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Micro Motion®
R-Series Sensor

Instruction Manual

June 2001

Micro Motion

FISHER-ROSEMOUNT™ Managing The Process Better.™

Micro Motion®
R-Series Sensor

Instruction Manual

For technical assistance, phone the Micro Motion Customer Service Department:
- In the U.S.A., phone 1-800-522-6277, 24 hours
- Outside the U.S.A., phone 303-530-8400, 24 hours
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

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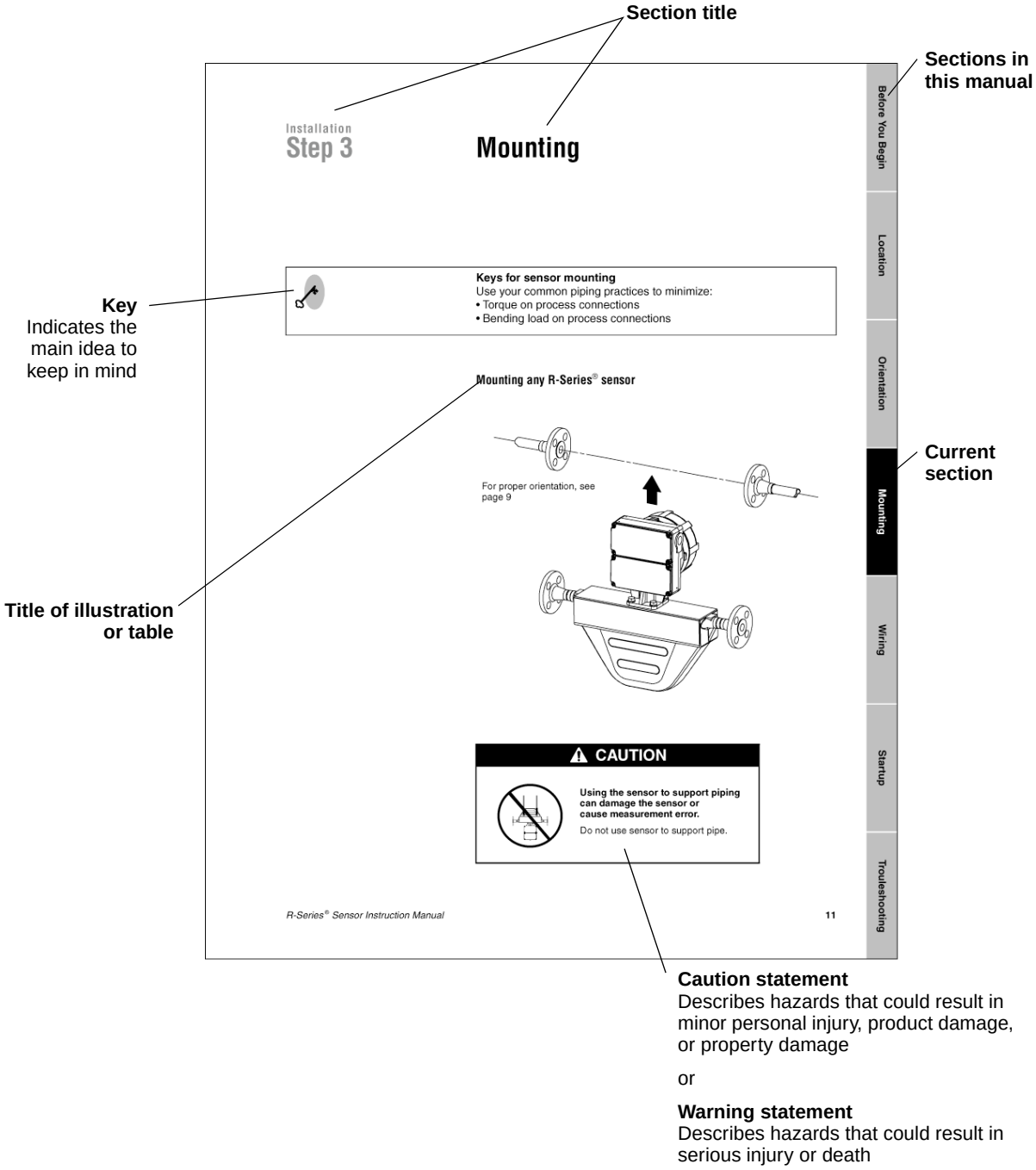


Before You Begin

Your new sensor

Your new Micro Motion® R-Series sensor is one part of a Coriolis flowmetering system. The other component of the flowmeter is a transmitter.

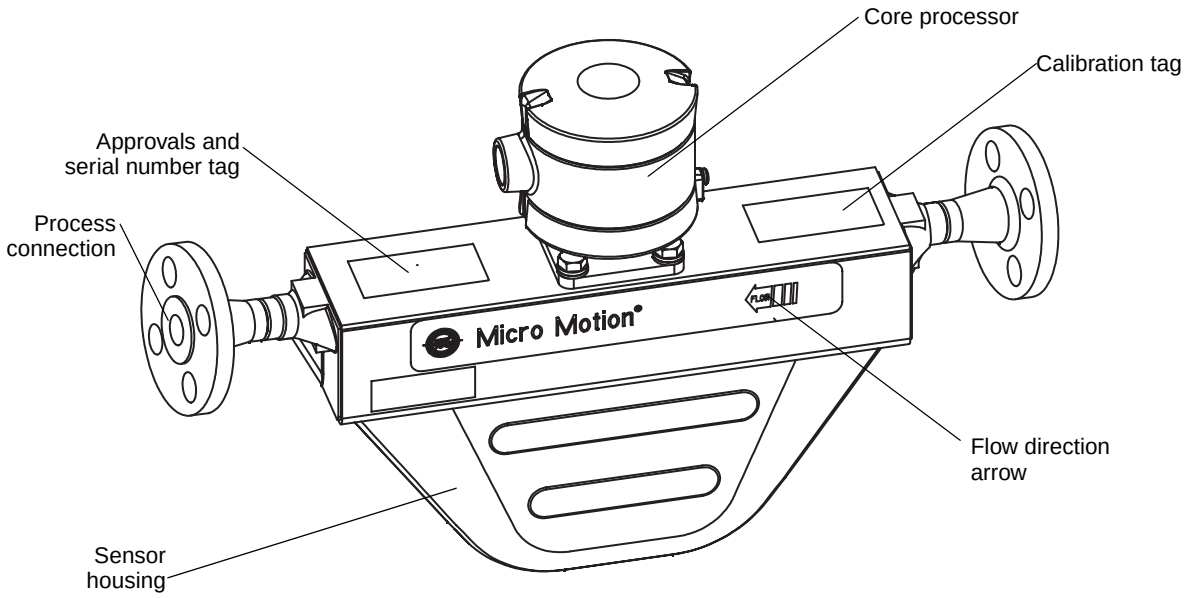
Transmitter connections
R-Series sensors may be connected to any of these Micro Motion transmitters:
- Series 1000 or 2000
- IFT9703
- Model 5300

R-Series sensors are available with four types of transmitter connection interfaces:
- Core processor for connection to a remotely mounted Series 1000 or 2000 transmitter, or to a direct host
- Integrally mounted Model 1700 or 2700
- A 9-wire junction box for connecting to a 9-wire Model 1700 or 2700 transmitter
- Integrally mounted IFT9703 or Model 5300

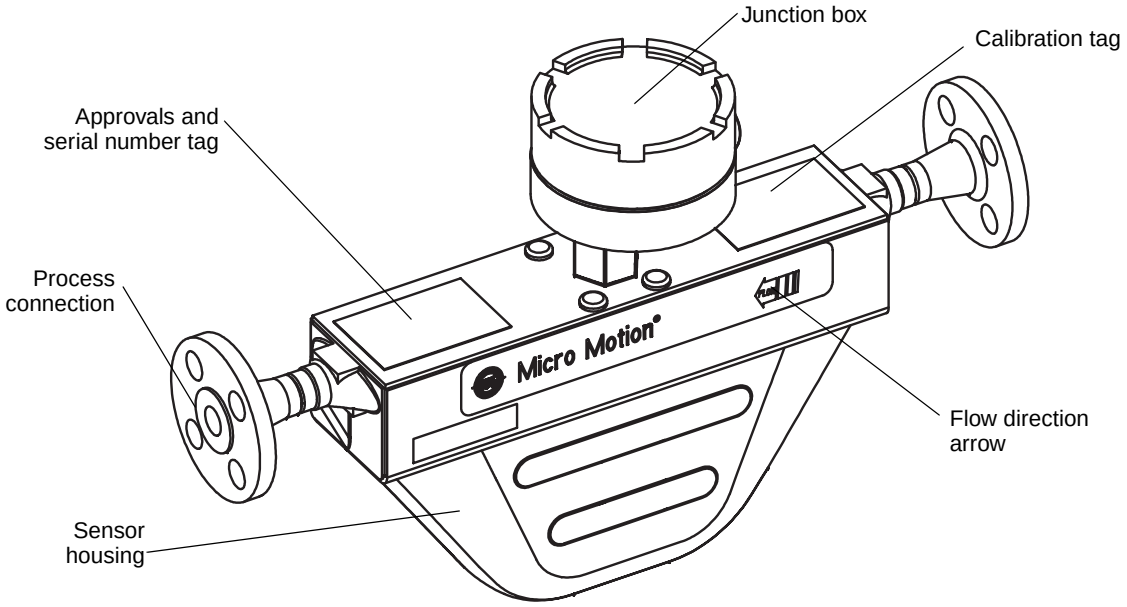
European installations
R-Series sensors comply with EMC directive 89/336/EEC and low-voltage directive 73/23/EEC, including all amendments, when properly installed in accordance with the guidelines and instructions described in this manual.

Sensor components
Components of the sensor are illustrated on pages 2 and 3. Dimensions are provided in Appendix A, page 37.

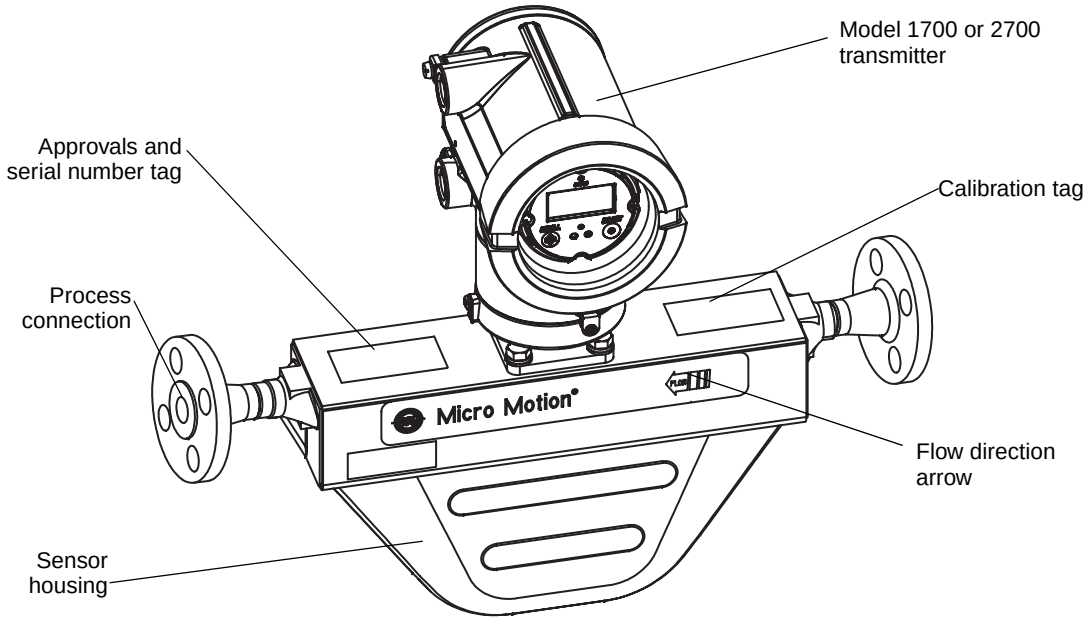
Sensor with core processor



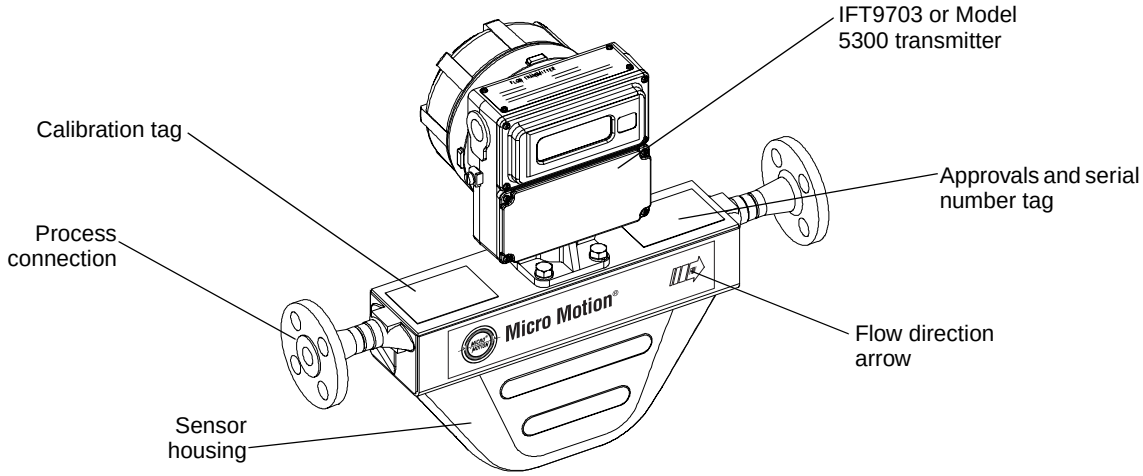
Sensor with junction box



Sensor with integrally mounted Model 1700 or 2700 transmitter



Sensor with integrally mounted IFT9703 or Model 5300 transmitter



The installation process

Installing your new sensor involves five steps:

Step 1. Location
Determining the proper location for the sensor, taking into account hazardous areas, process piping, transmitter location, and valves. See page 5.

