Section 4 Operation and Maintenance

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SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions can result in death or serious injury.

- Do not remove the instrument cover in explosive environments when the circuit is live.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and the terminals.

Troubleshooting

If a malfunction is suspected despite the absence of a diagnostic message on the communicator display, follow the procedures described below to verify that the flowmeter hardware and process connections are in good working order. Always approach the most likely and easiest-to-check conditions first.

Symptom	Possible Cause	Corrective Action
Low Reading	Annubar not fully installed (not spanning the inner diameter of the pipe)	• Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. • Consult Factory if dimensions do not match. • During re-installation mark tip of Annubar, install, remove and inspect marking to insure contact with opposite side of the pipe.
	Annubar not aligned properly in flow profile	• Refer to the installation instructions in Section 2 of this manual for proper alignement straight across pipe I.D., with upstream sensing holes facing straight upstream in flow profile.
	Annubar not installed in proper pipe size	• Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. • Consult Factory if dimensions do not match.
	Annubar installed to close too an upstream flow disturbance, such as a pipe elbow	• Compare installation to recommended straight pipe run referenced in the installation instructions in Section 2 of this manual.
	DP Transmitter not zeroed properly, or not configured correctly	• Verify DP sensor has been zeroed properly. • Verify transmitter range is correct, and if square root output is correct. • Verify Annubar Calc sheet represents fluid density properly so that transmitter is configured correctly for the application.
High Reading	Annubar not installed in proper pipe size	• Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. • Consult Factory if dimensions do not match.
	DP transmitter not zeroed properly or not configured properly	• Verify DP sensor has been zeroed properly. • Verify transmitter range is correct, and if square root output is correct. • Verify Annubar Calc sheet represents fluid density properly so that transmitter is configured correctly for the application.
Erratic Signal / Negative Reading / No reading	Annubar sensor is installed backwards	• Verify that the flow arrow on the instrument connections of the Annubar is pointing in the direction of flow.
	Annubar sensor is broken or missing	• Remove sensor and verify that the Annubar sensing element is in tact and undamaged.
	Instrument valves are closed	• Verify the high and low instrument valves are open.
	Annubar Flowmeter is mounted too close to flow disturbance	• Verify the installation and compare with recommended installation distances from disturbances as shown in Installation section of this manual.
	Air in instrument impulse lines (liquid applications)	• Reinstall impulse lines, eliminating high areas in which air can collect.
	Noisy DP signal from vertical down steam or liquid application	• Relocate Annubar to a location that is not vertical down or use the transmitter dampening to smooth out the DP signal.
Annubar Sensor too long or too short	Pipe dimensions were not properly supplied	• Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. • Consult Factory if dimensions do not match.
	The mounting hardware supplied is not the correct length	• Check mounting height and compare to the dimensions shown in the Dimensional Drawings. • Consult factory if dimensions do not match.
	Annubar sensor looks too long (Pak-lok or Flange-lok Models)	• Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. • Consult factory if dimensions do not match. • Review the installation instructions found in section 2 and review the images of a proper installation.
	Opposite Side Support is not installed on pipe	• Install Opposite side support (if required by Annubar model) as specified in the installation instructions found in Section 2.

Symptom	Possible Cause	Corrective Action
Annubar Sensor won't fit in the drilled hole	Drill hole is not the proper size	• Verify that the drill hole matches the size specified in the installation instructions found in Section 2. • Re-drill the mounting hole with proper drill hole size.
	Drill hole is not aligned properly with Annubar mounting hardware	• Verify that the mounting hardware is centered over pipe hole. • If necessary, re-install mounting hardware.
	Hole was torch-cut (pipe fragments blocking hole)	• Re-Drill the hole in a different location as specified in the installation instructions found in Section 2.
Severe Vibration of the Sensor	Annubar is not properly sized for the application	• Verify process conditions on the Calculation Data Sheet are accurate. • Consult Factory if process conditions have changed.
	The tip of the Annubar Flowmeter is not properly bottomed for Pak-lok, Flange-lok or Flo-tap Models	• For Flo-tap models, turn crank handle until the sensor is bottomed per the installation instructions found in Section 2. • For Pak-lok and Flange-lok models, tighten the nuts per the installation instructions found in Section 2.
	Excessive Pipe Vibration	• Check vibration on pipe and install additional supports for Annubar if necessary. Consult factory.
Incorrect Measurement	Failed RTD	• See maintenance section for removal and testing of RTD element.
	Transmitter out of calibration	• See calibration procedures for the appropriate style transmitter.
	Transmitter improperly configured	• Verify flow configuration information for MultiVariable(TM) Mass Flow transmitters or scaled variable information for 3051S DP transmitters. • Also verify the 20 mA point set in the transmitter corresponds to the 20 mA point in the conrtol system.

