Flow Monitor Installation and Maintenance Instructions for Vane and Piston Style Variable Area Flow Monitors

See our Website for a copy of the Warranty Statement at www.flowmeters.com or give us a call at 248/542-9635 to have one sent.
Installation and Instruction Manual for
Universal Flow Monitors, Inc. Flow Monitors

The following manual includes the installation and maintenance instructions for flow meters manufactured by Universal Flow Monitors Inc. All flow monitors are individually calibrated for use with a specific fluid requested in the order entry process. Different fluids should not be used without first consulting the factory to verify compatibility of materials and flow parameters, such as viscosity and specific gravity for liquids, or operating pressure, temperature and specific gravity for gases, of the new application. Meter designs are of the variable-area type and operate with a relatively low, pressure drop. The flow elements are either a swinging vane or a repositioning piston.

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How the swinging-vane design works
Fluid enters at A, passes around the semi-circular vane B, exits at outlet C. The vane resists the flow because of the spring D. The further the vane is pushed the larger the passageway E becomes. This minimizes the increase in pressure drop. The vane shaft turns to operate the pointer F and remote signal devices such as the switch G. The shaft can also turn switch cams and transducers to actuate any remote readout devices present.

How the piston design works
Fluid flow causes a spring-loaded piston A having a circular opening at its center B to move along the axis of a precision-tapered shaft C. This creates a variable orifice in direct proportion to the flow rate. The equilibrium position of the piston is mechanically linked to the readout pointer D, and the strong force developed as fluid pressure acts on a large piston area that easily actuates the readout device E. Pressure drop increases over rated flow range, averaging 3 PSI.

How the in-line piston design works
Fluid flow causes a spring-loaded piston A having a circular opening at its center B to move along the axis of a precision-tapered shaft C. This creates a variable orifice in direct proportion to the flow rate. The piston is mechanically linked to the readout pointer D and actuates switch E or a transmitter (not shown). Pressure drop increases over rated flow range, averaging 3 PSI.

Installation
These are in-line devices that can be mounted in any position without affecting performance. First, attach the meter at the port marked “in” by the appropriate means (threaded or flanged) ensuring the flow goes into that port. When threading pipe into a cast iron meter, do not use teflon tape to seal the pipe threads. Then connect the meter at the “out” port. The installation diagrams on pages 10-13 give the critical mounting dimensions. To insure maximum accuracy, install control valves downstream of the flow meter. Units may have visual indication of flow only, or use a variety of switches, potentiometers, transmitters, or pneumatic switches.
Setting Single Electrical Switches

Usually the switches are set at the factory as indicated in the model code on the nameplate, or as indicated on an attached paper tag. To reset the switch point for common switch options 1, 1B, 3, 11, 53, 61, and 71, proceed as follows.

**Warning:** Shut off the electric power to the control box before opening it.

1. Remove the nameplate, window, and gasket from the control box.
2. The cam that actuates the switch is located just under the pointer. The position of the cam dictates the flow rate at which the cam will trip the switch.
3. Turn the pointer so that it points at the desired flow rate on the scale. Against low spring forces you can do this by grasping the pointer itself (and holding it in position while you adjust the cam).

**NOTE:** Some flow meters with higher spring forces (medium, large, and extra large vane style) have an extended shaft which provides a means of manually moving the vane and simulating flow. A wrench (supplied with those units) is used to turn an extension of the shaft located at the back of the unit, opposite from the control box. Flow meters with very high spring force and no extended shaft (typically MN, MM, MH, series) can be handled by *removing the bowl (under the housing).*

**WARNING:** Isolate meter from process and be sure to bleed off any remaining pressure, as well as purge the line of any hazardous chemical prior to removing the bowl.

To maintain factory calibration accuracy, mark the bowl mounting orientation and replace the bowl in the same position after the cam is properly adjusted. The vane is then grasped and turned. To get the edge of the vane out of its recessed seat, use a socket head screw wrench as a lever, inserting it into one of the vane set screws to rotate the vane. To properly set the cam, the set point must be approached from the normal flow condition. I.E., a low flow contact is set for decreasing flow by moving the indicator above the low flow set point and adjusting the cam to activate or deactivate the switch just as it arrives at the low flow setting. To set the cam for an increasing set point, the cam is adjusted to activate/deactivate the switch as it approaches the set point from zero. 4. While holding the pointer/shaft/vane in the desired position, depress the cam ring fully (approx. 1/16 inch) and rotate it until the switch actuates (clicks). Release your downward pressure and the cam ring will lock at that position.