Step 2. Orientation
Determining the desired orientation for the sensor in the process pipeline. See page 9.

Step 3. Mounting
Installing the sensor in the pipeline. See page 13.

Step 4. Wiring
Connecting the flowmeter cable to the sensor and transmitter. See page 15.

Step 5. Startup
Requirements for flowmeter startup. See page 21.

Additional information

In addition to installation instructions, the following subjects are also covered in this manual:

- **Troubleshooting** for problems that might be attributable to the sensor begins on page 23.
- **Product specifications**, including sensor dimensions and process connection options, are listed in Appendix A, page 37.
- **Maintenance of labels** is explained in Appendix B, page 51.
- **Return policy** for Micro Motion equipment is described in Appendix C, page 55.

Location

Keys for sensor location

The sensor may be located anywhere in the process line, as long as the following conditions are met:

- Before operation, you must be able to stop flow through the sensor. (During the zeroing procedure, flow must be stopped completely, and the sensor tubes must be full of process fluid.)
- During operation, the sensor tubes must remain full of process fluid.
- The sensor must be installed in an area that is compatible with the classification specified on the approvals tag. (See illustrations, on pages 2–3)
- If the sensor is equipped with an integrally mounted transmitter, you must consider the environmental requirements of the integrally mounted transmitter, visibility of the transmitter display, and the classification specified on the transmitter approvals tag.

Pipe run

Micro Motion sensors do not require a straight run of pipe upstream or downstream. If two identical sensors are installed in series, they must be at least 5 ft (1.5 m) apart.

Cable to transmitter

The maximum wiring distances are shown in the table below.

Wiring Distances

Cable	Maximum wiring distance
9-wire to a Model 1700 or 2700 transmitter	60 ft (20m)
9-wire to all other transmitters	1,000 ft (300 m)
4-wire 18 AWG to a Model 1700 or 2700 transmitter, or a direct host	1,000 ft (300 m)
4-wire 20 AWG to a Model 1700 or 2700 transmitter, or a direct host	500 ft (150 m)
4-wire 22 AWG to a Model 1700 or 2700 transmitter, or a direct host	300 ft (90 m)

Temperature, humidity, and vibration

Install the sensor according to specified limits.

Process fluid temperature limits
Process fluid temperature limits are –40 to 300 °F (–40 to 150 °C) for sensors with a junction box.

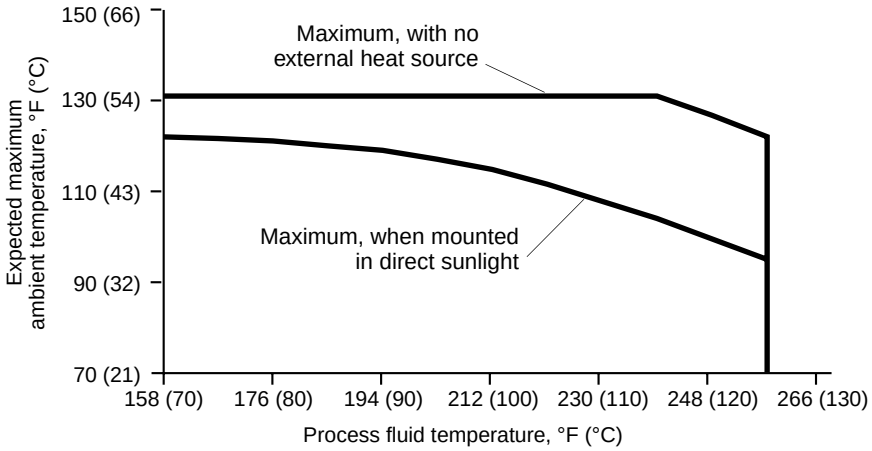
Process fluid temperature limits are –40 to 257 °F (–40 to 125 °C) for sensors with a core processor or an integrally mounted IFT9703 or Model 5300 transmitter. If the process fluid temperature is going to exceed this temperature, you must use a junction box model sensor with a 9-wire Series 1000 or 2000 transmitter.

Ambient temperature limits
- For sensors with a core processor:
  - operating temperature limits of –40 to 140 °F (–40 to 60 °C)
- For sensors with an integrally mounted transmitter
  - Model 1700 or 2700 transmitter—operating temperature limits of: –40 to 140 °F (–40 to 60 °C)
  - IFT9703 or Model 5300 transmitter:
  - With optional display (IFT9703 only): 32 to 131 °F (0 to 55 °C)
  - Without display: –22 to 131 °F (–30 to 55 °C)
- For sensors with a junction box:
  - –22 to 131 °F (–30 to 55 °C)

At their upper limits, process fluid temperature and ambient temperature restrict each other.

Environmental limits on electronics
- Humidity limits: 5 to 95% non-condensing
- Vibration limits: per IEC 68.2.6, 2 g, endurance sweep, 10 to 2000 Hz, 50 sweep cycles

Effect of ambient temperature on maximum process fluid temperature for sensors with an IFT9703 or Model 5300 transmitter



Valves

After the sensor and transmitter have been fully installed, you must perform the zeroing procedure. During the zeroing procedure, flow through the sensor must be halted and the sensor tubes must be completely full of process fluid. A shutoff valve, downstream from the sensor, is recommended to halt flow during the zeroing procedure. For more information about zeroing, see page 21.

Hazardous area installations

To comply with requirements for an intrinsically safe (I.S.) installation, you must use a Micro Motion I.S. installation instruction manual when installing the sensor in a hazardous area. An I.S. manual is shipped with an approved flowmeter.

A complete list of hazardous area classifications for Micro Motion R-Series sensors is provided on page 42.

To obtain a copy of an I.S. manual via the World Wide Web, go to:

- **www.micromotion.com**

If you don't have access to the World Wide Web, you can obtain an I.S. manual by contacting the Micro Motion Customer Service Department:

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
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Orientation

Keys for sensor orientation
The sensor will function properly in any orientation if the sensor flow tubes remain filled with process fluid.

Flow direction

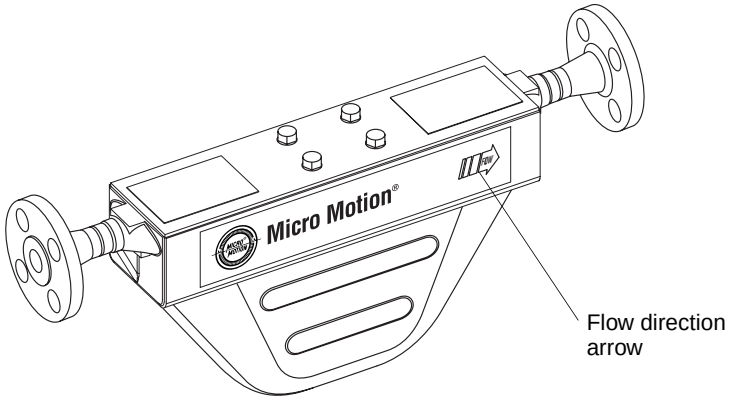
Micro Motion sensors measure accurately regardless of flow direction.

Flow direction arrow
The sensor features a flow direction arrow (see illustration below), but the sensor will measure flow in either direction.

If the process fluid flows in the direction opposite to the flow direction arrow, flowmeter outputs might not behave as expected unless the transmitter is configured appropriately. For more information, including configuration instructions, refer to the transmitter instruction manual.

Vertical pipeline
If the sensor is installed in a vertical pipeline, liquids and slurries should flow upward through the sensor. Gases may flow upward or downward.

Flow direction arrow



Integrally mounted transmitter and display

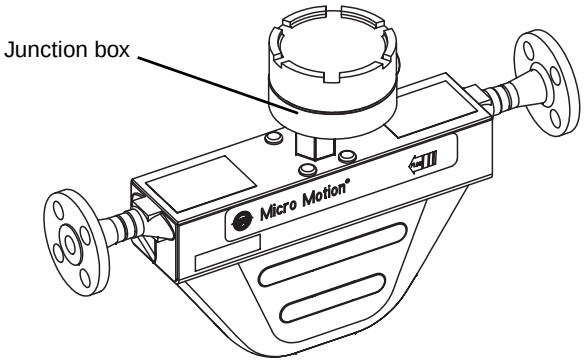
If the transmitter is integrally mounted to the sensor, the transmitter and display can be independently rotated for easier access or greater visibility. For information about rotating the transmitter or display, see the instruction manual shipped with the transmitter.

Sensor junction box

If the sensor has a junction box, you will need to connect a 9-wire flowmeter cable to the sensor junction box and the transmitter.

If possible, install wiring with the junction box opening pointed down, or install a drip leg in the conduit, to reduce the risk of condensation or excessive moisture in the junction box.

Standard junction box



Orientation of the conduit opening of the core processor

If the sensor has a core processor and is used with a remotely mounted transmitter, you will need to connect a 4-wire cable or two shielded 2-wire cables between the core processor and a Series 1000 or 2000 transmitter.

⚠ WARNING

Twisting the core processor will damage the sensor.

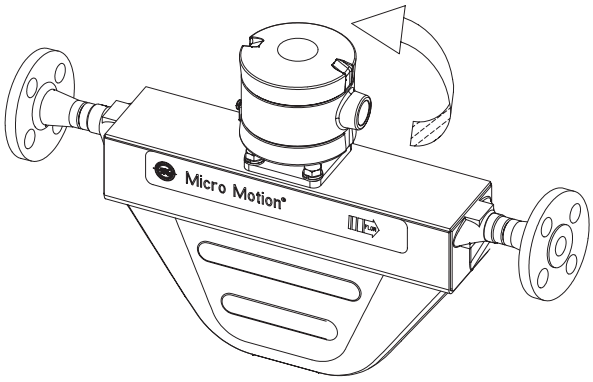
Do not twist the plastic wiring module inside the core processor.

Before wiring is attached, the core processor conduit ring rotates independently from the terminals inside. Rotate only the conduit ring, and not the entire core processor. If the entire core processor is rotated the sensor will be damaged.

To orient the conduit opening:

1. Remove the core processor cover.
2. Rotate the conduit ring a maximum of ¼ turn to orient the conduit opening. Do not twist the plastic module inside the core processor.

R-series core processor

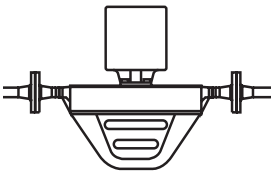
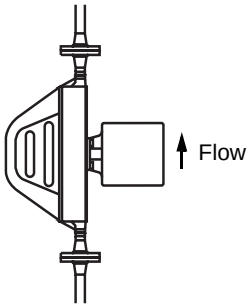
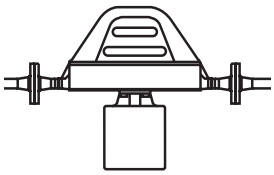
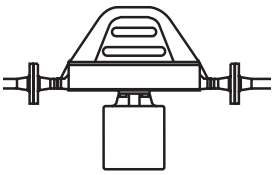
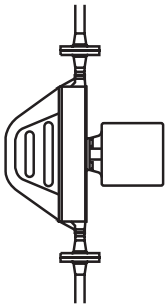
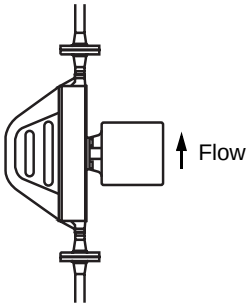
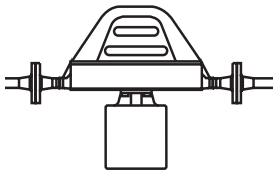


Orientation *continued*

Process fluid

Typical sensor orientations are shown below:
- For measuring liquids, see row 1.
- For measuring gases, see row 2.
- For measuring slurries, see row 3.