RTD MAINTENANCE

This section covers RTD maintenance procedures.

Replacing an RTD

Direct Mount

If an RTD needs to be replaced on a direct mounted Annubar Flowmeter, proceed as follows:

1. Close instrument valves to ensure that the pressure is isolated from the transmitter.
2. Open the bleed valves on the transmitter to remove all pressure.
3. Remove the cap and the RTD wiring only from the temperature housing and from the transmitter.
4. Remove the transmitter.
5. Remove the RTD plug.
6. Pull the RTD wire out of the nipple and remove the RTD. Remove the RTD by inserting the wires through a $^{7}/_{16}$-in. deep socket. Then use pliers or vise grips to rotate the socket. The RTD is in a thermowell. No live line pressure will be present.
7. Install the new RTD and thread finger tight plus $^{1}/_{8}$ of a turn. Thread the wires through the nipple. Note it may be easier to remove the terminal block from the temperature housing to reinsert the RTD wires.
8. Using appropriate thread lubricant, reinstall the $^{1}/_{2}$-in. NPT plug.
9. Use the same PTFE gaskets to reinstall the transmitter to the Annubar Flowmeter sensor head.
10. Use a torque wrench to tighten the stainless steel hex nuts in a cross pattern to 300 in-lbs.
11. Reconnect the RTD wires in the temperature housing and replace the cover.
12. Open the instrument valves.

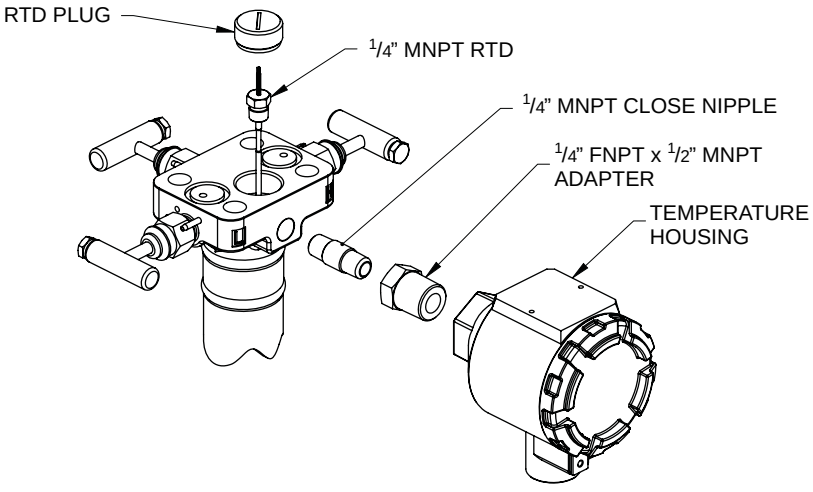


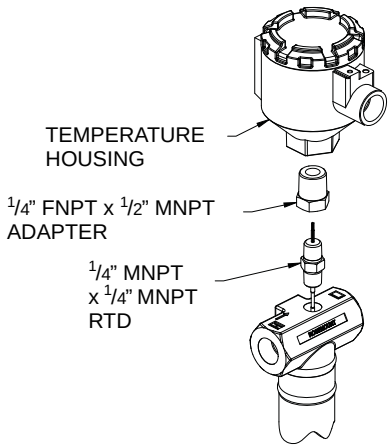
Figure 4-1. Exploded view of Direct Mounted Annubar, Integral RTD installation

Remote Mount

If an RTD needs to be replaced on a remote mounted Annubar Flowmeter, proceed as follows:

1. Close instrument valves to ensure that the pressure is isolated from the transmitter.
2. Open the bleed valves on the transmitter to remove all pressure.
3. Remove the cap from the temperature housing.
4. Remove the RTD wiring from the terminal block.
5. Remove the temperature housing from the head.
6. Pull the RTD wire out of the nipple and remove the RTD. The RTD is in a thermowell. No live line pressure will be present.
7. Install the new RTD and thread the wires through the nipple.
8. Using the appropriate thread lubricant or tape, install the terminal housing onto the remote head.
9. Reconnect the RTD wires to the terminal.
10. Open the instrument valves.

