User's Guide

FV100/FV100-T Series
Installation & Operation Manual on Vortex Shedding Flowmeter & Temperature (optional) Transmitter

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

CONTENTS

Specifications

Maximum operating pressure: 300 PSIG (20 Bar)
Minimum operating pressure: See page 6 & 10 (Pressure Drop Charts)
Maximum operating temperature (fluid and ambient): 185°F (85ºC), 186°F to 210°F (85ºC to 99ºC) with reduced rating of the solid state relay.
Minimum operating temperature (fluid and ambient): 35°F (2ºC).
Maximum Flow: Meters may be over ranged, occasionally, up to 125% of capacity without damaging the meter**
**Output is clamped at 21mA, 6.3% over range, display will indicate up to 125% FS
Capacities: 3/4" 25 GPM (95 LPM); 1" 50 GPM (190 LPM); 1 1/2" 100 GPM (380 LPM); 2" 200 GPM (750 LPM)
Process Connections: NPT female
Wetted Parts: Brass, PVDF & Viton
Enclosure Rating: Type 1, 3, 4, 12, & 13, IP65
Power Requirement: 10 - 30 Vdc @ 80 mA ⎓

⚠ Caution: The unit shall be supplied by a SELV (separated extra-low voltage) source in accordance with CSA Standard C22.2 No.1010.1-92 Annex H.

Display: 3 digit LED digital display, 0.3" high

Environmental conditions: This device has been designed for use in Installation category I, pollution degree 4, at altitudes up to 2000 meters (6560 ft.), either indoors or outdoors as defined in CSA Standard C22.2 No.1010.1-92.

Flow (electrical)

Accuracy: ± 5% of Full Scale
Analog Output: 4-20 mA (600 ohm @ 24 Vdc) proportional to flow
Response Time: 1.5 seconds to 63% of step change
Repeatability: ± 0.25% of actual flow
Alarm Output: Low flow, Solid State SPST Relay, rated to 125 mA @ 30 Vdc, up to 185° F, *50 mA @ 30 Vdc between 186° F & 210° F (85-99° C)
Alarm Deadband: 5% of full scale
Alarm State: NO or NC above setpoint (selectable)
Electrical Connection: 5-pin micro dc male connector

Temperature (electrical)

Accuracy: ± 1% of Full Scale
Analog Output: 4-20 mA (600 ohm @ 24 Vdc); 4 mA= 32° F (0° C) to 20 mA = 212° F (110° C)
Response Time: 1.5 seconds to 63% of step change
Repeatability: ± 0.25% of actual temperature
Alarm Output: High temperature, Solid State SPST Relay, rated to 125 mA @ 30 Vdc, up to 185° F, *50 mA @ 30 Vdc between 185° & 210° F (85-99° C)
Alarm Deadband: 2% of full scale
Alarm State: Same as selected for Flow

OPERATION

FV100 is an inline flow meter that utilizes the vortex shedding principle. The fluid strikes a bluff body generating vortices (eddies) that move downstream. The vortices form alternately, from one side to the other. A piezoelectric sensor housed in a sensor tube directly downstream of the bluff senses the pressure zones created by the vortices. The sensor generates a frequency directly proportional to the vortices (flow). The pulses are then amplified by the circuit board and converted to a 4-20 mA output, which is also linear with flow. Flow can be displayed on the LED display in either GPM or LPM. Selection of the preferred units of measure is made from two white front panel push buttons. There is also a solid state relay output that can be set for a low flow contact from 15% to 90% of full-scale flow. The relay can be configured to be NC (normally closed) or NO (normally open) at flow (above set point). It will change state on decreasing flow upon reaching the setpoint.

FV100-T meters combine temperature measurement with the flow measuring features of **FV100 Series**. The housing utilizes a temperature sensor housed in a small thermowell directly downstream of the flow sensor. **FV100-T** meters display temperature or flow on the LED display. Temperature can be displayed in either degrees Fahrenheit or Celsius and is selectable from the two white front panel buttons. There is a 4-20 mA output proportional to temperature and a solid state relay that can be configured for a high temperature set point. The relay function will be the same as selected for flow, normally closed or normally open, **below** set point, since it is a high alarm. So, you have two transmitters in one - flow and temperature.