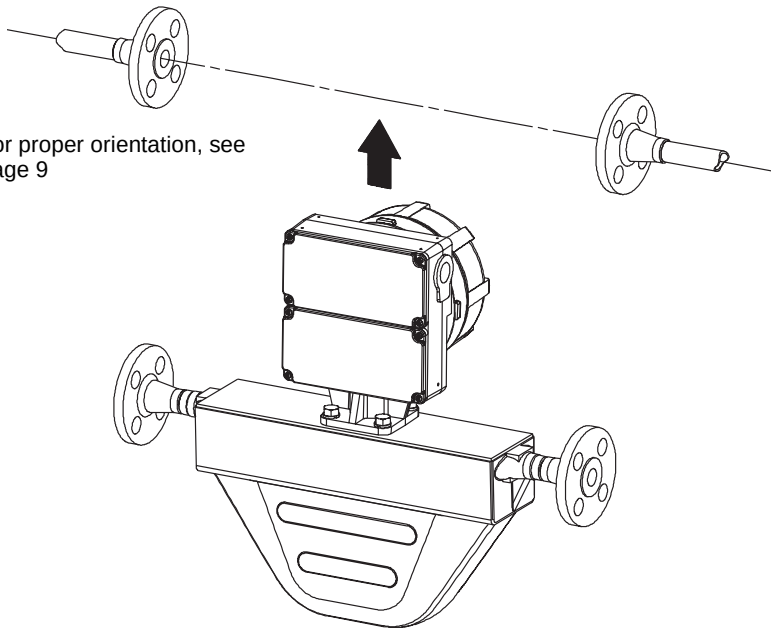
Orientation for R-Series sensors

Fluid being measured	Preferred orientation	Alternative orientations	
Liquids	Tubes down Horizontal pipeline	Flag mount Vertical pipeline Self-draining	Tubes up Horizontal pipeline Self-draining
			
Gases	Tubes up Horizontal pipeline		Flag mount Vertical pipeline
			
Slurries	Flag mount Vertical pipeline Self-draining		Tubes up Horizontal pipeline Self-draining
			

Mounting

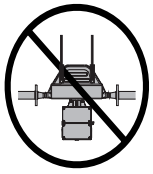
Keys for sensor mounting
Use your common piping practices to minimize:
- Torque on process connections
- Bending load on process connections

Mounting any R-Series sensor



For proper orientation, see page 9

⚠ CAUTION



Using the sensor to support piping can damage the sensor or cause measurement error.

Do not use sensor to support pipe.

Wiring

Hazardous area installations

To comply with requirements for an intrinsically safe (I.S.) installation, you must use the appropriate Micro Motion I.S. installation instruction manuals, in addition to this manual, when wiring the sensor in a hazardous area. An I.S. manual is shipped with an approved flowmeter.

For hazardous area installation in Europe, use standard EN 60079-14 as a guideline if national standards are not in effect.

⚠ WARNING

Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion.

- Make sure the hazardous area specified on the sensor approvals tag is suitable for the environment in which the sensor is installed. See illustration, page 2.
- For installation in an area that requires intrinsic safety, use this document with Micro Motion UL, CSA, installation instructions.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

To obtain a copy of an I.S. manual via the World Wide Web, go to:

- **www.micromotion.com**

If you don't have access to the World Wide Web, you can obtain an I.S. manual by contacting the Micro Motion Customer Service Department:

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
- Outside the U.S.A., phone 303-530-8400
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

A complete list of UL, CSA, and European approvals for R-Series sensors is provided on page 42.

Wiring the sensor

If the sensor has a junction box, see the cable preparation instructions that are shipped with the sensor cable.

If the sensor is integrally mounted to a Model 1700 or 2700 transmitter with a core processor or to an IFT9703 or Model 5300 transmitter, no sensor to transmitter wiring is required.

If the sensor has a core processor, see *Sensor 4-wire connection,* page 17

Sensor grounding

Ground the sensor and transmitter independently.

The sensor can be grounded via the piping, if joints in the pipeline are ground-bonded, or by means of a ground screw on the outside of the core processor or junction box housing.

⚠ CAUTION

Improper grounding could cause measurement error.

To reduce the risk of measurement error:
- Ground the flowmeter to earth, or follow ground network requirements for the facility.
- For installation in an area that requires intrinsic safety, refer to Micro Motion UL, CSA, or CENELEC installation instructions.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

If national standards are not in effect, adhere to these guidelines:
- Use copper wire, 14 AWG (2.5 mm^2) or larger wire size.
- Keep all ground leads as short as possible.
- Ground leads must have less than 1 ohm impedance.
- Connect ground leads directly to earth, or follow plant standards.

Sensor 4-wire connection

Shielded 4-wire or two shielded 2-wire cable should be used unless the cable is run in continuous metallic conduit.

Maximum wire lengths are:

- 300 ft (100 m) of 22 AWG (0.35 mm)
- 1,000 ft (300 m) of 18 AWG (0.8 mm)

Connect the four color-coded wires or shielded 2-wire cable wires to the numbered core processor terminals. Connect the shield wire to the ground screw.

At the transmitter, connect the opposite end of each color-coded wire to the mating-connector slot with the same number as the core processor terminal. Refer to the transmitter instruction manual for complete wiring instructions.

⚠ CAUTION

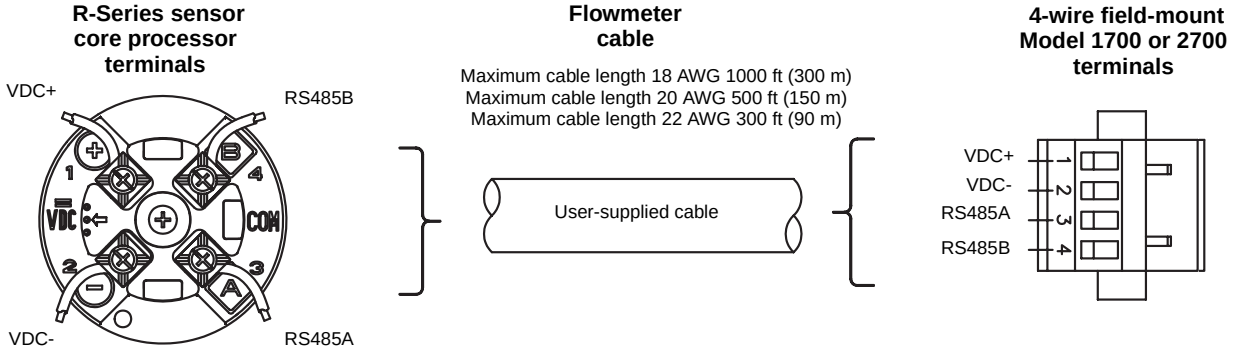
Failure to seal the core processor and transmitter housing could cause a short circuit, which would result in measurement error or flowmeter failure.

To reduce risk of condensation or excessive moisture in the core processor or transmitter housing:
- Seal all conduit openings.
- Install drip legs in conduit or cable.
- Fully tighten core processor cover and all transmitter housing covers.

Wiring the core processor to a remote host and power supply other than a Model 1700 or 2700 transmitter

The power supply must not supply any load other than a core processor(s). The power supply outputs must not be connected to an external ground. The power supply and/or the communications host must not allow any electromagnetic interference to be coupled onto the four wires to the core processor. A recommended power supply is the SDN series of 24 VDC power supplies manufactured by Sola/Hevi-Duty.

Wiring the 4-wire core processor to the Model 1700 or 2700 transmitter



Sensor 9-wire connection

The instructions in this section explain how to connect a fully prepared 9-wire Micro Motion flowmeter cable to the sensor and transmitter.

- The procedure for preparing Micro Motion cable and cable glands is described in the instructions that are shipped with the cable.
- Install cable and wiring to meet local code requirements.

⚠ CAUTION

Failure to seal the sensor junction box and transmitter housing could cause a short circuit, which would result in measurement error or flowmeter failure.

To reduce risk of condensation or excessive moisture in the junction box or transmitter housing:

- Seal all conduit openings.
- Install drip legs in conduit or cable.
- Fully tighten sensor junction box cover and all transmitter housing covers.

Cable connections to the sensor and transmitter

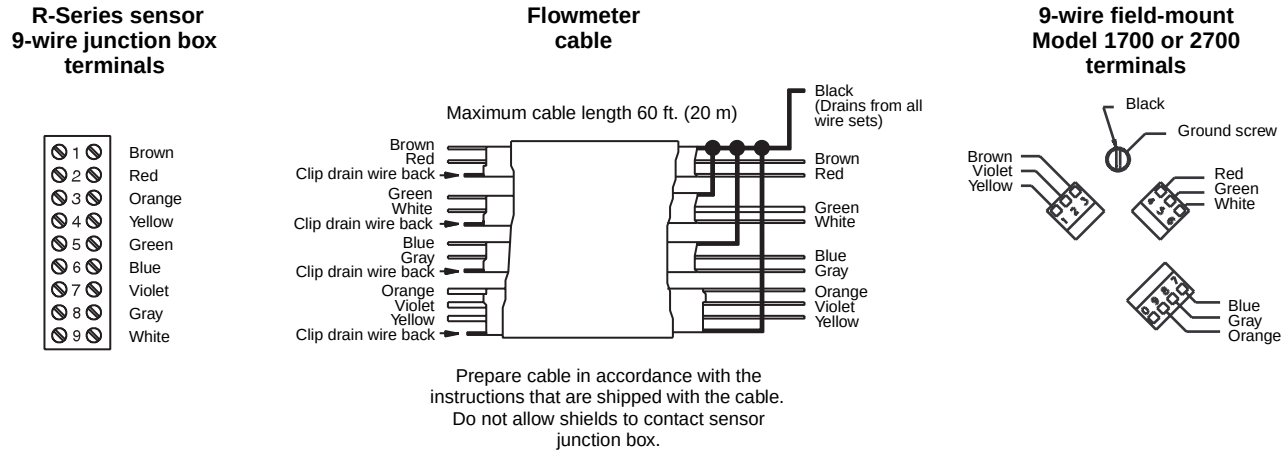
The wiring procedure is the same for the sensor and transmitter. Refer to the wiring diagrams on page 18, and follow these steps:

1. Locate the wires by color.
2. Insert the stripped ends of the individual wires into the terminal blocks. No bare wires should remain exposed.
   - At the sensor, connect wiring inside the junction box or core processor housing.
   - At the transmitter, connect wiring to the transmitter's intrinsically safe terminals for sensor wiring.
3. Tighten the screws to hold the wires in place.
4. Ensure integrity of gaskets, then close the junction box or core processor cover and tighten all screws. Tightly close all housing covers on the transmitter.

⚠ CAUTION

Drain wires from a 9-wire cable must be clipped at the sensor end and insulated with heat-shrink wrapping. Failure to properly terminate drain wires will cause sensor error.

Wiring the 9-wire junction box to the Model 1700 or 2700 field-mount transmitter



Prepare cable in accordance with the instructions that are shipped with the cable. Do not allow shields to contact sensor junction box.

Startup

Zeroing

After the flowmeter has been fully installed, you must perform the zeroing procedure. Flowmeter zeroing establishes flowmeter response to zero flow and sets a baseline for flow measurement. Refer to the transmitter instruction manual for information on performing the zeroing procedure.

⚠ CAUTION

Failure to zero the flowmeter at initial startup could cause measurement error.

Zero the flowmeter before putting the meter in operation.

Configuration, calibration, and characterization

You can use the transmitter to configure, calibrate, and characterize the meter. For more information, refer to the transmitter instruction manuals.

The following information explains the difference between configuration, calibration, and characterization. Certain parameters might require *configuration* even when *calibration* is not necessary.

Configuration parameters include such items as measurement units, flow direction, damping values, and slug flow parameters. If requested at time of order, the meter is configured at the factory according to customer specifications.

Calibration accounts for the flowmeter's sensitivity to flow, density, and temperature. Calibration is done at the factory.

Characterization is the process of entering calibration factors for flow, density, and temperature directly into transmitter memory, instead of performing field calibration procedures. Calibration factors can be found on the sensor serial number tag and on the certificate that is shipped with the sensor.

The following manuals include instructions for flowmeter configuration, calibration, and characterization:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using ProLink II Software with Micro Motion Transmitters*
- *IFT9703 Transmitter Instruction Manual*
- *Model 5300 Transmitter with FOUNDATION fieldbus*
- *Series 1000 and 2000 Transmitter Manuals*

Customer Service

The Micro Motion Customer Service Department is available for assistance with flowmeter startup if you experience problems you cannot solve on your own.

For help online, use the Micro Motion Expert2™ system at:

www.micromotion.com

Or telephone Micro Motion at:

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277), 24 hours
- Outside the U.S.A., phone 303-530-8400, 24 hours
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

If possible, provide us with the model numbers and/or serial numbers of your Micro Motion equipment, which will assist us in answering your questions.

Troubleshooting

General information

For troubleshooting help, see the Expert2 system online at **www.micromotion.com**.

Most troubleshooting is performed at the transmitter. However, the following troubleshooting topics are described in this manual:
- *Zero drift,* page 24
- *Erratic flow rate,* page 25
- *Inaccurate flow rate or batch total,* page 26
- *Inaccurate temperature reading,* page 28

If you cannot find the problem you are looking for, check the transmitter instruction manual or one of the following manuals:
- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using ProLink II Software with Micro Motion Transmitters*

You can also use Fisher-Rosemount™ Asset Management Solutions (AMS) software to troubleshoot Micro Motion flowmeters. For instructions on using AMS software, refer to the AMS on-line help.

To troubleshoot the flowmeter, you might need a digital multimeter (DMM) or similar device, the transmitter display, if it has one; and one of the following:
- HART Communicator
- ProLink software
- AMS software
- Modbus master controller
- Fieldbus host controller
- Profibus host

If you cannot find the problem you are looking for, or if troubleshooting fails to reveal the problem, contact the Micro Motion Customer Service Department.