Figure 4-2. Exploded view of Remote Mounted Annubar, Integral RTD installation



Electrical RTD Check Procedure

If the RTD is not functioning properly, perform the following checks to determine if the RTD is failed. Figure 4-3 shows the schematic of a 4-wire RTD.

Continuity Check

1. Using an Ohm meter or a Multimeter, check the resistance between each of the red and white wires.
2. If the resistance measured represents the proper temperature, proceed to the Grounding Check.
3. If the resistance measured does not represent the proper temperature or no resistance is measured (ie. Open circuit), the RTD is damaged and must be replaced.

Grounding Check

1. Using an Ohm meter or a Multimeter , test for each wire of the RTD to the sheath for a resistance value. If the RTD is installed in the Annubar sensor, test to the instrument connections of Annubar instead of the sheath of the RTD. All tests should measure an infinite resistance (i.e. Open circuit) between the RTD wires and the sheath.
2. If all tests verify an open circuit, the RTD is functioning properly.
3. If any tests confirm a shorted wire to the RTD sheath, the RTD is damaged and must be replaced.

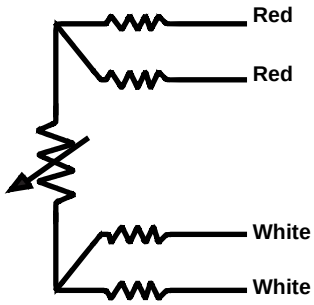


Figure 4-3. Schematic of a typical 4-wire RTD

Pak-lok, Flange-lok, and Flo-tap Maintenance

The Pak-lok, Flange-lok, and Flo-tap models utilize a packing gland mechanism to sustain a seal on the process fluid. Periodically the packing rings need to be checked to ensure that they are continuing to seal properly.

- Check the packing gland for leaks. If a leak is present, check that the nuts are tightened down on the packing studs. If the leak persists, then the packing rings should be replaced.
- If the process fluid goes through large degrees of temperature cycling, verify that the packing is tightened down sufficiently and that the tip of the Annubar is still secured against the opposite side pipe wall. A leak would indicate the packing has loosened. Also, excessive vibration of the Pak-Lok, Flange-lok, or Flo-tap model could indicate the tip of the sensor is no longer secured to the pipe wall. For the Pak-lok or Flange-lok models, retighten the nuts to ensure that the packing is sufficiently tightened and that the tip of the Annubar is still secured against the opposite side pipe wall. For the flo-tap models, tighten the drive nuts or rotate the crank clockwise until the sensor is secured against the opposite side pipe wall. Retighten the packing gland nuts to ensure that the packing is sufficiently tightened.
- If there is excessive vibration present in the Annubar, immediate attention is required as the sensor may no longer be secured against the opposite side pipe wall. This could result in the sensor bending, cracking, or breaking. For the Pak-lok or Flange-lok models, retighten the nuts to ensure that the packing is sufficiently tightened and that the tip of the Annubar is still secured against the opposite side pipe wall. For the flo-tap models, tighten the drive nuts or rotate the crank clockwise until the sensor is secured against the opposite side pipe wall. Retighten the packing gland nuts to ensure that the packing is sufficiently tightened. If excessive vibration is still present, contact an Emerson Process Management representative.
- If the packing rings appear brittle, old, or compressed beyond further use, a new set of rings should be ordered for replacement. Installation instructions can be found in the Section 2 of this manual.