APPLICATIONS

FV100/FV100-T can be used on low viscosity clean or dirty water-like liquids that are compatible with brass, PVDF & Viton. Metered fluids should not include long fibers or a significant level of abrasive solids. Bluffs are replaceable, as are the sensors, should abrasive wear occur over time. Typical applications will be for cooling loops using water, 50% solutions of glycols, and water soluble machine coolant (up to 10%). These applications are found in most process industries, including rubber, steel, fabrication, manufacturing, refining, paper, chemical, food, petrochemical and power. They cannot be used on flammable liquids or gases including air.

NOTE: If this equipment is used in any manner not specified herein, the protection provided by the equipment may be impaired.

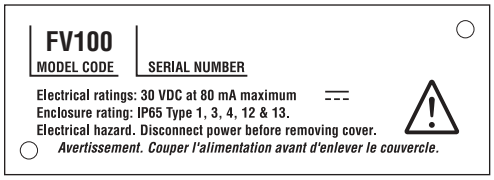
Cleaning: These meters do not require any special cleaning of the external surfaces. If cleaning is desired, do not use any strong solvents, detergents, or chemicals. Brushing away accumulations of dirt or wiping with a cloth and water is suggested.

USING THIS MANUAL

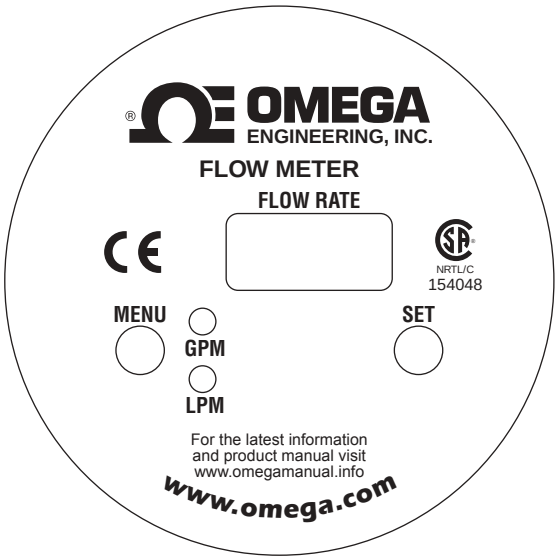
To use this manual, you will require the model code, which can be found on the nameplate of the meter, as shown on the example below. See page 10 for "**Model Codes**." The Model Code will allow you to determine the minimum & maximum flow capabilities for each as well as related pressure drops.

All **FV100** or **FV100-T** meters are equal in terms of features and functions. The only difference is the flow capacity of the various sizes.

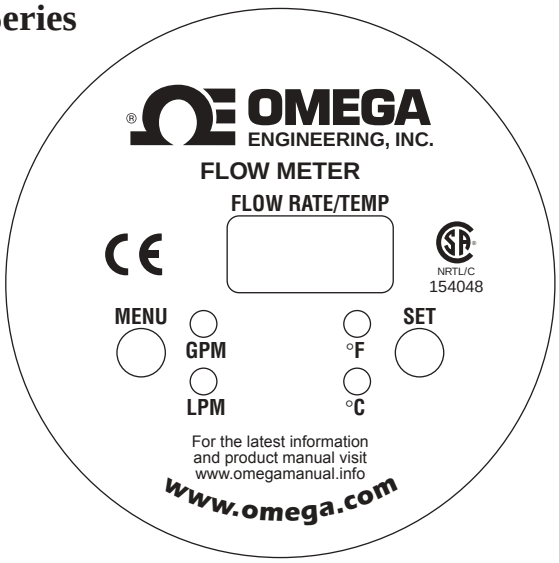
MODELPLATE EXAMPLES



FEATURES: FV100 Series



FEATURES: FV100-T Series



INSTALLATION

There are no upstream or downstream piping requirements to achieve the operating specifications given herein. The meters may be installed in any position as long as good piping installation requirements are adhered to for best results. This includes proper support of adjacent piping to minimize inherent vibrations produced within the system. Unions of the same pipe size and full port isolation ball valves may be installed for ease of removal and servicing of equipment, if required. Meters should be placed in horizontal, slightly ascending runs or vertical runs to prevent entrained air from accumulating in the meter. They should not be placed at the highest point in the piping for this same reason. Piping system should be filled slowly to prevent water hammer from damaging sensor. The meter sensor can also be damaged by reverse flow.