If possible, provide us with the model numbers and/or serial numbers of your Micro Motion equipment, which will assist us in answering your questions.
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Zero drift

Symptom

The flowmeter indicates the process fluid is flowing while flow is stopped; or indicates a flow rate that does not agree with a reference rate at low flow, but does agree at higher flow rates.

Troubleshooting instructions

To troubleshoot zero drift, you will need one of the communications devices listed on page 29 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot zero drift.

Troubleshooting zero drift

Procedure	Instructions	What to do next
1. Check for leaking valves and seals		• If no leaks are found, go to step 2 • If leaks are found, eliminate them, then go to step 15
2. Check the flow units	See page 29	• If the flow units are OK, go to step 3 • If the flow units are wrong, change them, then go to step 15
3. Make sure the flowmeter was zeroed properly	See page 21	• If the flowmeter was zeroed properly, go to step 4 • If the flowmeter was not zeroed properly, zero it, then go to step 15
4. Check for the proper flow calibration factor	See page 31	• If the flow cal factor is correct, go to step 5 • If the flow cal factor is incorrect, change it, then go to step 15
5. Check the damping value	See page 32	• If the damping value is OK, go to step 6 • If the damping value is too low, change it, then go to step 15
6. Check for two-phase flow	See page 35	• If there is no two-phase flow, go to step 7 • If there is two-phase flow, fix the problem, then go to step 15
7. Check for moisture in the sensor junction box	See page 34	• If there is no moisture present, go to step 8 • If there is moisture in the junction box, dry out and seal the junction box, then go to step 15
8. Check for faulty or improperly installed flowmeter wiring	See page 30	• If the wiring is OK, go to step 9 • If the wiring is faulty, fix or replace it, then go to step 15
9. Check for faulty or improperly installed grounding	See page 34	• If the grounding is OK, go to step 10 • If the grounding is incorrect or faulty, fix it, then go to step 15
10. Check for mounting stress on the sensor	See page 34	• If the sensor mount is OK, go to step 11 • If there are mounting stresses, fix it, then go to step 15
11. Check for vibration or crosstalk	See page 35	• If there is no vibration or crosstalk, go to step 12 • If there is vibration or crosstalk, eliminate it, then go to step 15
12. Make sure the sensor is oriented properly	See page 9	• If the sensor is oriented properly, go to step 13 • If the sensor is not oriented properly, change the orientation, then go to step 15
13. Check for plugging or build-up on the sensor flow tubes	See page 36	• If the tubes are not plugged, go to step 14 • If there is plugging or build-up, clear the tubes, then go to step 15
14. Check for RF interference	See page 33	• If there is no interference, or the source cannot be detected, go to step 16 • If there is interference, eliminate it, then go to step 15
15. Check again for zero drift		• If there is no longer any zero drift, you've solved the problem • If the zero drifts again, start over at step 3 or go to step 16
16. Contact Micro Motion	Phone numbers are listed on page 23	

Erratic flow rate

Symptom

The flowmeter indicates the flow rate is varying, even though it is steady.

Troubleshooting instructions

To troubleshoot an erratic flow rate, you will need one of the communications devices listed on page 29 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an erratic flow rate.

Troubleshooting erratic flow rate

Procedure	Instructions	What to do next
1. Check for erratic flow rate at the transmitter	See page 29	• If the signal is stable at the transmitter, go to step 2 • If the signal is erratic at the transmitter, go to step 4
2. Check for faulty output wiring	See page 29	• If the output wiring is OK, go to step 3 • If the output wiring is faulty, repair or replace it, then go to step 13
3. Check the receiving device for malfunctions	See instruction manual for the device	• If the receiving device is OK, go to step 4 • If the receiving device is faulty, contact the manufacturer
4. Check the flow units	See page 29	• If the flow units are OK, go to step 5 • If the flow units are wrong, change them, then go to step 13
5. Check the damping value	See page 32	• If the damping value is OK, go to step 6 • If the damping value is too low, change it, then go to step 13
6. Check for stable drive gain	See page 32	• If the drive gain is stable, go to step 7 • If the drive gain is not stable, go to step 11
7. Check for a stable density reading	See page 32	• If the density reading is stable, go to step 8 • If the density reading is not stable, go to step 11
8. Check for faulty or improperly installed flowmeter wiring	See page 30	• If the flowmeter wiring is OK, go to step 9 • If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 13
9. Check for faulty or improperly installed grounding	See page 34	• If the grounding is OK, go to step 10 • If the grounding is incorrect or faulty, fix it, then go to step 13
10. Check for vibration or crosstalk	See page 35	• If there is no vibration or crosstalk, go to step 11 • If there is vibration or crosstalk, eliminate it, then go to step 13
11. Check for two-phase flow	See page 35	• If there is no two-phase flow, go to step 12 • If there is two-phase flow, fix the problem, then go to step 13
12. Check for plugging or build-up on the sensor flow tubes	See page 36	• If the tubes are not plugged, go to step 14 • If there is plugging or build-up, clear the tubes, then go to step 13
13. Check again for erratic flow rate	See page 29	• If the signal is no longer erratic, you've solved the problem • If the signal is still erratic, start over at step 1 or go to step 14
14. Contact Micro Motion	Phone numbers are listed on page 23	

Inaccurate flow rate or batch total

Symptom

The flowmeter indicates a flow rate or batch total that does not agree with a reference rate or total.

Troubleshooting instructions

To troubleshoot an inaccurate flow rate or batch total, you will need one of the communications devices listed on page 29 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate rate or total.

Troubleshooting inaccurate flow rate or batch total

Procedure	Instructions	What to do next
1. Check for the proper flow calibration factor	See page 31	• If the flow cal factor is correct, go to step 2 • If the flow cal factor is incorrect, change it, then go to step 15
2. Check the flow units	See page 29	• If the flow units are OK, go to step 3 • If the flow units are wrong, change them, then go to step 15
3. Make sure the flowmeter was zeroed properly	See page 21	• If the flowmeter was zeroed properly, go to step 4 • If the flowmeter was not zeroed properly, zero it, then go to step 15
4. Is the flow measurement configured for mass or volume?	See page 29	• If the configuration is for mass, go to step 6 • If the configuration is for volume, go to step 5
5. Check for the proper density calibration factor	See page 31	• If the dens cal factor is correct, go to step 6 • If the dens cal factor is incorrect, change it, then go to step 15
6. Make sure the density reading is accurate for the fluid	See page 32	• If the density reading is correct, go to step 7 • If the density reading is wrong, go to step 11
7. Make sure the temperature reading is accurate for the fluid	See page 32	• If the temperature reading is correct, go to step 8 • If the temperature reading is wrong, go to step 14
8. Is the flow measurement configured for mass or volume?	See page 29	• If the configuration is for mass, go to step 11 • If the configuration is for volume, go to step 9
9. Is the reference total based on a fixed density value?		• If the total is based on a fixed value, go to step 10 • If the total is not based on a fixed value, go to step 11
10. Change flow units to mass flow units	See page 29	• Go to step 15
11. Check for faulty or improperly installed grounding	See page 34	• If the grounding is OK, go to step 12 • If the grounding is incorrect or faulty, fix it, then go to step 15
12. Check for two-phase flow	See page 35	• If there is no two-phase flow, go to step 13 • If there is two-phase flow, fix the problem, then go to step 15
13. Check the scale (or reference measurement) for accuracy	Use your plant procedures	• If the scale is accurate, go to step 14 • If the scale is not accurate, fix it, then go to step 15
14. Check for faulty or improperly installed flowmeter wiring	See page 30	• If the flowmeter wiring is OK, go to step 16 • If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 15
15. Run a new batch and check again for an inaccurate rate or total		• If the rate or total is correct, you've solved the problem • If the rate or total is wrong, start over at step 2 or go to step 16
16. Contact Micro Motion	Phone numbers are listed on page 23	

Inaccurate density reading

Symptom

The flowmeter density measurement is erratic, or is lower or higher than the density of the fluid.

Troubleshooting instructions

To troubleshoot an inaccurate density reading, you will need one of the communications devices listed on page 29 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate density reading.

Troubleshooting inaccurate density reading

Procedure	Instructions	What to do next
1. Check for stable density reading at the transmitter	See page 32	• If the density reading is stable, go to step 2 • If the density reading is not stable, go to step 3
2. Check for the proper density calibration factor	See page 31	• If the dens cal factor is correct, go to step 4 • If the dens cal factor is incorrect, change it, then go to step 11
3. Check for faulty or improperly installed flowmeter wiring	See page 30	• If the flowmeter wiring is OK, go to step 4 • If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 11
4. Check for faulty or improperly installed grounding	See page 34	• If the grounding is OK, go to step 5 • If the grounding is incorrect or faulty, fix it, then go to step 11
5. Check to see if the density reading is low or high	See page 32	• If the density reading is low, go to step 6 • If the density reading is high, go to step 10
6. Run a quality check on the process fluid	Use your plant procedures	• If the product quality is OK, go to step 7 • If the product quality is not OK, fix it, then go to step 11
7. If you checked the wiring in step 3, go to step 8, otherwise, check for faulty or improperly installed flowmeter wiring	See page 30	• If the flowmeter wiring is OK, go to step 8 • If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 11
8. Check for two-phase flow	See page 35	• If there is no two-phase flow, go to step 9 • If there is two-phase flow, fix the problem, then go to step 11
9. Check for vibration or crosstalk	See page 35	• If there is no vibration or crosstalk, go to step 12 • If there is vibration or crosstalk, eliminate it, then go to step 11
10. Check for plugging or build-up on the sensor flow tubes	See page 36	• If the tubes are not plugged, go to step 12 • If there is plugging or build-up, clear the tubes, then go to step 11
11. Check again for inaccurate density reading at the transmitter	See page 32	• If the reading is correct, you've solved the problem • If the reading is still wrong, start over at step 1 or go to step 12
12. Contact Micro Motion	Phone numbers are listed on page 23	

Inaccurate temperature reading

Symptom

The flowmeter temperature reading is different than expected.

Troubleshooting instructions

To troubleshoot an inaccurate temperature reading, you will need one of the communications devices listed on page 29 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate temperature reading.

Troubleshooting inaccurate temperature reading

Procedure	Instructions	What to do next
1. Check for faulty or improperly installed flowmeter wiring	See page 30	• If the flowmeter wiring is OK, go to step 2 • If the flowmeter wiring is faulty, fix or replace it, then go to step 3
2. Check for the proper temperature calibration factor	See page 31	• If the temp cal factor is correct, go to step 4 • If the temp cal factor is incorrect, change it, then go to step 3
3. Check again for inaccurate temperature reading at the transmitter	See page 32	• If the reading is correct, you've solved the problem • If the reading is still wrong, start over at step 1 or go to step 4
4. Contact Micro Motion	Phone numbers are listed on page 23	

Troubleshooting at the transmitter

The tables in the preceding sections refer you to this section for instructions on troubleshooting at the transmitter. To troubleshoot at the transmitter, you might need a digital multimeter (DMM) or similar device; the transmitter display; if it has one, and one of the following:

- HART Communicator
- ProLink software
- AMS software
- Modbus master controller
- Fieldbus host controller
- Profibus host or configuration tool

Checking the flow units

Check or change the flow units (unit of measure) configuration at the transmitter. If necessary, refer to the instruction manual (or on-line help for software) for the method you choose.

- Use a HART Communicator, ProLink software, or AMS software
- Use a fieldbus or Profibus host controller
- Use the Model 1700 or 2700 display

Make sure the configured units of measure are the ones you want. Also, make sure you know what the abbreviations mean. For example, *g/sec* is grams per second, not gallons per second.

Checking for erratic flow rate at the transmitter

Before troubleshooting erratic flow rate, you must first determine whether it is a result of the transmitter or a connected output device. Check for an erratic flow signal at the transmitter using any of the following methods. If necessary, refer to the instruction manual (or on-line help for software) for the method you choose.

- Use a HART Communicator, ProLink software, or AMS software
- Use a fieldbus or Profibus host controller
- Use a DMM on the transmitter's 4-20 mA or frequency output terminals

If the flow rate or output signal is not erratic at the transmitter outputs, the problem is not with the transmitter.

Checking for faulty output wiring

Having already checked the output at the transmitter end (above), use a DMM to check the signal at the other end (the receiving end) of the output wiring. If the signal is not erratic, the problem is not with the output wiring.

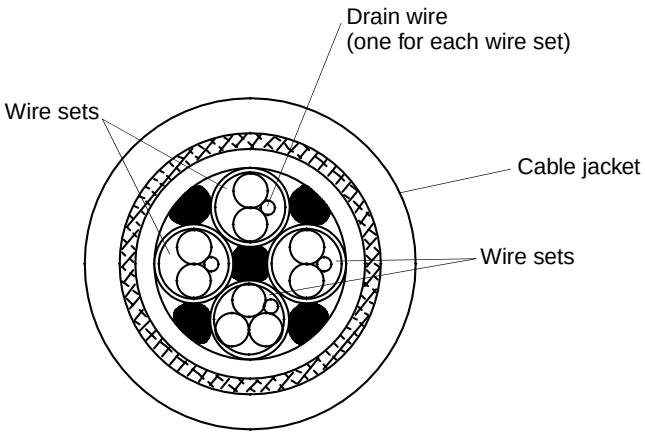
Checking for faulty flowmeter wiring for a 9-wire installation
Wiring problems are often incorrectly diagnosed as a faulty sensor. Examine wiring between the sensor and transmitter as follows:

1. ***Check the cable preparation.*** The flowmeter cable must be prepared correctly. The most common problem is improperly prepared drain wires. See illustration, below, and the cable preparation instructions that are shipped with the cable.