Table 4-1. Replacement Part Numbers for Pak-lok, Flange-lok, and Flo-tap Packing

Model	Packing Kits	Part Number
Pak-lok or Flange-lok	Sensor Size 1 Grafoil (Standard)	28-503002-920
	Sensor Size 2 Grafoil (Standard)	28-503002-921
	Sensor Size 3 Grafoil (Standard)	28-503002-922
	Sensor Size 1 PTFE (Option P2)	28-503002-910
	Sensor Size 2 PTFE (Option P2)	28-503002-911
	Sensor Size 3 PTFE (Option P2)	28-503002-912
Flo-tap	485 Sensor Size 1 Grafoil (Standard)	28-505010-900
	485 Sensor Size 2 / 585 Sensor Size 22 Grafoil (Standard)	28-505010-901
	485 Sensor Size 3 / 585 Sensor Size 44 Grafoil (Standard)	28-505010-902
	485 Sensor Size 1 PTFE (Option P2)	28-505010-910
	485 Sensor Size 2 / 585 Sensor Size 22 PTFE (Option P2)	28-505010-911
	485 Sensor Size 3 / 585 Sensor Size 44 PTFE (Option P2)	28-505010-912

Gas Entrapment

In certain liquid applications (i.e. – buried water lines) it may be necessary to mount the transmitter and Annubar above the pipe. This can lead to gas entrapment in the impulse piping which causes erratic flow readings.

One way to combat this problem is to install Automatic Vent Packages (AVP) on the impulse lines. The vents will purge the gas periodically and keep the impulse lines clear. The key to the installation is installing the vents and impulse piping so that any gas travels up to the vents and away from the transmitter. Vents can usually be installed at any time. Please contact your Emerson Process Management representative for more details.

Dirt Accumulation

One inherent advantage of an Annubar primary element over devices such as orifice plates is the ability to function in flows carrying dirt and grease. However, under extreme cases, some of the sensing ports are completely obstructed or the outside shape is drastically changed by buildup.

There are two methods of cleaning the Annubar primary element to restore performance. Mechanical cleaning is the more certain method, but does require removal of the Annubar primary element. Purging is effective if the accumulation covers the sensing ports or blocks internal passages.

In applications where a large amount of foreign material exists, it may be necessary to perform a routine preventative maintenance by removing the Annubar primary element for cleaning. The outer surfaces should be cleaned with a soft wire brush. The internal passages should be cleaned with compressed air. If necessary, a solvent for dissolving foreign material may be appropriate.

Purging with an external fluid source under a higher pressure is an effective means of retaining clear pressure pathways in the Annubar primary element.

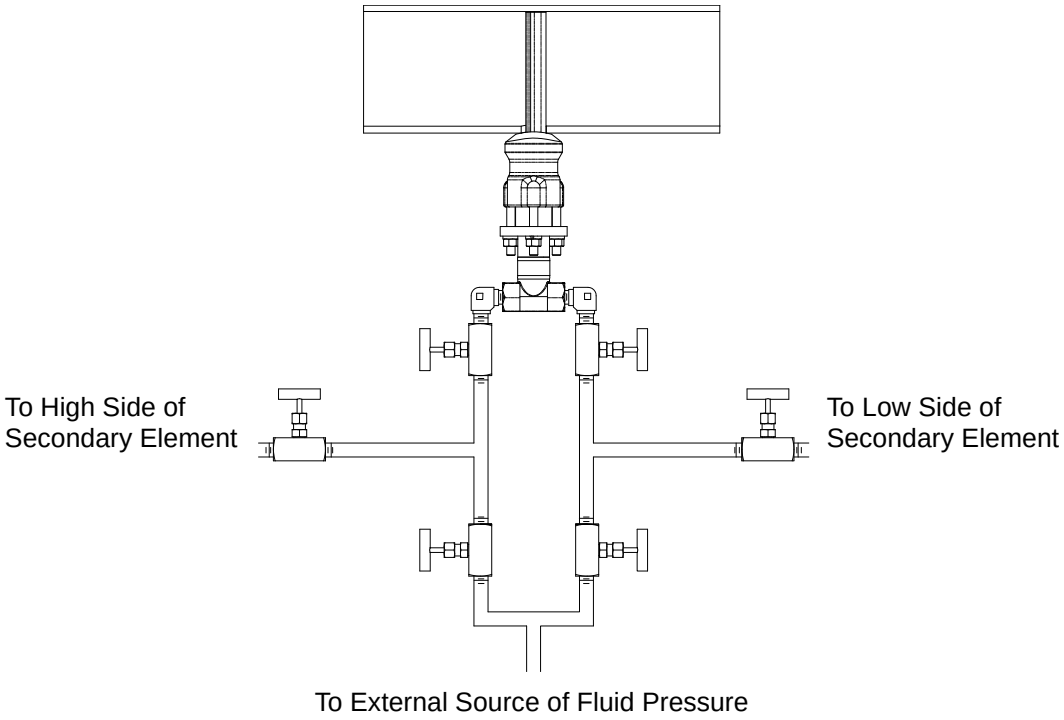
The following precautions should be taken:

1. The purging fluid must be compatible with the process fluid and shouldn't cause other problems such as contamination.
2. The purging fluid should be preheated or pre-cooled if the temperature difference of the fluid and the process exceeds 150 °F (66 °C).
3. The differential pressure transmitter or meter should be isolated from the purge fluid to prevent over-ranging.
4. Continuous purging is not recommended.

The length of time between purges, or the cycle time, as well as the length and volume of the purge cycle must be determined experimentally. Some guidelines established as a starting point for experimentation are as follows:

1. Supply pressure of at least 60 PSIG (415 kPa-g) and not exceeding 115 PSIG (795 kPa).
2. Purge air flow rate of at least 40 SCFM (68 Nm^3/h) when flowing at 60 PSIG (415 kPa).
3. Purge duration of at least 60 seconds.
4. Purge with dry air (less than 5% moisture by weight).
5. Stainless steel purge tubing should have a minimum of 1/2 in. (12.5 mm) O.D. and at least 0.035 in. (0.89 mm) wall thickness. Care must be taken to protect the secondary instrumentation from high pressures and temperatures when purging an Annubar primary element. Ear protection is also recommended for all personnel in the vicinity of the system being purged. See figure for sample set-up.

Figure 4-4. Impulse Tube Arrangement for Purge



Main Steam Line Annubar Maintenance

Due to the extreme conditions that the Rosemount 585 Main Steam Line Annubar Flowmeters come into contact with, it should be removed and inspected annually to check for wear. Emerson Process Management recommends a visual inspection and a Dye Penetrant; examine to identify any cracks or wear on the Annubar sensor. After the Annubar sensor is inspected, it is recommended to replace the packing rings to ensure a proper seal. Table 4-2 shows the replacement part numbers for the packing rings and other spare parts.

Table 4-2. Replacement Part Numbers for the Packing Rings and other Spare parts

Packing Kits	Part Number	Quantity
Packing Rings – Split	19006-67	2
Packing Rings – Solid Carbon/Graphite	19006-04	3
Packing Gland Stud	16147-07	16
Packing Gland / Support Plate Nuts	16068-06	16
Support Plate Lock Washers	00-101005-01	8
Packing Gland Washers	16103-01	8
Locking Rod	30343-02	2
Roll Pins for Locking Rod	00-101007-01	4
Locking Nuts	16068-01	8
Locking Washers	00-101005-03	8

Emerson Process Management also recommends that the Annubar sensor is removed for steam blow down and other maintenance procedures. The sensor must be replaced with the packing gland plug to seal the mounting hardware.

Removal Procedures

1. Allow the Annubar sensor and the mounting hardware to cool.
2. Loosen the Packing Gland Nuts.
3. Remove the Locking Nuts and Washers from the top of the Locking Rods.
4. Slide the Annubar Sensor out of the mounting hardware.

Installation of the Packing Gland Plug

1. Place the packing into the packing gland with the two split rings (Garlock style 1303FEP) on the outside and the three Garlock Carbon/Graphite solid die-formed rings on the inside. Make sure the splits in the outer packing are 180° apart.
2. Slide the Packing Gland Plug through the packing and install the locking rods, nuts, and washers.
3. Tighten the packing gland nuts to 25 to 30 ft.-lbs. (34 to 41 Nm).

Refer to the Section 2 of this manual for reinstallation procedures of the Annubar sensor.