average.

TABLE 5-4. AVG RT VALUES

TOTAL VALUES IN AVERAGE	CHOICE			
	AVG.1	AVG.2	AVG.3	AVG.4
1	0	0	0	0
2	1	0	0	0
4	0	1	0	0
8	1	1	0	0
16	0	0	1	0
32	1	0	1	0
64	0	1	1	0
128	1	1	1	0
256	0*	0*	0*	1*
512	1	0	0	1
1024	0	1	0	1
2048	1	1	0	1
4096	0	0	1	1
8192	1	0	1	1
16384	0	1	1	1
32768	1	1	1	1

The fifth choice, AVG.5, selects the filter type, adaptive or fixed. AVG.5=0 selects the ABC* (Adaptive Bandwidth Control) filter which keeps track of the signal history and detects systematic changes. When changes occur, it repeatedly reduces the number of values in the average. When the input rate is changing slowly, ABC repeatedly extends the number of readings averaged, so that excellent noise reduction is obtained.

AVG.5=1 selects the fixed-number-average filter, similar to the time constant of an analog first-order filter. Although much slower than the ABC filter, this fixed filter does give the familiar single-exponential response to step and ramp input changes. The AVG.5 factory preset value is 0.

5.4.4 IN.SC.OF (Rate, Sq Rt, Batch)

IN.SC.OF (Input Scale and Offset) is used to calibrate analog input, using the calibration data on the back of the Isolated Analog Input Board. (The Isolated Pulse Input Board may be used in a situation where it also requires calibration, but this is rare.)

** Patent applied for.*

IN.SC.OF can also be used to calibrate both the Isolated Analog Input Board and the incoming signal.

See Appendix C for more information and calibration instructions.

5.4.5 OT.SC.OF (Rate, Sq Rt, Batch)

OT.SC.OF (Output Scale and Offset) converts the meter reading to the desired analog output signal. It takes two data points–each based on an actual display reading–and uses them to produce the corresponding analog output values. Analog output can be either direct acting or reverse acting.

Internally, the meter takes the two data points and calculates the scale (the slope of the line defined by the two points) and the offset (the output when the display reading is 0). Then it automatically converts display readings according to the calculated values using the following equation:

Output = (Display reading ❊ SCale) + OFfset

You must know the desired output that the display readings correspond to.

OT.SC.OF can also be used to set the slope of an analog output ramping function. (See Appendix K.)

Use Table 5-5 to configure OT.SC.OF. Read from left to right starting with the Press command. The first line reads, "Press the MENU button repeatedly until the display reads OT.SC.OF."

TABLE 5-5. OT.SC.OF CONFIGURATION

STEP	PRESS:	THE DISPLAY SHOWS:	UNTIL THE DISPLAY SHOWS:	COMMENTS
1	MENU repeatedly		OT.SC.OF	You are now ready to configure OT.SC.OF
2	▶/STOP	READ 1		

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Table 5-5 (cont'd)

STEP	PRESS:	THE DISPLAY SHOWS:	UNTIL THE DISPLAY SHOWS:	COMMENTS
3	▶/STOP	000000.		Now enter the display reading of the "low" output signal: Press the ▲/DISPLAY button repeatedly to set the flashing digit; press the ▶/STOP button to move to new digits
4	MENU	OUTPT 1		
5	▶/STOP	000000.		Enter the output value that you would like the READ 1 to correspond to: Press the ▲/DISPLAY button repeat edly to set the flashing digit; press the ▶/STOP button to move to new digits When you press the MENU button next, the first data point will be saved
6	MENU	READ 2		
7	▶/STOP	000000.		Enter the display reading of the "high" output signal: Press the ▲/DISPLAY button repeat edly to set the flashing digit; press the ▶/STOP button to move to new digits
8	MENU	OUTPT 2		
9	▶/STOP	000000.		Enter the output value that you would like the READ 2 to correspond to: Press the ▲/DISPLAY button repeat edly to set the flashing digit; press the ▶/STOP button to move to new digits When you press the MENU button next, the first data point will be saved
10	MENU	RTE DP		You have successfully calculated OT.SC.OF

NOTE: If you receive an error message just after pressing the MENU button for the last time, note the message and see Appendix H.

Factory preset settings pertain to current output and are as follows:

READ 1	= 0	OUT 1	= 4 mA
READ 2	= 10000	OUT 2	= 20 mA

5.4.6 RTE DP (Rate, Sq Rt)

RTE DP (Rate Decimal Point) is used to select the resolution of the RATE display. The factory preset value is RRRRRR.

Press the MENU button repeatedly until the display reads RTE DP. Press the ▶/STOP button to display the current decimal point position. The display will show RRRRRR and the decimal point will flash. Change the position of the decimal point by pressing the ▲/DISPLAY button repeatedly, then press the MENU button to store the desired position.

The settings for this parameter are interdependent with settings for setpoints and those for offsets (IN.SC.OF and RTE OF).

If you receive an ERR 02 message, the placement of your decimal point has left insufficient display places to accommodate one of the setpoints. The meter sets that setpoint to the maximum value possible with the restrictive decimal point position and continues.

If you receive an ERR O1 message, the placement of the decimal point has left insufficient display places to accommodate a programmed offset value. The meter cannot continue. You must choose a decimal point setting that allows display of all offset digits.

5.4.7 RTE OF (Rate, Sq Rt)

RTE OF (Rate Offset) allows you to directly enter a known RATE offset. It does not affect TOTAL readings in any way. The factory preset is 0.

Please note that RTE OF is entered in display units, the units of measure corresponding to the RATE display reading. Factory preset display units are Hertz (Hz), pulses per second.

Press the MENU button repeatedly until the display shows RTE OF.

Press the ▶/STOP button; the display will show the current offset; the first digit will flash. Press the ▲/DISPLAY button to set the flashing digit, and advance to the next one by pressing the ▶/STOP button. When the desired number has been entered, press the MENU button. The meter will store RTE OF and advance to the next parameter.

The setting for this parameter is interdependent with that for RTE DP.

5.4.8 RTE SC (Rate, Sq Rt)

RTE SC (RATE Scale) allows you to directly enter a known RATE scale. It is used to convert input units to other display units. It does not affect TOTAL readings in any way. The factory preset operator is MULTIP and the factory preset value is 000001.

Press the MENU button repeatedly until the display reads RTE SC. Press the ▶/STOP button; the display will flash the current scale, either DIVIDE or MULTIP. Press the ▲/DISPLAY button to toggle the display to the correct operator, then press the ▶/STOP button. The display will show the current scale factor in 6 digits. Set each digit by repeated pressing of the ▲/DISPLAY button, and move to new digits and the decimal point by pressing the ▶/STOP button. (You may move the decimal point to any position here; it is not interdependent with other parameter settings.)

Press the MENU button to store RTE SC and advance to the next parameter

5.4.9 TOT DP (Rate, Sq Rt, Batch)

TOT DP (Total Decimal Point) allows you to select the resolution of the TOTAL display. The factory preset is TTTTTT.

Press the MENU button repeatedly until the display reads TOT DP, then press the ▶/STOP button. The display will show TTTTTT and the current decimal point will flash. Change the position of the decimal point by pressing the ▲/DISPLAY button repeatedly, then press the MENU button to store the desired position.

The setting for this parameter is interdependent with that for TOT OF.

If you receive an ERR 02 message, the placement of your decimal point has left insufficient display places to accommodate one of the

setpoints. The meter adjusts the decimal point and continues after displaying an ERR O2.

If you receive an ERR O1 message, the placement of the decimal point has left insufficient display places to accommodate the programmed TOT OF value. The meter cannot continue. You must choose a decimal point setting that allows display of all offset digits. Press the ▶/STOP button, reconfigure the decimal point position, then press the MENU button to store the desired position. The meter will advance to the next parameter.

5.4.10 TOT OF (Rate, Sq Rt, Batch)

TOT OF (Total Offset) allows you to offset the displayed TOTAL value. This value is loaded onto the TOTAL display when a RESET-C is initiated in Batch Mode, or a RESET-A is initiated in Rate or Sq Rt Modes. The factory preset value is 0. The maximum allowable offset is 500.

Please note that TOT OF is entered in display units–the units of measure corresponding to the TOTAL display reading. Factory preset display units are pulses or counts.

Press the MENU button repeatedly until the display shows TOT OF. Press the ▶/STOP button; the display will show the current offset; the first digit will flash. Press the ▲/DISPLAY button to set the flashing digit, and advance to the next one by pressing the ▶/STOP button. When the desired number has been entered, press the MENU button. The meter will store TOT OF and advance to the next parameter.

The setting for this parameter is interdependent with that for TOT DP.

5.4.11 TOT SC (Rate, Sq Rt, Batch)

TOT SC (TOTAL Scale) is used to convert TOTAL to units other than those of the input. It does not affect RATE readings in any way. The factory preset is MULTIP and the factory preset value is 000001.

Press the MENU button repeatedly until the display reads TOT SC. Press the ▶/STOP button; the display will flash the current scale, either DIVIDE or MULTIP. Press the ▲/DISPLAY button to toggle the display to the correct operator, then press the ▶/STOP button. The display will show the current scale factor in 6 digits. Set each

digit by repeated pressing the ▲/DISPLAY button, and move to new digits and the decimal point by pressing the ▶/STOP button. (You may move the decimal point to any position here; it is not interdependent with other parameter settings.)

Press the MENU button to store TOT SC and advance to the next parameter.

5.4.12 AL TI (Rate, Sq Rt, Batch)

AL TI (Alarm Time) defines the pulse duration in seconds of one (and only one) setpoint that is set to Pulsed in choices CF3.3 through CF3.7. (Any pulsed setpoint that is not the designated setpoint as defined by AL TI, defaults to a pulse duration of 70 to 140 ms.) The factory preset setpoint is 0 and the factory preset time is 00:00.

When the setpoint is set to 0, AL TI is used to ramp the analog output function. (Configuration choice CF3.1 must be set to 4.) The pulse duration becomes the ramp time–the time it takes to completely open a closed valve. (See Appendix K.)

Press the MENU button repeatedly until the display shows AL TI, then press the ▶/STOP button. The display will show the designated setpoint (which should flash) followed by an equal sign and the corresponding pulse duration. Press the ▲/DISPLAY button repeatedly to set the setpoint, then press the ▶/STOP button and the ▲/DISPLAY button to advance to, and set, the digits of the pulse duration. Pulse duration cannot exceed 99.99 s. Press the MENU button to store AL TI and advance to the next parameter.

5.4.13 GATE T (Rate)

GATE T (Gate Time) refers to the length of time in which the meter accepts input pulses for a single rate calculation. The longer GATE T, the better the resolution. (GATE T, is not used for the rate calculation; a similar, but much more accurate method called Measurement Time is used.)

There are 5 choices: (approximately) 0.03 s, 0.10 s, 0.30 s, 1.00 s, and 3.00s. The factory preset value is 0.30 s.

Press the MENU button repeatedly until the display reads GATE T. Press the ▶/STOP button. The display will flash the current setting. Press ▲/ DISPLAY repeatedly to sequence through the possible choices, then press the MENU button to store the desired GATE T and advance to the next parameter.

5.4.14 BAUD, SER.CNF, DAT FT, BUS FT, ADDRES, SER TI (Rate, Sq Rt, Batch)

BAUD, SER.CNF, DAT FT, BUS FT, ADDRES, and SER TI are parameters that configure RS-232 and RS-485 board communications.
BAUD (RS-232, RS-485)

BAUD refers to the data transfer rate through the communications channel linking two or more devices. There are seven choices:

300, 600, 1200, 2400, 4800, 9600, and 19,200

The factory preset is 9600.

Press the MENU button until the display shows BAUD, then press the ▶/STOP button. The display will flash the current baud rate. Press the ▲/DISPLAY button repeatedly to sequence through the seven possible rates, then press the MENU button to store the desired rate and advance to the next parameter.

SER.CNF (RS-232, RS-485)

SER.CNF (Serial Configuration) sets the serial communications format. Table 5-6 shows SER.CNF settings; factory preset values are asterisked.

TABLE 5-6. SERIAL COMMUNICATIONS CONFIGURATION AS SET BY SER.CNF

PARAM.	CHOICE	SETTING	RESULTING ACTION
SER.CNF	SER.1	0	No parity
		1*	Sets the parity bit to ODD
		2	Sets the parity bit to EVEN
	SER.2	0*	Sets the stop bit to one
		1	Sets the stop bit to two
	SER.3	0	Sends longs messages in several pieces
		1*	Sends long messages in a single piece

Press the MENU button until the display shows SER.CNF, then press the ▶/STOP button. The display will flash the current setting for SER.1. Press the ▲/DISPLAY button repeatedly to sequence through and choose one of three possible settings, then press the ▶/STOP button to advance to the next choice. Set SER.2 and SER.3 similarly. Press the MENU button to store the settings and advance to the next parameter.

DAT FT (RS-232, RS-485)

DAT FT (Data Format) controls the message response to Point-to-Point Continuous Transmission and V01 commands. It determines whether or not certain characters or values are sent along with the basic message. Factory preset values are asterisked.

TABLE 5-7. MESSAGE RESPONSE AS SET BY DAT FT

PARAM	CHOICE	SET'G	DISABLES /ENABLES	RESULTING ACTION		
				RATE MODE	SQ. RT MODE	BATCH MODE
DAT FT	DAT.1	0 1*	Disables Enables	Addition of alarm status character to the message		
	DAT.2	0 1*	Disables Enables	Addition of RATE value to the message		Addition of BATCH count to the message
	DAT.3	0 1*	Disables Enables	Addition of AVG RT value to the message		Addition of BAT NO to the message
	DAT.4	0 1*	Disables Enables	Addition of TOTAL value to the message		
	DAT.5	0 1*	Disables Enables	Addition of TIME to the message		
	DAT.6	0 1*	Disables Enables	Addition of RATE unit of measurement		Addition of BATCH count unit of measurement
	DAT.7	0 1*	Disables Enables	Addition of AVG RT unit of measurement		Addition of BAT NO unit of measurement
	DAT.8	0 1*	Disables Enables	Addition of TOTAL unit of measurement		

Press the MENU button until the display shows DAT FT, then press the ▶/STOP button. The display will flash the current setting for DAT.1. Press the ▲/DISPLAY button one or two times to set the choice to 0 or 1, then press the ▶/STOP button to advance to the next choice. Set choices DAT.2 through DAT.8 similarly. Press the MENU button to store the settings and advance to the next parameter.

BUS FT (RS-232, RS-485)

BUS FT (Bus Format) configures the serial communications format. Table 5-8 shows BUS FT settings; factory preset values are asterisked.

TABLE 5-8. BUS CONFIGURATION AS SET BY BUS FT

PARAM	CHOICE	SETTING	RESULTING ACTION		
			RATE MODE	SQ RT MODE	BATCH MODE
BUS FT	BUS.1	0*	Does not add a check sum to the message		
		1	Adds a check sum to the message		
	BUS.2	0	Does not add a line feed <LF> to the message		
		1*	Adds a line feed <LF> to the message		
	BUS.3	0*	Does not add a command ECHO in front of the message		
		1	Adds a command ECHO in front of the message		
	BUS.4	0*	Sets the meter to Point-to-Point Mode		
		1	Sets the meter to Multipoint Mode		
	BUS.5	0*	Sets Point-to-Point Mode to Continuous		
		1	Sets Point-to-Point Mode to Command		
	BUS.6	0*	In Point-to-Point Mode, sets RTS handshake to Message		
		1	In Point-to-Point Mode, sets RTS handshake to Character		
	BUS.7	0*	Sets the meter for RS-232 communications		
		1	Sets the meter for RS-485 communications		
	BUS.8	0*	Separator for DAT FT choices 1, 2, 3, and 4 is the SPACE		
		1	Separator for DAT FT choices 1, 2, 3, and 4 is the <CR> (Carriage Return)		

Press the MENU button until the display shows BUS FT, then press the ▶/STOP button. The display will flash the current setting for BUS.1. Press the ▲/DISPLAY button one or two times to set the choice to 0 or 1, then press the ▶/STOP button to advance to the next choice. Set choices BUS.2 through BUS.8 similarly. Press the MENU button to store the settings and advance to the next parameter.

ADDRES (RS-232, RS-485)

ADDRES (Address) specifies the meter ID. It is important in RS-485 communications (when multiple meters share the same bus) that each meter have a different address. The address can be from 0 to 199.

Press the MENU button repeatedly until the display shows ADDRES, then press the ▶/STOP button. The meter will show the current address. Press the ▲/DISPLAY button repeatedly to set each digit, and the ▶/STOP button to advance to the next digit. Press the MENU button to store the desired address and advance to the next parameter.

SER TI (RS-232, RS-485)

SER TI (Serial Time) specifies the interval of time in seconds between consecutive transmissions in Point-to Point or Continuous Mode. The SER TI value can be from 1 to 59999 s. A zero setting sends transmissions as fast as possible. The factory preset value is 1 s.

Press the MENU button repeatedly until the display shows SER TI, then press the ▶/STOP button. The display will show the current SER TI value with the first digit flashing. Set each digit by repeated pressing of the ▲/DISPLAY button and advance to the next digit by pressing the ▶/STOP button. Press the MENU button to store the desired SET TI and advance to the next parameter.