2. ***Check wire terminations.*** Check to be sure wires are secured tightly in the terminal blocks, and making good connections. Make sure no wires remain exposed at either end of the flowmeter cable.

3. ***Check ohm levels.*** If the cable was properly prepared and terminal connections are good, check resistance across wire pairs to determine whether the flowmeter cable is faulty. The procedure is performed first at the transmitter, then at the sensor. Follow these steps:
   a. Disconnect the transmitter's power supply.
   b. Disconnect sensor wiring from the transmitter's flowmeter terminals.
   c. Use a DMM to measure resistance across wire pairs at the transmitter end of the cable. See the table on page 31.
      • If the measured value is within the range listed in the table, reconnect wiring and restore power to the transmitter.
      • If the measured resistance is outside the range listed in the table, repeat the measurements at the sensor junction box.
      - If resistance values measured at the sensor are also outside the range listed in the table, the sensor might be faulty.

Cross-section of cable with drain wires



Nominal resistance ranges for flowmeter circuits

Notes

- Disconnect wires from terminals before checking resistance values.
- Temperature-sensor value increases 0.38675 ohms per °C increase in temperature.
- Nominal resistance values will vary 40% per 100°C. However, confirming an open coil or shorted coil is more important than any slight deviation from the resistance values presented below.
- Resistance across blue and gray wires (right pickoff circuit) should be within 10% of resistance across green and white wires (left pickoff circuit).
- Actual resistance values depend on the sensor model and date of manufacture.
- Reading across wire pairs should be steady.

Circuit	Wire colors	Nominal resistance range
Drive coil	Brown to red	8 to 2650 Ω
Left pickoff	Green to white	16 to 300 Ω
Right pickoff	Blue to gray	16 to 300 Ω
Temperature sensor	Orange to violet	100 Ω at 0°C + 0.38675 Ω / °C
Lead length compensator	Yellow to violet	100 Ω at 0°C + 0.38675 Ω / °C

Checking the calibration factors

Check or change the flow, density, or temperature calibration factors at the transmitter. The temperature cal factor is for Models 1700 or 2700, 5300, and 9703 only. If necessary, refer to the instruction manual (or on-line help for software) for the method you choose.

- Use a HART Communicator, ProLink software, or AMS software
- Use the host controller
- Use the Model 1700 or 2700 display

Enter the calibration factors that are listed on the flowmeter serial number tag. (Calibration factors are also listed on the certificate that was shipped with the meter.) If the calibration factors at the flowmeter are already correct, the problem is not with the calibration factors.

Checking the damping value
Check or change the damping value at the transmitter. If necessary, refer to the instruction manual (or on-line help for software) for the method you choose.
• Use the Model 1700 or 2700 display
• Use a HART Communicator, ProLink software, or AMS software
• Use the host controller

In most applications, the damping value should be greater than or equal to 0.8 seconds. If the damping value is already greater than or equal to 0.8 seconds, the problem is probably not with the damping value.

Damping values less than 0.8 seconds are used in very few applications. After troubleshooting is complete, if you have a question about whether your application might require a lower damping value, contact the Micro Motion Customer Service Department. Phone numbers are listed on page 23. The two most common applications affected by a damping value that is too high are:
• Very short batching applications
• Very short-pass proving applications

Checking the drive gain
Contact Micro Motion to check the drive gain. Phone numbers are listed on page 23.

Checking the density or temperature reading
View the flowmeter density or temperature measurement in any of several ways:
• Use the transmitter display, if it has one
• Use a HART Communicator, ProLink software, or AMS software
• Use the connected output device, if there is one
• Use the host controller

If necessary, test the process fluid to confirm the flowmeter measurement is correct.

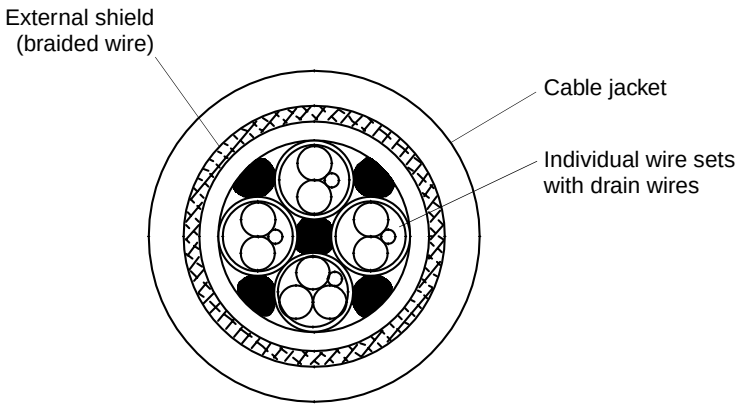
Checking for RF or transient-voltage interference

Radio-frequency (RF) or transient-voltage interference can affect the input or output signals at the transmitter. If you suspect interference, and can eliminate the source, do so before checking the alternatives described below.

Output wiring. Output wiring can be affected by RF interference. Make sure output wiring from the transmitter is properly grounded in accordance with the instructions in the transmitter manual. Also make sure no wires remain exposed at either end of output wiring.

Flowmeter cable. If the flowmeter cable does not have an external shield (see illustration, below), and is not installed in conduit, it could be affected by RF interference. Also make sure no wires remain exposed at either end of the flowmeter cable.

Cross-section of externally shielded cable



Troubleshooting at the sensor

The tables in the preceding sections refer you to this section for instructions on troubleshooting at the sensor. To troubleshoot at the sensor, you might need a digital multimeter (DMM) or similar device. For some procedures, you might also need the transmitter manual.

Checking flowmeter grounding

The sensor can be grounded via the piping, as long as joints in the pipeline are ground-bonded, or by means of a ground screw on the outside of the sensor junction box.

- Transmitter grounding is described in the transmitter instruction manual.

If the sensor is not grounded via the piping, and if national standards are not in effect, adhere to these guidelines to ground the sensor via the junction box:

- Use copper wire, 14 AWG (2.5 mm^2) or larger wire size.
- Keep all ground leads as short as possible.
- Ground leads must have less than 1 ohm impedance.
- Connect ground leads directly to earth, or follow plant standards.

For hazardous area installation in Europe, use standard EN 60079-14 as a guideline if national standards are not in effect.

Checking for moisture in the sensor junction box or core processor

All wiring compartments must be fully sealed to prevent a short circuit. A short circuit would result in measurement error or flowmeter failure.

Open the junction box compartment cover to check for moisture. If moisture is present, dry out the compartment. Do not use contact cleaner. Follow these guidelines to avoid risk of condensation or excessive moisture from accumulating:

- Seal all conduit openings.
- Install drip legs in conduit or cable.
- Check integrity of all gaskets and O-rings.
- Close and seal all housing covers.

Checking for mounting stress on the sensor

Because each installation is unique, it is not possible to offer a definitive solution for mounting problems. However, mounting stresses can be caused by one or more of the following conditions:

- The pipeline is being supported by (hung from) the sensor.
- Misaligned piping was drawn together by the sensor.
- An unsupported pipeline is not sturdy enough to support the sensor.

If you are unable to determine whether the process connections are being subjected to mounting stress, contact Micro Motion for additional assistance. Phone numbers are listed on page 23.

Checking for vibration and crosstalk

Micro Motion sensors have been designed to minimize the effect of vibration. In very rare cases, however, vibration or crosstalk can affect flowmeter operation. *Crosstalk* is the transfer of resonant vibration from one sensor to another, and sometimes occurs when two like-size sensors are installed in close proximity to each other and are operating on the same fluid.

Micro Motion meters are rarely affected by vibration, so vibration or crosstalk is probably not the problem. If you are not sure whether vibration or crosstalk is affecting the sensor, contact Micro Motion for additional assistance. Phone numbers are listed on page 23.

Checking for 2-phase flow

Two-phase flow occurs when air or gas is present in a liquid process stream, or when liquid is present in a gas process stream. Two-phase flow has several causes, as described below.

Leaks. Leaks can occur at process connections, valve seals, and pump seals, resulting in air being introduced into a liquid stream. Air might also be drawn in at the system inlet. Check the system for leaks, and repair any leaks that are found.

Cavitation and flashing. Cavitation and flashing are caused by operating the system at or near the process fluid vapor pressure, resulting in pockets of air or gas being introduced into the process fluid. If the sensor is near a device that causes pressure drop, such as a control valve, locating the sensor upstream from the device can decrease the risk of flashing. Alternatively, increasing back pressure downstream from the sensor can also reduce the risk of cavitation and flashing.

Cascading. Cascading of the fluid can occur when the flow rate diminishes to the point where the sensor tube is only partially filled. Often, this occurs because fluid is flowing downward through a sensor installed in a vertical pipeline. (When a sensor is mounted this way, it is called the flag-mount orientation.)

To help eliminate cascading, fluids should flow upward through a flag-mounted sensor. Mounting the sensor in the preferred orientation often reduces cascading. (See *Orientation,* page 9.) Increasing back pressure downstream from the sensor can also reduce or eliminate cascading.

High points in the system. When measuring liquids, *entrained air* (pockets of non-condensable gas) can collect in high points of a fluid system. If the fluid velocity is low, and/or the high points are very high relative to the system, entrained air pockets can grow and persist. If the air pocket releases and passes through the sensor, measurement error could occur. One possible solution is to install vent valves or air eliminators at a high point in the system, upstream from the sensor. Use your common plant practices if you choose to install vent valves or air eliminators.

Low points in the system. When measuring gases, liquid condensate can collect in low points of a fluid system. If the fluid velocity is low, and/or the low points are very low relative to the system, condensates can accumulate and persist. If the liquid passes through the sensor, measurement error could occur. One possible solution is to install condensate valves at a low point in the system, upstream from the sensor. Use your common plant practices if you choose to install condensate valves.

Checking for plugging or build-up

If the process fluid tends to build up in the piping, the sensor can become plugged or partially plugged due to build-up of material inside the sensor flow tubes. To determine whether plugging or build-up has occurred, check at the transmitter for a high drive gain and high density reading (page 32).

- If the drive gain and the density reading are both high, flush or clean the sensor, then check for an accurate density reading on water (or some other fluid with a known density). If the density is still wrong, plugging of the tube is probably not the problem.
- If either the drive gain or the density reading is not high, plugging of the tube is probably not the problem.

Appendix
A

R-Series Specifications

Performance specifications

Liquid flow specifications		Mass		Volume	
Nominal flow range[1]		***lb/min***	***kg/h***	***gal/min***	***l/h***
	R025	0 to 50	0 to 1360	0 to 6	0 to 1360
	R050	0 to 150	0 to 4080	0 to 18	0 to 4080
	R100	0 to 600	0 to 16,325	0 to 72	0 to 16,325
	R200	0 to 1600	0 to 43,550	0 to 192	0 to 43,550
Maximum flow rate[2]		***lb/min***	***kg/h***	***gal/min***	***l/h***
	R025	100	2720	12	2720
	R050	300	8160	36	8160
	R100	1200	32,650	144	32,650
	R200	3200	87,100	384	87,100
Accuracy[3]	Series 1000/2000 transmitter	±0.5% of rate[4]			
	All other transmitters	±0.5% of rate ± [(zero stability / flow rate) x 100]% of rate			
Repeatability[3]	Series 1000/2000 transmitter	±0.25% of rate[4]			
	All other transmitters	±0.25% of rate ± [½(zero stability / flow rate) x 100]% of rate			
Zero stability		***lb/min***	***kg/h***	***gal/min***	***l/h***
	R025	0.01	0.27	0.0018	0.41
	R050	0.03	0.82	0.0054	1.22
	R100	0.12	3.27	0.0216	4.90
	R200	0.32	8.71	0.0576	13.07

[1] Micro Motion has adopted the terminology "nominal flow range." The upper limit of this range is the flow rate at which water at reference conditions causes approximately 15 psi (1 bar) of pressure drop for Micro Motion R-Series flowmeters.

[2] The maximum flow rate for volume measurement is based on a process-fluid density of 1 g/cc. For fluids with density other than 1 g/cc, the maximum volume flow rate equals the maximum mass flow rate divided by the fluid's density.

[3] Flow accuracy includes the combined effects of repeatability, linearity, and hysteresis. All specifications for liquids are based on reference conditions of water at 68 to 77 °F (20 to 25 °C) and 15 to 30 psig (1 to 2 bar), unless otherwise noted.

[4] When flow rate is less than (zero stability/.005), accuracy equals ±[(zero stability/flow rate) x 100]% of rate and repeatability equals ±[½(zero stability/flow rate x 100]% of rate.

