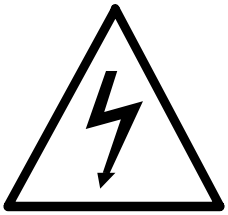
Table of Contents

Important safety information



Danger: Avoid electric shock. Do not connect power when the instrument cover is partially or completely removed.

Unpacking and Inspection

Your flow controller package includes the following items:

- OMEGA FPM-9010A Flow Controller
- Two stainless steel mounting brackets
- Mounting Instructions w / self-adhesive template
- Panel gasket

Chapter 1

Introduction

1.1 Introduction

Your new OMEGA FPM-9010A Flow Controller has been specifically designed for liquid flow rate measurement in process pipes. The controller's compact 1/4 DIN enclosure (front) is NEMA 4X/IP65 rated and ideal for installing into instrumentation panels with limited space.

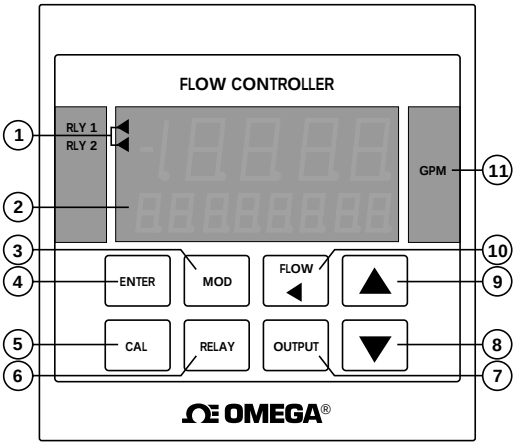
Modular "plug-in" input/output option cards allow you to customize your flow controller to your flow system's requirements. The controller's unique "slide-out" chassis design makes option installation fast and simple. Smart self-configuring microprocessor based circuitry automatically inventories installed options during power-up, allowing you to upgrade your system in seconds without the need for additional equipment.

The unit's front panel features a highly visible 4.5- digit (seven segment) and 8-digit (alpha-numeric) liquid crystal display with adjustable contrast. Active flow rate, accumulation, and alarm relay information is quickly accessed at a glance. During calibration the user is prompted with clear step-by-step instructions on the unit's front panel display.

The OMEGA FPM-9010A Flow Controller also accepts other analog inputs, such as 4 to 20 mA or 0 to 5 VDC, etc.

The technical data given in this publication is for general information purposes only. It implies no warranty of any kind.

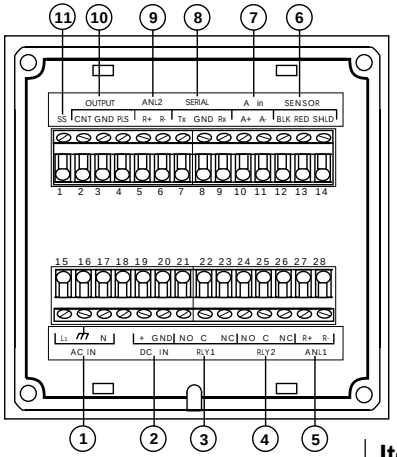
1.2 Front Panel Description



Item 11:
Remove front bezel to change unit tags under clear overlay window. The unit tags are attached to the rear cover of the manual.

Item	Function
1. Relay Annunciators:	Indicate activation status of optional output "alarm" relays 1 & 2
2. LCD Display:	Shows flow, calibration, accumulation, and relay activation status information
3. MOD	A) Accesses one of three calibration menus: CAL, RELAY, OUT B) Enables a calibration parameter for modification C) Restores a calibration parameter to it's original value during calibration
4. ENTER	A) Stores a calibration value into memory after modification B) Used to display available input / output options during normal operation.
5. CAL	A) Accesses the CAL "view-only" menu B) Used in conjunction with MOD key to access the main CAL menu
6. RELAY	A) Accesses the RELAY "view-only" menu B) Used in conjunction with MOD key to access the RELAY calibration menu
7. OUTPUT	A) Accesses the OUTPUT "view-only" menu B) Used in conjunction with MOD key to access the OUTPUT calibration menu
8. ▼	Decreases the value of a selected calibration digit
9. ▲	Increases the value of a selected calibration digit
10. FLOW ◄	A) Returns the unit to normal operation mode B) Selects a digit for modification during calibration
11. Unit Tags	Most engineering units and blanks available for custom applications (included). User selected and installed for specific applications.

1.3 Rear Panel Description



Note: *Rear terminals accept 18 to 22 AWG wire*

Item	Function
1. AC IN	90 to 132 VAC or 180 to 264 VAC system power connection
2. DC IN	17 to 30 VDC system power connection
3. RLY 1	Alarm relay #1 (COM, NO, NC) contact set for external device control (optional)
4. RLY 2	Alarm relay #2 (COM, NO, NC) contact set for external device control (optional)
5. ANL1	Analog output #1 from option socket #1 (optional)
6. Sensor	Flow sensor input connection (frequency)
7. A in	Analog signal input connection (optional)
8. Serial	Serial outputs (future availability)
9. ANL2	Analog output #2 from option socket #2 (optional)
10. Output	CNT emits an open collector pulse output for each increment of totalizer. PLS emits a TTL frequency output in phase with the sensor input
11. SS	Unused Terminal

Chapter 2

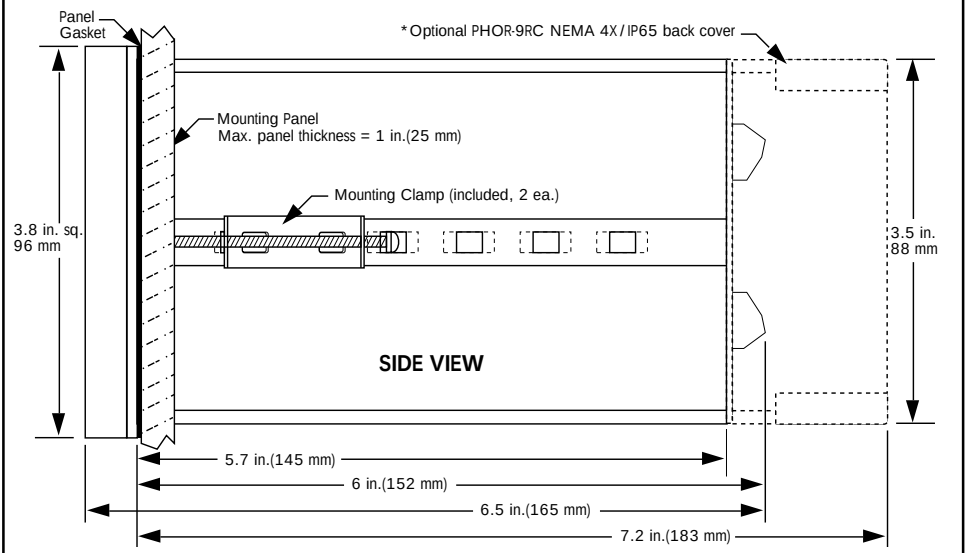
Installation and Operation

2.1 Mounting Instructions

The OMEGA FPM-9010A Flow Controller's 1/4 DIN enclosure is specifically designed for panel mounting. Adjustable mounting brackets allow mounting in panels up to 1 in. (25 mm) thick. An adhesive template and instructions are included to insure proper installation.