5.4.15 SET TI (Rate, Sq Rt, Batch)

SET TI is the time in HH:MM:SS format that is loaded on the TIME display when the front-panel RESET button is pressed.

The clock can run on two cycles, a 24-hour cycle and a 99-hour cycle. If you set HH less than 24, it runs on the 24-hour cycle. If you set HH greater than 24 and less than or equal to 99, the clock runs on the 99-hour cycle. The factory preset value is 12:00:00; the clock will run on the 24-hour cycle.

Press the MENU button until the display shows SET TI, then press the ▶/STOP button. The display will show the current setting with the first digit flashing. Set each digit by pressing the ▲/DISPLAY button repeatedly, and go on to new digits by pressing the ▶/STOP button. Press the MENU button to store the desired time and advance to the next parameter.

5.4.16 BAT DP (Batch)

BAT DP (Batch Decimal Point) sets the BATCH decimal point position. The factory preset value is RRRRRR.

Press the MENU button repeatedly until the display shows BAT DP, then press the ▶/STOP button. The display will show BBBBBB and the current decimal point will flash. Change the position of the decimal point by pressing the ▲/DISPLAY button repeatedly, then press the MENU button to store the desired position.

If you receive an error message, press the ▶/STOP button, reconfigure the decimal point position, then press the MENU button to store the desired position.

NOTE: The meter will show an error message, STORED then B LOAD. You will then need to press the RESET button one time to go back to BAT DP and reposition the decimal point.

5.4.17 B LOAD (Batch)

B LOAD (Batch Load) is the loading value of the BATCH count (unit count). This value is loaded onto the display when the front panel RESET button is pressed while BATCH is displayed.

It can be used to reset the BATCH count to a positive number when operation has been halted and you want to load a specific BATCH value so that the operation will pick up exactly where it left off. In this case, you would configure the B LOAD value just before resuming operation; immediately after resuming operation, a RESET-B would load the desired BATCH value on the display.

The factory preset value is 0.

Press the MENU button repeatedly until the display shows B LOAD, then press the ▶/STOP button. The display will show the current B LOAD in 6 digits with the first digit flashing. Press the ▲/DISPLAY button repeatedly to set each digit, then press the ▶/STOP button to advance to next digit. Press the MENU button to store the desired B LOAD and advance to the next parameter.

5.4.18 BAT SC (Batch)

BAT SC (Batch Scale) is the BATCH scale factor. The factory preset is MULTIP and the factory preset value is 000001.

Press the MENU button repeatedly until the display shows BAT SC, then press the ▶/STOP button; the display will flash the current scale, either DIVIDE or MULTIP. Press the ▲/DISPLAY button to toggle the display to the correct scale, then press the ▶/STOP button. The display will show the current scale factor in 6 digits. Set each digit by repeated pressing of the ▲/DISPLAY button, and advance to new digits by pressing the ▶/STOP button. Press the MENU button to store BAT SC and advance to the next parameter.

5.4.19 CAL VZ, CAL VS, CALmAZ, CALmAS

CAL VZ (Calibrate Voltage Zero), CAL VS (Calibrate Voltage Span), CALmAZ (Calibrate milliamp Zero), CALmAS (Calibrate milliamp Span) are parameters that are used to calibrate the Isolated Analog Output board.

See Appendix D for more information and calibration instructions.

5.5 STEP-BY-STEP PROGRAMMING EXAMPLE 1: RATE MODE; SHAFT RPM FROM A GEAR-TOOTH DETECTOR

Figure 5-1 shows the Basic Meter receiving TTL or CMOS pulses from a detector measuring the teeth on a gear.

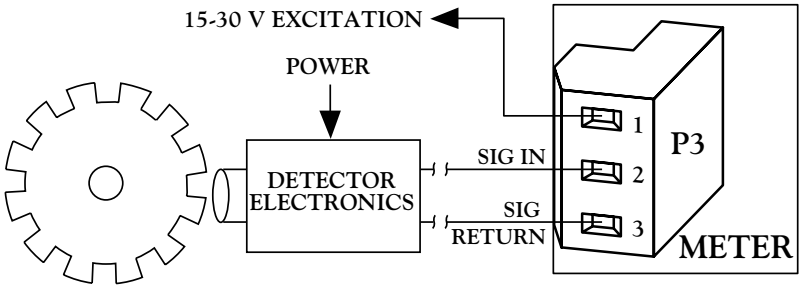


Figure 5-1. Basic Meter Connection to a Gear Detector

5.5.1 DETERMINING THE RATE SCALE (RTE SC)

TOTAL is not used in a shaft-speed application, no digital communications are used, and the example has no Analog Output. Therefore, many associated parameters will not be used.

The first step in this application is to decide what units you want the meter to display. Let's say that you want the meter to display revolutions per minute.

Rotation of the shaft produces X revolutions per minute (RPM) times N gear teeth to produce RPM*N pulses per minute. The meter's factory preset RATE units are Hertz (Hz), pulses per second. Therefore, the display would show RPM*N/60. To get a reading in RPM:

RTE SC = 60/N

If N = 12 (12 teeth on the gear),

RTE SC = 60/12 = 5.00000

5.5.2 CONFIGURING THE METER

This section shows you how to configure the meter for the first example. There are only a limited number of parameters that need to be changed from factory preset values, but all parameters that affect RATE up to RTE SC will be covered in case the corresponding preset values have been changed through experimentation or previous configuration.

1. Set all Lockouts to 0 (Section 5.3.2). All possible parameters will be displayed in sequence when you repeatedly press the MENU button.

2. Set the MODE to Rate (Section 5.4.1). The meter will reset and revert to Run Mode when you press the MENU button to store the selected MODE.

3. Press the MENU button five times to advance past MODE to CNFG 1. Set all CNFG parameters equal to 0 (Section 5.4.2).

4. Make sure IN.SC.OF is programmed to set the scale to 1 and the offset to 0 (Appendix C). Input the following values:

INPUT 1 = 0
READ 1 = 0
INPUT 2 = 100000
READ 2 = 100000

5. Set RTE DP to RRRRR.R (Section 5.4.6). This gives 0.1 RPM resolution.

   Ignore any ERR 02 message. This indicates a setpoint overflow that can easily be corrected when or if you set setpoints later.

6. Set RTE OF equal to 0 (Section 5.4.7).

7. Set RTE SC to MULTIP and a scale of 5 as calculated above (Section 5.4.8).

This concludes RATE programming. All other parameters (for TOTALs, Alarm Time, Gate Time, Serial Communications, etc.) have no effect on RATE measurements.

See Section 4.9.2 and Section 5.4.2 to program setpoints.

See Section 5.6 for adding TOTALs to a different example.

If you want the clock to run in the background, set SET TI (Section 5.4.15). To start TIME, press the ▲/DISPLAY button until you see TIME and the reading in HH:MM:SS is displayed, then press the RESET button.

After all parameters have been set to required values, you may want to set the corresponding Lockouts equal to 1 so that your settings cannot be changed.

Assuming the meter has been connected to the flowmeter and is operating correctly in Rate Mode, it will display the RATE in GPM when the ▲/DISPLAY button is pressed.

If the shaft in this example drove a mill roller, conveyor belt, vehicle wheel or other rotary-to-linear device, TOTAL could be used to measure distance or amount of product passed.

5.6 STEP-BY-STEP PROGRAMMING EXAMPLE 2: LINEAR FLOW; ADDING TOTAL TO RATE WITH EXCITATION FROM THE BASIC METER

In this example, the pulse source is a 100-pulse-per-gallon linear flowmeter (i.e., a turbine meter) which is powered by the unregulated 16 V excitation from the Basic Meter. See Figure 5-2.

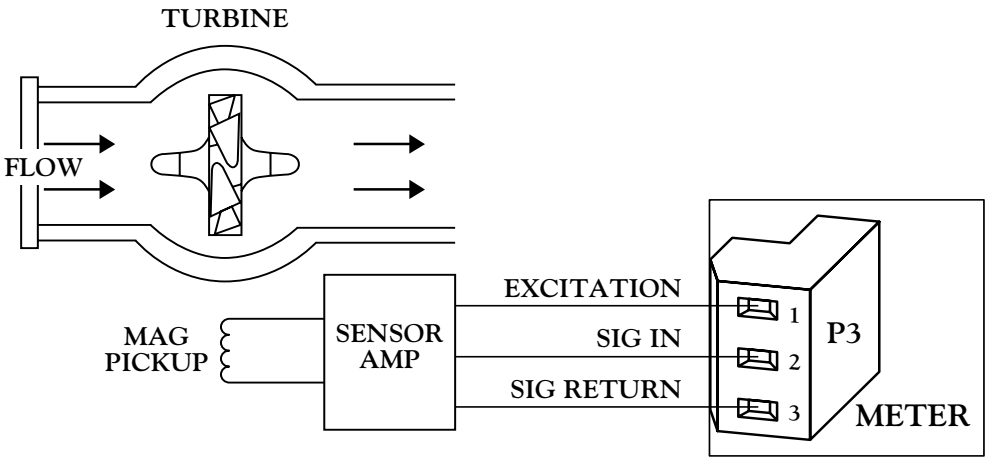


Figure 5-2. Basic Meter Connection to a Shaft Position Detector

To demonstrate the meter's scale and offset capability, set the RATE display to GPM (gallons per minute), but the TOTAL to Cubic Feet. This can be done because the decimal point location, scale factor and offset settings for RATE are completely independent of those for TOTAL.

An external signal (e.g., a limit switch closure or timing pulse) is connected to P2-3 (RESET-A) and is used to reset the TOTAL.

5.6.1 DETERMINING THE RATE DECIMAL POINT (RTE DP) AND RATE SCALE (RTE SC)

Once again the pulse source does not have an offset, so the only RATE parameters to be set are the decimal point (RTE DP) and scale factor (RTE SC).

Selecting the RTE DP position as RRRR.RR gives a possible full scale reading of 9999.99 GPM, or (dividing by 60) 166.67 gal/s. With 100 pulses per gallon, the maximum pulse rate would be 16.67 kHz.

Without offset,

$$\text{RTE SC} = \frac{\text{Desired Reading}}{\text{Actual Input Reading}}$$

$$= \frac{9999.99}{16667} = 0.60000$$

This is an easy MULTIP scale factor.

5.6.2 DETERMINING THE TOTAL DECIMAL POINT (TOT DP) AND TOTAL SCALE (TOT SC)

Selecting the decimal point as TTTTT.T gives a full-tank value of 99,999.9 cubic feet, where each cubic foot = 7.481 gallons.

The number of pulses N received for 1 cubic foot is

N = 1.0 * 7.481 * 100 = 748.1

$$\text{RTE SC} = \frac{\text{Desired Reading}}{\text{Actual Input Reading}}$$

$$\text{RTE SC} = \frac{1}{748.1}$$

This yields a DIVIDE scale of 748.1.

5.6.3 CONFIGURING THE METER

This section shows you how to configure the meter for the second example. There are only a limited number of parameters that need to be changed from the factory preset values, but all parameters up to TOT SC will be covered in case the corresponding factory presets have been changed through experimentation or previous configuration.

1. Set all Lockouts equal to 0 (Section 5.3.2). All possible parameters will be displayed in sequence when you repeatedly press the MENU button.

2. Set the MODE until you see Rate on the display (Section 5.4.1). The meter will reset and revert to Run Mode when you press the MENU button to store the selected MODE.

3. Press the MENU button five times to advance past MODE to CNFG 1. Set all CNFG parameters to 0 (Section 5.4.2).

4. Make sure IN.SC.OF is programmed to set the scale to 1 and the offset to 0 (Appendix C). Input the following values:

INPUT 1 = 0
READ 1 = 0
INPUT 2 = 100000
READ 2 = 100000

5. Set RTE DP to RRRR.RR as discussed in Section 5.4.6.

   Ignore any ERR 02 message. This indicates a setpoint overflow that can easily be corrected when or if you set setpoints later.

6. Set RTE OF equal to 0 (Section 5.4.7).

7. Set RTE SC to MULTIP and a scale of 0.6 as calculated in Section 5.4.8.

8. Set TOT DP to TTTTT.T as discussed in Section 5.4.9. This gives you 0.1 Cubic Foot resolution.

   Ignore any ERR 02 message. This indicates a setpoint overflow that can easily be corrected when or if you set setpoints later.

9. Set TOT OF equal to 0 (Section 5.4.10).

10. Set the TOT SC to DIVIDE and the factor to 748.1 (Section 5.4.11).

This concludes RATE and TOTAL programming.

See Sections 4.9.2 and 5.4.2 to program setpoints.

If you want the Clock to run in the background, set SET TI (Section 5.4.15). To start TIME, press the ▲/DISPLAY until you see TIME on the display and the reading in HH:MM:SS is displayed, then press the RESET button.

After all parameters have been set to required values, you may want to set the corresponding Lockouts equal to 1 so that your settings cannot be changed.

Assuming the meter has been connected to the flowmeter and is operating correctly in Rate Mode, it will display the RATE in GPM and the TOTAL in Cubic Feet when the ▲/DISPLAY button is pressed.

6. Operating the Meter

This section contains simple instructions for operating the meter in different modes.

Once your meter is configured and power is applied, it will start to operate in Run Mode immediately. Operating it is very simple.

6.1 RATE MODE

The meter can display four different measurements in Rate Mode: RATE, AVG RT (Average Rate), TOTAL, and TIME.

1. To display any one of these measurement values, press the ▲ /DISPLAY button and wait. The meter will flash the name of the measurement briefly, then display the corresponding value. Press the ▲ /DISPLAY button repeatedly to sequence through all four Rate Mode measurements.

2. To reset measurement values and associated latched alarms, perform the following resets:

    a. $\overline{\text{RESET-A}}$ to reset the TOTAL count and TOTAL latched alarms

    b. $\overline{\text{RESET-B}}$ to start a new AVG RT period, reset RATE latched alarms, or reset hysteretic action

    c. $\overline{\text{RESET-C}}$ to reset the TIME as configured by the SET TI value

   You can also press the front-panel RESET button. This will perform a $\overline{\text{RESET-A}}$, $\overline{\text{RESET-B}}$, or $\overline{\text{RESET-C}}$, depending on which quantity is displayed. (See Section 4.10.4.4.)

6.2 SQ RT MODE

The meter can display four different measurements in Sq Rt Mode: SQ RT, AVG RT (Average Rate), TOTAL, and TIME.

1. To display any one of these measurement values, press the ▲ /DISPLAY button button and wait. The meter will flash the name of the measurement briefly, then display the corresponding value. Press the ▲ /DISPLAY button repeatedly to sequence through all four Sq Rt Mode measurements.

2. To reset measurement values and associated latched alarms, perform the following resets:

   a. $\overline{\text{RESET-A}}$ to reset the TOTAL count and TOTAL latched alarms

   b. $\overline{\text{RESET-B}}$ to start a new AVG RT period, reset RATE latched alarms, or reset hysteretic action

   c. $\overline{\text{RESET-C}}$ to reset the TIME as configured by the SET TI value

   You can also press the front-panel RESET button. This will perform a $\overline{\text{RESET-A}}$, $\overline{\text{RESET-B}}$, or $\overline{\text{RESET-C}}$, depending on which quantity is displayed. (See Section 4.10.4.4.)

6.3 BATCH MODE

The meter can display four different measurements in Batch Mode: BATCH, BAT NO (Number of Batches), TOTAL, and TIME.

1. To display any one of these measurement values, press the ▲/DISPLAY button and wait. The meter will flash the name of the measurement briefly, then display the corresponding value. Press the ▲/DISPLAY button repeatedly to sequence through all four Batch Mode measurements.

2. To reset measurement values and associated latched alarms, perform the following resets:

    a. $\overline{\text{RESET-A}}$ to reset the BATCH count and unlatch BATCH latched alarms

    b. $\overline{\text{RESET-B}}$ to reset the BAT NO and unlatch BAT NO latched alarms

    c. $\overline{\text{RESET-C}}$ to reset the TOTAL, unlatch TOTAL latched alarms, and reset TIME as configured by the SET TI value

   You can also press the front-panel RESET button. This will load the B LOAD value, or perform a $\overline{\text{RESET-B}}$ or $\overline{\text{RESET-C}}$, depending on which quantity is displayed. (See Section 4.10.5.4.)

3. To stop operation, press the ▶/STOP button. This will activate all setpoints and put the system in an alarm state. Press the ▶/STOP button again after 3 seconds to reset alarms and resume operation.

Appendices

APPENDIX A
BASIC METER: GENERAL INFORMATION, SPECIFICATIONS, JUMPER CONFIGURATION, AND WIRING

A.1 GENERAL INFORMATION

The Basic Meter is defined as the meter with no optional boards. It accepts input pulses with a low level less than 1 V and a high level greater than 3.5 V from most active sources including TTL or CMOS sources, inactive sources such as open collector outputs and contact closures, and provides unregulated sensor excitation (14 - 20 V at 75 mA).

As the Basic Meter, the meter can operate in Rate Meter/Totalizer, Batch Controller, and Clock Modes. These modes are shown on the display as RATE, BATCH, and TIME.