Performance specifications
continued

Gas flow specifications		Standard Volume[1]	
Nominal flow range[2]		***scfm[3]***	***Nm^3/h[4]***
	R025	215	375
	R050	650	1140
	R100	2490	4350
	R200	not rated for gas	
Maximum flow rate		***scfm***	***Nm^3/h***
	R025	390	663
	R050	1000	1699
	R100	4400	7476
	R200	not rated for gas	
Accuracy[5]	Series 1000/2000 transmitter	±1.0% of rate[6]	
	All other transmitters	±1.0% of rate ± [(zero stability / flow rate) x 100]% of rate	
Repeatability[5]	Series 1000/2000 transmitter	±0.5% of rate[6]	
	All other transmitters	±0.5% of rate ± [(zero stability / flow rate) x 100]% of rate	
Zero stability		***scfm***	***Nm^3/h***
	R025	0.1330	0.2681
	R050	0.3989	0.8143
	R100	1.5957	3.2473
	R200	not rated for gas	

[1]Air density at standard conditions, 14.73 psia (1.016 bara), 60 °F (15.5 °C), equals 0.077 lb/ft³ (1.200 kg/m³).
[2]Micro Motion has adopted the terminology "nominal flow range." The upper limit of this range is the flow rate at which air at 60 °F (15.5 °C) and 1000 psig (70 bar) causes approximately 15 psid (1 bar) of pressure drop for Micro Motion R-Series flowmeters.
[3]Air at 60 °F and 1000 psi causes approximately 14.7 psi pressure drop.
[4]Air at 0 °C and 70 bar causes approximately 1 bar pressure drop.
[5]Flow accuracy includes the combined effects of repeatability, linearity, and hysteresis. All specifications for gas are based on air at 60 °F (15.5 °C) and 1000 psig (70 bar), unless otherwise noted.
[6]When flow rate is less than (zero stability/.005), accuracy equals ±[(zero stability/flow rate) x 100]% of rate and repeatability equals ±[zero stability/flow rate x 100]% of rate.

Performance specifications *continued*

Pressure specifications

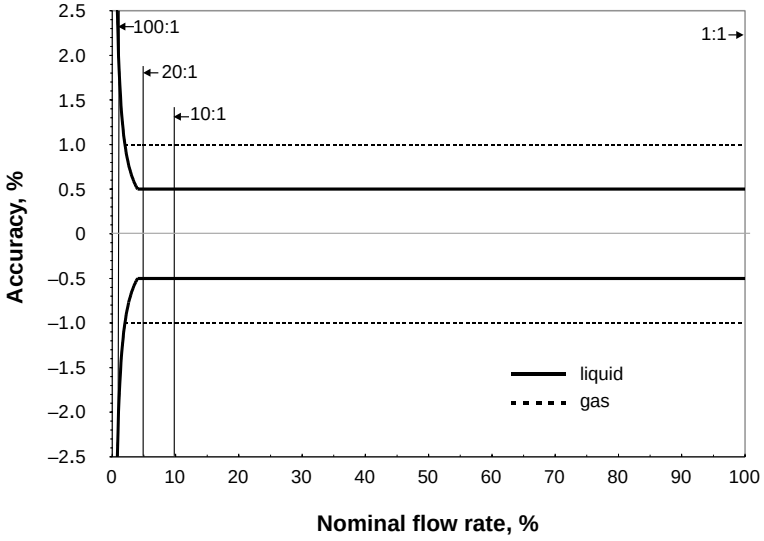
Flow tube rating[1]	All models	1450 psi	100 bar
Housing rating	All models	*Housing is not rated for pressure containment.*	

[1] *Pressure rating at 77 °F (25 °C), according to ASME B31.3.*

Performance specifications *continued*

Typical accuracy, turndown, and pressure drop with 1700/2700 transmitters

To determine accuracy, turndown, and pressure drop using your process variables, use the Micro Motion flowmeter selection guide. Download a free copy from our Web site at **www.micromotion.com**, or contact your local Micro Motion representative.



Turndown	100:1	20:1	10:1	1:1
Accuracy, ±%				
liquid	2.0	0.50	0.50	0.50
gas	2.0	1.0	1.0	1.0
Pressure drop,				
liquid (psi)	<0.1	0.1	0.3	4.2
liquid (bar)	<0.005	0.007	0.021	0.979
gas (psi)	<0.1	<0.1	0.2	14.7
gas (bar)	<0.005	<0.005	0.014	1.014

Functional specifications – all meters

Temperature limits

Process fluid	Sensors with j-box	–40 to 300 °F (–40 to 150 °C)
	All other models	–40 to 257 °F (–40 to 125 °C)
Ambient temperature	Storage	–40 to 185 °F (–40 to 85 °C) without optional display –4 to 158 °F (–20 to 70 °C) with optional display
	Operation	–22 to 131 °F (–30 to 55 °C) without optional display 32 to 131 °F (0 to 55 °C) with optional display
Process fluid vs. ambient temperature		At their upper limits, process fluid temperature and ambient temperature restrict each other. *For CENELEC-compliant sensors, the minimum process fluid and ambient temperature is –40 °C. The CENELEC "T" rating and hazardous area classification depend on the maximum process fluid and ambient temperature.* *See page 43.*

Functional specifications – all meters *continued*

Hazardous area classifications

Micro Motion R-Series sensors are intrinsically safe when properly connected to an approved transmitter. Approval agency on sensor approval tag must match agency on transmitter approval tag.

UL is a U.S.A. approvals agency, CSA is a Canadian approvals agency, and CENELEC is a European standards organization.

UL[(1)] and CSA

When properly mounted integrally to an IFT9703 or Model 5300 transmitter, the sensor can be installed in the following hazardous areas:

Class I, Div. 2, Groups A, B, C, and D
Class II, Div. 2, Groups F and G

When properly connected to a core processor or integrally mounted Model 1700 or 2700 transmitter, the sensor can be installed in the following hazardous areas:

Class I, Div. 1, Groups C and D
Class I, Div. 2, Groups A, B, C, and D
Class II, Div. 1, Groups E, F, and G

When properly connected remotely to a Micro Motion transmitter via the junction box supplied with the sensor, the sensor can be installed in the following hazardous areas:

Class I, Div. 1, Groups C and D
Class I, Div. 2, Groups A, B, C, and D
Class II, Div. 1, Groups E, F, and G

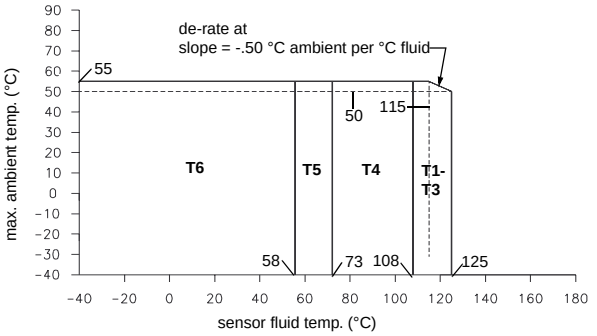
[(1)]At time of printing, UL approval for Micro Motion R-Series meters with Series 1000 and 2000 transmitters is pending.

Functional specifications – all meters *continued*

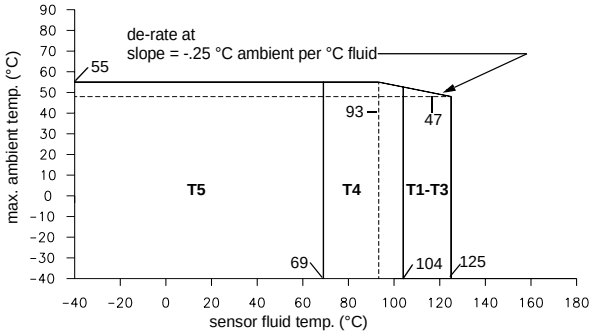
Hazardous area classifications *continued*

CENELEC[1]

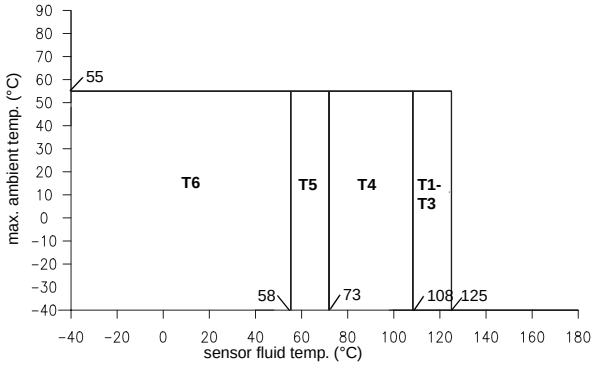
flowmeters with integrally mounted IFT9703 or 5300 transmitter
R025, R050, R100, R200
EEx ib IIC T1-T6



flowmeters with core processor
R025, R050, R100, R200
EEx ib IIC T1-T5



flowmeters with j-box
R025, R050, R100, R200
EEx ib IIC T1-T6



[1] The CENELEC "T" rating is defined as the maximum surface temperature of the flowmeter. The "T" rating, and the ambient temperature, restrict the maximum allowable temperature of the process fluid (listed above). Ambient temperature limits for CENELEC-compliant flowmeters are –40 °C and 55 °C.

Physical specifications

Material of construction

Wetted parts[1]		316L stainless steel
Housings	Sensor	304L stainless steel
	Core processor	CF-3M stainless steel
	Integrally mounted transmitter or j-box	epoxy polyester painted cast aluminum

Weight[2]

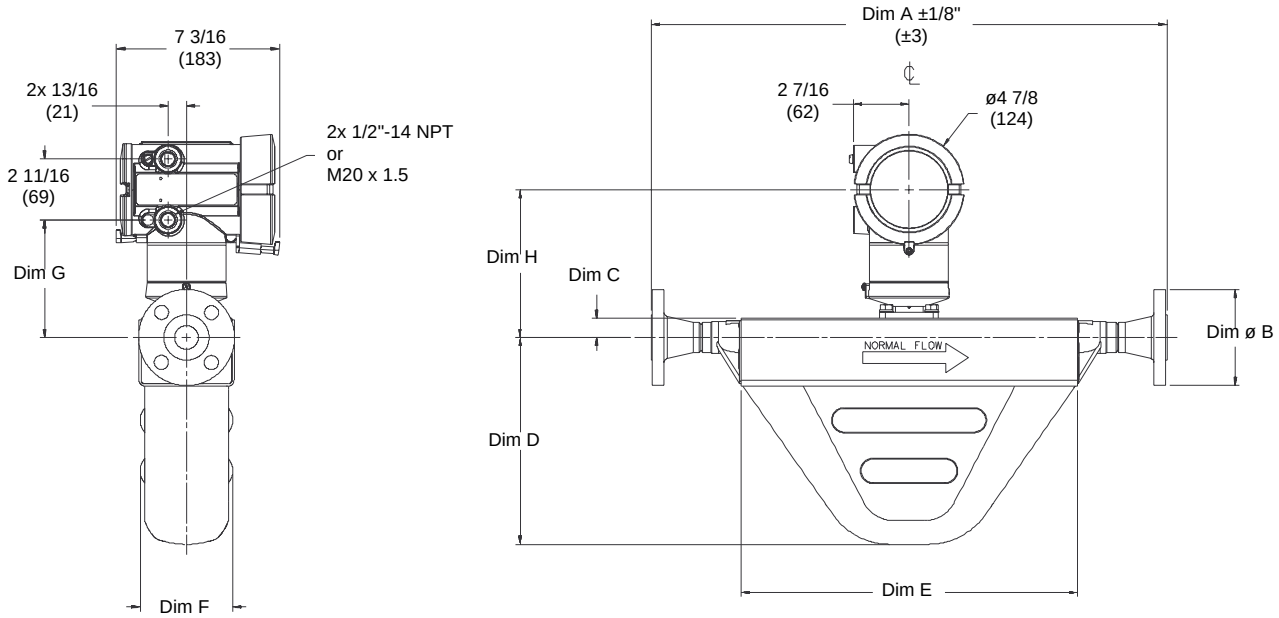
Sensor with j-box	R025	11 lb	5 kg
	R050	13 lb	6 kg
	R100	22 lb	10 kg
	R200	42 lb	19 kg
Sensor with local core processor	R025	14 lb	7 kg
	R050	15 lb	7 kg
	R100	24 lb	11 kg
	R200	44 lb	20 kg
Sensor with integrated 9703/5300 transmitter	R025	15 lb	7 kg
	R050	16 lb	8 kg
	R100	26 lb	12 kg
	R200	46 lb	21 kg
Sensor with integrated 1700/2700 transmitter	R025	29 lb	13 kg
	R050	29 lb	14 kg
	R100	42 lb	19 kg
	R200	79 lb	36 kg

[1] General corrosion guides do not account for cyclical stress, and therefore should not be relied upon when choosing a wetted material for your Micro Motion flowmeter. Please refer to Micro Motion's corrosion guide for material compatibility information.
[2] Weight of flowmeter with 150 lb weld neck raised face flanges.