For outdoor and/or stand alone installations the splash-proof NEMA 4X/IP65 back cover kit is recommended (ordered separately).

Figure 1
External dimensions

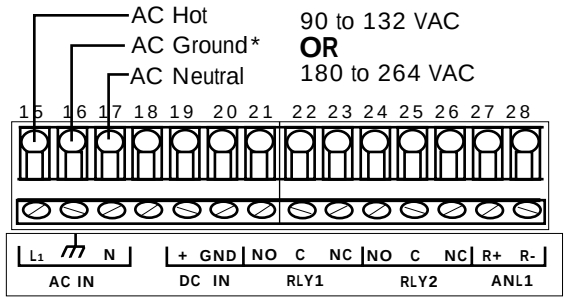


Panel Cutout Instructions

Recommended panel cutout 90 mm (3.54 in.) square. Maximum panel cutout 92 mm (3.62 in.) square, DO NOT exceed. Use adhesive backed template (included)

2.2 Power Connections

AC Power Connections



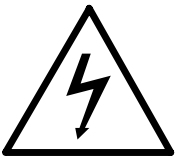
Instructions

1. Jumper selectable for 90 to 132 ***OR*** *180 to 264 VAC operation. Confirm AC power configuration before applying power. See section 4.2 pg# 19*

*2. *A direct or low impedance AC ground (earth ground) MUST be used for proper operation.*

3. To reduce the possibility of noise interference, AC power lines must be isolated from signal lines.

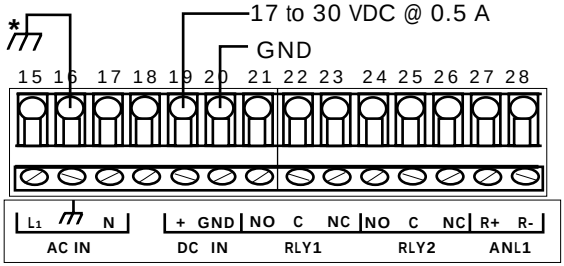
Figure 2
AC power wiring



Danger: *Avoid electric shock. Do not connect power when the instrument cover is partially or completely removed.*

DC power is recommended when ground fault interrupt devices (GFI's) are used.

DC Power Connections



Note: AC/DC power can be connected simultaneously, using DC power as an uninterrupted power source.

**A direct or low impedance earth ground MUST be used for optimum performance.*

Figure 3
DC power wiring

2.3 Input Connections

Four input sources are accepted:

Note: *See section 4.4 for a listing of available input cards.*

A. Non-isolated Frequency Inputs

Frequency (non-iso) card: Accepts non-isolated, 0 to 10 kHz @ 0.2 Vp-p minimum sine or square wave signal inputs. This card requires dip switch configuration prior to operation.

B. Isolated Frequency Inputs

Frequency (iso) card: Accepts isolated, 0 to 10 kHz @ 0.5 Vp-p minimum sine or square wave signal inputs. No configuration required.

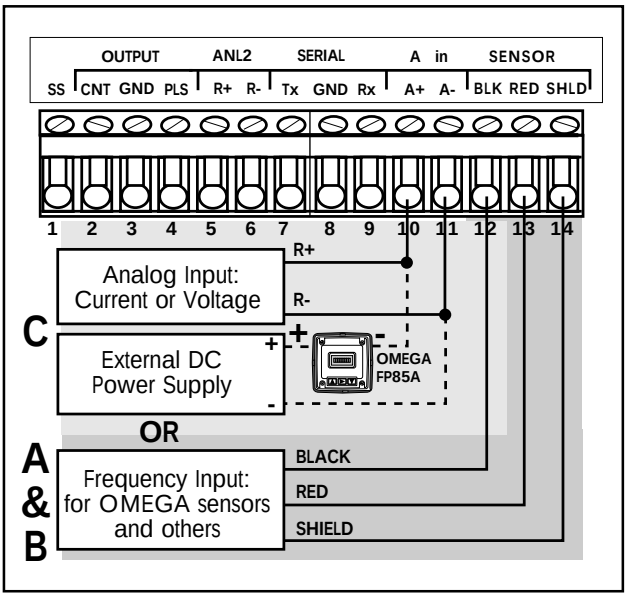
C. Analog Inputs

Two analog input cards are offered:

- Analog (iso) current, 4 to 20 / 0 to 20 mA
- Analog (iso) voltage, 0 to 5 / 0 to 10 VDC

Input ranges are software selectable, requiring no internal configuration.

Figure 4
Input Wiring



To reduce the possibility of noise interference, separate input lines from AC power lines.

2.4 Standard Output Connections

Standard Outputs
An open collector counter pulse output (CNT) and a sensor pulse output (PLS) are included with your unit.

The counter pulse output (synchronous w/totalizer) emits an open collector 150 ms pulse with a **maximum** current sinking capacity of 50 mA @ 30 VDC, and is ideal for driving an external counter or accumulator. **An external DC power supply and current limiting resistor are required for operation.**

The sensor pulse output (PLS) emits a standard TTL frequency output in phase with the sensor input and can be used to drive OMEGA instruments (except OMEGA FPM-5800) and other TTL compatible devices.