A.2 SPECIFICATIONS

DISPLAY

TYPE:	14-segment, red or green LED
DIGIT HEIGHT:	0.54-inch (13.7-mm)
DECIMAL POINTS:	Six positions, programmable
LEADING ZEROS:	Blanked
OVERRANGE INDICATION:	Displayed in exponential format
DIMMING:	100% and 50% brightness levels, programmable
DISPLAY UPDATE TIME:	0.03 to 3 seconds, programmable
INDICATOR LIGHTS:	4 alarms and 3 status modes

ENVIRONMENT

NORMAL OPERATING TEMP.:	0° to 50°C (32° to 122°F)
DERATED OPERATING TEMP.:*	0° to 40°C (32° to 104°F)
*When operating at 253V/50Hz and maximum load (4-20mA, 4 alarms on, and 75 mA excitation)	
STORAGE TEMP.:	-40° to 85°C (-40° to 185°F)
RELATIVE HUMIDITY:	90% at 40°C (non-condensing)

POWER

AC VOLTAGE:	115/230Vac +/-10%
CONSUMPTION:	12.5 watts, max
POWER FAILURE:	Counter values and time stored in nonvolatile memory
AC FREQUENCY:	50/60 Hz
EXTERNAL FUSE PROTECTION RECOMMENDED:	
115Vac	IEC127-2/III, 125mA, 250V (Time-Leg) or UL Slow-Blow, 125mA, 250V
230Vac	IEC127-2/III, 63mA, 250V (Time-Leg) or UL Slow-Blow, 63mA, 250V
BATTERY BACKUP: (For internal clock only.)	6-12 Vdc @ 50 mA

MAIN BOARD

SETPOINT OUTPUT:	5 open-collector transistors
POWER RATING:	150 mA dc @ 1 V sink, 30 V when open

GENERAL

THRESHOLD:	1 V to 3.5 V
PROTECTION LEVEL:	24 V
FREQUENCY RANGES:	0.2 Hz to 20 kHz
TRIGGER SLOPE:	Positive
CONNECTION:	3-Socket Input Plug
SENSOR EXCITATION:	14 to 20 V @ 75 mA non-regulated
INPUT RESISTANCE:	30 kΩ pull-up resistor to +5 V
ACCURACY:	0.001% of reading ±1LSD, ±trigger error

CASE

MATERIAL:	94V-O UL-rated polycarbonate
DIMENSIONS:	(HxWxD) 1.89 x 3.78 x 5.86 in. (48 x 96 x 149 mm)
PANEL CUTOUT:	1/8 DIN (HxW) 1.772 x 3.622 in (45 x 92 mm)

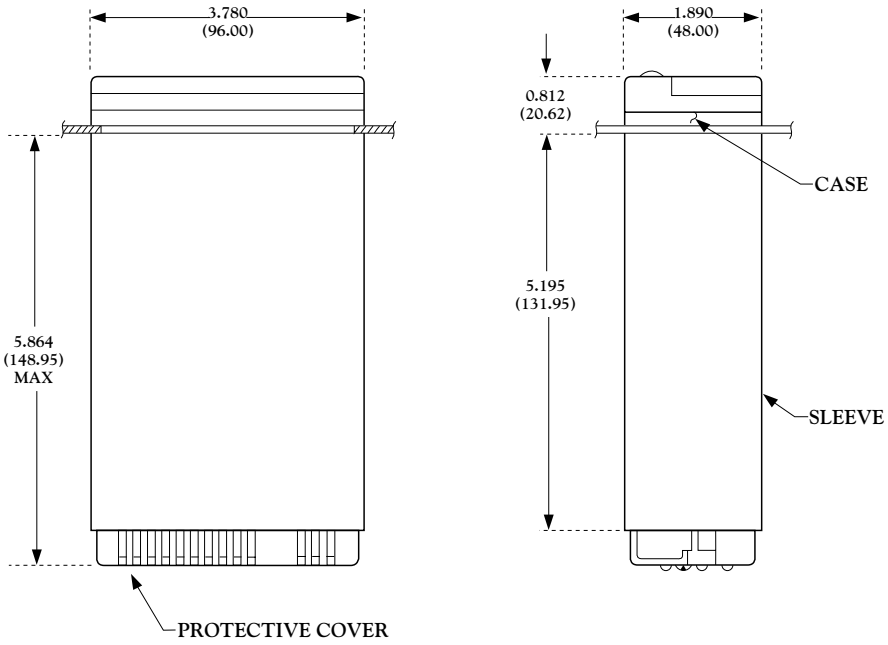


Figure A-1. Meter Housing

A.3 MAIN BOARD JUMPER LOCATIONS AND CONFIGURATION

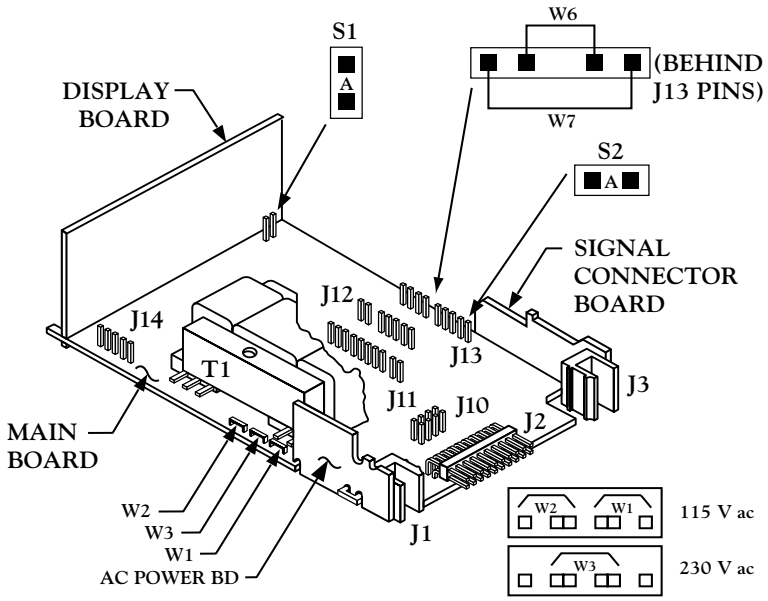


Figure A-2. Main Board Jumper Locations

Two push-on jumpers and two wired-in jumpers on the Main Board allow the Basic Meter to measure pulses and provide non-isolated excitation.

TABLE A-1. MAIN BOARD JUMPERS

JUMPER	LOCATION, VIEWING THE BOARD FROM THE REAR OF THE METER	FUNCTION
S1-A	On the right, immediately behind the Display Board	Enables push buttons to control lockout programming
S2-A	First two pins of J13 on the right side of the Main Board	Channels non-isolated excitation out to P3-1; remove if input board used
W1 and W2	Left side	Enables 115-V operation
W3	Left side	Enables 230-V operation
W6 and W7	Right side of Main Board next to J13	Bypasses isolation circuitry used for option boards; remove if input board used

See Appendix J for factory preset settings.

For non-isolated excitation, make sure jumper S2-A is installed on the rear two pins of J13 at the left rear of the main board.

A.4 INPUT CONNECTIONS

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

For the Basic Meter, input is wired to P3-2, the common ground to P3-3, and jumpers S2-A, W6 and W7 channel unregulated excitation to P3-1. Refer to Figure A-4.

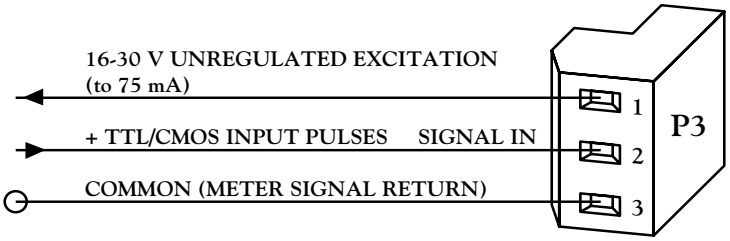


Figure A-4. Basic Meter Wiring

A.4.1 TTL OR CMOS PULSE SOURCE

Input from the pulse source is wired to P3-2 and the common ground to P3-3. Jumpers S2-A, W6, and W7 channel unregulated excitation to P3-1 (14 to 20 V at 75 mA).

Figure A-5 shows the connection of a TTL or CMOS pulse source to the basic meter. The same wiring applies to any TTL/CMOS source output.

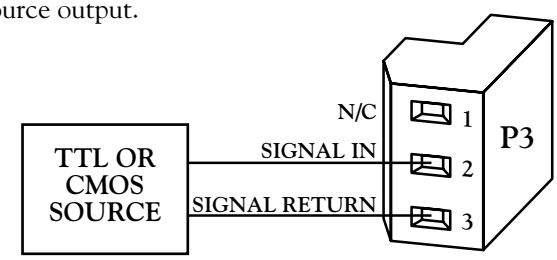


Figure A-5. TTL Source to the Basic Meter

The pulse source (including any wiring drop) should have a low threshold less than 1 V, and a high threshold greater than 3.5 V but not over 25 V. The meter provides a 30 kΩ pullup to its 5 V supply. The meter's pullup current lifts the pulse level when the signalling device is in the "open" state. Added external pullup current can be required if you have both high pulse frequency (i.e., higher than 5 kHz) and high capacitance (e.g., leads over 100 feet long).

If excitation from the meter is not required, S2-A may or may not be installed.

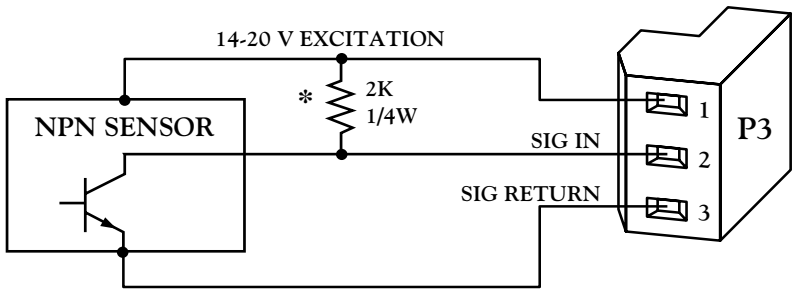
For pulse sources that need to be isolated from the meter's control/output logic levels (on P2), or that need amplification, use the Isolated Pulse Input Board. See Appendix B.

A.4.2 OPEN COLLECTOR OUTPUTS

Basic Meter

Figure A-6 shows the unregulated meter excitation of a sensor with an NPN transistor output feeding the meter with pulses, going low when the NPN is shut.

PNP outputs can also be connected to the meter, but an external pulldown resistor is required to override the internal pullup at the meter's input.



*Anti-noise resistor for long leads

Figure A-6. NPN Sensor to the Basic Meter

Figure A-6 also applies to most Darlington NPN outputs, since the meter's lower threshold is more than 1 V.

A.4.3 CONTACT-CLOSURE INPUT

Figure A-7 shows a contact-closure input to the Basic Meter. Internal pullup is provided, and when P2-9 is shorted to (jumpered to) P2-10, a debounce filter is also provided. (If P2 is wired, connect these two adjacent lines).

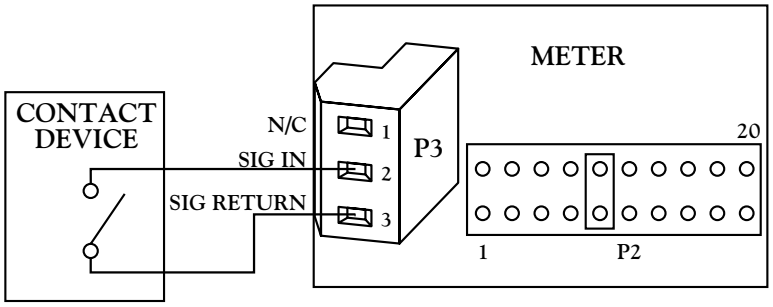


Figure A-7. Contact-Closure Input to the Basic Meter

APPENDIX B
ISOLATED PULSE INPUT BOARD: GENERAL INFORMATION, SPECIFICATIONS, JUMPER CONFIGURATION, AND WIRING

B

Isolated Pulse Input Board

B.1 GENERAL INFORMATION

The Pulse Input Board conditions low-amplitude pulses for both low-level (>20 mV rms) and high-level (up to 230 V rms) input signals. It provides galvanic isolation (354 V, IEC spacing), selectable hysteresis, filtering, clamping of overscale pulses, and regulated 5, 8.2 or 12.6 V excitation.

B.2 SPECIFICATIONS

SENSOR EXCITATION: (regulated, selectable)	5 V @ 50mA 8.2 V @ 50mA 12.6 V @ 70mA
CONNECTION:	2, 3-socket input plugs
INPUT SENSITIVITY	
LOW LEVEL:	20 mV rms
HIGH LEVEL:	2 - 5 V (See Table B-2)
MAXIMUM INPUT	
LOW LEVEL:	60 V rms
HIGH LEVEL:	230 V rms
INPUT IMPEDANCE	
LOW LEVEL:	100 kΩ pullup to excitation
HIGH LEVEL:	150 kΩ pullup to excitation in parallel with 90 kΩ minimum
NAMUR SENSOR PROVISIONS:	1 kΩ series resistor with 8.2 V excitation
CONTACT CLOSURE FREQUENCY RANGE:	8 ON/OFF per second

B.3 JUMPER LOCATIONS AND CONFIGURATION

Figure B-1 shows the Isolated Pulse Input Board jumper locations.

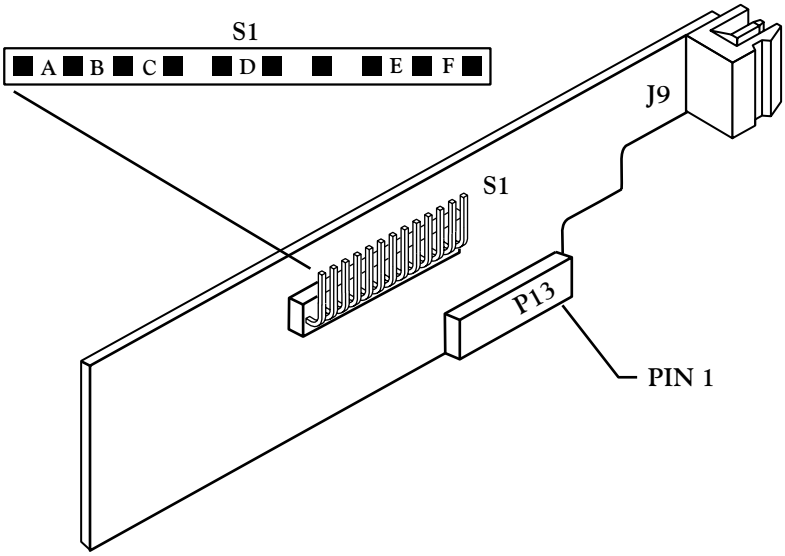


Figure B-1. The Isolated Pulse Input Board

Jumpers have the following functions. Factory presets are asterisked:

S1-B* Enables 12.6 V Excitation @ 70 mA (See Table B-4)
S1-C Enables 5.0 V Excitation @ 50 mA (See Table B-4)
S1-A Enables 8.3 V Excitation @ 50 mA (See Table B-4)
None Enables 8.1 V Excitation @ 50 mA (See Table B-4)
S1-D Shifts low-level thresholds positively (See Table B-3)
S1-E Counts pulse on high-to-low transition
S1-F* Counts pulse on low-to-high transition

Table B-1 shows excitation voltage for different S1 positions. The factory preset is asterisked.

TABLE B-1. ISOLATED PULSE INPUT BOARD EXCITATION VOLTAGES

	EXCITATION VOLTAGE LIMITS (V)	
S1 POSITION	LOWER LIMIT	UPPER LIMIT
S1-B*	11.8	13.3
S1-A	7.9	8.8
S1-C	4.75	5.3

High-level signal input (on connector P9-2) threshold levels are as shown in Table B-2

TABLE B-2. ISOLATED PULSE INPUT BOARD: HIGH-LEVEL INPUT THRESHOLDS

EXCITATION (V_{CC})		**4.75**	**5.3**	**7.9**	**8.8**	**11.8**	**13.3**
High Threshold (V)	**Min**	1.40		2.3		3.5	
	Max		1.65		2.75		4.1
Low Threshold (V)	**Min**	0.75		1.25		1.9	
	Max		0.95		1.55		2.3

Table B-3 shows low-level signal input (on connector P3-2) and corresponding threshold limits. The factory preset condition is asterisked.

TABLE B-3. ISOLATED PULSE INPUT BOARD: LOW-LEVEL INPUT THRESHOLDS

EXCITATION(V_{CC})			**4.7**	**5.25**	**7.5**	**8.5**	**11.8**	**13.2**
S1-D Removed*	High Threshold (mV)	**Min**	9		16		28	
		Max		21		31		45
	Low Threshold (mV)	**Min**	–6		–6		–6	
		Max		8		9		9
S1-D Installed	High Threshold (mV)	**Min**	15		26		43	
		Max		30		44		65
	Low Threshold (mV)	**Min**	2		6		11	
		Max		16		21		29

In Tables B-2 and B-3, the two voltages given for each switching level show the hysteresis (the voltage difference between the low-to-high switch point and the high-to-low transition). Hysteresis eliminates multiple counts when the incoming pulses are noisy.

There is also an Input Jumper Label on the case showing jumper options for both the Isolated Pulse Input Board and the Isolated Analog Input Board.

B.4 HIGH-LEVEL PULSE CONDITIONING

The board's high-level input provides a 150 k pullup to the selected excitation voltage (with jumpers configured as shown in Tables B-2 and B-3). This input is buffered with 90 k series resistance and clamping diodes to ground and excitation so that overscale and/or bipolar pulses are readied for the 2/4 V hysteretic pulse detection levels (as shipped).