5. If you can’t hear the switch click, you can determine contact closure with an ohmmeter connected across the switch terminals. Connect to the common and normally open or normally close on the switch.

6. To check the setting, direct the pointer again to the desired flow rate, noting where the switch actuates. Make adjustments as necessary. If the bowl was removed please place on guide roll pins and firmly tighten, in a X motion.

7. It’s much easier to set the switch point if you can do it with actual flow present. Adjust the flow to the desired point where you want a signal to occur and turn the cam to actuate the switch as outlined above.

8. Replace window, nameplate, and gasket before turning on electric power.

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**Exploded View**

Single switch assembly

* NOTE: It is recommended that all Teflon bowl seals be replaced when bowl is removed. This is symbol "T" found in model code. (ex. MN-IIT-etc.)
Setting Dual Electrical Switches
Cam Set Screw Adjustment
For switch options 2, 2B, 4, 7C, 17, 17C, 18, 18C, 19, 19C, 30, 31, 54, 62, and 72, cams are supplied with set screws for adjustment. Dual switch units have two independent cams, stacked one on top of the other.

**WARNING:** Shut off electric power to control box before removing control box cover.

1. Remove the nameplate, window, and gasket from the control box.
2. With a 5/16 nut driver remove upper switch from control box.
3. Using a 1/8" hex wrench*, loosen lower cam screw just enough to rotate cam.
4. Turn the pointer so that it points at the desired flow rate on the scale. Against low spring forces you can do this by using a screwdriver and turning the pointer screw (and holding it in position while you adjust the cam).

**NOTE:** Some flow meters with higher spring forces (medium, large, and extra large vane style) have an opening on the opposite side of the meter from the control box. A wrench (supplied with those units) can be used to turn an extension of the shaft. Flow meters with very high spring force and no extended shaft (medium) can be changed by removing the bowl (under the housing).

**WARNING:** Isolate meter from process and be sure to bleed off any remaining pressure, as well as purge the line of any hazardous chemical prior to removing the bowl.

To maintain factory calibration accuracy, mark the bowl mounting orientation and replace the bowl in the same position after the cams are properly adjusted. The vane is then grasped and turned. To get the edge of the vane out of its recessed seat, use a socket head screw wrench as a lever, inserting it into one of the vane set screws to rotate the vane. To properly set the cam, the set point must be approached from the normal flow condition. I.E., a low flow contact is set for decreasing flow by moving the indicator above the low flow set point and adjusting the cam to activate or deactivate the switch just as it arrives at the low flow setting. To set the cam for an increasing set point, the cam is adjusted to activate/deactivate the switch as it approaches the set point from zero.

5. While holding the pointer, shaft and vane in the desired position, rotate the bottom cam until it actuates the bottom switch (switch will click). Still holding the pointer, shaft and vane in the desired position, tighten the cam screw with a hex wrench. **NOTE:** If you cannot hear the switch click, you can determine contact closure with an ohmmeter connected across the switch terminals. The lower switch is now set.
6. To check the setting, move the pointer again to the desired flow rate, noting where the switch actuates. Make adjustments as necessary.
7. It's much easier to set the switch point if you can do it with actual flow present. Adjust the flow to the desired point where you want a signal to occur and turn the cam to actuate the switch as outlined above.
8. Place upper switch back into position in control box.
9. Again using a 1/8" hex wrench loosen upper cam just enough to rotate on dial.
10. Repeat steps 4 through 6.
11. Replace the gasket, window and nameplate before turning electrical power on.

*Due to control box space constraints, the supplied 1/8 inch hex wrench has been modified by grinding down the short end of the wrench. Additional modified wrenches can be obtained through UNIVERSAL FLOW MONITORS, consult factory.