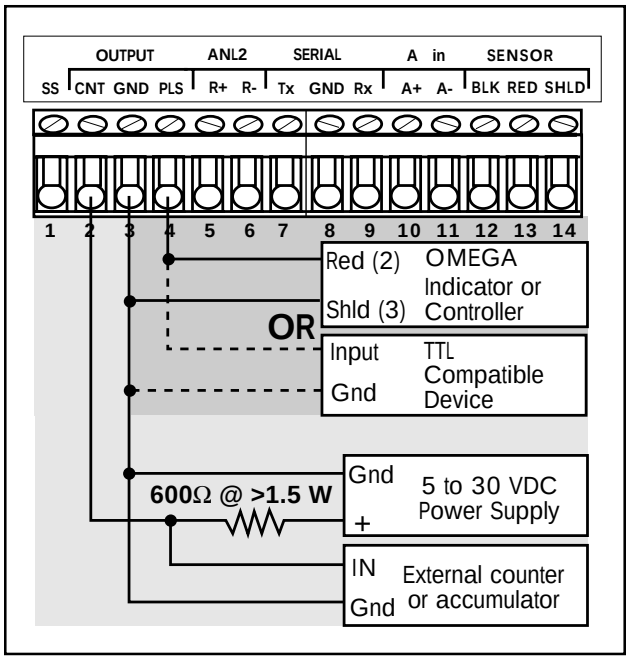


Figure 5
Sensor pulse output (PLS) / counter output (CNT) wiring

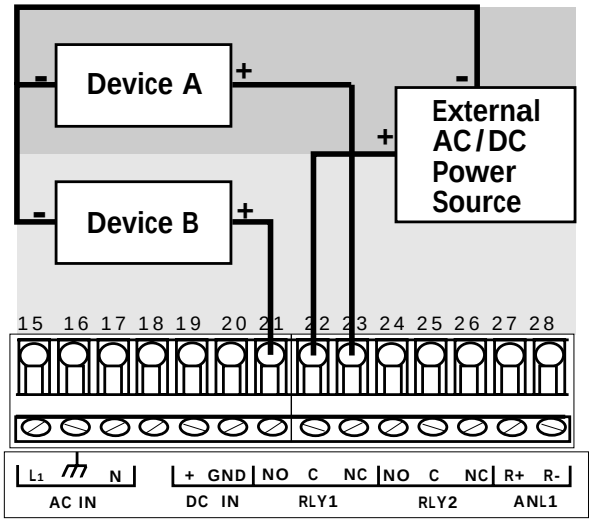
To reduce the possibility of noise interference, separate output lines from AC power lines.

2.5 Relay Output Connections

The 2-Relay option provides two relays for external device control. Each relay's contacts are rated for 5 A maximum. Both NO and NC contacts may be used individually or simultaneously as shown.

Figure 6
2-Relay wiring

Device A is powered during normal operation. Power is discontinued when relay is energized. Device B is not powered during normal operation. Power is applied after relay is energized.



Note: *Relay contacts are rated as 5 A @ 250 VAC or 5 A @ 30 VDC maximum resistive load.*

To reduce the possibility of noise interference, separate AC relay lines from input / output lines.

2.6 Verifying Analog Outputs

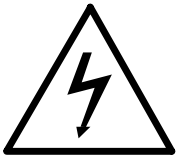
Installed analog output options can be configured to either of the unit's rear analog output terminals: ANL1 or ANL2. Configuration is determined by which sockets the options are installed. Options installed in option socket #1 are configured to the rear ANL1 terminals, options installed in socket #2 are configured to the rear ANL2 terminals (see section 4.3).

Prior to connection, determine which options are configured to terminals ANL1 and ANL2 as follows:

1. Apply power to unit.

2. Press: ENTER; available input / output options are individually prompted on the display.

3. Record option configurations for ANL1 and ANL2 in the spaces provided. This information is necessary for wiring analog outputs in the next section.



Danger: *Avoid electric shock. Do not connect power when the instrument cover is partially or completely removed.*

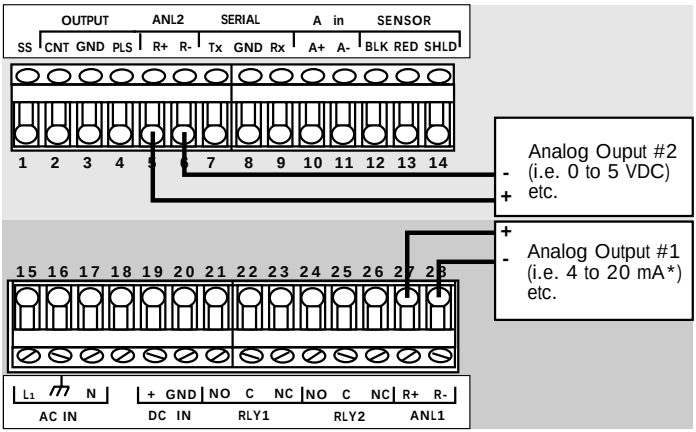
Option Record
ANL1= (i.e. 4 to 20 mA)
ANL2= (i.e. N / A)

Note: *The unit displays N / A for unavailable options.*

2.7 Analog Output Connections

0 to 20 / 4 to 20 mA isolated or non-isolated output as well as 0 to 5 / 0 to 10 VDC isolated or non-isolated outputs are available. See section 4.4 for a list of available output cards.

Figure 7
Analog output wiring



**The 4 to 20 mA option is jumper configurable for 0 to 20 mA operation. Refer to section 4.6*

Note: *The maximum loop impedance for the 4 to 20 mA / 0 to 20 mA output is 425 Ω. The minimum load impedance for the 0 to 5 V / 0 to 10 V output is 1 kΩ (1000 Ω). To reduce the possibility of noise interference, separate output lines from AC power / relay lines.*

Chapter 3

System Configuration

3.1 Introduction

All the functions which can be modified are contained in three menus:

The CAL (calibrate) menu contains those functions which pertain to the input signal and how it is interpreted by the instrument (i.e. K-factor, totalizer reset). The CAL menu also provides access to the security code and display contrast features.

The RELAY menu contains all the functions necessary to control any output relays, such as relay

setpoint, hysteresis etc.

The OUTPUT menu provides access to the functions which define and control all analog output signals, i.e. 4 to 20 mA, 0 to 5 VDC etc.