Physical specifications

Dimensions — R-Series sensors with 1700 or 2700 transmitter

Dimensions in *inches* (mm)



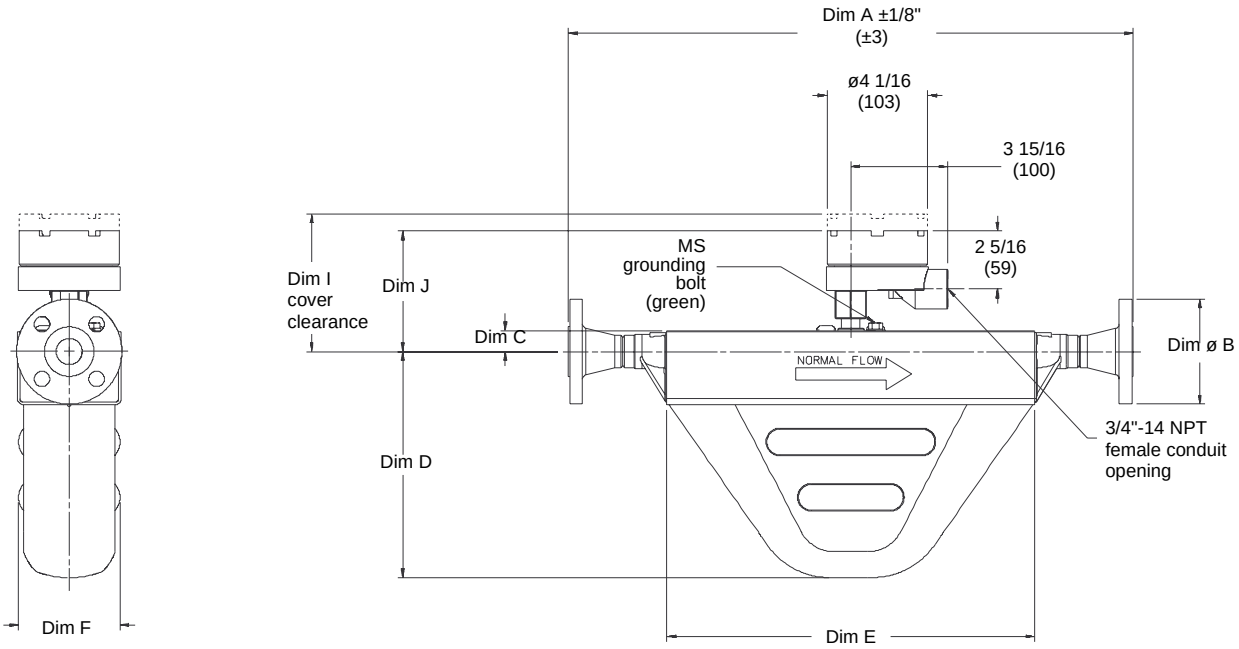
Model		Dimensions[1] C	D	E	F	G	H
R025	*inches*	5/8	5 1/8	9 3/4	2 13/16	6 3/8	7 11/16
	(mm)	(15)	(130)	(247)	(72)	(161)	(196)
R050	*inches*	5/8	6 3/4	11 7/8	2 15/16	4 15/16	6 5/16
	(mm)	(15)	(171)	(301)	(74)	(126)	(160)
R100	*inches*	7/8	9 1/8	14 7/8	4 1/8	5 3/16	6 9/16
	(mm)	(22)	(232)	(378)	(104)	(132)	(166)
R200	*inches*	1 3/4	12 9/16	17 7/8	5 5/8	6 1/16	7 7/16
	(mm)	(44)	(319)	(454)	(144)	(155)	(189)

[1]For dimensions A and B, see process fittings table, pages 49 and 50.

Physical specifications *continued*

Dimensions — R-Series sensors with j-box

Dimensions in *inches* (mm)



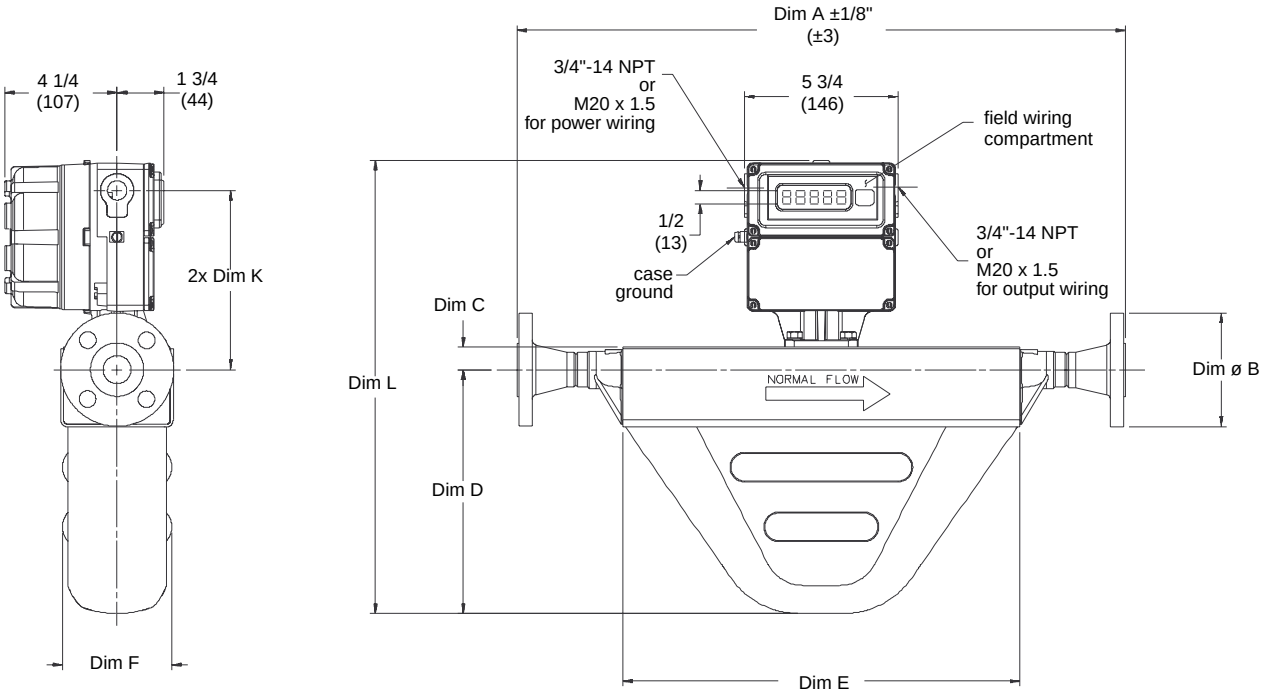
Model		Dimensions[1] C	D	E	F	I	J
R025	*inches*	5/8	5 1/8	9 3/4	2 13/16	5 5/16	4 5/8
	(mm)	(15)	(130)	(247)	(72)	(135)	(118)
R050	*inches*	5/8	6 3/4	11 7/8	2 15/16	5 5/16	4 5/8
	(mm)	(15)	(171)	(301)	(74)	(135)	(118)
R100	*inches*	7/8	9 1/8	14 7/8	4 1/8	5 9/16	4 7/8
	(mm)	(22)	(232)	(378)	(104)	(141)	(124)
R200	*inches*	1 3/4	12 9/16	17 7/8	5 5/8	6 7/16	5 13/16
	(mm)	(44)	(319)	(454)	(144)	(164)	(147)

[1] *For dimensions A and B, see process fittings table, pages 49 and 50.*

Physical specifications *continued*

Dimensions — R-Series sensors with 9703 or 5300 transmitter

Dimensions in inches (mm)



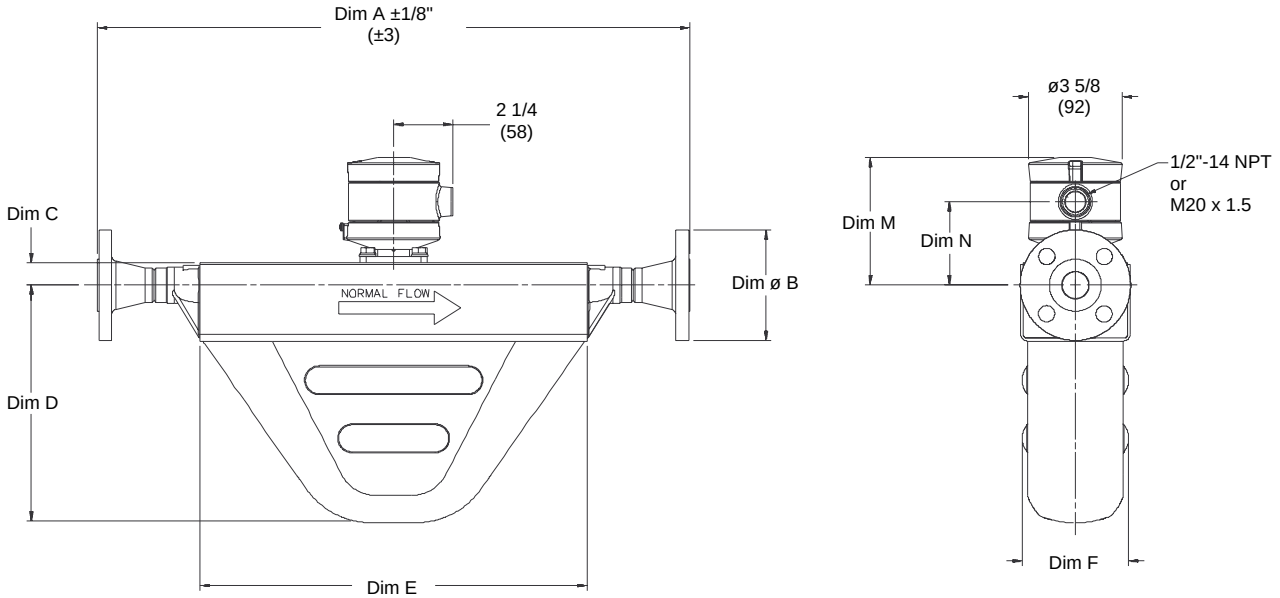
Model		Dimensions[1] C	D	E	F	K	L
R025	*inches*	5/8	5 1/8	9 3/4	2 13/16	6 1/2	12 3/4
	(mm)	(15)	(130)	(247)	(72)	(165)	(324)
R050	*inches*	5/8	6 3/4	11 7/8	2 15/16	6 1/2	14 5/16
	(mm)	(15)	(171)	(301)	(74)	(165)	(364)
R100	*inches*	7/8	9 1/8	14 7/8	4 1/8	6 3/4	17
	(mm)	(22)	(232)	(378)	(104)	(171)	(432)
R200	*inches*	1 3/4	12 9/16	17 7/8	5 5/8	7 5/8	21 5/16
	(mm)	(44)	(319)	(454)	(144)	(194)	(541)

[1] *For dimensions A and B, see process fittings table, pages 49 and 50.*

Physical specifications *continued*

Dimensions — R-Series sensors with local core processor

Dimensions in inches (mm)



Model		Dimensions[1] C	D	E	F	M	N
R025	*inches*	5/8	5 1/8	9 3/4	2 13/16	6 1/16	4 3/8
	(mm)	(15)	(130)	(247)	(72)	(154)	(111)
R050	*inches*	5/8	6 3/4	11 7/8	2 15/16	4 5/8	2 15/16
	(mm)	(15)	(171)	(301)	(74)	(118)	(75)
R100	*inches*	7/8	9 1/8	14 7/8	4 1/8	4 7/8	3 3/16
	(mm)	(22)	(232)	(378)	(104)	(125)	(82)
R200	*inches*	1 3/4	12 9/16	17 7/8	5 5/8	5 13/16	4 1/8
	(mm)	(44)	(319)	(454)	(144)	(147)	(104)