**Exploded View**
Dual switch assembly
WARNING: Instrument to AC power lines constitute a potential electric shock to users. Make certain that the branch circuit is disconnected from the power supply before touching anything inside the control box.

Electric Switch Wiring Diagrams
Make connections according to the appropriate diagram below. (Switches may be removed to facilitate wiring them.)

Pneumatic Switch Option
Universal's pneumatic switch option gives you reliable air-operated remote signalling. The switch is available on all Universal flow monitors. The unit is actually a cam-operated 5-port multi-purpose 4-way valve with flow paths that can be optionally connected, to supply ON-OFF signals.

The valve has a hardened stainless steel packless spool sliding in an electronics nickel plated body. The unit is best used with instrument air. In any case, the air must be clean and dry. Connection is simplified with its push-on type barb tube connectors. No tubing inserts, ferrules, collars, seals, or threads are required. (Tubing should be 1/8" I.D.) The unit comes mounted in the standard flow monitor control box.

Operation
The operation of this switch is the same as directional valves commonly used to direct flow to air cylinders, motors, and similar devices. The function of the switch is to provide air control signals to activate a remote and/or pilot-operated signalling device, or as part of a logic circuit.

ON-OFF Signalling
For simple ON-OFF operation of the valve, to signal a low-flow condition, just three ports are utilized. (See simplified fluid power symbol.) Port 3 is the "IN" port, port 4 is the "OUT" port, and port 5 is the "Exhaust" port.

When flow is above the minimum level required (above the switch point), the valve is held in the cam-controlled position, routing the air to exhaust. So the control box is purged with instrument air during normal operation. When flow falls below the switch point, the valve shifts to the spring-controlled position. Port 3 to 4 is then connected, completing the circuit to the signaling device.

Cam-controlled position shown at left, spring-controlled position at right.
Periodic Maintenance
Periodic maintenance (Vane type meters)
Check the meter function by varying flow though it and observing if the flow indications are tracking. If not, there may be an obstruction around the flow sensing element.

**CAUTION:** Shut off flow to the meter and bleed off pressure prior to disassembly. The meter may also have to be purged if it is metering hazardous materials.

Mark position of bowl on both the body and bowl to ensure reassembly in the proper position. Open the flow chamber as show in the diagram. Check for obstructions and remove any. If the vane is in good condition (not pitted or corroded), and the spring is intact, it is likely the original calibration is still good. Reassemble the meter, matching the marks previously made on the bowl and meter body, and continue the operation. Actual verification of flow accuracy requires a flow prover or calibration flow test stand.

If there is no sign of corrosion or blockage and the flow element is still frozen in place, it is likely that the O-rings have been chemically attacked. If the attack is not likely to be repeated, then replacement O-rings can be ordered as a seal kit. If the chemical attack is due to a permanent change in fluid conditions, then the meter must be rebuilt using new O-rings of a different material. Please consult the factory when making this selection. It is also possible that gaskets, switches, control box mechanical moving parts and O-rings may become damaged and need replacement. Select these parts kits from page 12-28 according to the flow meter model number.

Periodic Maintenance (Piston type meters)
In the piston design, individual springs cannot be changed. All internal parts are contained in a replaceable capsule, including a piston, piston seal, and stainless steel spring. The capsule is easily removed to correct a malfunction or to change the flow range, as follows:

**CAUTION:** Shut off flow to the meter and bleed off pressure prior to disassembly. The meter may also have to be purged if it is metering hazardous materials.

Loosen the four cap screws from the lower end cap, and pull the end cap and attached flow sensing capsule out of the housing. The capsule may be cleaned by flushing in a liquid, or by a blast of compressed air. However, we do not recommend disassembly of the capsule. Before installing a cleaned or replacement capsule, clean the interior of the housing with a rag or brush. The tell-tale arm that controls the motion of the pointer must be held out of the way while the capsule is installed. This is done by removing the name plate from the control box, and moving the pointer, by hand, in the direction of maximum scale reading while slipping the capsule and end cap into position. The pointer may then be released, the end cap tightened, and the face plate reinstalled. If your model number contains a “Z,” followed by digits, you have a non-standard option. Please contact the factory for an explanation of your complete model number.
Periodic Maintenance (In-Line Piston type meters)
In the in-line piston design, individual springs cannot be changed. Internal parts include a piston, piston seal, orifice plate, orifice plate o-ring, piston guide and stainless steel springs. The components are easily removed to correct a malfunction or to change the flow range, as follows:

CAUTION: Shut off flow to the meter and bleed off pressure prior to disassembly. The meter may also have to be purged if it is metering hazardous materials.