CAL Menu [CAL]

(frequency)
- K-factor
- K-factor decimal
- Upper display timebase
- Totalizer reset
- Totalizer multiplier
- Display averaging
- Display decimal
- Contrast adjust
- Security code

(Analog)
- Range selection
- Minimum flow rate
- Maximum flow rate
- Totalizer reset
- Totalizer multiplier
- Display averaging
- Display decimal
- Contrast adjust

RELAY Menu [RELAY]

(LO / HI)
- Relay 1 LO / HI
- Relay 1 setpoint
- Relay 1 hysteresis
- Relay 2 LO / HI
- Relay 2 setpoint
- Relay 2 hysteresis

(Pulse)
- Relay 1 Pulse
- Relay 1 pulse flow unit setting
- Relay 2 Pulse
- Relay 2 pulse flow unit setting

OUTPUT Menu [OUTPUT]

- Minimum flow rate
- Maximum flow rate
- Low output adjust
- High output adjust

Note: *A security function is provided which allows the user to "lock out" the calibration menus, restricting access to calibration settings. See Figure 14 .*

All menus are loop type menus which repeat until [FLOW ◀] is pressed.

All menus operate using a standard sequence:

1. Press: [MOD] to enable calibration sequence.
2. Enter security code (when active) using: [▲] [▼] [FLOW ◀] ; press: [ENTER]
3. Select menu: [CAL] [RELAY] [OUTPUT]; press menu key to select item.
4. Press: [MOD] to enable modifying item.
5. Alter item using: [▲] [▼] [FLOW ◀]; press: [ENTER] to save entry.
6. Press corresponding menu key to advance to next menu item.
7. Repeat steps 4-6 for each menu item. Exit menu by pressing: [FLOW ◀]

Legend

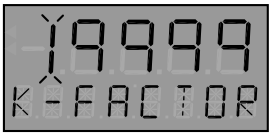
= Press Keypad

18888 XXXXXXXX = FPM-9010A Display

= Decision Block

= Calibration procedure

K-factor Setting



"1" is displayed only when previously selected.

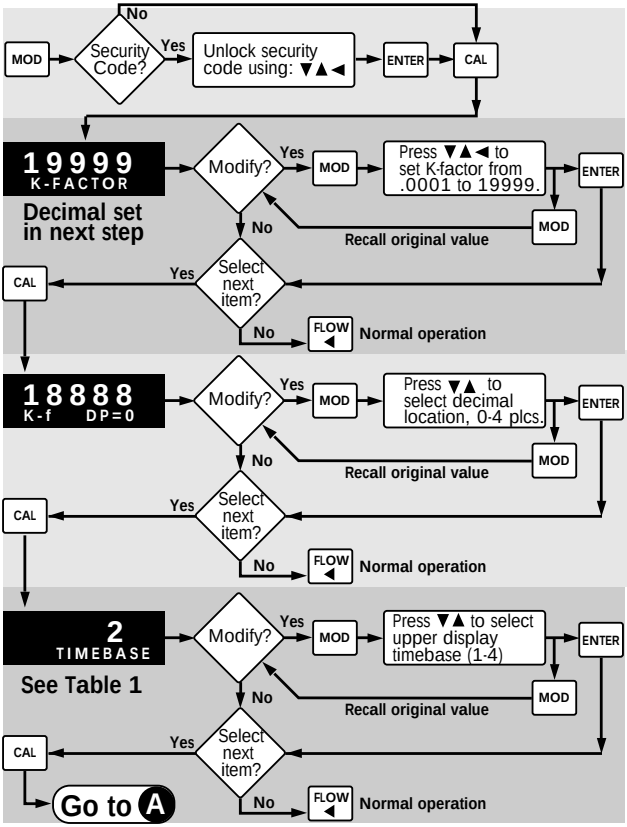
"1" flashes when deselected.

Table 1

Select upper display time-base:
1= flow displayed in seconds
2= flow displayed in minutes
3= flow displayed in hours
4= flow displayed in days

Note: Accumulator not affected by timebase.

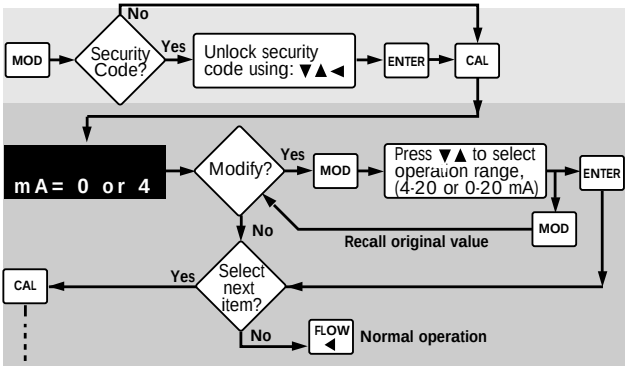
3.2 Calibration Menu, Frequency Inputs

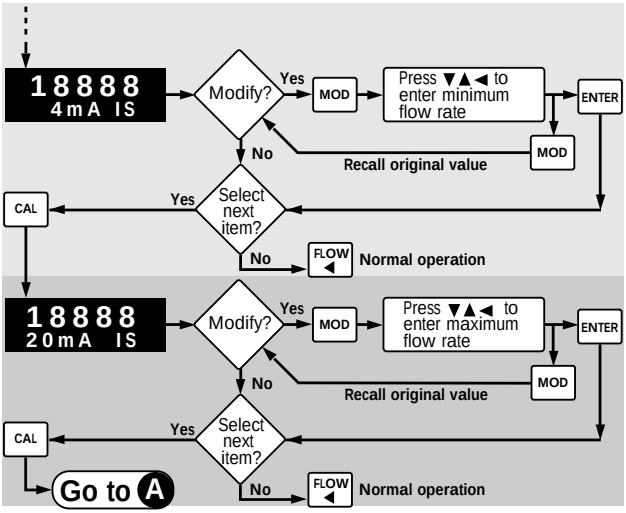


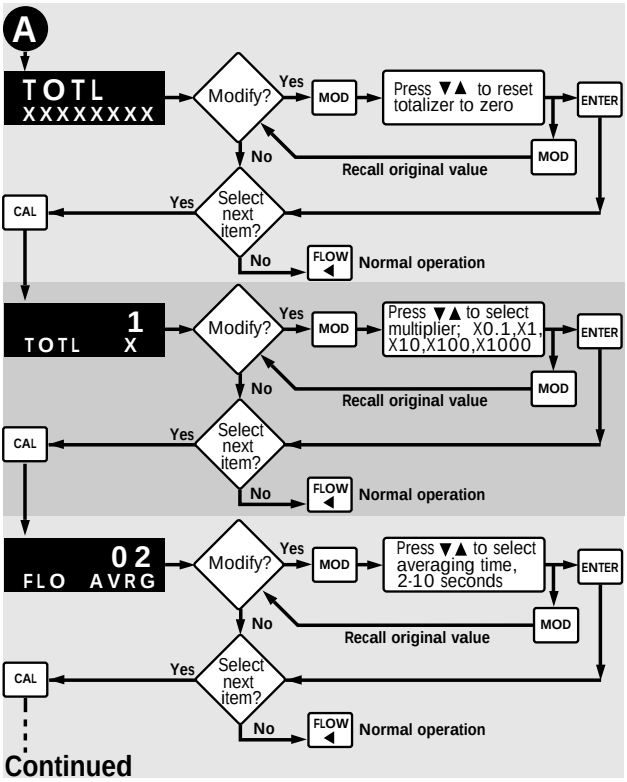
3.3 Calibration Menu, Analog Inputs

4 to 20 mA option illustrated

Note: *The unit's software recognizes which input card / configuration is inserted, therefore displaying the corresponding calibration value.*