Isolation ball valves, when used, should be in the full open position. Throttling valves should always be placed downstream of the meter, a minimum of 10 pipe diameters downstream.

Teflon® tape or pipe sealant can be used in mounting the meter to the piping when using good technique. **Teflon**® tape, if not applied properly to the connecting piping, can become caught on the bluff and affect the flow measurement.

Use of diaphragm or piston pumps will affect metering performance, unless they are installed with a properly sized pulsation dampener and pressure control valve, to minimize pulsating flow. The piping system **must** create some backpressure on the meter to allow vortex formation and to prevent cavitation, especially at full flow. Minimum required back pressure is 10 PSIG at max flow and 70° F (21° C). Higher back pressures are required at elevated temperatures and occasional surges to 125% of max flow.

This situation will not be encountered in most installations. If while increasing the flow, the signal or displayed flow appears to drop off, but reappears when flow is reduced, contact OMEGA to determine back pressure requirements to extend the flow range to the capacity of the meter.

Electrical/Wiring/Grounding

Electrical Service: General Purpose

Electrical Classification: Non-hazardous Type 1, 2, 3, 4 (equal to IP 65), 12, & 13

Power Requirements: 24 VDC (10-30 VDC) @ 80 mA

Electrical Connections: 5-Pin micro style for FV100 or 8-Pin micro style for FV100-T, DC

Cabling: 5 or 8 Pin DC female shielded cable (do not connect shielding at the panel)

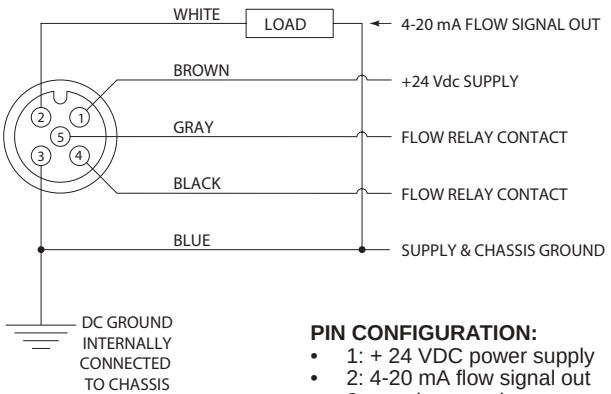
Grounding: **Note, that DC and Chassis Grounds are internally connected to eliminate electrical noise. If this poses a problem with your control wiring, please contact UFM for an alternative solution.**

Current Output: 4-20 mA (Note: Use of a 250 Ohm, 0.1%, 1/2 watt precision resistor will produce a 1-5 VDC signal for voltage input receivers)

Solid State Relay: Optically isolated, current limited to 125 mA @ 30 VDC up to 185° F (85° C), de-rated to 50 mA @ 30 VDC between 186° & 210° F (86° C to 99° C)

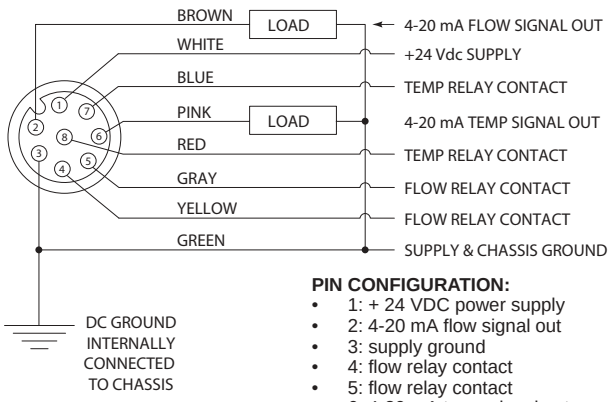
WIRING DIAGRAMS (Pin Configurations)