Loosen the six cap screws from the end cap, and pull the end cap and attached flow sensing piston out of the housing. Remove the two stainless steel springs. The piston and springs may be cleaned by flushing in a liquid, or by a blast of compressed air. However, we do not recommend disassembly of the piston. Before installing a cleaned or replacement piston and springs, clean the interior of the housing with a rag or brush. The tell-tale arm that controls the motion of the pointer must be held out of the way while the capsule is installed. This is done by removing the name plate from the control box, and moving the pointer, by hand, in the direction of maximum scale reading while slipping the springs, piston, and end cap into position. The pointer may then be released, the end cap tightened, and the face plate reinstalled. If your model number contains a “Z,” followed by digits, you have a non-standard option. Please contact the factory for an explanation of your complete model number.
**Calibration Notes**

If the flowmeter will be used to measure flows at varying pressures (as in applications for portable meters) a standard unit calibrated for 90 psig @ 70°F is supplied, and correction factors from Table 1 are applied against the readings to get actual SCFM.

If the flowmeter is to measure air at a constant and repeatable pressure, it will be factory calibrated to read directly in actual SCFM, with air temperature assumed to be 70°F. Readings taken with air at other than 70°F can be corrected by using the correction factors in Table 2.

<table>
<thead>
<tr>
<th>Table 1 Pressure</th>
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<tbody>
<tr>
<td>PSIG</td>
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<tr>
<td>Factor</td>
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<table>
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<tr>
<th>Table 2 Temperature</th>
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<tbody>
<tr>
<td>Temp °F</td>
</tr>
<tr>
<td>Factor</td>
</tr>
</tbody>
</table>

\[
\frac{\sqrt{\frac{14.7}{14.7 + 90.0}} \cdot \sqrt{\frac{14.7}{14.7 + X}}}{X = \text{System Pressure}}
\]
Dimensional Information

"A" Style Control Box

"R" Style Control Box

"T" Style Control Box
**Piston Body**

**Small Body**

<table>
<thead>
<tr>
<th>CONTROL BOX STYLE</th>
<th>&quot;A&quot; BOX</th>
<th>&quot;M&quot; BOX</th>
<th>&quot;R&quot; BOX</th>
<th>&quot;T&quot; BOX</th>
<th>&quot;X&quot; BOX</th>
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<tbody>
<tr>
<td>DIM &quot;R1&quot;</td>
<td>5.62</td>
<td>5.06</td>
<td>7.25</td>
<td>7.00</td>
<td>8.38</td>
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<td>DIM &quot;R2&quot;</td>
<td>5.06</td>
<td>5.68</td>
<td>6.68</td>
<td>6.50</td>
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DIM "R1" SWING RADIUS (TO CONTROL BOX)

DIM "R2" SWING RADIUS (TO CONTROL BOX)
In-Line Piston Body

CONTROL BOX STYLE

<table>
<thead>
<tr>
<th>CONTROL BOX STYLE</th>
<th>&quot;A&quot;, &quot;L&quot; OR &quot;Z&quot; BOX</th>
<th>&quot;T&quot; BOX</th>
<th>&quot;R&quot; BOX</th>
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<td>7.20</td>
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<td></td>
<td></td>
<td></td>
<td>8.08 FOR 2 SWITCHES &amp; 2 JUNCTION BOXES 8.08 FOR ALL OTHER OPTIONS</td>
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MX Body

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<th>&quot;M&quot; BOX</th>
<th>&quot;R&quot; BOX</th>
<th>&quot;T&quot; BOX</th>
<th>&quot;X&quot; BOX</th>
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<td>DIM &quot;C&quot;</td>
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<td>6.75</td>
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MH Body