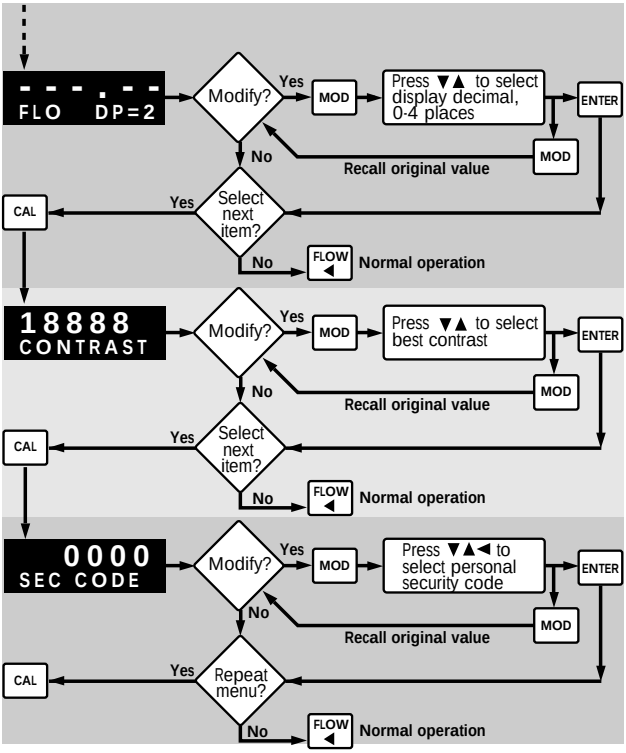






Exiting Menu

Menu will repeat until FLOW ◄ *is pressed.*


FLO DP=2
Modify?
Yes
MOD
Press ▼▲ to select display decimal, 0·4 places
ENTER
No
MOD
Recall original value
Yes
Select next item?
CAL
No
FLOW ◄
Normal operation
18888
CONTRAST
Modify?
Yes
MOD
Press ▼▲ to select best contrast
ENTER
No
MOD
Recall original value
Yes
Select next item?
CAL
No
FLOW ◄
Normal operation
0000
SEC CODE
Modify?
Yes
MOD
Press ▼▲◄ to select personal security code
ENTER
No
MOD
Recall original value
Yes
Repeat menu?
CAL
No
FLOW ◄
Normal operation

3.4 2-Relay Operations

The 2-Relay option allows you to configure individual setpoints, LO or HI operation, and hysteresis values for two independent on / off relays.

• Relay Setpoints: Setpoints represent the flow rate at which each relay is energized.

• Relay Hysteresis: Hysteresis values directly effect the LO and HI relay modes, specifying how far the flow will rise above (LO Relay Mode) or fall below (HI Relay Mode) each relay's setpoint prior to de-energizing the relay. The main purpose for hysteresis is to eliminate relay "chatter", caused by a flow hovering around a relay's setpoint. Hys-teresis values are programmed in direct flow units and must be less than the corresponding relay setpoint. Hysteresis only applies when exiting an alarm condition.

• LO Relay Operation: In LO operation, the relay is energized when the flow drops below the set-point, and is de-energized when the flow rises above the setpoint plus hysteresis. See Figure 8.

• HI Relay Operation: In HI operation, the relay is energized when the flow rises above the setpoint and is de-energized when the flow falls be-low the setpoint plus hysteresis. See Figure 9.

• Pulse Relay Setting: Setting relay 1 or 2 to the Pulse operation mode means the relay will be cycled (energized) for a 150 ms period each time a user specified quantity is measured.

Figure 8
***LO** relay operation mode*

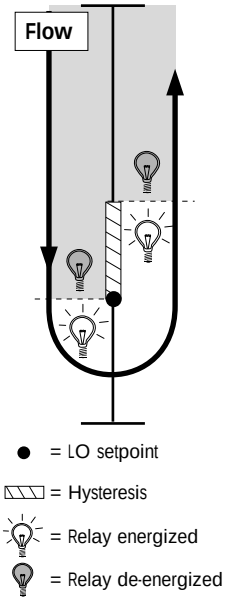
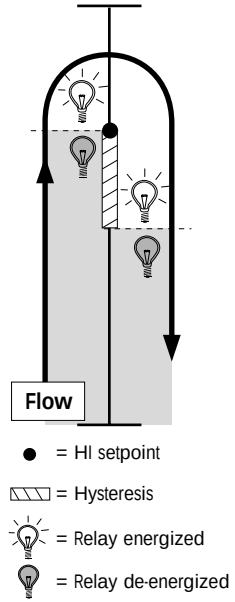
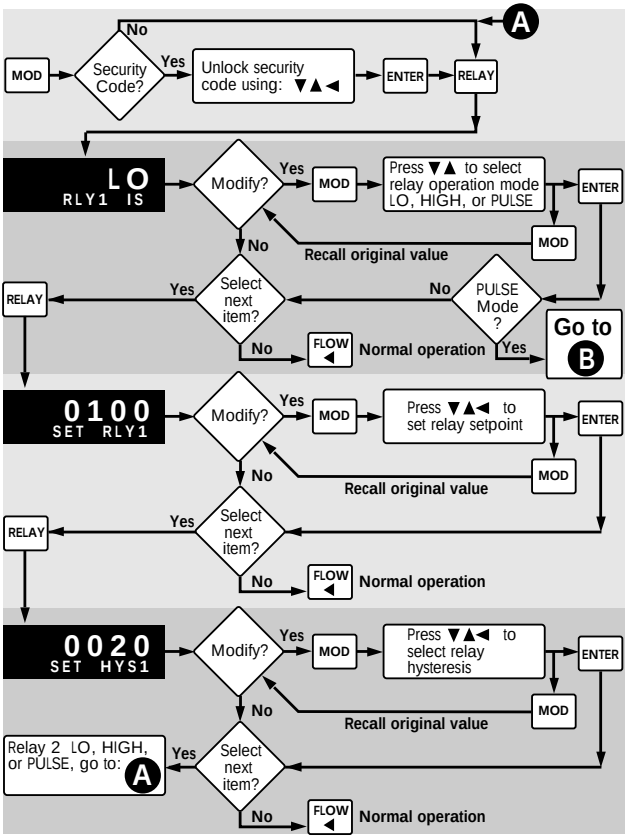