FV100 (FLOW ONLY)



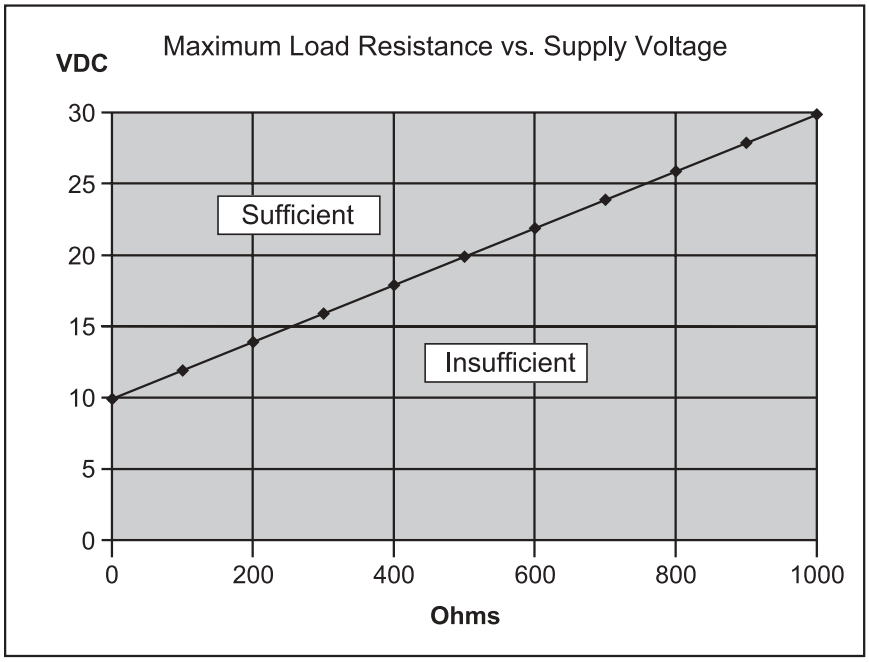
PIN CONFIGURATION:
- 1: + 24 VDC power supply
- 2: 4-20 mA flow signal out
- 3: supply ground
- 4: flow relay contact
- 5: flow relay contact

FV100-T (FLOW AND TEMPERATURE)



PIN CONFIGURATION:
- 1: + 24 VDC power supply
- 2: 4-20 mA flow signal out
- 3: supply ground
- 4: flow relay contact
- 5: flow relay contact
- 6: 4-20 mA temp signal out
- 7: temp relay contact
- 8: temp relay contact

DC Power Supply Voltage Requirements



CONFIGURATION (Setup)

FV100 comes pre-calibrated and pre-configured in Gallons Per Minute, with the Solid State Relay set for 0 flow, which inactivates the relay. To change the engineering units displayed to LPM, reset the solid state relay for a minimum flow condition, or change the relay function (nc-normally closed or no-normally open) requires a simple reconfiguration. By powering up the meter, it can be reconfigured or checked at the bench or installed position.

To configure the **FV100** display for **GPM** or **LPM**, press the **SET** button so that the LED next to the desired engineering unit is lit. To configure the set point, or alarm function, hold the **MENU** button down until the display indicates "**flo**", then "**AL**", then release it. The LED display will indicate zeros or a set point. Change the setting, by pressing the **MENU** button. Each time it is pressed, it will step the set point upwards, holding it down will ramp the set point up quickly until the desired set point is approached, then pressing discreetly will step it up to the desired setting. At the highest setting for each meter capacity, it will roll over to 0. Then as the **MENU** button is pressed it will step or ramp up if held down. Once the desired set point is displayed, use the **SET** button to enter the value.

If no set point is required, then select 0 with the **SET** button - this will inactivate the relay, as well as the local LED indicator, which flashes on reaching the set point. The two LED indicators that are adjacent to **GPM** & **LPM** flash when the flow drops to or below the set point. If **GPM** has been selected, it will remain on solid and the **LPM** indicator will flash. The opposite occurs when **LPM** is the selected unit of measure displayed.

CONFIGURATION (Setup) continued...

The next parameter, relay function, will automatically appear. It may indicate "**nc**", normally closed, or "**no**", normally open. Pressing the **MENU** button will change the relay function from one to the other. To select the desired relay condition, merely press the **SET** button. The relay function selected is at the normal flow condition, above set point. So, by selecting "**no**", the relay will be open above the set point and close on reaching the set point or lower. Conversely, if "**nc**" is selected, the relay will be closed above the set point and open at or below set point.

Once the relay function is set, the meter will return to the run mode. If no flow is present, the meter should display zeros and the LED adjacent to the unit of measure not selected will be flashing to indicate a low flow condition (unless a set point of zero was selected).

FV100-T includes the features of **FV100** plus temperature. **FV100-T** has a second set of LED's adjacent to the **SET** button. One is labeled **F**, for degrees Farenheit, and the second **C**, for degrees Celcius.

To setup the flow portion of **FV100-T**, the flow variable must be displayed. Pressing the **MENU** button one time, toggles between the displayed variables of flow and temperature. Press the **MENU** button once if temperature is the displayed variable. Then complete the setup for the flow variable as, described above under **FV100**.

To configure the temperature portion of **FV100-T** , press the **MENU** once, if the temperature variable is not displayed. Temperature, since it is being measured on power up, will be displayed as degrees **F** or **C** dependent upon the status of the LED indicators adjacent to the two units of measure. To enter a set point, hold the **MENU** button down until "**t**", then "**AL**" are displayed, consecutively. The display will then indicate the set point. To change, press the **MENU** button to step the value upward, or hold the **MENU** button down to quickly ramp up the setting, releasing as the desired value is approached, and then pressing incrementally until the set point is reached. Then press the **SET** button to enter the selected value. Again, as in the flow set point, if the set point is passed, continue holding the **MENU** button down and it will roll over to zero and continue increasing until released and incremented slowly to the desired value. After selecting the set point the meter will return to the run mode.**

****NOTE**: The relay function for temperature is the same as selected for flow. If the "**nc**", normally closed condition is selected for flow, it will also function the same way for temperature. The relay function (status) is always at the normal condition. So, if "**nc**" is selected, the relay will be closed above the flow set point and below the temperature set point. That is because we are normally looking for a low flow condition and a high temperature condition in cooling applications. When either set point is reached for flow or temperature, its respective relay will change state. **The set points, when selected in either GPM or LPM and F or C, will automatically convert to the correct value, if the other unit of measure is selected.**

FV100-T LED Indicators

The LED's adjacent to the engineering units of **GPM, LPM, F, & C** have two functions. The first is to indicate the process variable being displayed and its respective engineering unit, the second to indicate alarm conditions. If temperature is being displayed, say 75 F, then 75 will appear in the display and the LED adjacent to **F** will be lit. If the temperature would increase to its respective set point, then the actual value will be displayed, the **F** LED will remain lit and the LED adjacent to **C** would begin flashing. If, at the same time, there is a low flow condition, both LED's next to **GPM & LPM** will also flash - indicating a flow fault also, so that you can press the **MENU** button to verify the flow rate.

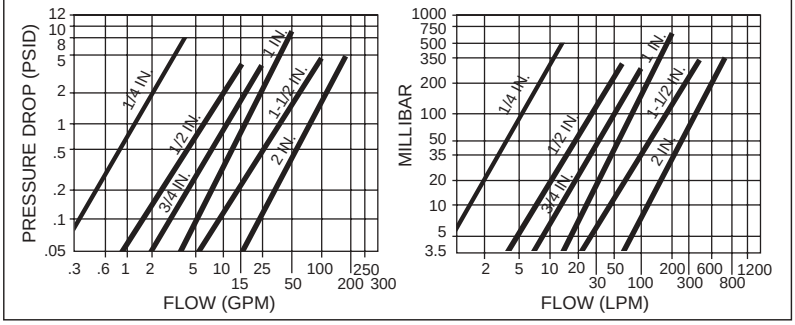
In either case, if flow or temperature is the displayed value, when a fault condition occurs on the nondisplayed value, the two indicator LED's associated with that variable will both flash to provide a local indication of a fault. The solid state relays will still function independently, also regardless of the variable being displayed. As will the 4-20 mA outputs.

MODEL CODES

MODEL CODE SELECTION

Code	Flow Only	Flow and Temperature	Pipe Size in Inches	Flow Range GPM Min	GPM Max	LPM Min	LPM Max
FV103	x		3/4	2.5	25	9	95
FV103-T		x	3/4	2.5	25	9	95
FV104	x		1	5	50	20	190
FV104-T		x	1	5	50	20	190
FV105	x		1 1/2	10	100	40	380
FV105-T		x	1 1/2	10	100	40	380
FV106	x		2	20	200	75	750
FV106-T		x	2	20	200	75	750

PRESSURE DROP CHARTS



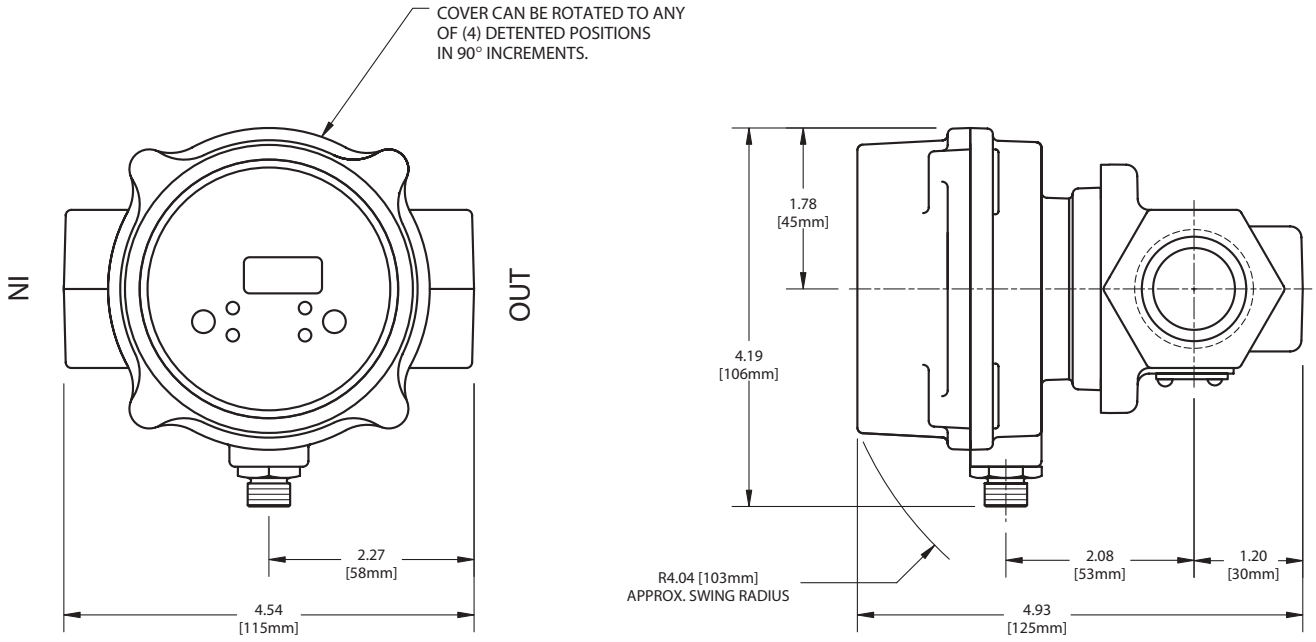
CABLING AVAILABLE with METERS

Series	Description	Length in Meters	Part Number
FV100	5 pin female	1	FV100-C1
		3	FV100-C2
		10	FV100-C3
FV100-T	8 pin female	1	FV100-CT1
		3	FV100-CT2
		10	FV100-CT3

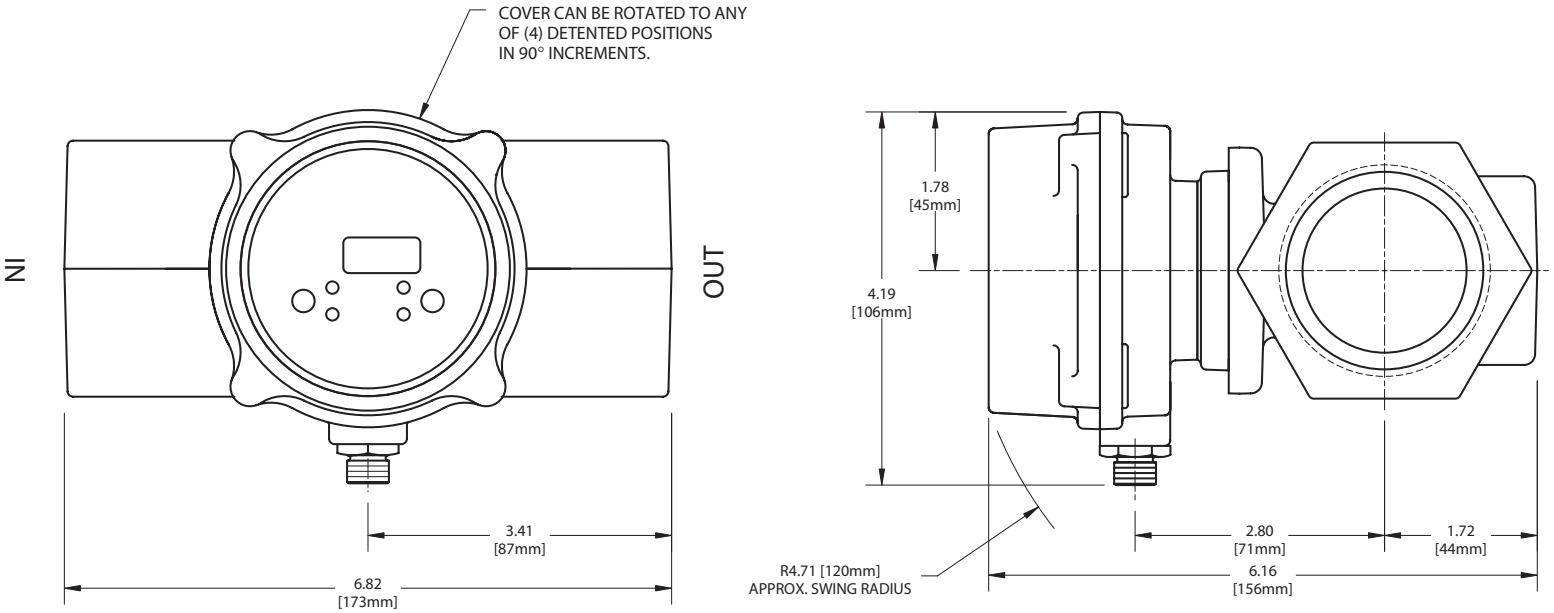
Installation Dimensions

INSTALLATION DRAWINGS						
Size	**A**	**B**	**C**	**D**	**E**	**F**
3/4" & 1"	4.54 [115mm]	2.27 [58mm]	4.04 [103mm]	2.08 [53mm]	4.19 [106mm]	1.78 [45mm]
1 1/2" & 2"	6.82 [173mm]	3.41 [87mm]	4.71 [120mm]	2.80 [71mm]	4.19 [106mm]	1.78 [45mm]

Installation Drawings, 3/4" & 1"



Installation Drawing, 1 1/2" & 2"



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA'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 having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'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 OMEGA:

1. Purchase Order 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 OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

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

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- Laboratory Heaters

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- Industrial Water & Wastewater Treatment
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