[1] *For dimensions A and B, see process fittings table, pages 49 and 50.*

Physical specifications—all meters *continued*

R025 fitting options[1]	Fitting code	Dim. A, face-to-face *inches (mm)*	Dim. B, outside diam. *inches (mm)*
1/2" ANSI 150 lb weld neck raised face flange	113	16 1/16 (408)	3 1/2 (89)
1/2" ANSI 300 lb weld neck raised face flange	114	16 7/16 (418)	3 3/4 (95)
1/2" ANSI 600 lb weld neck raised face flange	115	16 15/16 (431)	3 3/4 (95)
1/2" NPT female CAJON size 8 VCO fitting	319	14 1/16 (358)	---
1/2" sanitary fitting (Tri-Clamp compatible)	121	14 1/16 (358)	1 (25)
15 mm DIN PN40 weld neck, DIN 2635, type C face	116	15 5/16 (389)	3 3/4 (95)
15 mm DIN PN100/160 weld neck, DIN 2637, type E face	120	15 7/8 (403)	4 1/8 (105)
15 mm DIN 11851 aseptic coupling	222	14 (355)	1 5/16 (34)
15 mm JIS 10K/20K weld neck raised face flange	122	15 9/16 (395)	3 3/4 (95)
15 mm JIS 40K weld neck raised face flange	221	16 9/16 (422)	4 1/2 (115)
R050 fitting options[1]			
1/2" ANSI 150 lb weld neck raised face flange	113	18 3/16 (463)	3 1/2 (89)
1/2" ANSI 300 lb weld neck raised face flange	114	18 9/16 (472)	3 3/4 (95)
1/2" ANSI 600 lb weld neck raised face flange	115	19 1/16 (485)	3 3/4 (95)
3/4" NPT female CAJON size 12 VCO fitting	239	16 7/16 (418)	---
3/4" sanitary fitting (Tri-Clamp compatible)	322	15 15/16 (405)	1 (25)
15 mm DIN PN40 weld neck, DIN 2635, type C face	116	17 7/16 (443)	3 3/4 (95)
15 mm DIN PN100/160 weld neck, DIN 2637, type E face	120	18 (457)	4 1/8 (105)
25 mm DIN PN40 weld neck, DIN 2635, type C face	131	17 5/8 (447)	4 1/2 (115)
15 mm DIN 11851 aseptic coupling	222	16 1/8 (409)	1 5/16 (34)
15 mm JIS 10K/20K weld neck raised face flange	122	17 11/16 (449)	3 3/4 (95)
15 mm JIS 40K weld neck raised face flange	221	18 11/16 (475)	4 1/2 (115)
R100 fitting options[1]			
1" ANSI 150 lb weld neck raised face flange	128	22 3/4 (578)	4 1/4 (108)
1" ANSI 300 lb weld neck raised face flange	129	23 1/4 (591)	4 7/8 (124)
1" ANSI 600 lb weld neck raised face flange	130	23 3/4 (603)	4 7/8 (124)
1" sanitary fitting (Tri-Clamp compatible)	138	21 3/8 (543)	2 (50)
25 mm DIN PN40 weld neck, DIN 2635, type C face	131	21 1/2 (546)	4 1/2 (115)
25 mm DIN PN100/160 weld neck, DIN 2637, type E face	137	22 15/16 (583)	5 1/2 (140)
25 mm DIN 11851 aseptic coupling	230	20 5/8 (525)	1 5/16 (34)
25 mm JIS 10K/20K weld neck raised face flange	139	21 3/4 (552)	4 15/16 (125)
25 mm JIS 40K weld neck raised face flange	229	23 (584)	5 1/8 (130)

[1] *Fittings listed here are standard options. Other types of fittings are available. Contact your local Micro Motion representative.*

Physical specifications—all meters *continued*

R200 fitting options[1]	Fitting code	Dim. A, face-to-face *inches (mm)*	Dim. B, outside diam. *inches (mm)*
1 1/2" ANSI 150 lb weld neck raised face flange	341	24 13/16 (630)	5 (127)
1 1/2" ANSI 300 lb weld neck raised face flange	342	25 5/16 (642)	6 1/8 (155)
1 1/2" ANSI 600 lb weld neck raised face flange	343	25 13/16 (655)	6 1/8 (155)
2" ANSI 150 lb weld neck raised face flange	418	24 15/16 (633)	6 (152)
2" ANSI 300 lb weld neck raised face flange	419	25 7/16 (645)	6 1/2 (165)
2" ANSI 600 lb weld neck raised face flange	420	26 3/16 (665)	6 1/2 (165)
1 1/2" sanitary fitting (Tri-Clamp compatible)	351	23 5/16 (592)	2 (50)
2" sanitary fitting (Tri-Clamp compatible)	352	22 15/16 (582)	2 1/2 (64)
40 mm DIN PN40 weld neck, DIN 2635, type C face	381	23 9/16 (599)	5 15/16 (150)
50 mm DIN PN40 weld neck, DIN 2635, type C face	382	23 11/16 (601)	6 1/2 (165)
50 mm DIN PN100 weld neck, DIN 2637, type E face	378	25 1/4 (642)	7 11/16 (195)
50 mm DIN PN160 weld neck, DIN 2638, type E face	376	25 13/16 (656)	7 11/16 (195)
40 mm DIN 11851 aseptic coupling	353	23 3/16 (590)	2 9/16 (65)
50 mm DIN 11851 aseptic coupling	354	23 5/16 (592)	3 1/16 (78)
40 mm JIS 10K weld neck raised face flange	385	23 1/2 (596)	5 1/2 (140)
40 mm JIS 20K weld neck raised face flange	387	23 1/2 (596)	5 1/2 (140)
50 mm JIS 10K weld neck raised face flange	386	23 7/16 (596)	6 1/8 (155)
50 mm JIS 20K weld neck raised face flange	388	23 5/8 (601)	6 1/8 (155)
50 mm JIS 40K weld neck raised face flange	389	25 7/16 (647)	6 1/2 (165)

[1] *Fittings listed here are standard options. Other types of fittings are available. Contact your local Micro Motion representative.*

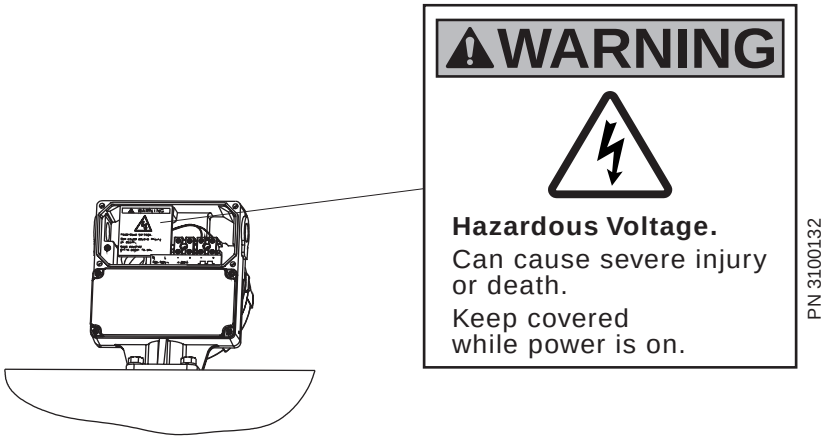
Appendix
B

Label Maintenance and Replacement

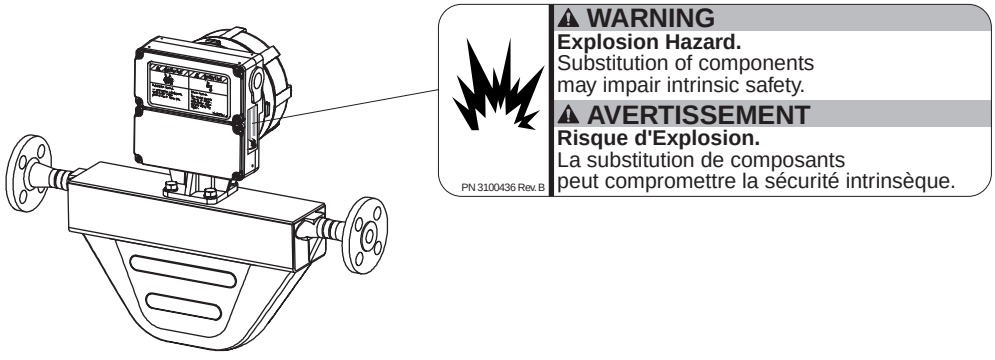
Micro Motion product safety labels have been designed in accordance with the voluntary standard, ANSI Z535.4. If any of the labels illustrated below is illegible, damaged, or missing, promptly have a new one installed. The sensor includes the safety labels illustrated below.

Contact Micro Motion for replacement labels:
- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
- Outside the U.S.A., phone 303-530-8400
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

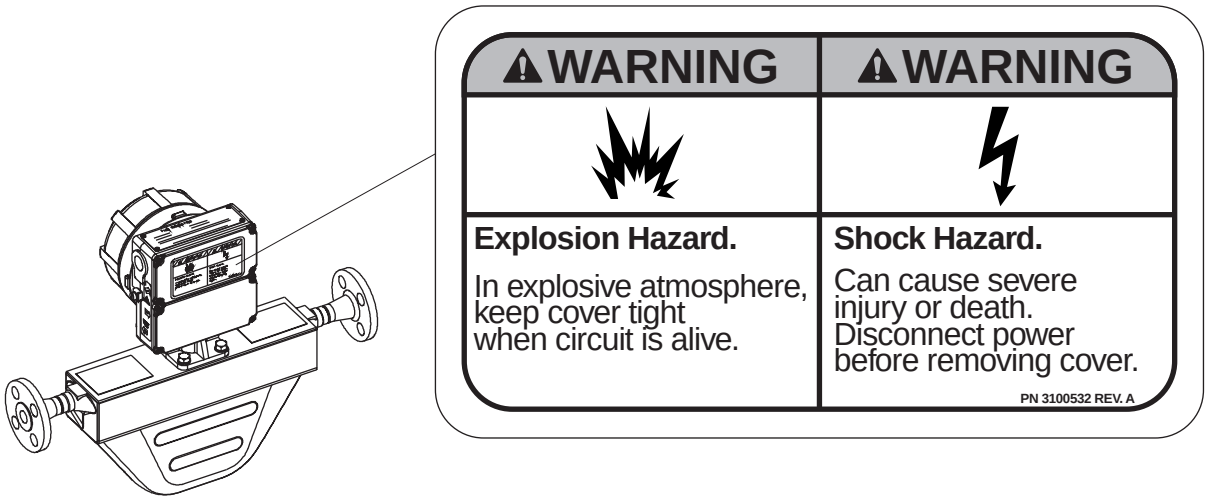
Label number 3100132



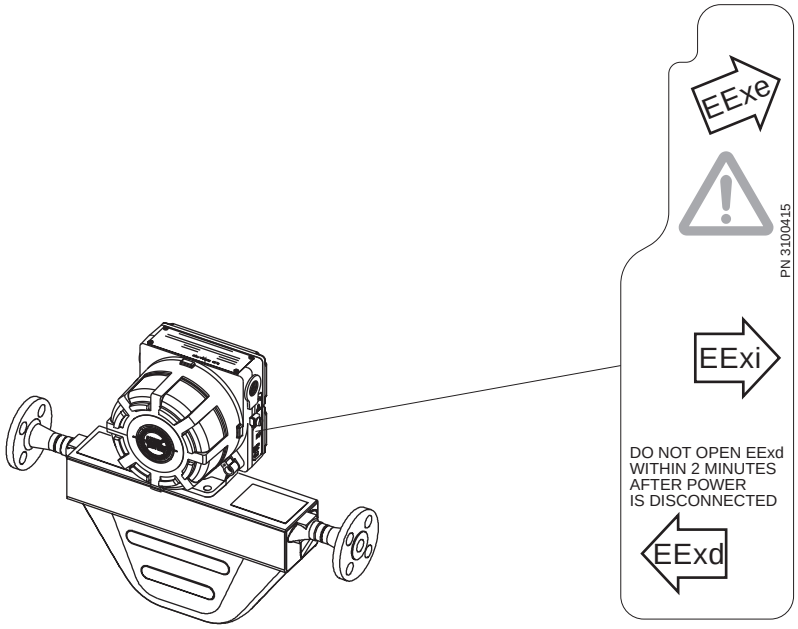
Label number 3100436



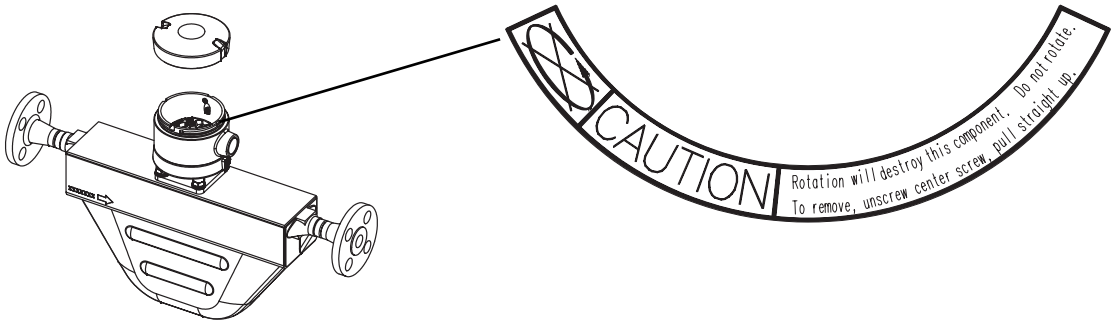
Label number 3100532



Label number 3100415



Label number 3600460



Appendix
C

Return Policy

General guidelines

Micro Motion return procedures must be followed for you to meet the legal requirements of applicable U.S. Department of Transportation (DOT) regulations. They also help us provide a safe working environment for our employees. Failure to follow these requirements will result in your equipment being refused delivery.

To return equipment, contact the Micro Motion Customer Service Department for return procedures and required documentation:

- In the U.S.A., phone **1-800-522-6277** or **1-303-530-8400** between 6:00 a.m. and 5:30 p.m. (Mountain Standard Time), Monday through Friday, except holidays.
- In Europe, phone **+31 (0) 318 549 549**, or contact your local sales representative.
- In Asia, phone **(65) 777-8211,** or contact your local sales representative.

Information on return procedures and forms are also available on our Web site, at **www.micromotion.com**.

New and unused equipment

Only equipment that has not been removed from the original shipping package will be considered new and unused. New and unused equipment includes sensors, transmitters, or peripheral devices which:

- Were shipped as requested by the customer but are not needed, or
- Were shipped incorrectly by Micro Motion.

Used equipment

All other equipment is considered used. This equipment must be completely decontaminated and cleaned before being returned. Document all foreign substances that have come in contact with the equipment.

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