

# INSTALLATION, OPERATION AND MAINTENANCE

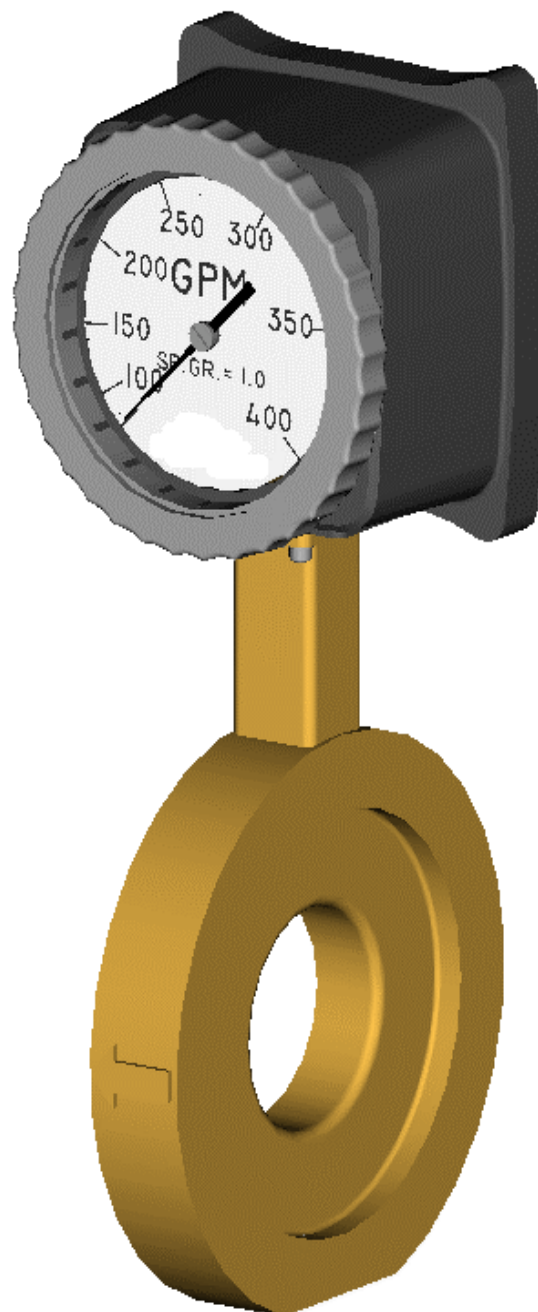
## Threaded and Wafer Style Flowmeters

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**Wafer Style Flowmeter**  
**Figure 1**

# 1.

## Principle of Operation

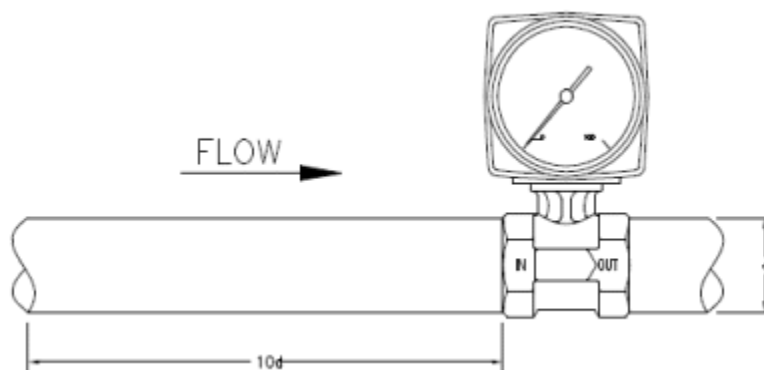
These threaded and wafer style flowmeters measure flow rate by sensing the pressure differential created across the flow nozzle which is machined into the body of the flowmeter. A pair of matched, opposed bellows sense the differential pressure and drive a mechanical linkage to indicate flow rate directly on the dial. (When fitted with a blind transmitter or digital display readout, the bellows and mechanical linkage are replaced with a solid state differential pressure sensor).

# 2.

## Installation Planning and Site Selection

Select a site which is convenient for viewing and which provides service access to the front and rear of the flowmeter. Note that the dial can be ordered in any orientation at 90 degree increments and can be easily re-oriented in the field. See "Changing the Dial Orientation" in the installation section. The site selected should provide at least 10 pipe diameters of straight meter size pipe between the flow meter inlet and any upstream fitting such as elbow, tee or valves. There are no special requirements for the downstream connections to the meter.

Note that the flow meters are calibrated based on schedule 40 pipe connections. Tubing and hoses do not have the same ID as pipe and should be transitioned to pipe at least 10 pipe diameter upstream of the flowmeter to achieve rated accuracy.



Installation Conditions  
Figure 2

Avoid placing the flow meter where it will be subjected to water hammer and mount the flowmeter rigidly to minimize shock or vibration.

Flow meters installed outdoors or exposed to splashing liquids should be ordered with a gasketed case.

**Protect from freezing liquids.**

# 3.

## Installation

### 3.1 Safety Considerations

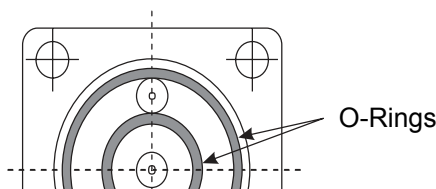
**Do not exceed the pressure and temperature limits marked on the nameplate of the flow meter. Although each flow meter is pressure tested to 150% of nameplate rating, overpressure may cause injury, leaking or flow meter damage.**

Temperature ratings are determined by the effects on the mechanical linkage, elastomer seals and electronics (if electronics are fitted). If temperature ratings are exceeded, the flow meter may be damaged or fail. Contact the factory for application assistance for expanded temperature operation.

### 3.2 Changing the Dial Orientation

Note the flow direction arrows on the body. If necessary, change the dial facing direction by removing the four screws holding the body to the housing. **Do not remove the two screws holding the housing to the cell block assembly.**

Position the housing at any 90 degree position. Replace the four screws taking care not to pinch the o-ring seals.



O-Ring Installation  
Figure 3

### 3.3 Changing from Horizontal to Vertical or Vertical to Horizontal

#### ABS Housing

Remove the lens by rotating counter-clockwise by hand. **Do not remove the pointer.** Move the dial forward gently by prying with a small knife at the 12:00 o'clock position. Rotate the dial to the desired viewing position and push the dial into position. There are 4 locating indents on the dial edge and housing to position the dial at 90 degree increments.

#### Aluminum Housing

Using a small screwdriver blade to lift the end of the retainer ring up and out of the housing recess, remove the retainer ring and dial crystal. **Do not remove the pointer.** Remove the two screws holding the dial and rotate the dial to the desired viewing position. Reinstall the screws to hold the dial in position. It may be necessary to shorten the screws to approximately 1/8" (3mm) to avoid contact with gear movement.

#### Either Housing

Rezero the flow meter using the FINE ADJUSTMENT procedure.

### 3.4 Threaded Bodies

Make up thread joints using a suitable sealant. Be sure threads are clean and free of burrs before making up joint.

### 3.5 Wafer Style Bodies

Install the flow meter between mating flanges. Take care to center the gaskets so that they do not protrude at all into the pipeline which will cause significant error.

# 4.

## Operation and Maintenance

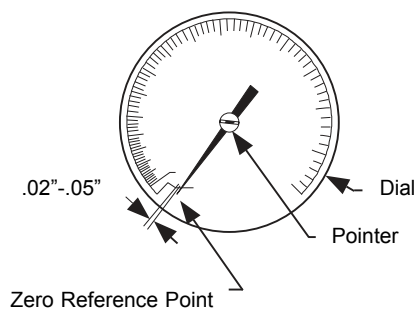
### 4.1 Preventative Maintenance

The flow meter does not require routine lubrication or service of any kind. Keep the interior of the flow meter housing clean and free of dust, moisture, oils or corrosive materials. Protect the flow meter from dripping or splashing corrosives or solvents which may attack meter exterior and eventually damage the internal mechanism.

### 4.2 Checking Zero

Water hammer or pressure surges can displace the bellows and cause the zero to shift. If the pointer does not return to the zero reference point when flow through the meter is zero, or if the pointer does not move away from the zero reference point at 12-15% of full scale flow, then check the zero adjustment as follows:

- Stop flow.
- Remove the lens
- Observe the position taken by the pointer. When properly adjusted, the pointer should point to the zero reference point as shown in Figure 4.
- If the pointer is positioned within 1/2" (12mm) of zero reference point, then follow FINE ADJUSTMENT procedure to re-zero flow meter.
- If the pointer is positioned more than 1/2" (12mm) from the zero reference point, then follow the COARSE ADJUSTMENT procedure.



Zero Reference Point

Figure 4



Pointer Preload

Figure 5

### 4.3 Checking the Pointer Preload

If the fine adjustment has been performed repeatedly, the pointer return spring preload should be checked. Manually rotate the pointer CCW toward full scale. The pointer should stop at full scale. If the pointer goes beyond full scale, adjust with the cam nut following the COARSE ADJUSTMENT procedure. Otherwise, go to the FINE ADJUSTMENT procedure.

### 4.4 Coarse Zero Adjustment

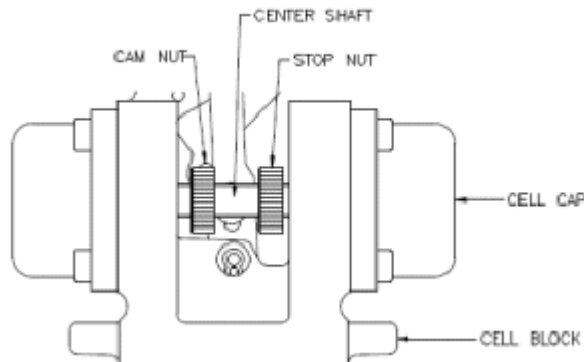
If necessary to restore spring preload, place a small screwdriver in the slotted pointer hub. Grip the pointer close to the hub on both sides of the hub and rotate the hub approximately one-quarter turn clockwise with respect to the pointer. Check preload by rotating the pointer CCW toward full scale. When properly adjusted, the pointer should stop at full scale.

# 4.

## Operation and Maintenance (Continued)

Release the pointer. Using the cam nut, adjust the lever so that the pointer points to the zero reference point.

Check the position of the stop nut. Applying force to the stop nut, manually move the center shaft to the right (as seen from the rear) and make certain that the stop nut contacts the cell block when the pointer stops. If necessary, adjust the stop nut to stop the pointer near the 6 o'clock position. The factory set point is the "U" in "USA".



Cam Nut and Stop Nut

Figure 6

**IMPORTANT: The stop nut must stop the center shaft movement before the bellows hit the cell cap. If the bellows hit the cell cap, the bellows or cap can be damaged causing leaking or meter error.**

Adjust the cam nut until the pointer points at the zero reference point. Gently tap the flow meter housing to overcome residual friction while making the adjustment.

Test for freedom of the pointer movement by rotating the pointer approximately 30 degrees and releasing. Pointer should return quickly to the zero reference point. Clean and reinstall the lens.

### 4.5 Fine Zero Adjustment

*Note: if fitted with 4-wire transmitter or with reed switches, do not use this procedure. Do all adjustments with the coarse zero adjustment. Adjustment of the zero using this method will require recalibration of the reed switches or transmitter.*

Grip the pointer close to the hub on both sides of the hub and rotate the hub with respect to the pointer. The pointer should aim directly at the "zero reference point" printed on the dial as shown in figure 4.

Gently tap the flow meter housing to overcome residual friction while making the adjustment. Test for freedom of pointer movement by rotating the pointer approximately 30 degrees and releasing. Pointer should return quickly to zero reference. Clean and reinstall lens.

### 4.6 Flow Calibration

The orifice has been factory adjusted to provide the proper differential pressure for accurate flow meter operation. NIST traceable certifications are available when ordered prior to shipment or may be obtained by returning the flow meter for recalibration. Field calibration may be verified using the following procedure:

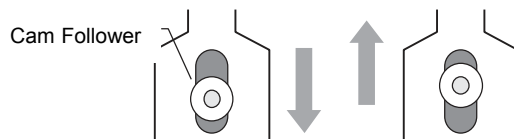
Check the zero adjustment of the pointer. Cycle the flow rate from zero to full scale three to four times and observe the pointer motion. Pointer should return to zero smoothly.

# 4.

## Operation and Maintenance

Establish a known flow rate through the flow meter corresponding to approximately 90% of full scale and observe the flow meter indication. Move the camfollower up to decrease the pointer indication or down to increase the pointer indication.

To move the cam follower up, rest a screwdriver on the cell block with the blade between the cell block and center shaft. Pry gently up on the cam follower. To move the cam follower down, place the screwdriver on top of the cam follower. With the blade resting against the case press gently down. Take care not to put excessive forward pressure on the cam follower to prevent the "C" clip on the pivot shaft from coming off. Re-zero the flow meter using the cam nut.



**Cam Follower Adjustment**

**Figure 7**

Check flow meter indication at 50% of full scale. The flow meter should indicate actual flow rate within 3% of full scale. If meter does not indicate actual flow, consult factory.

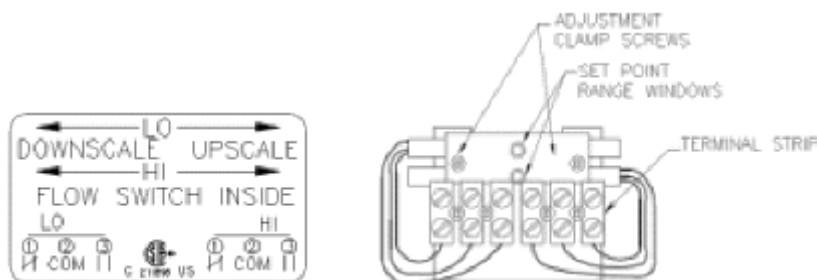
### 4.7 Cleaning of Pressure Ports

Remove the flow meter housing from the body by removing the 4 screws. Remove the pulsation snubbers from the body by inserting a small wood screw into the hole in the pulsation snubbers and gently pull them out. Clean the passages in the body and snubbers and reassemble. If you are unable to clean without further disassembly, the flow meter should be returned to the factory for service.

Reassemble the flow meter housing to the body in the desired viewing position. Take care to properly seat the inner and outer o-rings before tightening screws.

### 4.8 Adjustment of Reed Switches

Check the flow meter zero and correct if necessary using the coarse or fine zero procedure before proceeding. Connect continuity tester to N.O. contact. Loosen the switch clamp. Establish the desired flow rate for switch tripping. Slide the switch to the left most position. Range window should show a partial or complete green mark. Slowly slide to the right while monitoring N.O. contact. Switch will close. Continue to slide to the right. Switch will open (false trigger). Continue to slide right until switch closes again. Adjust by sliding to the right to raise set point, left to lower. Tighten clamp. Note: Tiny adjustments may be required to reach the desired set point.



**Reed Switch Adjustment**

**Figure 8**

# 5.

## Trouble-shooting

### 5.1 Pointer Fluctuation

Mechanical fluctuation of the pointer is usually a symptom of excessive turbulence in the pipeline. This is frequently caused by valves or fittings installed too close to the flow meter inlet. If moving the meter is not practical, snubbers with smaller holes (heavy duty snubbers) can be installed to increase the mechanical dampening of the flow meter. (Pulsation snubbers are installed standard on all gas flowmeters and on liquid flow meters unless ordered with viscosity correction).

### 5.2 Zero Shift

The need to frequently re-zero the flow meter is an indication of excessive water hammer. Piping or operating procedures should be changed to reduce water hammer in order to prolong the life of the flowmeter.

### 5.3 Sluggish Meter Response

Sluggish flow meter response can be caused by inadequate pointer return spring preload or by clogging of the pressure passages with debris. To check spring preload, see CLEANING OF PRESSURE PORTS.

# 6.

## Correction Factors

### 6.1 Liquid Service

If the specific gravity of the fluid being metered differs from the value marked on the flowmeter dial, a correction factor, J, must be applied to the flow meter reading to obtain the actual flow rate.

Actual flow rate = J x flow meter reading

where:

$$J = \sqrt{\frac{S_c}{S_a}}$$

$S_c$  = Specific Gravity for which the flow meter is calibrated

$S_a$  = Actual specific gravity of the fluid being metered.

Example:

Flow meter, calibrated for water (specific gravity = 1.0) reads 12.5 GPM for a lubricating oil with a specific gravity of 0.85. What is the actual flow rate?

$$J = \sqrt{\frac{1.0}{0.85}} = \sqrt{1.1765} = 1.085$$

Therefore, actual flow = 1.085 x 12.5 = 13.56 GPM



# 6.

## Correction Factors (Continued)

### 6.2 Compressed Gas Service

If the gas pressure or temperature varies from the values marked on the flow meter dial, then a correction factor, K, must be applied to the flow meter reading to obtain the actual flow rate.

Actual flow rate = K x flow meter reading

where:

$$K = \sqrt{\left(\frac{(Pa + 14.7)}{(Pc + 14.7)}\right) \left(\frac{(Tc + 460)}{(Ta + 460)}\right)}$$

Pa = Actual gas pressure at inlet to flow meter, psig

Pc = Calibrated gas pressure marked on the flow meter dial, psig

Ta = Actual gas temperature at inlet to flow meter, °F

Tc = Calibrated gas temperature marked on the flow meter dial, °F

Example:

Flow meter calibrated for compressed gas air at 100°F and 80 psig, reads 100 SCFM at an actual temperature of 70°F and pressure of 85 psig. What is the actual flow rate?

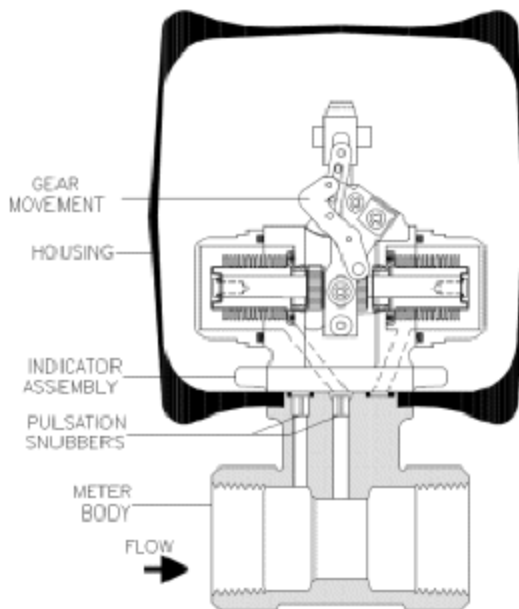
$$K = \sqrt{\left(\frac{(85 + 14.7)}{(80 + 14.7)}\right) \left(\frac{(100 + 460)}{(70 + 460)}\right)}$$

$$K = \sqrt{(1.05)(1.06)} = 1.05$$

Therefore, actual flow rate = 1.05 x 100 = 105 SCFM

# 7.

## Cutaway View



**Cutaway View Front  
Figure 9**