Tying P9-1 to ground (P3-3), provides a low-pass filter with a corner of about 8 Hz (20 ms nominal time constant) for noise rejection, suitable for relay contacts up to 8 cycles per second (with about 50% duty cycle).

SPST (Single-Pole Single-Throw) switches can use the 1 kΩ internal resistor between the input (P9-2) and P9-3 as a pullup or pulldown, by tying P9-3 to +V or ground (P3-3), as appropriate.

B.5 LOW-LEVEL PULSE CONDITIONING

If P3-2 is used as the input instead of P9-2, very low amplitude pulses can be detected, as shown by the tables in Section B.3. Jumper S1-C is provided to optimize the detection levels for unipolar pulses: when installed, it moves the switching thresholds up by about half of the hysteresis voltage.

The low-level input provides a 100 kΩ pullup to Excitation, 50 kΩ series resistance, and clamps to Excitation and ground. Operation over the full pulse frequency rating (20 kHz) is achieved with 40mV rms, 20kHz input or 1kHz with 20 mV rms input.

B.6 EXCITATION FOR SENSORS

The tables in Section B.3 show jumper configuration producing 12.6, 8.2 or 5 V of excitation to drive input devices. Like both the high-level and low-level inputs, this excitation is galvanically isolated from the rest of the meter (i.e., the control input/outputs on P2).

Excitation current is limited to 50 mA. Up to 70 mA is available when V_{CC} = 12.6 is selected. However, the 12.6 V may drop to 11.0 V.

B.7 INPUT WIRING CONNECTIONS

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

High-level input (up to 230 V) is wired to P9-2. Low-level signals (20 mV and up) are wired to P3-2 and P3-3.

Excitation is channeled to P3-1. S1-A, S1-B or S1-C select 8.2, 12.6 or 5 V excitation respectively.

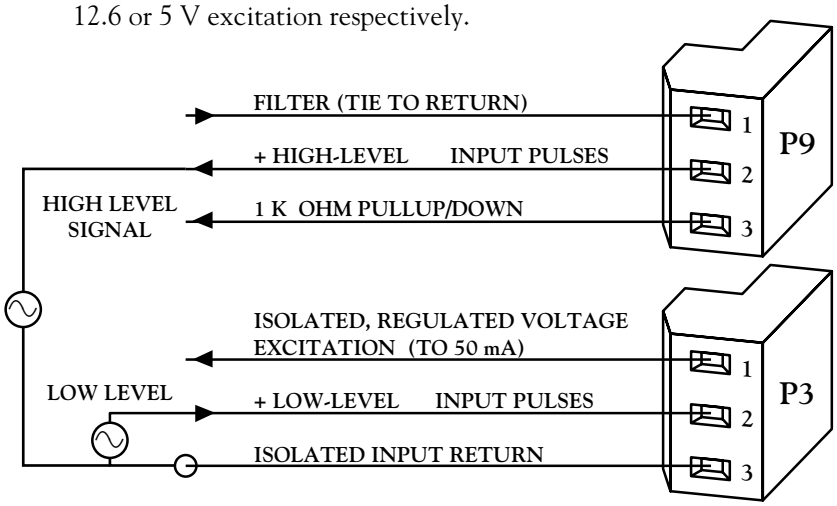


Figure B-2. Isolated Pulse Input Board Wiring

B.7.1 LOW-LEVEL INPUTS

Figure B-3 shows the Pulse Input Board used to condition the bipolar output of a low-level (20 mV rms or more) magnetic pickup. The regulator voltage jumper S1 should be in the S1-C position to lower the excitation voltage to 5 V and the threshold below 20 mV.

Low-level unipolar outputs (with the same voltage swings) can be matched by using Jumper S1-D on that board, which elevates the two switching thresholds by approximately half of the hysteresis of each range.

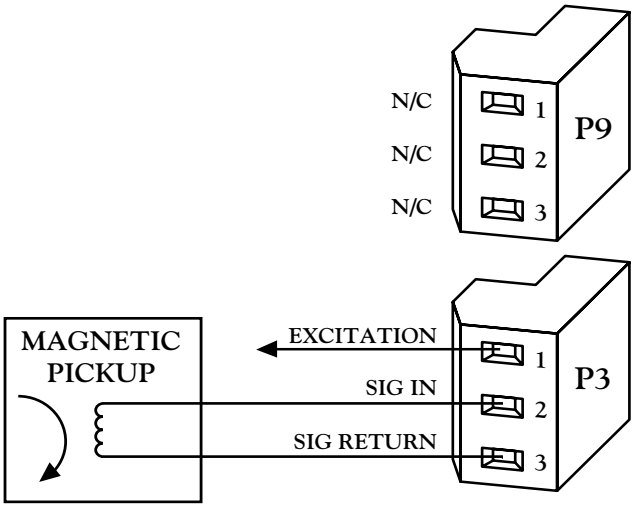


Figure B-3. Low-level Magnetic Pickup Input to the Isolated Pulse Input Board

B.7.2 NAMUR PROXIMITY SENSOR

Figure B-4 shows the use of the Pulse Input Board with a NAMUR proximity sensor (less than 1 mA when ON, more than 3 mA when OFF). The 1 kΩ resistor is built in, and the 8.2 V excitation is obtained by removing jumpers S1-A, S1-B, S1-C, and S1-D. Installing S1-A increases the excitation by about 0.2 V.

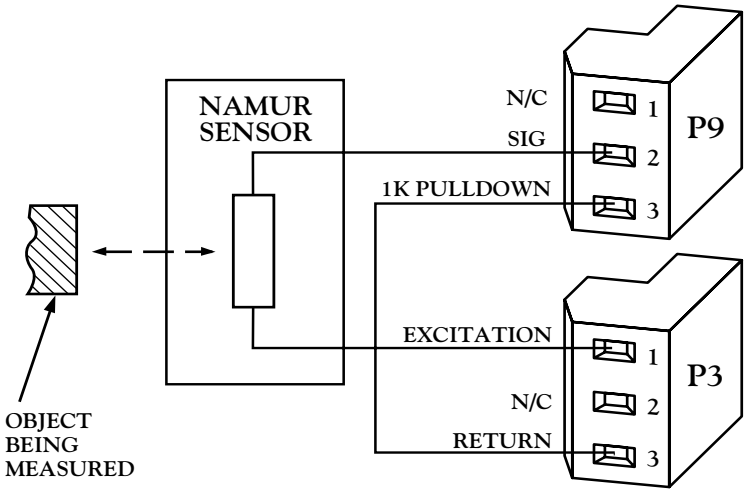
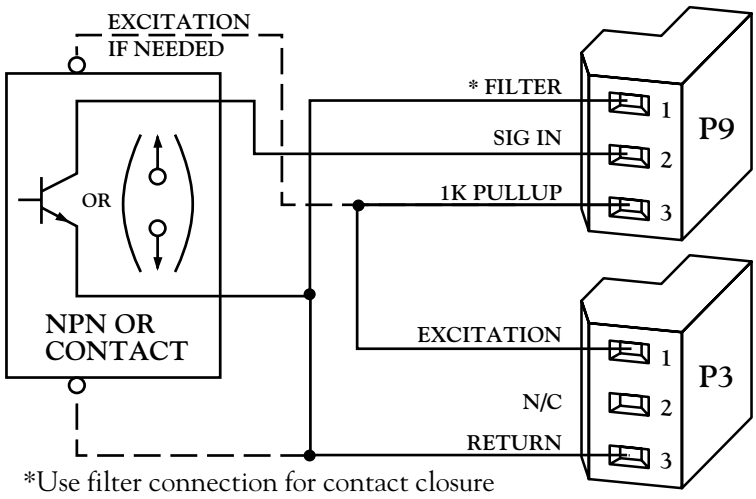


Figure B-4. NAMUR Sensor Input to the Isolated Pulse Input Board

B.7.3 NPN TRANSISTOR OR CONTACT-CLOSURE

Figure B-5 illustrates the use of the Pulse Input Board with sensor NPN transistor or contact closure output. Contact closures benefit from the debounce filter connection, P9-1 to ground (P3-3).



*Use filter connection for contact closure

Figure B-5. NPN Input to the Isolated Pulse Input Board

Darlington inputs with low-levels up to 1.9 V are accepted by the Pulse Input Board. See Figure B-6.

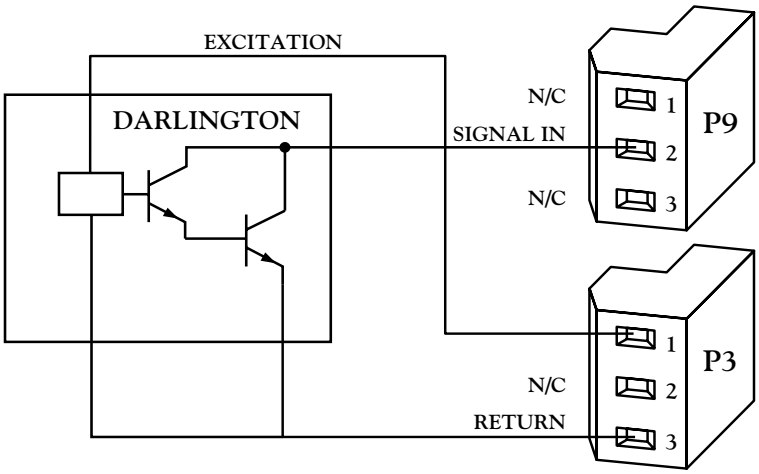
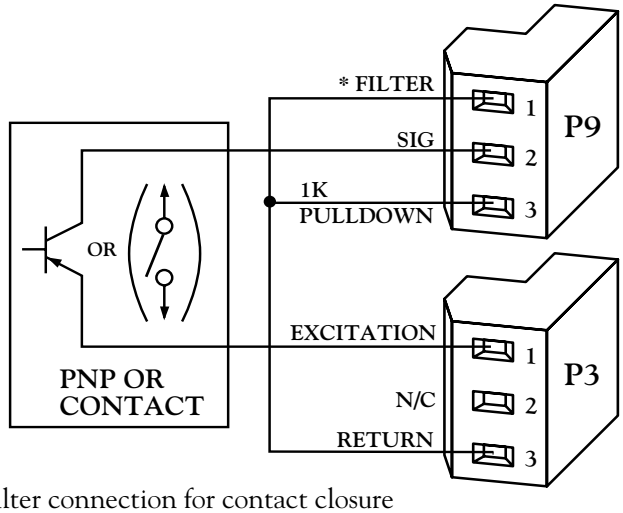


Figure B-6. Darlington Input to the Isolated Pulse Input Board

B.7.4 PNP TRANSISTOR OR CONTACT-CLOSURE

Figure B-7 shows the use of the Pulse Input Board with sensor PNP transistor or contact closure to the + excitation supply.



*Use filter connection for contact closure

Figure B-7. PNP Input to the Isolated Pulse Input Board

B.7.5 LOW-LEVEL UNIPOLAR SOURCE OUTPUT

Figure B-8 shows a wiring scheme useful for low-level unipolar outputs such as light-modulated resistances (install S1-C and S1-D).

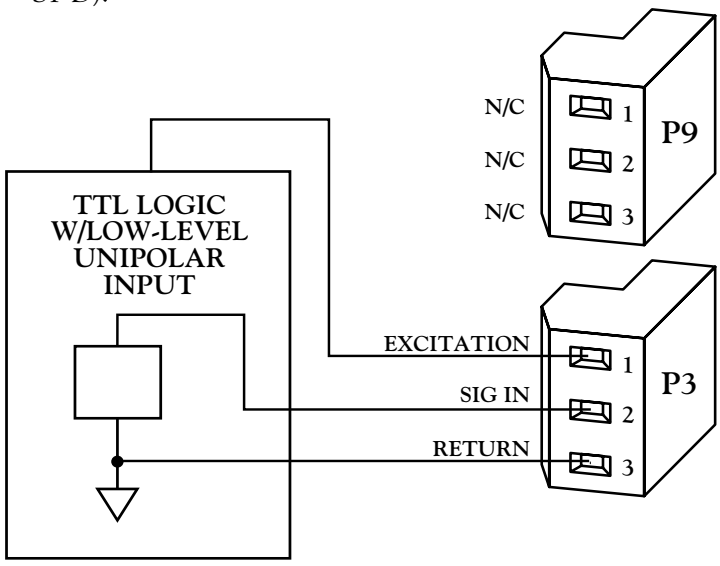


Figure B-8. Low-Level Unipolar Input to the Isolated Pulse Input Board

B.7.6 WIRING TABLE

Table B-4 shows suggested wiring, jumper configuration, and signal levels for numerous Isolated Pulse Input Board signal sources.

TABLE B-4. ISOLATED PULSE INPUT BOARD WIRING

SIGNAL SOURCE	WIRING CONFIGURATION	JUMPER CONFIG-URATION	SIGNAL LEVEL	
			LOW/MIN	HIGH/MAX
TTL	P9-2, Signal In P9-3, Return P3-2, Leave open or tie to high-level excitation P3-1, Excitation output; 5 V up to 50 mA	S1-C	< 0.4 V	> 2.0 V
NPN Open Collector, 2-or 3-wire	P9-2, Signal In P3-3, To Return P3-2, Leave open or tie to high-level excitation P3-1, Excitation output; 12.6 V up to 70 mA P9-3, Connect to P3-1	S1-B	< 1.4 V	
PNP Open Collector	Same as NPN above, but connect P9-3 to P3-3 (Return)	S1-B		> 6 V (voltage drop on switch must be <6 V)
NAMUR 2-wire	P3-1, Excitation P9-2, Return P9-3, Connect to P3-3 (Return)	S1-A	OFF: I <1.0 mA	ON: I >2.9 mA
Low-Level Pickup	P3-2, Signal In P3-3, To Return P9-2, Leave open or tie to high-level excitation	S1-C	20 mV rms up to 1 kHz 50 mV rms @ 20 kHz	

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SIGNAL SOURCE	WIRING CONFIGURATION	JUMPER CONFIG-URATION	SIGNAL LEVEL LOW/MIN	HIGH/MAX
Low-Level POT	P3-2, Signal In P3-3, Return	S1-D, S1-A for 8.2 V Excitation @ 50 mA S1-B for 12.5 V Excitation @ 70 mA S1-C for 5 V Excitation @ 50 mA	See Table B-3	See Table B-3
Contact Closure	P9-2 and P3-3, Contact P9-1, Connect to P3-3 (Return)	S1-B	ON time > 50 ms	OFF time > 75 ms

APPENDIX C
ISOLATED ANALOG INPUT BOARD: GENERAL INFORMATION, SPECIFICATIONS, JUMPER CONFIGURATION, INPUT CONNECTIONS, AND CALIBRATION

C

Isolated Analog Input Board

C.1 GENERAL INFORMATION

The Isolated Analog Input Board converts voltage ranges from 400 mV to 10 V and current ranges from 1 mA to 20 mA to a pulse-rate range of 0 to 10 kHz, nominal, providing 354 V of galvanic isolation (IEC spacing) and excitation up to 25 mA. When the meter is equipped with this board, it can totalize (integrate) current or voltage input and provide digital square root capability to calculate flow rate from inputs proportional to differential pressure.

Note that this board requires a one-time calibration. See Section C.9.

This board enables the meter to operate in the Rate Meter/Totalizer/Square Root Extractor Mode. This mode is shown on the display as SQ RT.

The conversion factor between input voltage or current and the output pulse rate is calibrated to an exact number by using the calibration data on the back of the board and the IN.SC.OF (Input Scale and Offset) parameter. See Section C.9 for this calibration procedure.

As shipped, 4 mA produces approximately 280 Hz (or, with jumper change, 2 kHz) and 20 mA produces approximately 8.5 kHz.

C.2 SPECIFICATIONS

CONNECTION:	3-Socket Input Connector
SIGNAL RANGE:	0 - 5 V dc, 1 -5 V dc, 0 - 10 V dc, 0 - 1 mA dc, 4 - 20 mA dc*
SENSOR EXCITATION:	24 V @ 25 mA
INPUT RESISTANCE:	25 ohms
ISOLATION, SIG GND TO DIG GND:	354 Vp
LOW-LEVEL SHUTOFF:	Programmable
NON-LINEARITY MAX:	0.02% FS
ACCURACY:	0.05% FS at 25°C
TEMPCO:	50 ppm/°C

* Calibration data are provided for 4-20 mA and 0-5 V ranges only

C.3 JUMPER LOCATIONS AND CONFIGURATION

C

Isolated Analog Input Board

Figure C-1. Isolated Analog Input Board

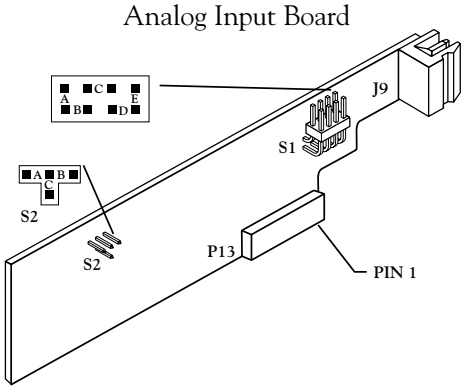


Table C-1. Isolated Analog Input Board Range Table

RANGE	USE JUMPERS
4 - 20 mA	S1-B*, S1-C*, S1-E*
0 - 1 mA	S1-C, S1-D
0 - 400 mV	S1-C
0 - 5 V	None
1 - 5 V	S1-B
0 - 10 V	S1-A

Jumpers establish the indicated ranges with +input to P9-2 and return from P9-3. The factory preset condition is asterisked.

S2 Jumper is used to control the output frequency (internally connected to the main board).

When totalizing over a long period of time (more than 2 days), S2-A or S2-C should be installed to reduce the output frequency. Therefore, the 2 billion counts internal capacity of counter is not overflowed.

Table C-2. Isolated Analog Input Board Output Frequency Table

S2 Position	Full-Scale Output Frequency	Minimum Time Before Internal Overflow
S2-A	100 Hz +/-10%	6 Months
S2-B*	6.4 KHz +/- 10%	60 Hours
S2-C	0.77 Hz +/- 10%	50 Years
S2 Removed	No output	N/A

There is also an Input Jumper Label on the case showing jumper options for both the Isolated Pulse Input Board and the Isolated Analog Input Board.

C.4 CURRENT SHUNTS

Table C-1 shows that current inputs are accommodated by placing a current shunt to ground with the meter sensitivity on the 400 mV range. (Note: This is accomplished internally via the jumpers.)

This low current-loop voltage compliance (low voltage drop) can be useful if the loop supply has a limited voltage range.

C.5 EXCITATION FOR SENSORS

If needed, P9-1 can supply regulated 24 V excitation up to 25 mA.

For current-loop transmitters driven by the meter's P9-1, the return is to P9-2, with no connection to P9-3.

For voltage-output devices or externally-powered current loops, the input is to P9-2 and return is connected to P9-3.

C.6 NORMAL-MODE REJECTION

The Isolated Analog Input Board provides two single-pole filters in tandem to provide the line-frequency rejection obtained by the selected gate time (GATE T). For the usual 0.30 s gate time, the 60 Hz rejection exceeds 60 dB (e.g., a line-frequency noise of 1% of full-scale signal causes only a 10 ppm change). At 50 Hz, this rejection drops by 3 dB, to 500:1.

C.7 RESPONSE TIME

For a step in the RATE, both RATE and TOTAL will be correct to 99% after 150 ms plus one gate time of 0.10 s or longer.

C.8 INPUT CONNECTIONS

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

With jumpers S2-A, W6 and W7 removed, the Isolated Analog Input Board furnishes +24 V excitation on P9-1, takes in analog voltage/current signals on P9-2, and has the common return on P9-3. The P3 connector is not used. Refer to Figure C-2.

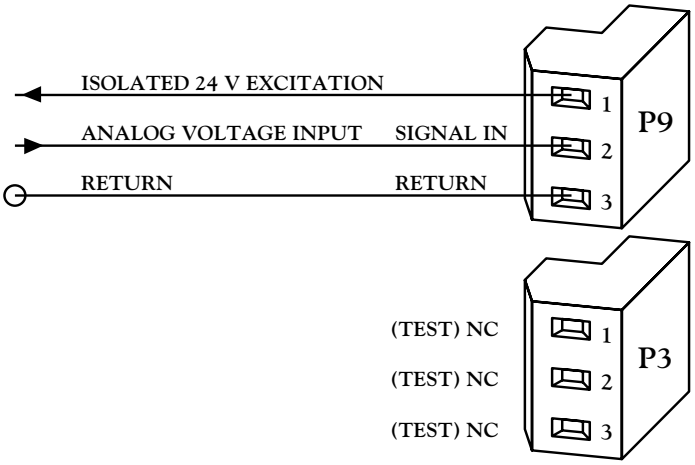


Figure C-2. Isolated Analog Input Board Wiring

C.8.1 DIFFERENTIAL PRESSURE TO ANALOG INPUT BOARD

Figure C-3 illustrates a differential-pressure flow transducer driving the meter via a current-loop transmitter with loop power supplied by the meter.

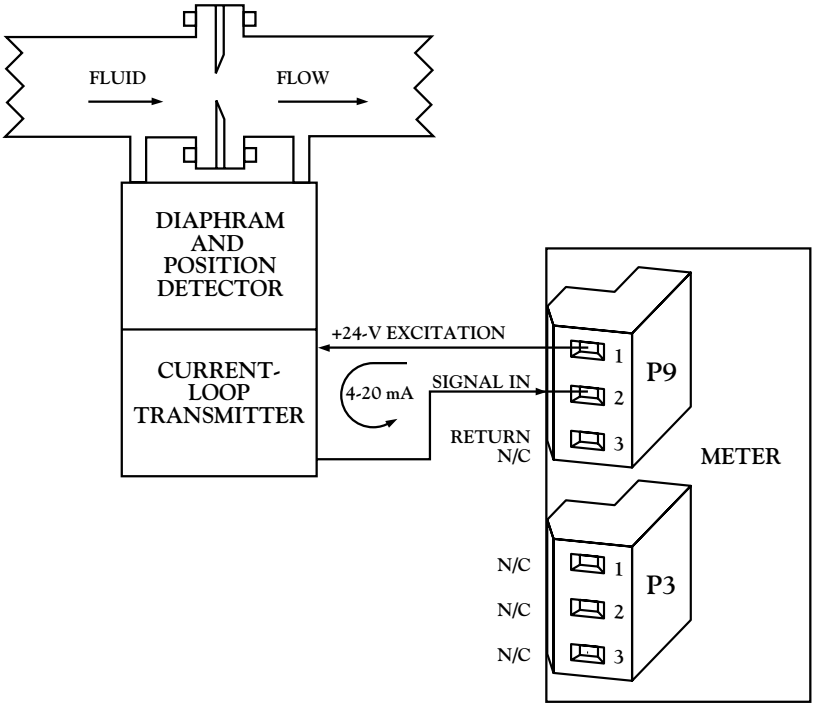


Figure C-3. Differential Pressure Input to the Isolated Analog Input Board

C.8.2 MULTIPHASE WATTS TRANSDUCER WITH SELF-POWERED TRANSMITTER OUTPUT

Figure C-4 shows a multiphase watts transducer with a self-powered transmitter output. The meter can now function as a wattmeter and a watthour meter.

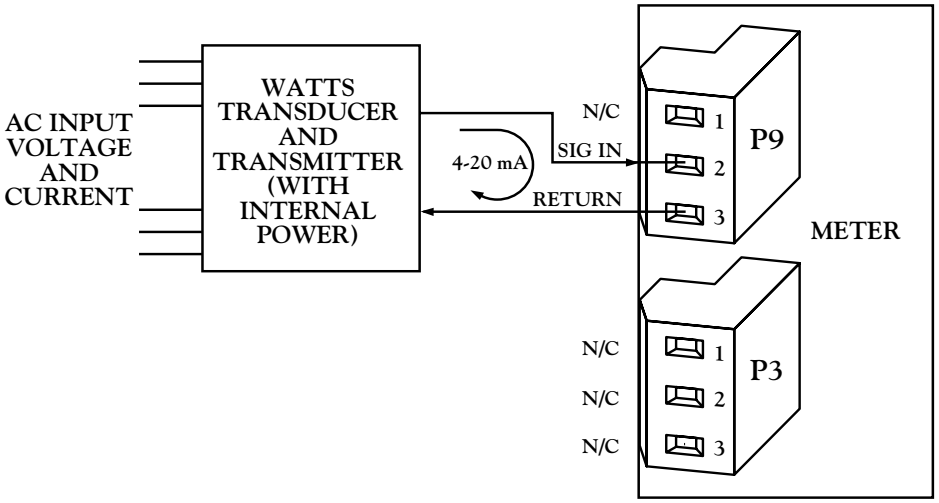


Figure C-4. Multiphase Watts Transducer Connection to the Isolated Analog Input Board

C.9 ONE-TIME-ONLY INPUT CALIBRATION

Once installed, this board must be calibrated using the IN.SC.OF (Input Scale and Offset) parameter and the calibration data on the back of the board. Figure C-5 shows the back of the board and the single label containing the data.

C

Isolated Analog Input Board

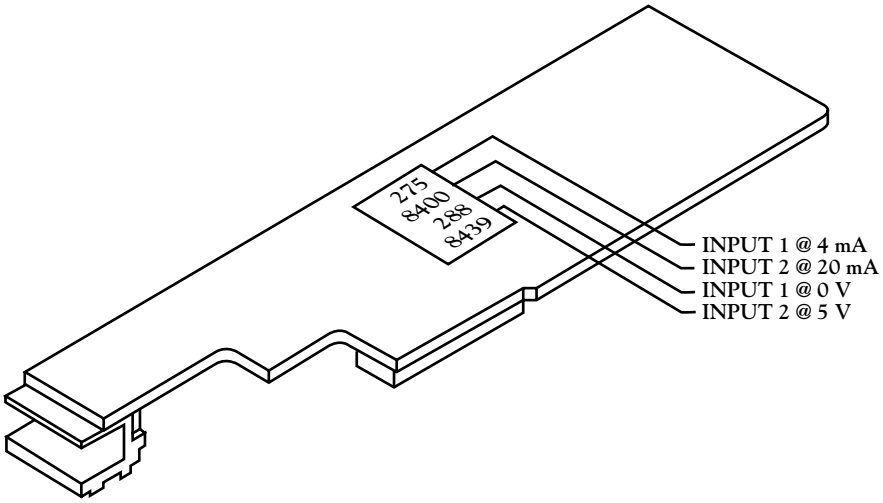


Figure C-5. Back of the Isolated Analog Input Board

Reading from top to bottom, the numbers correspond to the following data:

Input 1 @ 4 mA
Input 2 @ 20 mA
Input 1 @ 0 V
Input 2 @ 5 V

The first and second numbers correspond to actual meter readings in Hertz when the input is 4 mA and 20 mA, respectively. They are used as low and high data points to calibrate a board with Current input. The third and fourth numbers correspond to actual meter readings in Hertz when the input is 0 V and 5 V, respectively. These numbers are used as low and high data points to calibrate a board with Voltage input.

The meter takes two data points and calculates the scale (the slope of the line defined by the two points) and the offset (the reading if the input signal were 0). It then automatically converts incoming signals according to the calculated values using the following equation:

Display reading = (Input signal + OFfset) * SCale

If you recorded the calibration data just before installing the board, they are in Section 2.3.3.2.

Re-write the numbers here so that they are handy when you do the calibration:

Input 1 @ 4 mA = _____

Input 2 @ 20 mA = _____

Input 1 @ 0 V = _____

Input 2 @ 5 V = _____

The meter must be in the Rate Mode to configure IN.SC.OF.

Use Table C-3 to configure IN.SC.OF. Read from left to right, starting with the PRESS command. The first line reads, "Press MENU button repeatedly until the display shows IN.SC.OF. You are now ready to configure IN.SC.OF."

TABLE C-3. IN.SC.OF CONFIGURATION

	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
1	MENU repeatedly		IN.SC.OF	You are now ready to configure IN.SC.OF
2	▶/STOP	INPUT 1		Enter the actual reading of the "low" input signal. If your input is current, it will be Input 1 @ 4 mA; if your input is voltage, it will be Input 1 @ 0 V:
3	▶/STOP	000000.		Press the ▲/DISPLAY button repeatedly to set the flashing digit; press the ▶/STOP button to move to new digits

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	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
4	MENU	READ 1		
5	▶/STOP	000000.		Enter the value that you would like the just-entered INPUT 1 to show on the display. This should be 0 (Hz): Press the ▲/DISPLAY button repeatedly to set the flashing digit; press the ▶/STOP button to move to new digits When you press the MENU button next, the first data point will be saved
6	MENU	INPUT 2		
7	▶/STOP	000000.		Enter the actual reading of the "high" input signal. If your input is current, it will be INPUT 2 @ 20 mA; if your input is voltage, it will be INPUT 2 @ 5 V: Press the ▲/DISPLAY button repeatedly to set the flashing digit; press the ▶/STOP button to move to new digits
8	MENU	READ 2		
9	▶/STOP	000000.		Enter the value that you would like the just-entered INPUT 2 to "read" on the display. This should be 10000 (Hz):

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	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
				Press the ▲/DISPLAY button repeatedly to set the flashing digit; press the ▶/STOP button to move to new digits When you press the MENU button next, the first data point will be saved
10	MENU	OT.SC.OF		You have successfully calibrated your Isolated Analog Input Board, or successfully calculated IN.SC.OF

NOTE: If you receive an error message just after pressing the MENU button for the last time, note the message and see Appendix H.

C.10 CALIBRATING THE INPUT SIGNAL

After you calibrate the Isolated Analog Input Board, you should test the input signal to make sure that your source is also calibrated. If possible, reduce the input to 0 and note the display reading; it should be 0 Hz. Then turn up the input so that it's fully open; the display should read 10,000 Hz. If your readings differ significantly from these, or you see that an intermediate input level gives you the wrong meter reading, you should perform another IN.SC.OF calibration that calibrates both the input signal and the Isolated Analog Input Board.

There are two requirements that must be met before calibrating:

1. The scale factors of IN.SC.OF and RTE SC must be set to 1, and the offsets of IN.SC.OF and RTE OF must be set equal to 0.

   You can do this manually by accessing these parameters one by one (Section 5), or automatically by using the Automatic Scale and Offset feature. The automatic procedure is much easier.

To use the Automatic Scale and Offset feature, set configuration choice CF4.8 equal to 1 (Section 5.4.2.). This sets the scale factors equal to 1 and the offsets equal to 0. Reset the meter by pressing the RESET button two times. At this point, old scale factors and offsets have been "erased." Now return to CF4.8 and set it equal to 0. This allows the scale factors and offsets to be altered as needed when you do the calibration.

2. You must know the desired meter readings that you want the "low" and "high" input levels to correspond to. This is very easy if you can turn input down all the way and turn it up all the way: The desired meter reading for 0 input is 0 Hz; the desired meter reading for maximum input level is 10,000 Hz.

   For intermediate inputs, somewhere between 0 and the maximum input, you will have to consult calibration data previously obtained for your input-to-flow measurement setup.

Use Table C-4 to configure IN.SC.OF for input signal/Analog Input calibration.

TABLE C-4. IN.SC.OF CONFIGURATION

	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
1	MENU repeatedly		IN.SC.OF	You are now ready to configure IN.SC.OF
2	▶/STOP	INPUT 1		
3	▶/STOP	000000.		Enter the actual meter reading of the "low"input signal
4	MENU	READ 1		Enter the value that you would like the just-entered INPUT 1 to show on the display. This will be 0 (Hz) if INPUT 1 was 0.
5	▶/STOP	000000.		When you press the MENU button next, the first data point will be saved

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	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
6	MENU	INPUT 2		
7	▶/STOP	000000.		Enter the actual meter reading of the "high"input signal
8	MENU	READ 2		Enter the value that you would like the just-entered INPUT 2 to show on the display. This will be 10,000 (Hz) if INPUT 2 corresponded to a maximum input level
9	▶/STOP	000000		When you press the MENU button next, the first data point will be saved
10	MENU	OT.SC.OF		You have successfully calibrated your input signal and Isolated Analog Input Board

APPENDIX D
ISOLATED ANALOG OUTPUT BOARD: GENERAL INFORMATION, SPECIFICATIONS, WIRING, AND CALIBRATION

D

Isolated Analog Output Board

D.1 GENERAL INFORMATION

The Isolated Analog Output Board converts meter output to independently scaled and offset unipolar voltage and/or unipolar current providing 354 V of galvanic isolation (IEC spacing). When the meter is equipped with this board, it can simultaneously transmit voltage (to 10 V) and current (to 21 mA, and 24 mA total), but only one type of output is calibrated. (For precise accuracy on both outputs at once, the non-calibrated output must be calibrated for gain and offset by external means.)

Precise analog levels are generated from digital code using a proprietary ASIC chip. Load resistance for the voltage output can be as low as 500Ω (20 mA at 10 V out) when current output is not used. Loop resistance for the current output can be as high as 600Ω (12 V compliance).

The OT.SC.OF parameter is used to convert a wide range of meter readings to the desired current or voltage output span (see Section 5.4.5).

The board can be configured to output RATE, AVG RT, and TOTAL readings in Rate and Sq Rt Modes; and BATCH count, BAT NO, and TOTAL readings in the Batch Mode. Output can also be configured as a ramp function for slow opening and closing of electrical valves. (See Section D.5.)

D.2 SPECIFICATIONS

ACCURACY:	±0.05% of FS @ 25°C
STEP RESPONSE:	10 to 90% full-scale 50 ms
TURNDOWN RATIO (OFFSET/SPAN):	100 with 0.01% resolution
TEMPCO:	50 ppm/°C
LOOP RESISTANCE:	up to 600Ω

D.3 JUMPER LOCATIONS AND CONFIGURATION

The Isolated Analog Output Board has no jumpers. All configuration is done via the front panel.

D.4 WIRING/CONNECTIONS

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

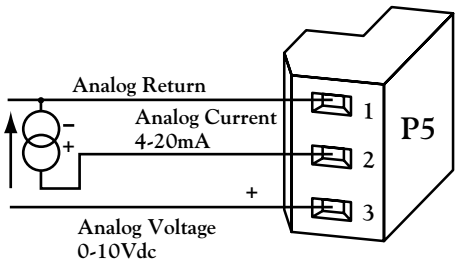


Figure D-1. Isolated Analog Output Board Wiring Connections.

D.5 ENABLING TRANSMISSION OF ANALOG OUTPUT DATA

The output configuration of the Isolated Analog Output Board is controlled by setting CF3.1 (see Section 5.4.2). The setting determines which analog value is sent. The factory preset value is asterisked. Refer to Table D-1

TABLE D-1. ISOLATED ANALOG OUTPUT BOARD: OUTPUT CONFIGURATION AS SET BY CF3.1

		RESULTING ACTION		
CHOICE	SETTING	RATE MODE	SQ RT MODE	BATCH MODE
CF3.1	0	Analog output is disabled		
	1*	RATE is sent		BATCH count is sent
	2	AVG RT is sent		BAT NO is sent
	3	TOTAL is sent		
	4	Output is ramped (See Appendix K)		

D.6 ONE-TIME-ONLY OUTPUT CALIBRATION

Once installed, this board must be calibrated using the four data points printed on the back of the board. These four points are

D

Isolated Analog Output Board

CAL VZ (Calibrate Voltage Zero), CAL VS (Calibrate Voltage Span), CALmAZ (Calibrate milliAmp Zero), CALmAS (Calibrate milliAmp Span). If you recorded them just before installing the board, they are in Section 2.3.3.3.

Re-write the numbers here so that they are handy when you do the calibration:

CAL VZ = _____

CAL VS = _____

CALmAZ = _____

CALmAS = _____

Use Table D-2 to calibrate the board. Read from left to right, starting with the PRESS command. The first line reads, "Press the MENU button repeatedly until the display shows CAL VZ. You are now ready to calibrate the Isolated Analog Output Board."

Table D-2. ISOLATED ANALOG OUTPUT BOARD CALIBRATION

	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
1	MENU repeatedly		CAL VZ	You are now ready to calibrate the Isolated Analog Output Board
2	▶/STOP	XXXXX		The first digit will flash. Input the CAL VZ data point by pressing the ▲/DISPLAY button to set the flashing digit, and the ▶/STOP button to move on to new digits. When you press the MENU button, this value will be stored

continued next page

Table D-3 (cont'd)

	PRESS:	THE DISPLAY WILL SHOW:	UNTIL THE DISPLAY SHOWS:	COMMENTS
3	MENU	CAL VS		
4	▶/STOP	XXXXX		Input the CAL VS data point. Press the ▲/DISPLAY button to set the flashing digit, and the ▶/STOP button to move on to new digits. When you press the MENU button, this value will be stored
5	MENU	CALmAZ		
6	▶/STOP	XXXXX		Input the CALmAZ data point. Press the ▲/DISPLAY button to set the flashing digit, and the ▶/STOP button to move on to new digits. When you press the MENU button, this value will be stored
7	MENU	CALmAS		
8	▶/STOP	XXXXX		Input the CALmAS data point. Press the ▲/DISPLAY button to set the flashing digit, and the ▶/STOP button to move on to new digits. When you press the MENU button, this value will be stored
9	MENU			The meter will immediately Reset and revert to Run Mode This concludes calibration.

APPENDIX E
ISOLATED PARALLEL BCD OUTPUT BOARD: GENERAL INFORMATION, SPECIFICATIONS, JUMPER CONFIGURATION, AND WIRING

E.1 GENERAL INFORMATION

E

Isolated Parallel BCD Output Board

The Isolated Parallel BCD Output Board produces binary-coded decimal output for direct connection to a printer or to an intelligent device such as a PLC (Programmable Logic Controller).

E.2 SPECIFICATIONS

BCD TYPE:	Isolated, stored, buffered, addressable, tri-state
DIGIT ADDRESSING:	3 or 6 digit at a time
OUTPUT LEVEL:	TTL/CMOS-compatible, 10 LSTTL loads
POWER:	External 5 V dc for isolated BCD; internal 5 V dc for non-isolated BCD

E.3 JUMPER LOCATIONS AND CONFIGURATION

Figure E-1 shows the locations of Isolated Parallel BCD Output Board jumpers.

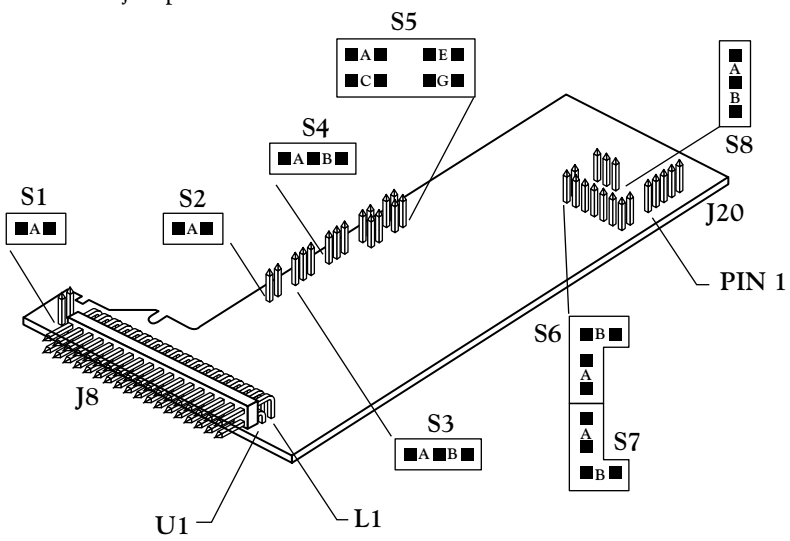


Figure E-1. Isolated Parallel BCD Output Board Jumpers

Table E-1 shows the function of BCD board jumpers. Asterisked jumpers are installed factory presets.

TABLE E-1. ISOLATED PARALLEL BCD OUTPUT BOARD JUMPERS

JUMPER	FUNCTION
S1-A	Installation brings OVERFLOW signal to P8-U18
S2-A	Installation enables 3-digit multiplex; removal enables 6-digit readout
S3-A	Installation enables 3-digit multiplex or 1-line board address
S3-B*	Installation enables 4-line board address
S4-A	Installation enables 3-digit multiplex
S4-B*	Installation enables 6-digit readout
S5-A	P8-U20 must be low to enable board; removal enables board when high or open
S5-C	P8-L20 must be low to enable board; removal enables board when high or open
S5-E	P8-U19 must be low to enable board; removal enables board when high or open
S5-G	P8-L19 must be low to enable board; removal enables board when high or open
S6-A	
S6-B	Installation selects internal power; removal selects
S7-A	isolated power
S7-B	
S8-A	Installation selects output data that is negative-true
S8-B*	Installation selects output data that is positive-true

E.4 WIRING

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.

All 6 digits of BCD are brought out to J8 (40 pins), but the upper 3 digits of data can also be multiplexed onto the lower 3 digit lines so that the data can be read 3 digits at a time if desired. J8 mates with a standard 40-pin connector, P8.

Figure E-2 shows an end-on view of P8. "U" designates the upper row of pins; "L" designates the lower row of pins.

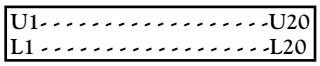


Figure E-2. End-On View of P8

Table E-2 shows the pin assignments for P8.

TABLE E-2. P8 PIN ASSIGNMENTS

FUNCTION	P8 PIN	P8 PIN	FUNCTION
BCD 400K	L-1	U-1	BCD 800K
BCD 100K	L-2	U-2	BCD 200K
ISO GND	L-3	U-3	SPARE
BCD 40K	L-4	U-4	BCD 80K
BCD 10K	L-5	U-5	BCD 20K
BCD 4K	L-6	U-6	BCD 8K
BCD 1K	L-7	U-7	BCD 2K
D.P. 2	L-8	U-8	D.P. 4
BCD 400	L-9	U-9	BCD 800
BCD 100	L-10	U-10	BCD 200
BCD 40	L-11	U-11	BCD 80
BCD 10	L-12	U-12	BCD 20
BCD 4	L-13	U-13	BCD 8
BCD 1	L-14	U-14	BCD 2
ISO GND	L-15	U-15	D.P. 1
$\overline{\text{DATA READY}}$	L-16	U-16	POLARITY
ISO V+	L-17	U-17	$\overline{\text{HOLD}}$
OVERFLOW	L-18	U-18	OVERFLOW
ADDRESS $\overline{\text{B4}}$	L-19	U-19	ADDRESS $\overline{\text{B8}}$
ADDRESS $\overline{\text{B1}}$	L-20	U-20	ADDRESS $\overline{\text{B2}}$

E.5 50-LINE CABLE COMPATIBILITY

The 40 lines of P8 are compatible with lines 9 through 48 of some 50-line busses. (The left-most 8 and right-most 2 are not used by this BCD option.)

E.6 ENABLING TRANSMISSION OF BCD DATA

The output configuration of the Isolated Parallel BCD Output Board is controlled by setting CF3.2 (see Section 5.4.2). The setting determines which BCD value is sent.

TABLE E-3. ISOLATED PARALLEL BCD OUTPUT BOARD: OUTPUT CONFIGURATION AS SET BY CF3.2

CHOICE	SETTING	RESULTING ACTION		
		RATE MODE	SQ RT MODE	BATCH MODE
CF3.2	0	BCD output is disabled		
	1	RATE is sent		BATCH count is sent
	2	AVG RT is sent		BAT NO is sent
	3	TOTAL is sent		
	4	TIME is sent		

E.7 $\overline{\text{HOLD}}$ CONTROL

P8-U17 is the $\overline{\text{HOLD}}$ line, referenced to the same ground as the BCD output (on P8-L15 and P8-L3). Pulling this line low freezes the BCD outputs. This is useful for a slow reading device or for asymmetric cable delays.

When released, all 6 digits of the BCD data are updated together.

E.8 $\overline{\text{DATA READY}}$ TIMING PULSES

The tri-state BCD outputs are always valid to within a few nano-seconds; a single update pulse controls all digits.

To generate a timing marker, P8-L16, $\overline{\text{DATA READY}}$, goes active low for approximately 200 µs at the time of each update. The polarity of this line is NOT CHANGED by S8, the data polarity control jumper.

E.9 BRINGING OUT THE BCD OVERFLOW LINE

P8-U18 can be used for BCD OVERFLOW by installing jumper S1-A. If this line is used for another purpose by some other equipment on the BCD bus, remove this jumper.

E.10 THREE-DIGIT-AT-A-TIME MULTIPLEX

When jumpers S2-A, S3-A, and S4-A are installed, P8-L20 and S5-C control the times when the upper 3 digits of the 6-digit BCD value appear on the output line (P8-U9 through P8-L14).

When jumper S5-C is installed, a LOW level on P8-L20 activates the upper 3 digit outputs; a high or open level disables them.

When jumper S5-C is removed, a high or open level on P8-L20 enables the upper 3 digits and a low level disables them.

When the upper 3 digits are NOT enabled, the lower 3 digits can be enabled the same way as jumper S5-A and P8-U20; they will appear on the same 12 lines.

E.11 SIX-DIGIT-AT-A-TIME BOARD ADDRESS

Jumpers S2-A and S4-A are removed for full parallel (6-digit) output.

When jumper S3-A is installed, the outputs are enabled by line P8-L20 ALONE: A low level enables the outputs when jumper S5-C is installed, and a high or open level does the job if S5-C is removed.

When jumper S3-A is removed, the outputs are enabled only when the selected 4-line address is applied to P8-U19, L19, U20, and L20. Each of these four is exclusive-ORed with its jumper, and the subsequent four outputs are ANDed to create a 1-of-16 enable mode.

If jumper S5-A is installed, P8-U20 must be LOW to enable the board.

If jumper S5-C is installed, P8-L20 must be LOW to enable the board.

If jumper S5-E is installed, P8-U19 must be LOW to enable the board.

If jumper S5-G is installed, P8-L19 must be LOW to enable the board.

If any of these jumpers are removed, the corresponding line must go HIGH or OPEN to assist the board enable; if all four jumpers are removed, for example, the board outputs are enabled ONLY when all four lines are HIGH or OPEN. A ground on any of the four input lines causes the outputs to go to the high impedance state.

E.12 SELECTING DATA POLARITY: JUMPER S8

Inserting the jumper in S8-B (the usual shipping position) makes the output data (including decimal point code) positive-true.

Placing the jumper in S8-A converts the data to negative-true.

E.13 DECIMAL POINT ADDRESS CODE

P8-U15, P8-L8, and P8-U8 output a 3-digit positive-true binary code for the location of the decimal point: 001 for the extreme right position, and 110 for the extreme left position (just to the right of the left-hand digit).

E.14 APPLYING NON-ISOLATED/ISOLATED POWER

Non-isolated power from the meter is enabled by installing jumpers S6-A, S6-B, S7-A, and S7-B. This bridges the isolation separation distance on the board. Current drawn is less than 10 mA.

To isolate these outputs from the other meter circuits, remove S6-A, S6-B, S7-A, and S7-B, and connect an external, nominal 5-V supply to P8-L17, with its ground return connected to P8-L15.

E.15 DRIVING A PRINTER

Direct connection of the 24 BCD lines and the 3 decimal point address lines is all that is needed for positive-true printers that accept a binary-coded decimal point address (which do not print the decimal point).

If your printer has more than 6 digits, tie the unused inputs to ground or V+, or leave them open (whichever produces blanks in those locations).

APPENDIX F
DUAL RELAY AND 4 RELAY OUTPUT BOARD: GENERAL INFORMATION, SPECIFICATIONS, JUMPER CONFIGURATION, AND WIRING

F.1 GENERAL INFORMATION

F

Dual Relay Output Board

The Dual Relay Output Board and 4 Relay Output Board provides two isolated (354 V per IEC spacing, 500 test), 7-ampere Form-C electro-mechanical relays that enable setpoint-triggered switching to an external device (plus two 1-ampere Form-C electro-mechanical relays for 4 Relay Option). Each relay can accommodate a single setpoint. 200 Ω, 2500pf snubbers are provided for each normally open contact.
These options may not be used with parallel BCD Board Option.

F.2 SPECIFICATIONS

OUTPUT TYPE: Dual Form-C relays or 4 Form-C relays
POWER RATING FOR RESISTIVE LOADS:
DUAL AND 4 RELAY: Two relays at P6 and P7
Normally open contact, 7 amp; 30Vdc or 230Vac
Normally closed contact, 7 amp; 30Vdc or 230Vac
4 RELAY ONLY: Two relays at P18
Normally open contact, 1 amp; 24Vdc or 30Vac
Normally closed contact, 1 amp; 24Vdc or 30Vac

F.3 JUMPER LOCATIONS AND CONFIGURATION

Figure F-1 shows the locations of Dual Relay Output Board jumpers, the P10 connector connecting the board to the Main Board, and the positions of P6 and P7, the output connectors. Table F-1 shows which jumpers are assigned to each relay. Defaults are asterisked.

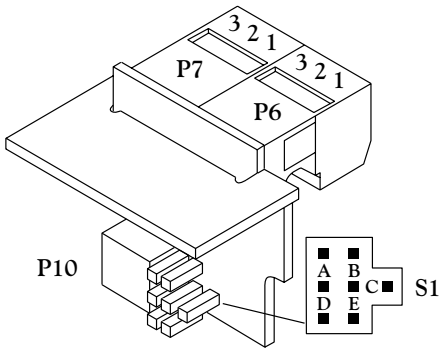


Figure F-1. Dual Relay Board Jumpers and Plugs

Table F-1. Dual Relay Board Jumpers

JUMPER	FUNCTION
S1-A*	Assigns SP 1 to Relay 1 (P6)
S1-B	Assigns SP 5 to Relay 2 (P7)
S1-C	Assigns SP 4 to Relay 2 (P7)
S1-D	Assigns SP 3 to Relay 1 (P6)
S1-E*	Assigns SP 2 to Relay 2 (P7)

Figure F-2 below show the locations of the 4 Relay Output Board jumpers, the P10 plug connecting the board to the Main Board, and the positions of P6, P7 and P18, the output plugs.

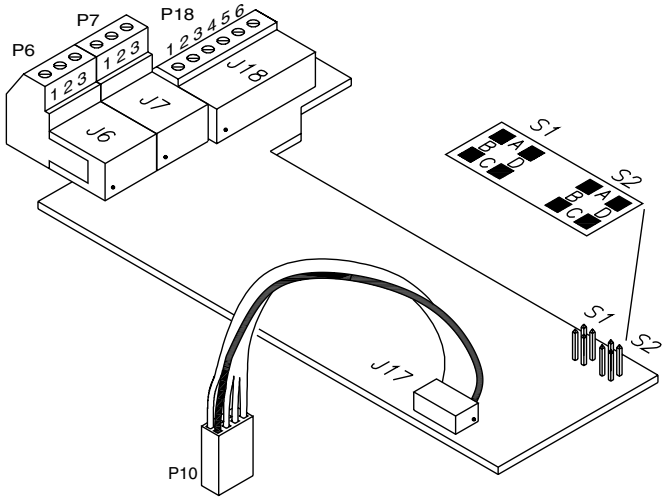


Figure F-2. 4 Relay Board Jumpers and Plugs.

F

Dual Relay Output Board

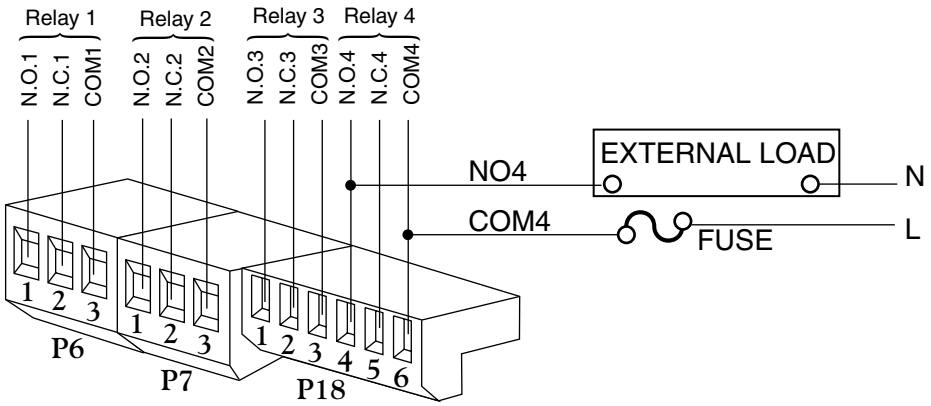
Table F-2 shows which jumpers are assigned to each relay. Defaults are asterisked.

Table F-2. 4 Relay Board Jumpers.

S1	S2	FUNCTION
A, C*	A, C*	Assigns SP1 to Relay 3 (P18) Assigns SP2 to Relay 4 (P18) Assigns SP3 to Relay 1 (P6) Assigns SP4 to Relay 2 (P7)
B, D	A, C	Assigns SP1 to Relay 1 (P6) Assigns SP2 to Relay 4 (P18) Assigns SP3 to Relay 3 (P18) Assigns SP4 to Relay 2 (P7)
B, D	B, D	Assigns SP1 to Relay 1 (P6) Assigns SP2 to Relay 2 (P7) Assigns SP3 to Relay 3 (P18) Assigns SP4 to Relay 4 (P18)
A, C	B, D	Assigns SP1 to Relay 3 (P18) Assigns SP2 to Relay 2 (P7) Assigns SP3 to Relay 1 (P6) Assigns SP4 to Relay 4 (P18)

F.4 WIRING

WARNING: Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications.



F

Dual Relay Output Board

Figure F-3. Relay Output Board Wiring Connections

Table F-3 shows the pin assignments for the P6, P7 and P18 plugs.

Table F-3. Pin Assignments for P6, P7 and P18

CONNECTOR	PIN	FUNCTION
P-6 (Relay 1 Connection)	1 2 3	NO1 (Normally Open) Common 1 NC1 (Normally Closed)
P-7 (Relay 2 Connection)	1 2 3	NO2 (Normally Open) Common 2 NC2 (Normally Closed)
P-18 (Relay 3 & 4 Connection for 4 Relay Option only.)	1 2 3 4 5 6	NO3 (Normally Open) Common 3 NC3 (Normally Closed) NO4 (Normally Open) Common 4 NC4 (Normally Closed)

APPENDIX G
ISOLATED RS-232 AND RS-485 SERIAL COMMUNICATIONS BOARDS: GENERAL INFORMATION, SPECIFICATIONS

G.1 GENERAL INFORMATION

The Isolated Serial RS-232 Communications Board provides an isolated digital communications channel between a single meter and another meter or device, or between a single meter and a computer. The Isolated Serial RS-485 Communications Board adheres to the IEC standard, providing an isolated channel between up to 32 meters and a single computer or intelligent device–but can actually address up to 199 devices.

G.2 SPECIFICATIONS

RS-232

BAUD RATES:	300, 600, 1200, 2400, 4800, 9600, and 19,200
CONNECTION:	RJ-11, 4-wire telephone jack; data in, data out, RTS, GND
RECEIVE CAPABILITY:	Allows for on-line setup and configuration monitoring and changes
TRANSMIT CAPABILITY:	Programmable to send RATE, AVG RT, TOTAL, and TIME (with or without units) in Rate and Sq Rt Modes; programmable to send BATCH count, BAT NO, TOTAL, and TIME (with or without units) in Batch Mode

RS-485

BAUD RATES:	300, 600, 1200, 2400, 4800, 9600, and 19,200
CONNECTION:	RJ-12, 6-wire telephone jack, Full or Half Duplex
RECEIVE CAPABILITY:	Allows for on-line setup and configuration monitoring and changes
TRANSMIT CAPABILITY:	Programmable to send RATE, AVG RT, TOTAL, and TIME (with or without units) in Rate and Sq Rt Modes; programmable to send BATCH count, BAT NO, TOTAL, and TIME (with or without units) in Batch Mode
MODES:	Alarm and normal
ADDRESSING:	0 (common address), 1 to 199

See the Serial Communications manual for more information on these boards.

APPENDIX H
ERROR MESSAGES

H.1 FLASHING ERR 01

ERR 01 indicates an OFFSET OVERFLOW. This happens when an offset value is too large to be displayed using the corresponding decimal point position. For example, you enter an offset value of 1000, then program the decimal point 3 places to the left. This would drive the resulting number, 1000.000, to seven digits, "overflowing" the 6-digit limit.

This condition must be corrected immediately because the meter is unable to continue calculations.

TO CORRECT: Press the MENU button and the meter will show the left-most decimal point position possible for the chosen offset. Press the MENU button again and the revised (meter-chosen) decimal point will be stored.

You can also press the RESET button. This will restore the decimal point to the previous setting.

H.2 FLASHING ERR 02

ERR 02 indicates a SETPOINT OVERFLOW. This happens when a setpoint value is too large to be displayed using the corresponding decimal point position. For example, you enter a setpoint value of 5000, then program the decimal point 3 places to the left. This would drive the resulting number, 5000.000, to seven digits, "overflowing" the 6-digit limit.

This condition is momentary; the display will flash ERR 02, self-correct by adjusting the decimal point to the far right position (not shown on the display), then return to Run Mode.

NOTE: This condition will not be shown if there is a simultaneous Offset Overflow (ERR 01), because the display will indicate the more serious error.

TO CORRECT: When the meter flashes ERR 02, it shifts the decimal point to accommodate the programmed setpoint value.

If you want to change the setpoint value as opposed to changing the decimal position, reprogram the setpoint in the usual manner with the SETPTS button, then adjust the decimal point accordingly.

The meter will also flash ERR 02 when the offset value for IN.SC.OF is larger than 38,000.

H.3 NOSTOR

During configuration, a NOSTOR message indicates that the attempt to store a newly set parameter or setpoint value in non-volatile memory (EEPROM) has failed. This results when the Lockout Choice L3C.7 has been set equal to 1.

TO CORRECT: Set L3C.7 equal to 0. This enables nonvolatile memory storage of changed parameter values.

There are times when you may want to disable nonvolatile memory storage (L3C.7=1) because you are changing setpoints very often (see Section 4.10.3). In this case, when you change the setpoint, the new value is written in operating memory only. The meter will display the NOSTOR message–assuring you that nonvolatile memory has not been changed–but will revert to Run Mode using the newly configured values in operating memory. These values will be in effect until power is removed.

As a reminder, after changing a setpoint, make sure you store the new value by pressing the SETPTS button. If you press the RESET button without first pressing the SETPTS button to store the value, that value is discarded and the meter continues to use the "old" value.

APPENDIX J
FACTORY PRESET CONFIGURATION SETTINGS/USER SETTINGS

This appendix shows the meter's factory preset settings. Each parameter contains a blank space or column entitled "User Setting" where you can enter your meter's actual settings. This is a very helpful reference, especially if you have multiple meters and need to keep track of the operating parameters of each one.

The following user settings correspond to this meter:

Serial No. _____

Other ID _____

Location _____

Date _____

MAIN BOARD JUMPERS

MAIN BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S1-A	Installed in all cases	Enables Lockout programming	
S2-A	Installed if no input board is installed	Channels non-isolated excitation to P3-1	
W1 and W2	Installed if meter is configured for 115 V operation	Enables 115 V Operation	
W3	Installed if meter is configured for 230 V operation	Enables 230 V operation	
W6 and W7	Installed if no input board is installed	Bypasses isolation circuitry for optional boards	

ISOLATED PULSE INPUT BOARD JUMPERS

PULSE INPUT BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S1-B	Installed	Enables 12.6 V excitation	
S1-F	Installed	Counts pulse on low-to-high transition	

ISOLATED ANALOG INPUT BOARD JUMPERS

ANALOG INPUT BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S1-B S1-C S1-E	Installed	Enables 4-20 mA input	

ISOLATED ANALOG OUTPUT BOARD JUMPERS - This board has no jumpers.

ISOLATED PARALLEL BCD OUTPUT BOARD JUMPERS

BCD OUTPUT BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S3-B	Installed	Enables 4-line board address	
S4-B	Installed	Enables 6-digit readout	
S8-B	Installed	Output Data is positive-true	

DUAL RELAY BOARD JUMPERS

DUAL RELAY BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S1-A	Installed	Assigns SP 1 to Relay 1(P6)	
S1-E	Installed	Assigns SP 2 to Relay 2(P7)	

4-RELAY BOARD JUMPERS

4-RELAY BOARD Jumper S1	Jumper S2	FACTORY PRESETS	FUNCTION	USER SETTING
A, C	A, C	Installed	Assigns SP1 to Relay 3 (P18)	
		Installed	Assigns SP2 to Relay 4 (P18)	
		Installed	Assigns SP3 to Relay 1 (P6)	
		Installed	Assigns SP4 to Relay 2 (P7)	

ISOLATED RS-232 SERIAL COMMUNICATIONS BOARD JUMPERS

This board has no jumpers.

ISOLATED RS-485 SERIAL COMMUNICATIONS BOARD JUMPERS

RS-485 BOARD JUMPERS	FACTORY PRESETS	FUNCTION	USER SETTING
S1-B	Installed	Enables Full Duplex communication	

SETPOINTS

SETPOINT	FACTORY PRESET	USER SETTING
1	100.	
2	200.	
3	300.	
4	400.	
5	12:00:00	

L1 CNF, L2 CNF, L3 CNF (LOCKOUTS)

All Lockouts are set equal to 0; the corresponding meter functions are all ENABLED.

LOCKOUT	CHOICE	FACTORY SETTING	ENABLED METER FUNCTION	USER SETTING
L1 CNF	L1C.1	0	Display and setting of Setpoints 1 and 2 through SETPTS button	
	L1C.2	0	Display and setting of Setpoints 3 and 4 through SETPTS button	
	L1C.3	0	Display and setting of Setpoint 5 through SETPTS button	

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LOCKOUT	CHOICE	FACTORY SETTING	ENABLED METER FUNCTION	USER SETTING
	L1C.4	0	Display and setting of CNFG 1 parameter	
	L1C.5	0	Display and setting of CNFG 2 parameter	
	L1C.6	0	Display and setting of CNFG 3 parameter	
	L1C.7	0	Display and setting of CNFG 4 parameter	
	L1C.8	0	Display and setting of AVG.CNF parameter	
L2 CNF	L2C.1	0	Display and setting of IN.SC.OF parameter	
	L2C.2	0	Display and setting of OT.SC.OF parameter	
	L2C.3	0	Display and setting of RTE DP, RTE OF, and RTE SC parameters	
	L2C.4	0	Display and setting of TOT DP, TOT OF, and TOT SC parameters	
	L2C.5	0	Display and setting of AL TI parameter	
	L2C.6	0	Display and setting of BAUD, SER.CNF, DAT FT, BUS FT, ADDRES, and SER TI parameters	

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LOCKOUT	CHOICE	FACTORY SETTING	ENABLED METER FUNCTION	USER SETTING
	L2C.7	0	Display and setting of SET TI parameter	
	L2C.8	0	Display and setting of GATE T parameter	
L3 CNF	L3C.1	0	Display of RATE, SQ RT, and BATCH through the ▲/DISPLAY button in Run Mode	
	L3C.2	0	Display of AVG RT, and BAT NO through the ▲/DISPLAY button in Run Mode	
	L3C.3	0	Display of TOTAL through the ▲/DISPLAY button in Run Mode	
	L3C.4	0	Display of TIME through the ▲/DISPLAY button in Run Mode	
	L3C.5	0	Display and setting of MODE parameter	
	L3C.6	0	Display and setting of CAL VZ, CALVS, CALmAZ, and CALmAS parameters	
	L3C.7	0	EEPROM (non-volatile) storage of changed settings	
	L3C.8	0	MENU button	

MODE

Factory preset MODE = Rate (Rate Meter/Totalizer Mode)

User Setting = _____

CNFG 1 THROUGH CNFG 4

In the following table, NC means Normally Closed.

PARAM	CHOICE	FACTORY SETTING	RESULTING ACTION			USER SETTING
			RATE	SQ RT	BATCH	
CNFG 1	CF1.1	0	SP 1 NC; SP 1 assigned to TOTAL		SP 1 NC; SP 1 assigned to BATCH count	
	CF1.2	0	SP 2 NC; SP 2 assigned to TOTAL		SP 2 NC; SP 2 assigned to BATCH count	
	CF1.3	0	SP 3 NC; SP 3 assigned to RATE if CF1.7=0; SP 3 used for AVG RT if CF1.7=1		SP 3 NC; SP 3 assigned to BATCH count	
	CF1.4	0	SP 4 NC; SP 4 assigned to RATE if CF1.8=0; SP 4 used for AVG RT if CF1.8=1		SP 4 NC; SP 4 assigned to TOTAL if CF1.7=0; for BAT NO if CF1.7=1	
	CF1.5	0	SP 5 NC; SP 5 assigned to TIME			
	CF1.6	0	Meter display bright			
	CF1.7	0	SP 3 assigned to RATE		SP 4 assigned to TOTAL	
	CF1.8	0	SP 4 assigned to RATE		BATCH counts up	

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PARAM	CHOICE	FACTORY SETTING	RESULTING ACTION RATE	SQ RT	BATCH	USER SETTING
CNFG 2	CF2.1	0	SP 1 output active ABOVE SP 1 value			
	CF2.2	0	SP 2 output active ABOVE SP 2 value			
	CF2.3	0	SP 3 output active ABOVE SP 3 value			
	CF2.4	0	SP 4 output active ABOVE SP 4 value			
	CF2.5	0	SP 5 output active ABOVE SP 5 value			
	CF2.6	0	SP 3 action undelayed		RESET action normal	
	CF2.7	0	SP 4 action undelayed		BAT NO counts up	
	CF2.8 115 V Models	0	Meter set for 60 Hz power			
	CF2.8 230 V Models	1	Meter set for 50 Hz power			
CNFG 3	CF3.1 (Analog Output)	1	RATE sent		BATCH count sent	
	CF3.2 (BCD Output)	1	RATE sent		BATCH count sent	
	CF3.3 (SP 1)	0	SP 1 output normal (unlatched)			
	CF3.4 (SP 2)	0	SP 2 output normal (unlatched)			

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PARAM	CHOICE	FACTORY SETTING	RESULTING ACTION RATE	SQ RT	BATCH	USER SETTING
	CF3.5 (SP 3)	0	SP 3 output normal (unlatched)			
	CF3.6 (SP 4)	0	SP 4 output normal (unlatched)			
	CF3.7 (SP 5)	0	SP 5 output normal (unlatched)			
	CF3.8	0	Cutoff disabled			
	CF3.9	1	Meter waits up to 2 s for final pulse before computing RATE		SP 3 value converted to equivalent input pulses for fast comparison	
CNFG 4	CF4.1	0	External $\overline{\text{RESET A}}$ (P2-3) triggered on pulse edge			
	CF4.2	1	Calibrated Analog Output = Current			
	CF4.3	0	Display HOLD (P2-16) = disabled			
	CF4.4	0	Print Request (P2-16) = disabled			
	CF4.5	0	10-ms output pulse on P2-15 at end of each RATE measurement		Pulse output on P2-15 low when input rate cut off, high if rate not cut off	
	CF4.6	0	BCD binary address decimal point right justified (See Appendix E)			
	CF4.7	0	Front-panel RESET = enabled			
	CF4.8	0	Autoscof = disabled		Front-panel STOP = disabled	

AVG.CNF (Running Average Configuration)

FACTORY PRESET AVERAGE				TOTAL VALS IN AVG	USER SETTING AVERAGE				TOTAL VALS IN USER AVG
1	2	3	4		1	2	3	4	
0	0	0	1	256					

AVG.5 factory preset is 0 (ABC - Adaptive Bandwidth Control - Filter)

AVG.5 User Setting = _____

IN.SC.OF (Input Scale and Offset)

If an Isolated Analog Input Board is ordered as a part of the meter and installed at the factory, IN.SC.OF has no INPUT and READ factory presets; the board was calibrated at the factory using the calibration data on the back of the board.

If an Isolated Analog Input Board had not been ordered, or was ordered separately using the board model number, INPUT and READ factory preset values are a scale of 1 and an offset of 0.

User Settings:
INPUT 1 = _____
READ 1 = _____
INPUT 2 = _____
READ 2 = _____

OUT.SC.OF (Output Scale and Offset)

METER VALUE	FACTORY SETTING	FUNCTION	USER SETTING	USER FUNCTION
READ 1	0	Calibrates		
OUT 1	4 mA	CURRENT		
READ 2	10000	output		
OUT 2	20 mA			

RTE DP (Rate Decimal Point)

Factory setting is RRRRRR.

User Setting = _____

RTE OF (Rate Offset)

Factory setting is 0.

User Setting = _____

RTE SC (RATE Scale)

Factory setting is MULTIP; factory preset value is 000001.

User Setting = _____

TOT DP (TOTAL Decimal Point)

Factory setting is TTTTTT.

User Setting = _____

TOT OF (Total Offset)

Factory setting is 0.

User Setting = _____

TOT SC (Total Scale)

Factory setting is MULTIP; factory preset value is 000001.

User Setting = _____

AL TI (Alarm Time)

Factory setting is 0 = 00:00 (Designated setpoint is 0; alarm time is 00:00)

User Setting = _____

GATE T (Gate Time)

Factory setting is 0.30 s.

User Setting = _____

BAUD (Data Transfer Rate)

Factory setting is 9600.

User Setting = _____

SER.CNF (Serial Configuration)

SER.CNF CHOICE	FACTORY SETTING	RESULTING ACTION	USER SETTING
SER.1	1	Sets parity bit to ODD	
SER.2	0	Sets stop bit to one	
SER.3	1	Sends long messages in single piece	

DAT FT (Data Format)

DAT FT CHOICE	FACTORY SETTING	ENABLED ADDITION TO MESSAGE			USER SETTING
		RATE MODE	SQ RT MODE	BATCH MODE	
DAT.1	1	Alarm status character			
DAT.2	1	RATE value		BATCH count	
DAT.3	1	AVG RT value		BAT NO	
DAT.4	1	TOTAL value			
DAT.5	1	TIME			
DAT.6	1	RATE unit of measure		BATCH count unit of measure	

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DAT FT CHOICE	FACTORY SETTING	ENABLED ADDITION TO MESSAGE			USER SETTING
		RATE MODE	SQ RT MODE	BATCH MODE	
DAT.7	1	AVG RT unit of measure		BAT NO unit of measure	
DAT.8	1	TOTAL unit of measure			

BUS FT (Bus Format)

BUS FT CHOICE	FACTORY SETTING	RESULTING ACTION			USER SETTING
		RATE MODE	SQ RT MODE	BATCH MODE	
BUS.1	0	Does not add check sum to message			
BUS.2	1	Adds line feed <LF> to message			
BUS.3	0	Does not add command ECHO in front of message			
BUS.4	0	Sets meter to Point-to-Point Mode			
BUS.5	0	Sets Point-to-Point Mode to Continuous			
BUS.6	0	In Point-to-Point Mode, sets RTS handshake to Message			
BUS.7	0	Sets meter for RS-232 communications			
BUS.8	0	Separator for DAT FT choices 1, 2, 3, and 4 is SPACE			

ADDRES (Address)

Factory setting is 001.

User Setting = _____

SER TI (Serial Time)

Factory setting is 1 s.

User Setting = _____

SET TI (Set Time)

Factory setting is 12:00:00.

User Setting = _____

BAT DP (Batch Decimal Point)

Factory setting is RRRRRR.

User Setting = _____

B LOAD (Batch Load)

Factory setting is 0.

User Setting = _____

BAT SC (Batch Scale)

Factory setting is MULTIP; Factory preset value is 000001.

User Setting = _____

CAL VZ, CAL VS, CALmAZ, CALmAS

There are no factory preset CAL VZ, CAL VS, CALmAZ, and CALmAS values: If no Isolated Analog Output Board is used, these parameters are not used. If an Isolated Analog Output Board is ordered as a part of the meter and installed at the factory, the board has been calibrated using exact CAL VZ, CAL VS, CALmAZ, and CALmAS values from the back of the board.

User Setting:

CAL VZ = _____

CAL VS = _____

CALmAZ = _____

CALmAS = _____

APPENDIX K
RAMP SPECIFICATIONS

K.1 DEFINITION

The ramping function is an output choice for the Isolated Analog Output Board as configured by CF3.1=4. It uses Setpoints 1 and 2 to slowly open and close an electrical valve. The opening interval (the amount of time it takes to completely open the valve) is determined by the AL TI parameter, and the slope of the opening over time is determined by the scale of the OT.SC.OF parameter.

K.1.2 EXAMPLE

Figure K-1 shows an example of a setup where the ramp function is used. The signal source is a flow measurement from a differential pressure flow meter that is converted to a 4-20 mA signal by the Isolated Analog Input Board. An electrical valve controls the flow to a 100,000 gallon tank. When the valve is fully open, the signal is 20 mA; when the valve is fully closed, the signal is 4 mA. Figure K-2 shows the graph of the valve opening and closing over time.

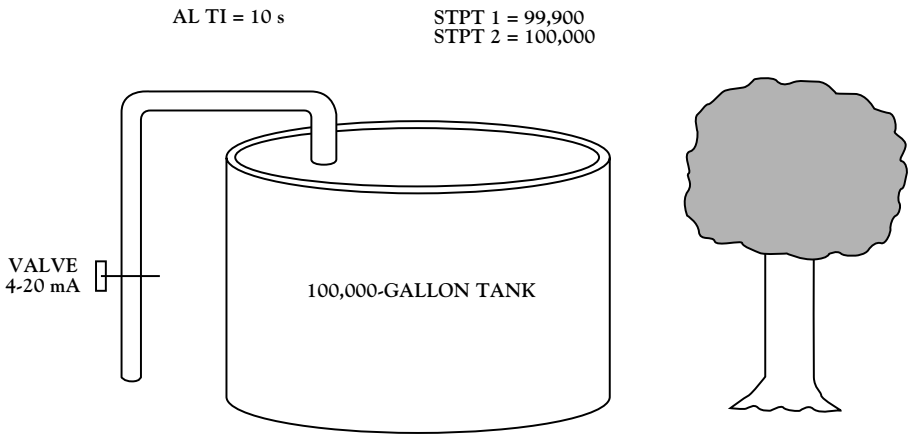


Figure K-1. A Setup Using Ramped Analog Output

When the tank is ready to be filled, a RESET-A is performed. This causes the electrical valve to slowly open and start filling the tank. The valve opens according to the slope of OT.SC.OF and the time specified by AL TI, which in this case is 10 s. It remains fully open delivering about 600 gallons per minute until Setpoint 1 is activated at

99,900 gallons. At this point, the filling valve starts ramping shut, using the negative slope of OT.SC.OF. It stops when it reaches approximately 8% fullscale (about 40 gallons per minute), then closes completely when Setpoint 2 is activated at 100,000 gallons.

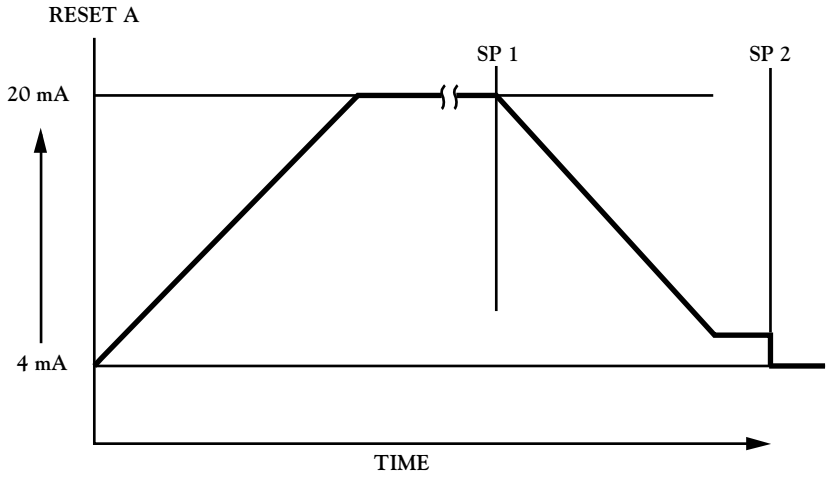


Figure K-2. Opening and Closing of the Valve Over Time

K.1.3 GUIDELINES

Follow these guidelines to use the ramping function with analog output:

1. Assign Setpoints 1 and 2 to TOTAL (Section 4.9) and set setpoint values as dictated by your application.

2. Set configuration choice CF3.1 to 4 (Section 5.4.2).

3. Configure OT.SC.OF (Section 5.4.5) so that the opening valve is open well before Setpoint 1.

4. Configure AL TI (Section 5.4.12) so that the Setpoint digit is 0 and the corresponding time is the amount of time it takes to completely open the valve. This time is usually about 10 s.

APPENDIX L
SPECIFICATIONS

L.1 BASIC METER

DISPLAY

TYPE:	14-segment, red or green LED
DIGIT HEIGHT:	0.54-inch (13.7-mm)
DECIMAL POINTS:	Six positions, programmable
LEADING ZEROS:	Blanked
OVERRANGE INDICATION:	Displayed in exponential format
DIMMING:	100% and 50% brightness levels, programmable
DISPLAY UPDATE TIME:	0.03 to 3 seconds, programmable
INDICATOR LIGHTS:	4 alarms and 3 status modes

ENVIRONMENT

NORMAL OPERATING TEMP.:	0° to 50°C (32° to 122°F)
DERATED OPERATING TEMP.:*	0° to 40°C (32° to 104°F)
*When operating at 253V/50Hz and maximum load (4-20mA, 4 alarms on, and 75 mA excitation)	
STORAGE TEMP.:	-40° to 85°C (-40° to 185°F)
RELATIVE HUMIDITY:	90% at 40°C (non-condensing)

POWER

AC VOLTAGE:	115/230Vac +/-10%
CONSUMPTION:	12.5 watts, max
POWER FAILURE:	Counter values and time stored in nonvolatile memory
AC FREQUENCY:	50/60 Hz
EXTERNAL FUSE PROTECTION RECOMMENDED:	
115Vac	IEC127-2/III, 125mA, 250V (Time-Leg) or UL Slow-Blow, 125mA, 250V
230Vac	IEC127-2/III, 63mA, 250V (Time-Leg) or UL Slow-Blow, 63mA, 250V
BATTERY BACKUP: (For internal clock only.)	6-12 Vdc @ 50 mA

MAIN BOARD

SETPOINT OUTPUT:	5 open-collector transistors
POWER RATING:	150 mA dc @ 1 V sink, 30 V when open

GENERAL

THRESHOLD:	1 V to 3.5 V
PROTECTION LEVEL:	24 V
FREQUENCY RANGES:	0.2 Hz to 20 kHz
TRIGGER SLOPE:	Positive
CONNECTION:	3-Socket Input Plug
SENSOR EXCITATION:	14 to 20 V @ 25 mA non-regulated
INPUT RESISTANCE:	30 kΩ pull-up resistor to +5 V
ACCURACY:	0.001% of reading ±1LSD, ±trigger error

CASE

MATERIAL:	94V-O UL-rated polycarbonate
DIMENSIONS:	(HxWxD) 1.89 x 3.78 x 5.86 in. (48 x 96 x 149 mm)
PANEL CUTOUT:	1/8 DIN (HxW) 1.772 x 3.622 in (45 x 92 mm)

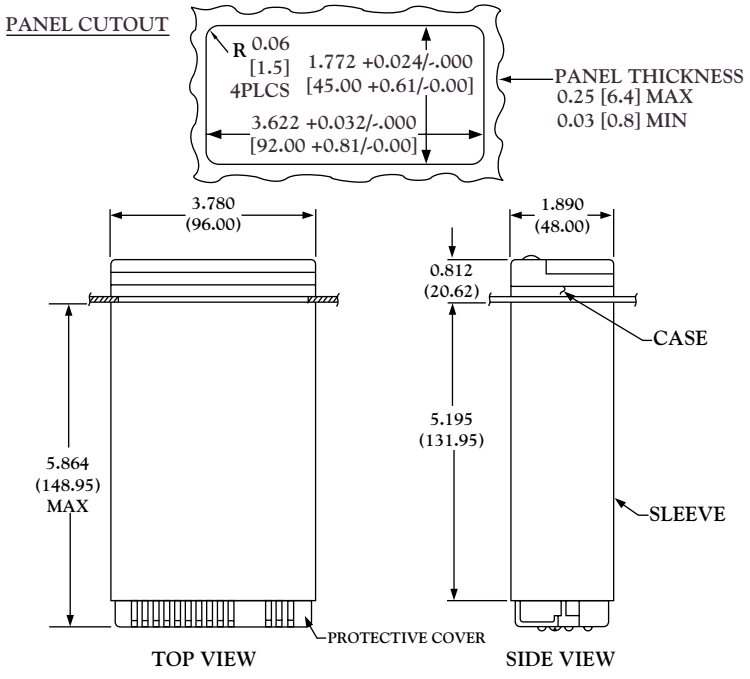


Figure L-1. Meter Housing and Panel Cutout

L.2 ISOLATED PULSE INPUT BOARD

SENSOR EXCITATION:	5 V @ 50 mA
(regulated, selectable)	8.2 V @ 50 mA
	12.6 V @ 70 mA
CONNECTION:	2, 3-socket input plugs
INPUT SENSITIVITY	
LOW LEVEL:	20 mV rms
HIGH LEVEL:	2 - 5 V (See Table B-2)
MAXIMUM INPUT	
LOW LEVEL:	60 V rms
HIGH LEVEL:	230 V rms
INPUT IMPEDANCE	
LOW LEVEL:	100 kΩ pullup to excitation
HIGH LEVEL:	150 kΩ pullup to excitation in parallel with 90 kΩ minimum
NAMUR SENSOR PROVISIONS:	1 kΩ series resistor with 8.2 V excitation
CONTACT CLOSURE	
FREQUENCY RANGE:	8 ON/OFF per second

L.3 ISOLATED ANALOG INPUT BOARD

CONNECTION:	3-Socket Input Connector
SIGNAL RANGE:	0 - 5 V dc, 1 -5 V dc, 0 - 10 V dc, 0 - 1 mA dc, 4 - 20 mA dc*
SENSOR EXCITATION:	24 V @ 25 mA
INPUT RESISTANCE:	25 ohms
ISOLATION, SIG GND TO DIG GND:	354 Vp
LOW-LEVEL SHUTOFF:	Programmable
NON-LINEARITY MAX:	0.02% FS
ACCURACY:	0.05% FS at 25°C
TEMPCO:	50 ppm/°C

* Calibration data are provided for 4-20 mA and 0-5 V ranges only

L.4 ISOLATED ANALOG OUTPUT BOARD

ACCURACY:	±0.05% of FS @ 25°C
STEP RESPONSE:	10 to 90% full-scale 50 ms
TURNDOWN RATIO (OFFSET/SPAN):	100 with 0.01% resolution
TEMPCO:	50 ppm/°C
LOOP RESISTANCE:	up to 600Ω

L.5 ISOLATED PARALLEL BCD OUTPUT BOARD

BCD TYPE:	Isolated, stored, buffered, addressable, tri-state
DIGIT ADDRESSING:	3 or 6 digit at a time
OUTPUT LEVEL:	TTL/CMOS-compatible, 10 LSTTL loads
POWER:	External 5 V dc for isolated BCD; internal 5 V dc for non-isolated BCD

L.6 DUAL RELAY AND 4 RELAY OUTPUT BOARD

OUTPUT TYPE:	Dual Form-C relays or 4 Form-C relays
POWER RATING FOR RESISTIVE LOADS:	
DUAL AND 4 RELAY:	Two relays at P6 and P7 Normally open contact, 7 amp; 30Vdc or 230Vac Normally closed contact, 7 amp; 30Vdc or 230Vac
4 RELAY ONLY:	Two relays at P18 Normally open contact, 1 amp; 24Vdc or 30Vac Normally closed contact, 1 amp; 24Vdc or 30Vac

L.7 ISOLATED RS-232 AND RS-485 SERIAL COMMUNICATIONS

RS-232

BAUD RATES:	300, 600, 1200, 2400, 4800, 9600, and 19,200
CONNECTION:	RJ-11, 4-wire telephone jack; data in, data out, RTS, GND
RECEIVE CAPABILITY:	Allows for on-line setup and configuration monitoring and changes
TRANSMIT CAPABILITY:	Programmable to send RATE, AVG RT, TOTAL, and TIME (with or without units) in Rate and Sq Rt Modes; programmable to send BATCH count, BAT NO, TOTAL, and TIME (with or without units) in Batch Mode

RS-485

BAUD RATES:	300, 600, 1200, 2400, 4800, 9600, and 19,200
CONNECTION:	RJ-12, 6-wire telephone jack, Full or Half Duplex
RECEIVE CAPABILITY:	Allows for on-line setup and configuration monitoring and changes
TRANSMIT CAPABILITY:	Programmable to send RATE, AVG RT, TOTAL, and TIME (with or without units) in Rate and Sq Rt Modes; programmable to send BATCH count, BAT NO, TOTAL, and TIME (with or without units) in Batch Mode
MODES:	Alarm and normal
ADDRESSING:	0 (common address), 1 to 199

See the Serial Communications manual for more information on these boards.

Warranty/Disclaimer

NEWPORT Electronics, Inc. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. In addition to NEWPORT's standard warranty period, NEWPORT Electronics will extend the warranty period for one (1) additional year if the warranty card enclosed with each instrument is returned to NEWPORT.

If the unit should malfunction, it must be returned to the factory for evaluation. NEWPORT's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by NEWPORT, if the unit is found to be defective it will be repaired or replaced at no charge. NEWPORT's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of NEWPORT's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to the NEWPORT Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO NEWPORT, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM NEWPORT'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting NEWPORT:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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