Figure 9
***HI** relay operation mode*



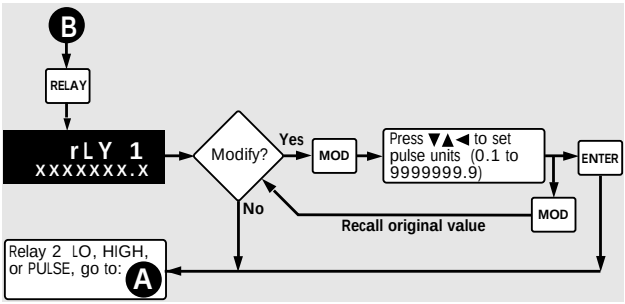
3.5 Calibration Menu, 2-Relay



Note: *Displayed decimal position set by CAL menu K-factor*

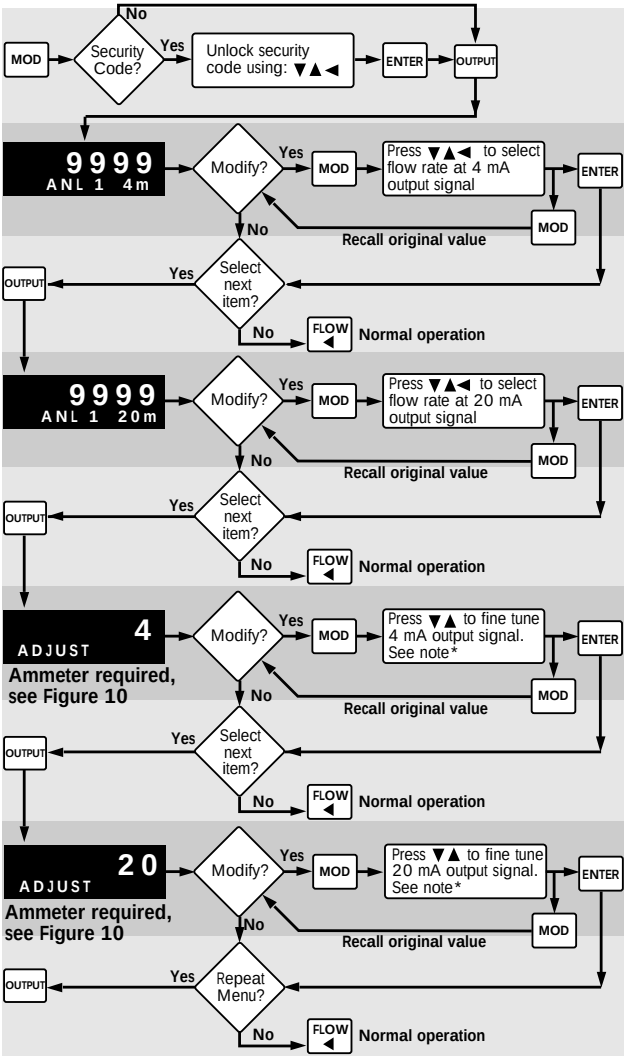
Exiting Menu

Menu will repeat until FLOW ◄ *is pressed.*



Note: *Relay cannot exceed 4 pulses per second.*

3.6 Calibration Menu, Analog Outputs



Exiting Menu

Menu will repeat until FLOW ◄ *is pressed.*

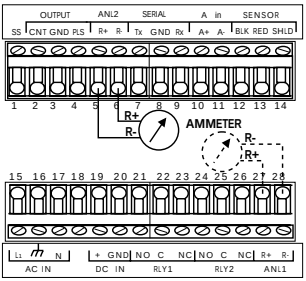
4 to 20 / 0 to 20 mA (iso / non-iso) options illustrated

***Note:** *Press:* FLOW ◄ *to quickly access the minimum or maximum current output signal*

Press: ▲ ▼ *to fine tune the current output signal*

Figure 10

The min. and max. current adjustment steps require an external ammeter for monitoring the current output.



3.7 View-Only Menus

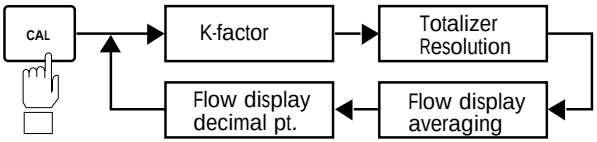
Note: *The view-only menus are designed for viewing only and DO NOT permit access for calibration of any kind. Menus will vary depending upon installed options.*

Three "view-only" menus (CAL, RELAY, and OUTPUT) are available during normal operation. Each view only menu provides the operator a means of browsing through calibration settings without disturbing system calibration and / or the flow process. When used in conjunction with the security feature, the view only menus allow an operator access to limited calibration information on the front display, excluding the ability to change system parameters without the supervisor's approval and personal security code.