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<th>&quot;R&quot; BOX</th>
<th>&quot;T&quot; BOX</th>
<th>&quot;X&quot; BOX</th>
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<tr>
<td>DIM &quot;B&quot;</td>
<td>6.12</td>
<td>7.56</td>
<td>9.62</td>
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**CONTROL BOX STYLE**

<table>
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<tr>
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<th>R/ BOX</th>
<th>T/ BOX</th>
<th>X/ BOX</th>
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<tbody>
<tr>
<td>DIM &quot;C&quot;</td>
<td>3.38</td>
<td>3.88</td>
<td>4.00</td>
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**Large Body**

- **WRENCH PORT TO JOG SWINGING VANE**
- **DIM "C"**: 10.81

**XHF Body**

- **WRENCH PORT (TO JOG SWINGING VANE)**
- **DIM "C"**: 15.25

**CONTROL BOX STYLE**

<table>
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<tr>
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<th>R/ BOX</th>
<th>T/ BOX</th>
<th>X/ BOX</th>
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<tbody>
<tr>
<td>DIM &quot;C&quot;</td>
<td>10.69</td>
<td>10.31</td>
<td>11.25</td>
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NOTICE
RETURN MATERIAL AUTHORIZATION
Please read the following UFM policy information carefully. By following the guidelines outlined below you will assist in providing a timely evaluation and response regarding the status of your flow meter. UFM evaluates all AUTHORIZED RETURNED MATERIALS in a timely manner and will promptly provide notification regarding the status of the related materials and/or a written quotation indicating the total charges and description of the necessary repairs.

1. All returns must have a RMA form completed by the customer.
2. Any meter returned that was previously in service must have the OSHA requirements completed and a MSDS included where applicable.
3. An RMA number will only be issued when UFM has received a copy of the completed RMA form and any applicable MSDS.
4. A “Return Goods” shipping label (located in the back of the Instruction Manual) must be used for returning materials to UFM.
5. A purchase order must accompany all returns to cover the cost of the repair evaluations.
6. Returned goods must be shipped prepaid or they will be rejected.

REPAIRABLE MATERIAL
Written authorization to proceed with the repair under the assigned Purchase Order, must be received within 30 days of repair quotation. If the unit(s) are repaired, the $90.00 evaluation charge will be applied to the quoted repair costs. If no repairs are authorized within this 30 day period, the customer will be billed $90.00 plus shipping charges and the materials will be returned to the customer.

NON-REPAIRABLE MATERIAL
A written notice that the material is not repairable will be provided to the customer by UFM. If no disposition to scrap or return the material is received from the customer within 30 days, unreparable material will be scrapped and the customer will be billed the $90.00 evaluation charge. If a UFM replacement unit is purchased within 30 days of non-repairable condition notice, the $90.00 evaluation fee will be waived. The return of non-repairable materials may be ordered by customer Purchase Order providing for shipping and handling charges.

RETURN FOR RESTOCK
All goods returned for restock adjustment must be:
A. New and unused.
B. Returned to the factory within ONE YEAR of date of original shipment.
C. Returned through the distributor where the goods were originally purchased.
This material will also be subject to an evaluation charge of $90.00 and must be accompanied by a Purchase Order. The customer will be advised of the restocking adjustment for all restockable goods. Upon acceptance of the restocking adjustment, by the customer, the $90.00 evaluation fee will be waived and a credit issued by UFM against the assigned Purchase Order. The customer will be advised of any non-restockable goods and will be charged the $90.00 evaluation fee plus any shipping charges if returned to the customer. If no disposition is received by UFM within 30 days, the goods will be scrapped and the $90.00 evaluation fee will be billed.

WARRANTY RETURNS
Warranty returns must be accompanied by a Purchase Order and must be shipped prepaid to UFM. UFM will review the goods and advise the customer of the evaluation and validity of the warranty claim. Valid warranty claims will be repaired or replaced at no charge. No evaluation fee will be charged to repairs made under valid warranty. Return shipping costs will be prepaid by UFM. Should UFM determine the returned material is not defective under the provisions of UFM’s standard warranty, the customer will be advised of needed repairs and associated costs. All materials returned without a valid warranty will be subject to the “Repairable Material” policy outlined above.
Form RMAP-100