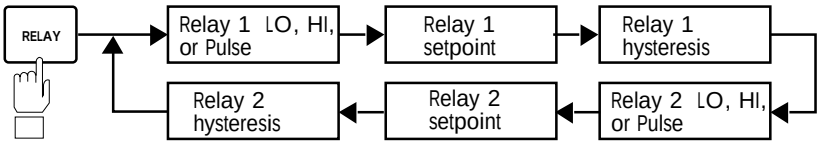
Access each of the three view only menus by pressing the corresponding menu key. After entering each of the three view only menus, each calibration parameter is sequentially displayed on the main and lower displays by successively pressing its corresponding menu key as follows:

Exiting Menus: *Exit view only menus at any time by pressing:* FLOW ◀

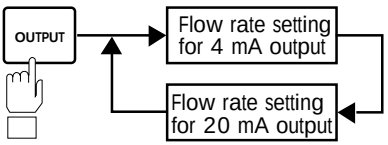
Main (CAL) view-only menu: *Frequency (iso / non-iso) input option illustrated*



Relay view-only menu: *2-Relay LO / HI output option illustrated*



Output view-only menu: *4 to 20 mA (iso / non-iso) output option illustrated*



Chapter 4

Technical Support

4.1 Accessing Internal Options

1. Remove bezel (1) by placing a coin in the notch (2), twist coin to remove the bezel from the instrument casing. See Figure 11

2. **Loosen the four front bracket screws (3)**, then loosen the center "jack-screw" (4). See Figure 12

3. Slide the electronics assembly (5) from the instrument casing. See Figure 13

4. Lift upper retainer with adhesive gasket to install / remove plug-in cards. Be sure plug-in cards are properly seated in slots before reassembling instrument. See Figure 13

Figure 11

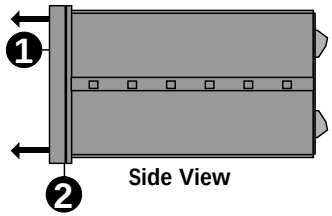


Figure 12

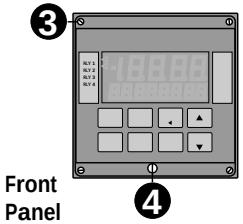
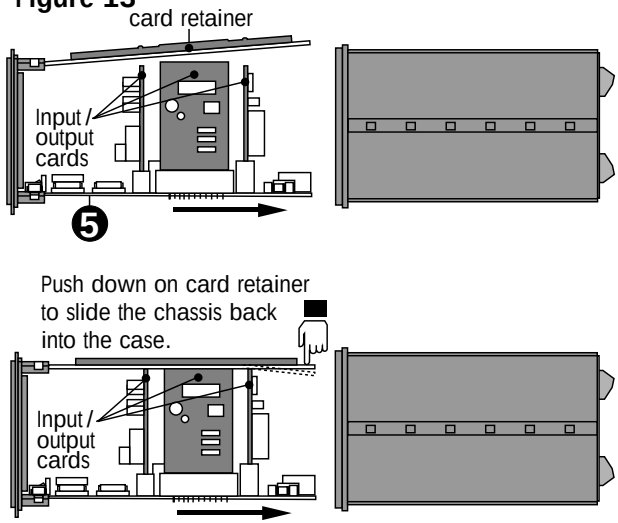


Figure 13

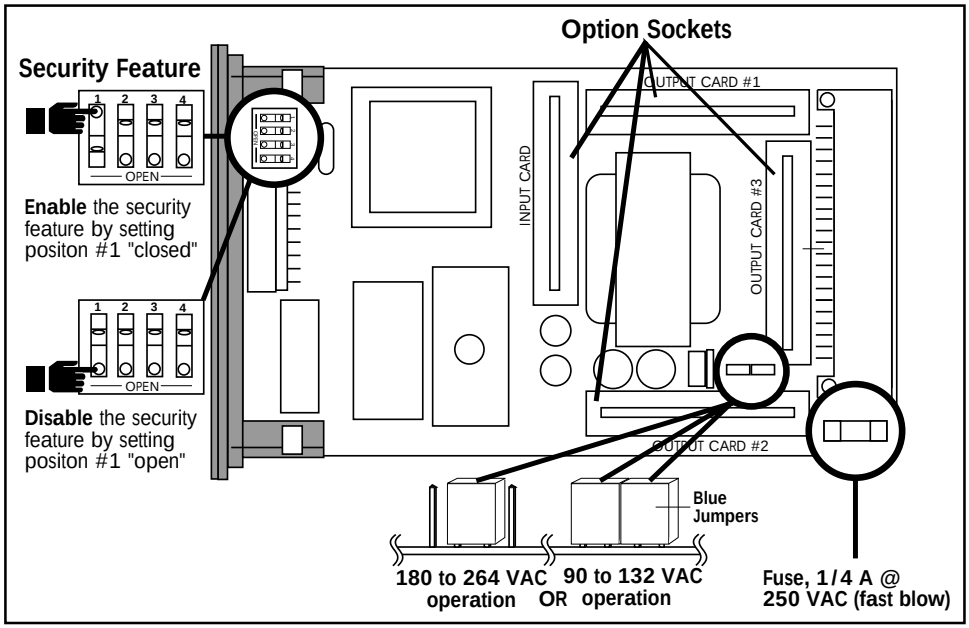


4.2 AC Power Configurations

Two AC power options are possible; 90 to 132 VAC, or 180 to 264 VAC. Each power option is selectable via internal jumpers on the main pc board. See Figure 14

Warning: *Check AC configuration before applying power to unit.*

Figure 14
Main PC Board



4.3 Installing Input/Output Options

Input/output option cards are "keyed" for proper insertion into four sockets. Sockets are located on the unit's main PC board and are clearly marked. See Figure 14 and table below:

Socket Labeled	Compatible Options
Input Card	Dedicated for input cards
Output Card #1	Accepts all analog output cards
Output Card #2	Accepts all analog output cards
Output Card #3	Dedicated for the 2-Relay output card.

4.4 Option Cards and Accessories

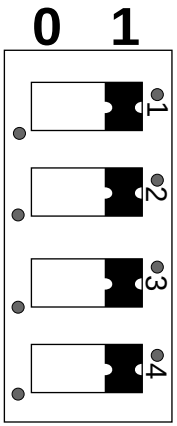
Part Number	Input Cards
FPM-9011A (requires configuration) See section 4.5	Frequency Input (non-isolated)
FPM-9012A (configuration not required)	Frequency Input (isolated)
FPM-9013A	4 to 20 / 0 to 20 mA input (isolated)
FPM-9014A	0 to 5 / 0 to 10 VDC input (isolated)
Part Number	**Output Cards**
PHOR-90-MA-N (requires configuration) See section 4.6	4 to 20 / 0 to 20 mA (non-isolated)
PHOR-90-5V-N	0 to 5 VDC (non-isolated)
PHOR-90-10V-N	0 to 10 VDC (non-isolated)
PHOR-90-MA-I (requires configuration) See section 4.6	4 to 20 / 0 to 20 mA (isolated)
PHOR-90-5V-I	0 to 5 VDC (isolated)
PHOR-90-10V-I	0 to 10 VDC (isolated)
PHOR-90-R2	2-Relay card
Part Number	**Accessories**
PHOR-9AP	OMEGA mounting adapter plate
PHOR-9RC	NEMA 4X / IP65 back cover
3-9010.650	Assorted engineering labels
3-9000.392	Conduit connector kit for NEMA 4X back cover (includes 3 connectors)

Part Number	Spare Parts
3-9000.525-1	Front bezel
3-9000.575	Panel mounting gasket
3-9000.560	Mounting Clamp
2400-0404	Front cover screws (4 each)
3-9000.570	Front cover gasket
PHOR-9FUSE	Fuse, 1 / 4 A @ 250 VAC (fast blow)

4.5 Input Card Configuration

The non-isolated Frequency Input Card requires dip switch configuration prior to operation. See Figure 15

Figure 15
Frequency (non-iso) input card dip switch settings



Frequency Input Card Dip Switch

Omega Sensor	Dip switch settings 1234	Function
FP-540 FP-2502	1011	5 VDC power to sensor with pull down resistor
FP-5300, FP-5100 TTL inputs	1111*	No power to sensor with pulldown resistor
FP-5200 FP-6000	1110	No power to sensor with no pulldown resistor
FP-5060 Series FP-5070-PV Series FP-5600 Series FP-2540 Series FMG2550 Series	1001	5 VDC power to sensor with pull up resistor

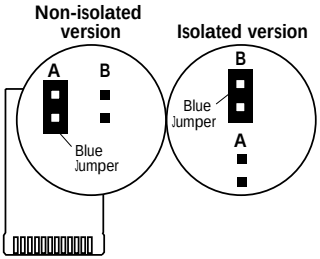
*Dip switch factory configured for the OMEGA FP-5300 Series Flow Sensors.

4.6 Output Card Configuration

Each 4 to 20 / 0 to 20 mA (iso or non-iso) output card contains jumper selections for it's operation range.

- Placing the blue jumper in the "**A**" position configures the card for 4 to 20 mA operation.
- Placing the blue jumper in the "**B**" position configures the card for 0 to 20 mA operation.

Figure 16
4 to 20 / 0 to 20 mA output cards

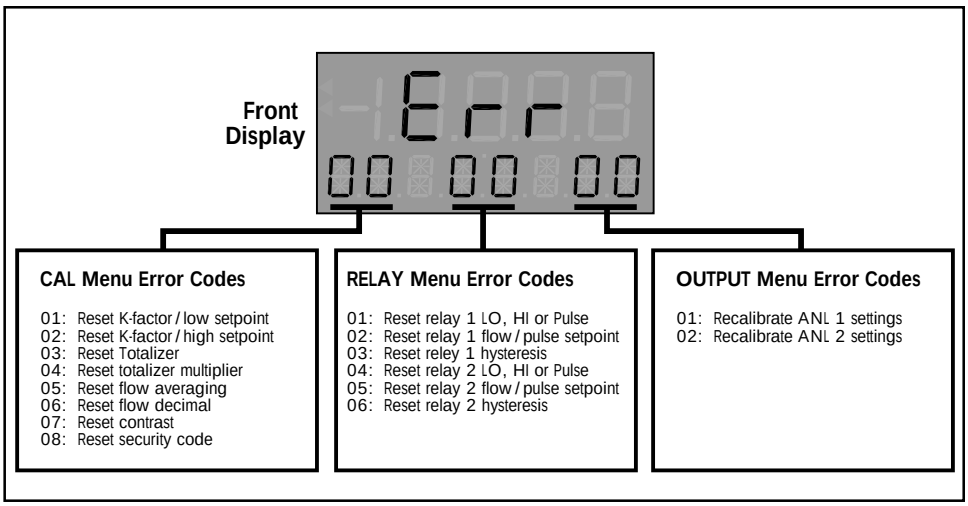


4.7 Troubleshooting

Error codes will be shown on the display after an abnormal occurrence, such as large amounts of electromagnetic interference or a large voltage transient on the AC power line occur.

Displayed error codes represent corrupted setup data in the internal memory which must be re-entered by the operator. See Figure 17.

Figure 17
Displayed error codes



Specifications

Power Requirements
17 to 30 VDC @ 0.5 A max. and / or
90 to 132 VAC @ 50 to 60 Hz or
180 to 264 VAC @ 50 to 60 Hz

Operating Temperature
0 to 55 °C (32 to 130 °F)

Relative Humidity
95% R.H. max., non-condensing

Enclosure
Materials: ABS plastic
Rating: NEMA 4X / IP65 front
NEMA 4X / IP65 rear cover (optional)
Dimensions: 3.5 X 3.5 X 6.0 in. /
88 X 88 X 165 mm

Memory Backup
Non-volatile RAM

Liquid Crystal Display
4.5 digits, 12.7 mm (0.5 in.) height (upper)
8 digits, 7.6 mm (0.3 in.) height (lower)
2 alarm annunciators
Accuracy: 0-5 kHz input, 0.05% of reading

Display Averaging
Programmable from 2 to 10 seconds

Noise Immunity
Exceeds IEC 801-2, level 3, IEC 801-3, level 2

Input Signal

Frequency (iso or non-iso):
Frequency range: 0 to 10 kHz
K-factor range: .0001 to 19999.
Minimum signal amplitude:
Non-iso freq input: 0.2 Vp-p

(continued)

Isolated freq input: 0.5 Vp-p
Isolation: 500 VDC to earth ground

Flow Current and Voltage (iso):
Input range: 4 to 20 mA or 0 to 20 mA
0 to 5 VDC or 0 to 10 VDC
Isolation: 500 VDC isolation to earth ground

Output Signals

Sensor Pulse Output
TTL compatible synchronous with sensor input
Max. current sink: 20 mA
Max. current source: 10 mA

Counter Pulse Output
Open collector transistor synchronous with totalizer
Max. current sink: 50 mA @ 30 VDC max.

2-Relay
Outputs: Two SPDT contact outputs: 5 A @ 250 VAC or 30 VDC resistive load max. current

Analog 4 to 20 or 0 to 20 mA
Response time: 2.5 s max. for 100% change
Maximum loop resistance: 425 Ω
Isolation: 500 VDC to earth ground
Accuracy: ±0.5% of full scale

Analog 0 to 5 or 0 to 10 VDC
Response time: 2.5 s max. for 100% change
Maximum loop resistance: 1 kΩ (1000 Ω)
Isolation: 500 VDC to earth ground (optional)
Accuracy: ±0.5% of full scale

Notes: