Micro Motion®
ELITE® Sensor

Instruction Manual
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ELITE® Sensor

Instruction Manual

For online technical support, refer to the EXPERT 2™ tool at www.expert2.com. To speak to a customer service representative, call the support center nearest you:

- In U.S.A., phone 1-800-522-MASS (1-800-522-6277)
- In Canada and Latin America, phone (303) 530-8400
- In Asia, phone (65) 6770-8155
- In the U.K., phone 0800 - 966 180 (toll-free)
- Outside the U.K., phone +31 (0) 318 495 670

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Before You Begin

Your new sensor

Your new Micro Motion® ELITE® sensor (CMF series) is one part of a Coriolis flowmetering system. The other part is a transmitter.

Transmitter connections
The sensor (except CMF300A) is available with two different transmitter connections:

• An integral core processor for connecting to a 4-wire remotely mounted transmitter or to a user-supplied remote host.

• A 9-wire junction box for connecting to a remotely mounted transmitter, or to a remotely mounted core processor.

The CMF300A sensor is available only with a remote junction box.

European installations
This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EC declaration of conformity for directives that apply to this product.

The EC declaration of conformity, with all applicable European directives, and the complete ATEX Installation Drawings and Instructions are available on the internet at www.micromotion.com/atex or through your local Micro Motion support center.

Sensor components
Components of the sensor are illustrated throughout the rest of this section.
Before You Begin  

Components of the CMF010 sensor  

With junction box  

With core processor  

CMF010: Side view of extended mount junction box  

CMF010: Side view of extended mount core processor
Components of the CMF025, CMF050, and CMF100 sensor

With junction box

With core processor

CMF050: Side view of extended mount junction box

CMF050: Side view of extended mount core processor
Components of the CMF200 and CMF300 sensor

With junction box

With core processor

CMF200: Side view of extended mount junction box

CMF200: Side view of extended mount core processor
Before You Begin continued

Components of the CMF300A sensor

Components of the CMF400 sensor: Integral booster amplifier with core processor
Before You Begin continued

Components of the CMF400 sensor: Remote booster amplifier with core processor

Components of the CMF400 sensor: Integral booster amplifier with junction box
Before You Begin continued

Components of the CMF400 sensor: Remote booster amplifier with junction box

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 9.

Step 2. Orientation
Determining the desired orientation for the sensor in the process pipeline. See page 13.

Step 3. Mounting
Installing the sensor in the pipeline. See page 19.

Step 4. Wiring
Connecting the flowmeter cable to the sensor and transmitter. See page 25.

Step 5. Startup
Requirements for flowmeter startup. See page 43.
Before You Begin continued

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 45.

- **Purge fittings** are described in Appendix A, page 59.

- **Rupture disks** are described in Appendix B, page 63.

- **Maintenance of labels** is explained in Appendix C, page 65.

- **Return policy** for Micro Motion equipment is described in Appendix D, page 67.
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 must be full of process fluid.)
• If the sensor has a core processor you must also consider environmental requirements of the core processor.
• During operation, the sensor must remain full of process fluid.
• The sensor must be installed in an area that is compatible with the classification specified on the sensor approvals tag. (See illustrations, pages 2-7.)

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 should be at least 5 ft (1.5 m) apart.

Maximum wiring distances
Use these guidelines for calculating maximum wiring distances. Maximum distance between sensor and transmitter depends on cable type. See Table 1.

Table 1. Maximum cable lengths

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Wire gauge</th>
<th>Maximum length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Motion 9-wire to an MVD</td>
<td>Not</td>
<td>60 feet (20 meters)</td>
</tr>
<tr>
<td>transmitter or core processor</td>
<td>applicable</td>
<td></td>
</tr>
<tr>
<td>Micro Motion 9-wire to all other</td>
<td>Not</td>
<td>1000 feet (300</td>
</tr>
<tr>
<td>transmitters</td>
<td>applicable</td>
<td>meters)</td>
</tr>
<tr>
<td>Micro Motion 4-wire</td>
<td>Not</td>
<td>1000 feet (300</td>
</tr>
<tr>
<td></td>
<td>applicable</td>
<td>meters)</td>
</tr>
<tr>
<td>User-supplied 4-wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power wires (VDC)</td>
<td>22 AWG</td>
<td>300 feet (90</td>
</tr>
<tr>
<td></td>
<td>(0,35 mm²)</td>
<td>meters)</td>
</tr>
<tr>
<td></td>
<td>20 AWG</td>
<td>500 feet (150</td>
</tr>
<tr>
<td></td>
<td>(0,5 mm²)</td>
<td>meters)</td>
</tr>
<tr>
<td></td>
<td>18 AWG</td>
<td>1000 feet (300</td>
</tr>
<tr>
<td></td>
<td>(0,8 mm²)</td>
<td>meters)</td>
</tr>
<tr>
<td>• Signal wires (RS-485)</td>
<td>22 AWG</td>
<td>1000 feet (300</td>
</tr>
<tr>
<td></td>
<td>(0,35 mm²)</td>
<td>meters)</td>
</tr>
<tr>
<td></td>
<td>larger</td>
<td></td>
</tr>
</tbody>
</table>
**CMF400 booster amplifier cable**
The CMF400 sensor is shipped with 10 feet (3 meters) of cable for connecting to the remote booster amplifier. For longer cable lengths, up to 60 ft (20 m), contact Micro Motion.

**CMF300A junction box**
The CMF300A high-temperature sensor comes with a 32-in (812 mm) pre-installed flexible conduit. This conduit is required for agency approval (e.g., UL, CSA, ATEX, etc.). A junction box is connected to the end of this cable by the factory. The junction box provides an exterior ground to the sensor and houses the terminal strip for the flowmeter cable.

**Environmental limits**
Install the sensor in a location that falls within the following limits:

**Process fluid temperature limits**
- -400 to +400 °F (-240 to +204 °C) for sensor with junction box
- -60 to +257 °F (-50 to +125 °C) for sensor with core processor
- -60 to +300 °F (-50 to +150 °C) for sensor with extended core processor
- +32 to +650 °F (0 to +343 °C) for CMF300A sensor

**Ambient temperature limits:**
- -40 to +140 °F (-40 and +60 °C) for sensor with core processor
- -40 to +248 °F (-40 to +120 °C) for CMF300A remote junction box

For ATEX approvals, process fluid temperature can be further restricted by ambient temperatures. For guidelines, go to www.micromotion.com/atex.

**CMF400 booster amplifier limits**
Install the booster amplifier in a location that falls within the following limits:
- Process fluid temperature limits between -40 to +140 °F (-40 to +60 °C) for the integrally mounted booster amplifier with either the core processor or junction box.
- Process fluid temperature limits between -400 to +400 °F (-240 to +200 °C) for the remotely mounted booster amplifier with either the core processor or junction box.
- Ambient temperature limits between -40 to +140 °F (-40 to +60 °C) with either a core processor or junction box.
Location continued

Core processor

The sensor with a core processor has a maximum process temperature limit of 257 °F (125 °C). If the process fluid temperature is expected to exceed this temperature you must use a junction box model sensor with a 9-wire Series 1000 or 2000 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 required to halt flow during the zeroing procedure.

Hazardous area installations

Make sure the hazardous area specified on the sensor approvals tag is suitable for the environment in which the sensor is installed. (See illustrations on pages 2-7.) For installation in an area that requires intrinsic safety, refer to Micro Motion UL, CSA, SAA, or ATEX documentation, shipped with the sensor or available from the Micro Motion web site.

For a complete list of hazardous area classifications for Micro Motion sensors, refer to the EXPERT2™ system at www.expert2.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)
• In Canada and Latin America, phone (303) 530-8400
• In Asia, phone (65) 6770-8155
• In the U.K., phone 0800 - 966 180 (toll free)
• Outside the U.K., phone +31 (0) 318 495 670
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 has a flow direction arrow (see illustrations, pages 2-7) to help you configure the transmitter for flow direction. The sensor measures flow in either direction; however, if the process fluid flows in the direction opposite to the flow direction arrow, then the transmitter must be 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.

Orienting the conduit opening
The conduit opening in the core processor housing or junction box should be pointed downward, to reduce the risk of condensation or moisture in the core processor or junction box. Follow the instructions in this section to rotate the core processor housing or junction box. If it is not possible to rotate the core processor housing or junction box, install wiring with drip legs in the conduit or cables.

Core processor housing
You can rotate the core processor housing independently from the terminals inside, before the wiring is attached. Rotate only the lid and core processor housing, and not the entire core processor. See the figure on page 14. If the entire core processor is rotated, the sensor will be damaged.

⚠️ CAUTION
Twisting the core processor will damage the sensor.
Do not twist the core processor.
Core processor mounted on ELITE sensor

To orient the core processor conduit opening:
1. The housing lid and core processor housing can be removed or installed by pressing and turning either clockwise or counterclockwise 1/4 turn.

2. Remove the housing lid.

3. Remove the core processor housing, disengaging it from the housing base.

4. Re-install the core processor housing so the conduit opening is in the desired location.

5. Re-install the housing lid.
Orientation continued

To orient the junction box conduit opening:
You can rotate the junction box independently from the terminals inside, before the wiring is attached. See the figure on page 15. Rotate the junction box in 1/4 turn increments to orient the conduit opening.

Junction box mounted on ELITE sensor

Process fluid
Typical sensor orientations are shown in the tables on the following pages:
- For measuring liquids, see page 16.
- For measuring gases, see page 17.
- For measuring slurries, see page 18.
### Orientations for measuring liquids

<table>
<thead>
<tr>
<th>Sensor model</th>
<th>Preferred orientation for measuring liquids</th>
<th>Alternative orientations for measuring liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMF010</td>
<td>Tubes flat&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF025</td>
<td>Tubes down&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF050</td>
<td>Tubes down&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF100</td>
<td>Tubes down&lt;br&gt;Self-draining</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF200</td>
<td>Tubes down&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF300</td>
<td>Tubes up&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF300A</td>
<td>Tubes down&lt;br&gt;Self-draining</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
<tr>
<td>CMF400</td>
<td>Tubes down&lt;br&gt;Horizontal pipeline</td>
<td>Flag mount&lt;br&gt;Vential pipeline</td>
</tr>
</tbody>
</table>

Micro Motion® ELITE® Sensor Instruction Manual
### Orientations for measuring gases

<table>
<thead>
<tr>
<th>Sensor model</th>
<th>Preferred orientation for measuring gases</th>
<th>Alternative orientations for measuring gases</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMF010</td>
<td>Tubes flat</td>
<td>Tubes up</td>
</tr>
<tr>
<td></td>
<td>Horizontal pipeline</td>
<td>Horizontal pipeline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flag mount Vertical pipeline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flow</td>
</tr>
<tr>
<td>CMF025</td>
<td>Tubes up</td>
<td>Flag mount Vertical pipeline</td>
</tr>
<tr>
<td>CMF050</td>
<td>Horizontal pipeline</td>
<td></td>
</tr>
<tr>
<td>CMF100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMF200</td>
<td>Tubes up</td>
<td>Flag mount Vertical pipeline</td>
</tr>
<tr>
<td>CMF300</td>
<td>Horizontal pipeline</td>
<td></td>
</tr>
<tr>
<td>CMF300A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMF400</td>
<td>Tubes up</td>
<td>Flag mount Vertical pipeline</td>
</tr>
<tr>
<td></td>
<td>Horizontal pipeline</td>
<td></td>
</tr>
</tbody>
</table>

---

*Micro Motion® ELITE® Sensor Instruction Manual* 17
Orientations for measuring slurries

<table>
<thead>
<tr>
<th>Sensor model</th>
<th>Preferred orientation for measuring slurries</th>
<th>Alternative orientations for measuring slurries</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMF010</td>
<td>Tubes flat</td>
<td>none</td>
</tr>
<tr>
<td></td>
<td>Horizontal pipeline</td>
<td></td>
</tr>
<tr>
<td>CMF025</td>
<td>Tubes up</td>
<td>none</td>
</tr>
<tr>
<td>CMF050</td>
<td>Horizontal pipeline</td>
<td></td>
</tr>
<tr>
<td>CMF100</td>
<td>Self-draining</td>
<td></td>
</tr>
<tr>
<td>CMF200</td>
<td>Flag mount</td>
<td>Tubes up</td>
</tr>
<tr>
<td>CMF300</td>
<td>Vertical pipeline</td>
<td>Horizontal pipeline</td>
</tr>
<tr>
<td>CMF300A</td>
<td>Self-draining</td>
<td>Self-draining</td>
</tr>
<tr>
<td>CMF400</td>
<td>Flag mount</td>
<td>Tubes up</td>
</tr>
<tr>
<td></td>
<td>Vertical pipeline</td>
<td>Horizontal pipeline</td>
</tr>
<tr>
<td></td>
<td>Self-draining</td>
<td>Self-draining</td>
</tr>
</tbody>
</table>
Mounting any ELITE® sensor

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

**CAUTION**
Using the sensor to support piping can damage the sensor or cause measurement error.
Do not use sensor to support pipe.
Optional CMF010 mounting

The CMF010 sensor can be mounted in-line, supported by the process piping like other sensors, or can be mounted to a wall or another solid structure using bolts, as illustrated below. Mount the sensor using bolts if the pipeline will not support the sensor. See illustration below.

CMF010 mounting with bolts

- **2 user-supplied bolts for mounting**
  - 5/16" (M8) max. diameter
  - 2 1/4" (58 mm) min. length

- Junction box can be rotated by hand (before wiring is attached) for access to mounting holes. Core processor does not need to be rotated for access to mounting holes. Rotation of the core processor will destroy the sensor. Do not rotate.

- If necessary, **rigid** standoffs may be installed (for example: steel washers are acceptable, rubber washers are not).

- **Mounting surface**
  If pipe supports are used, they should be rigidly supported by the same mounting surface as the sensor.
Mounting continued

CMF300A high-temperature sensors

The CMF300A high-temperature sensor comes with a 32-inch (812 mm) pre-installed flexible conduit. This conduit is required for agency approval (e.g., UL, CSA, ATEX, etc.).

A factory-supplied junction box is connected to the end of the flexible conduit. The junction box, illustrated below, provides an exterior ground to the sensor and houses the terminal strip for the flowmeter cable. Wiring is described starting on page 25.

CMF300A remote-mount junction box

Installing wafer-style sensors

A wafer-style sensor, which has no flanges or fittings, lets you "clamp" the sensor between process connections in the pipeline. ELITE CMF025, CMF050, and CMF100 sensors are available in the wafer style.

A wafer installation kit is shipped with wafer-style sensors. Kits are available to fit standard ANSI, DIN, and JIS fittings. Wafer kits contain the following pieces:
• 4 flange bolts
• 8 flange nuts
• 2 alignment rings, which help center the sensor between the bolts

To install a wafer-type sensor, follow the five steps below:

1. Make sure the bolts provided in the wafer installation kit fit your process connections.

2. Slip the sensor alignment rings over each end of the sensor wafer, then insert the sensor between the process connections in the pipeline, as illustrated below. Installing gaskets is recommended. (Micro Motion does not supply gaskets.)
Wafer-style assembly

3. Insert the bolts through both process connections, and thread the nuts onto the bolts. Tighten nuts as tight as you can with your fingers.

4. Rotate the sensor alignment rings in the direction that pushes the bolts outward, as illustrated below. Rotate both rings until the assembly is centered and tight.

5. With a wrench, tighten nuts in an alternating order, to ensure the process connections are evenly tightened.
Mounting continued

Tightening sensor alignment rings

Sensor wafer
Sensor alignment ring
Flange bolt

Rotate ring...
...to push bolts outward
Wiring

Hazardous area installations

The following warning applies to hazardous area installations:

⚠️ 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 illustrations, pages 2-7.
- For installation in an area that requires intrinsic safety, use this document with Micro Motion UL, CSA, SAA, or ATEX installation instructions.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

⚠️ CAUTION

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

- Ensure integrity of gaskets and O-rings.
- Grease all O-rings before sealing.
- Install drip legs in cable or conduit.
- Seal all conduit openings.

CMF400 sensor

For wiring between the sensor and transmitter, see page 34.
- The CMF400 also requires power-supply wiring to the booster amplifier. See page 27.
- The remote booster amplifier requires wiring of the drive wires. See page 27.
- If possible, install wiring with drip legs in the conduit or cables, to reduce the risk of condensation or excessive moisture in the junction box.
**Wiring continued**

**CMF400 booster amplifier**

The CMF400 booster amplifier requires wiring from an AC power supply. Between 85-250 VAC of power must be provided. See page 27 and page 28 for graphics on power supply wiring.

The sensor is shipped with 10 feet (3 meters) of cable for connecting to the remote booster amplifier. For longer cable lengths, up to 60 ft (20 m), contact Micro Motion.

**Wiring to remote booster amplifier**

![Diagram of wiring to CMF400 booster amplifier]

- **Violet**
- **Yellow**
- **Orange**
- **Blue**
- **Gray**
- **Red (factory wired)**
- **Brown (factory wired)**
- **White**
- **Green**

Match wire colors to the corresponding terminal wire colors from the remote booster amplifier. Clip remaining wires and insulate.

Install customer-supplied drive wiring, 18 AWG (0.75 mm²), from remote booster amplifier terminals 1 and 2 to terminals 1 and 2 on the sensor.
Wiring continued

Power supply wiring on remote booster amplifier

Remote booster amplifier with core processor

Provide 85-250 VAC power

Drive wires to the sensor

Remove screw at terminal cover before rewiring, then re-install.

Remote booster amplifier with junction box

Provide 85-250 VAC power

Drive wires to the sensor

Remove screw and terminal cover before rewiring, then re-install.
**Power supply wiring on integrally mounted booster amplifier**

(View of top cover)

Provide 85-250 VAC of power.

---

**WARNING**

**Explosion Hazard**

In a hazardous area:
- Do not open booster amplifier housing cover while booster amplifier is energized.
- Wait at least 30 minutes after power is shut off before opening.

---

**CAUTION**

Improper installation of wiring could cause measurement error or sensor failure.

- Shut off power before installing power-supply wiring.
- Follow all instructions to ensure sensor will operate correctly.
- Install drip legs in conduit or cable.
- Seal all conduit openings.
- Ensure integrity of gaskets, and fully tighten sensor junction-box cover and all transmitter housing covers.
Wiring continued

⚠️ 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 I.S. installation manuals.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

⚠️ CAUTION

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

- Ensure integrity of gaskets and O-rings.
- Grease all O-rings before sealing.
- Install drip legs in cable or conduit.
- Seal all conduit openings.

**CMF300A junction box**

**CMF300A high-temperature sensor**

The CMF300A high-temperature sensor comes with a 32-inch (812 mm) pre-installed flexible conduit. This conduit is required for agency approval (such as UL, CSA, ATEX, etc.).

A factory-supplied junction box is connected to the end of the flexible conduit. The junction box, illustrated below, provides an exterior ground to the sensor and houses the terminal strip for connecting the flowmeter cable from the transmitter.

- The procedure for installing wiring at the CMF300A junction box is described on page 30.
- If possible, install wiring with drip legs in the conduit or cables, to reduce the risk of condensation or excessive moisture in the junction box.
Wiring continued

CMF300A sensor cable and junction box

32-inch (812 mm) flexible conduit
- Liquid tight to meet CE requirements for European installations
- Permanently attached to sensor

3/4” NPT female conduit seal or cable gland for wiring to transmitter

Drip leg

Cable connections to CMF300A sensors with a junction box

To make connections at the CMF300A high-temperature sensor, follow these steps:

1. Unscrew junction-box cover, then remove retaining screw and terminals bracket from junction box.
2. Draw the cable from the transmitter into the junction box. Install a cable gland or water-tight conduit seal to ensure the junction box will remain sealed after installation.

3. Gather each set of wires together and bend back, outside junction box, in preparation for reinstalling bracket.

The external bonding terminal may be used for supplementary bonding connections to meet local code requirements.

4. Replace the bracket. Tighten retaining screw to secure bracket in junction box.
5. With bracket reinstalled, connect individual wires to terminals. Refer to the illustration and the table on page 33.
   • One side of each terminal block is for wires that come from the sensor.
   • The other side of each terminal block is for connecting wires from the transmitter.

6. Ensure integrity of gaskets, then reinstall and fully tighten the junction-box cover.

7. To make wiring connections at the transmitter, follow the instructions on page 28.

Wire-to-wire connections in CMF300A junction box

<table>
<thead>
<tr>
<th>From transmitter</th>
<th>From CMF300A sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>1</td>
</tr>
<tr>
<td>Red</td>
<td>2</td>
</tr>
<tr>
<td>Orange</td>
<td>3</td>
</tr>
<tr>
<td>Yellow</td>
<td>4</td>
</tr>
<tr>
<td>Green</td>
<td>5</td>
</tr>
<tr>
<td>Blue</td>
<td>6</td>
</tr>
<tr>
<td>Violet</td>
<td>7</td>
</tr>
<tr>
<td>Gray</td>
<td>8</td>
</tr>
<tr>
<td>White</td>
<td>9</td>
</tr>
</tbody>
</table>
Wiring continued

Wiring connections at CMF300A sensors

Connecting and shielding 9-wire cable

A 9-wire connection is required between the junction box and the core processor or transmitter. Micro Motion offers two types of 9-wire cable:

- Shielded
- Armored

Both cable types contain shield drain wires. You may also use jacketed cable with conduit.

Cable connections to sensor and to transmitter

The wiring procedure is the same for the sensor and transmitter. Refer to the wiring diagrams on pages 34–36, 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 to RFT9739 field-mount transmitter

Wiring to RFT9739 rack-mount transmitter
Wiring continued

Wiring to Model 3500 with screw or solder terminals

ELITE® sensor junction box terminals

Flowmeter cable

Maximum cable length 1000 ft. (300 m)

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

Model 3500 with screw-type or solder-tail terminals

Yellow c4
Violet c6
Green c8
Blue c10
Brown c12
a4 Black (Drains)
a6 Orange
All White
a10 Gray
a12 Red

Wiring to Model 3500 with I/O cable

ELITE® sensor junction box terminals

Flowmeter cable

Maximum cable length 1000 ft. (300 m)

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

Model 3500 with I/O cable

Not approved for I/O cable

Connect outer braid of shielded or armored cable

Wiring to Model 3700

ELITE® sensor junction box terminals

Flowmeter cable

Maximum cable length 1000 ft. (300 m)

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

Model 3700 terminals
Wiring continued

Wiring to IFT9701 or Model 5300 transmitters

Wiring the 9-wire connection to Model 2700 field-mount transmitter

Core processor to a 4-wire remote transmitter or remote host

To connect wiring at the core processor:

1. Use one of the following methods to shield the wiring from the core processor to the remote transmitter:

   • If you are installing unshielded wiring in continuous metallic conduit that provides 360° termination shielding for the enclosed wiring, go to Step 6, page 39.

   • If you are installing user-supplied cable gland with shielded cable or armored cable, terminate the shields in the cable gland. Terminate both the armored braid and the shield drain wires in the cable gland.


• If you are installing a Micro Motion-supplied cable gland at the core processor housing:

- Prepare the cable and apply shielded heat shrink as described below. The shielded heat shrink provides a shield termination suitable for use in the gland when using cable whose shield consists of foil and not a braid. Proceed to Step 2.

- With armored cable, where the shield consists of braid, prepare the cable as described below, but do not apply heat shrink. Proceed to Step 2.

2. Remove the cover from the core processor.

3. Slide the gland nut and the clamping insert over the cable.

4. For connection at the core processor housing, prepare shielded cable as follows (for armored cable, omit steps d, e, f, and g):

   a. Strip 4 1/2 inches (114 mm) of cable jacket.

   b. Remove the clear wrap that is inside the cable jacket, and remove the filler material between the wires.

   c. Remove the foil shield that is around the insulated wires, leaving 3/4 inch (19 mm) of foil or braid and drain wires exposed, and separate the wires.

   d. Wrap the shield drain wire(s) around the exposed foil twice. Cut off the excess wire.
Shield drain wire(s) wrapped twice around exposed shield foil

e. Place the EMI-shielded heat shrink over the exposed shield drain wire(s). The tubing should completely cover the drain wires.

f. Without burning the cable, apply heat (250 °F or 120 °C) to shrink the tubing.

Shielded heat shrink completely covers exposed drain wires

g. Position gland clamping insert so the interior end is flush with the heat shrink.

h. Fold the cloth shield or braid and drain wires over the clamping insert and approximately 1/8 inch (3 mm) past the O-ring.

i. Install the gland body into the core processor housing conduit opening.
5. Insert the wires through the gland body and assemble the gland by tightening the gland nut.

6. Identify the wires in the 4-wire cable. The 4-wire cable supplied by Micro Motion consists of one pair of 18 AWG (0.75 mm²) wires (red and black), which should be used for the VDC connection, and one pair of 22 AWG (0.35 mm²) wire (green and white), which should be used for the RS-485 connection. Connect the four wires to the numbered slots on the core processor, matching corresponding numbered terminals on the transmitter.

7. Reattach the core processor housing.

**WARNING**

Twisting the core processor will damage the sensor.

Do not twist the core processor.
8. Shield and shield drain wire(s) should not be grounded at the transmitter.

- For wiring at the transmitter, see the transmitter Quick Reference Guide (QRG).

- If you are connecting to an MVDSolo with MVD Direct Connect™ I.S. barrier supplied by Micro Motion, the barrier supplies power to the core processor. Refer to the barrier documentation to identify the terminals at the barrier.

- If you are connecting to an MVDSolo without I.S. barrier:

  - Connect the VDC wires from the core processor (see figure on page 40) to an independent power supply. This power supply must connect only to the core processor. A recommended power supply is the SDN series of 24-VDC power supplies manufactured by Sola/Hevi-Duty.

  - Do not ground either connection of the power supply.

  - Connect the RS-485 wires from the core processor (see figure below) to the RS-485 terminals at the remote host. Refer to the vendor documentation to identify the terminals.

Core processor terminals
Wiring continued

Sensor grounding

Ground the sensor and transmitter independently.

⚠️ 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, SAA, or ATEX documentation, shipped with the sensor or available from the Micro Motion web site.
• For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

The sensor can be grounded via the piping if the joints in the pipeline are ground-bonded. If the sensor is not grounded via the piping, connect a ground wire to the internal or external grounding screw, which is located on the core processor or junction box.

If national standards are not in effect, follow these guidelines:
• Use copper wire, 14 AWG (2.5 mm²) or larger wire size for grounding.
• Keep all ground leads as short as possible, less than 1 ohm impedance.
• Connect ground leads directly to earth, or follow plant standards.

Refer to the transmitter documentation for instructions on grounding the transmitter.
Installation
Step 5

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 instruction manuals include instructions for flowmeter configuration, calibration, and characterization:

- *Using the HART Communicator with Micro Motion 9700 Series Transmitters*
- *Using Prolink II Software with Micro Motion Transmitters*
- *Using ProLink II Software with Micro Motion Series 1000/2000 Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*
- *Series 3000 Detailed Setup Manual*
- *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.

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.

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
- In Canada and Latin America, phone (303) 530-8400
- In Asia, phone (65) 6770-8155
- In the U.K., phone 0800 - 966 180 (toll free)
- Outside the U.K., phone +31 (0) 318 495 670
- Or visit our website at [www.micromotion.com](http://www.micromotion.com).
Troubleshooting

General information

For troubleshooting help, see the EXPERT$_2$™ 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 47
- Erratic flow rate, page 48
- Inaccurate flow rate or batch total, page 49
- Inaccurate density reading, page 50
- Inaccurate temperature reading, page 51

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 9700 Series Transmitters
- Using ProLink II Software with Micro Motion Transmitters
- Using ProLink II Software with Micro Motion Series 1000/2000 Transmitters
- Using Modbus Protocol with Micro Motion Transmitters
- Series 3000 Detailed Setup Manual

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
Troubleshooting continued

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.

• In the U.S.A., phone 1-800-522-MASS (1-800-522-6277)
• In Canada and Latin America, phone (303) 530-8400
• In Asia, phone (65) 6770-8155
• In the U.K., phone 0800 - 966 180 (toll free)
• Outside the U.K., phone +31 (0) 318 495 670
### Troubleshooting zero drift

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Instructions</th>
<th>What to do next</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check for leaking valves and seals</td>
<td></td>
<td>• If no leaks are found, go to step 2&lt;br&gt;• If leaks are found, eliminate them, then go to step 15</td>
</tr>
<tr>
<td>2. Check the flow units</td>
<td>See page 51</td>
<td>• If the flow units are OK, go to step 3&lt;br&gt;• If the flow units are wrong, change them, then go to step 15</td>
</tr>
<tr>
<td>3. Make sure the flowmeter was zeroed properly</td>
<td>See page 43</td>
<td>• If the flowmeter was zeroed properly, go to step 4&lt;br&gt;• If the flowmeter was not zeroed properly, zero it, then go to step 15</td>
</tr>
<tr>
<td>4. Check for the proper flow calibration factor</td>
<td>See page 53</td>
<td>• If the flow cal factor is correct, go to step 5&lt;br&gt;• If the flow cal factor is incorrect, change it, then go to step 15</td>
</tr>
<tr>
<td>5. Check the damping value</td>
<td>See page 54</td>
<td>• If the damping value is OK, go to step 6&lt;br&gt;• If the damping value is too low, change it, then go to step 15</td>
</tr>
<tr>
<td>6. Check for two-phase flow</td>
<td>See page 57</td>
<td>• If there is no two-phase flow, go to step 7&lt;br&gt;• If there is two-phase flow, fix the problem, then go to step 15</td>
</tr>
<tr>
<td>7. Check for moisture in the sensor junction box</td>
<td>See page 56</td>
<td>• If there is no moisture present, go to step 8&lt;br&gt;• If there is moisture in the junction box, dry out and seal the junction box, then go to step 15</td>
</tr>
<tr>
<td>8. Check for faulty or improperly installed flowmeter wiring</td>
<td>See page 52</td>
<td>• If the wiring is OK, go to step 9&lt;br&gt;• If the wiring is faulty, fix or replace it, then go to step 15</td>
</tr>
<tr>
<td>9. Check for faulty or improperly installed grounding</td>
<td>See page 55</td>
<td>• If the grounding is OK, go to step 10&lt;br&gt;• If the grounding is incorrect or faulty, fix it, then go to step 15</td>
</tr>
<tr>
<td>10. Check for mounting stress on the sensor</td>
<td>See page 56</td>
<td>• If the sensor mount is OK, go to step 11&lt;br&gt;• If there are mounting stresses, fix it, then go to step 15</td>
</tr>
<tr>
<td>11. Check for vibration or crosstalk</td>
<td>See page 57</td>
<td>• If there is no vibration or crosstalk, go to step 12&lt;br&gt;• If there is vibration or crosstalk, eliminate it, then go to step 15</td>
</tr>
<tr>
<td>12. Make sure the sensor is oriented properly</td>
<td>See page 13</td>
<td>• If the sensor is oriented properly, go to step 13&lt;br&gt;• If the sensor is not oriented properly, change the orientation, then go to step 15</td>
</tr>
<tr>
<td>13. Check for plugging or build-up on the sensor flow tubes</td>
<td>See page 58</td>
<td>• If the tubes are not plugged, go to step 14&lt;br&gt; • If there is plugging or build-up, clear the tubes, then go to step 15</td>
</tr>
<tr>
<td>14. Check for RF interference</td>
<td>See page 54</td>
<td>• If there is no interference, or the source cannot be detected, go to step 16&lt;br&gt;• If there is interference, eliminate it, then go to step 15</td>
</tr>
<tr>
<td>15. Check again for zero drift</td>
<td></td>
<td>• If there is no longer any zero drift, you’ve solved the problem&lt;br&gt;• If the zero drifts again, start over at step 3 or go to step 16</td>
</tr>
<tr>
<td>16. Contact Micro Motion</td>
<td>Phone numbers are listed on page 46</td>
<td></td>
</tr>
</tbody>
</table>
Troubleshooting continued

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 51 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

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Instructions</th>
<th>What to do next</th>
</tr>
</thead>
</table>
| 1. Check for erratic flow rate at the transmitter | See page 52  | • 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 52  | • 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 51  | • 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 54  | • 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 54  | • 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 54  | • 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 52  | • 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 55  | • 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 57  | • 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 57  | • 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 58  | • 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 52  | • 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 46 |
**Troubleshooting continued**

**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 51 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate rate or total.

<table>
<thead>
<tr>
<th>Troubleshooting inaccurate flow rate or batch total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedure</strong></td>
</tr>
<tr>
<td>1. Check for the proper flow calibration factor</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2. Check the flow units</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3. Make sure the flowmeter was zeroed properly</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4. Is the flow measurement configured for mass or volume?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5. Check for the proper density calibration factor</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6. Make sure the density reading is accurate for the fluid</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>7. Make sure the temperature reading is accurate for the fluid</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>8. Is the flow measurement configured for mass or volume?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>9. Is the reference total based on a fixed density value?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>10. Change flow units to mass flow units</td>
</tr>
<tr>
<td>11. Check for faulty or improperly installed grounding</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>12. Check for two-phase flow</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>13. Check the scale (or reference measurement) for accuracy</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>14. Check for faulty or improperly installed flowmeter wiring</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>15. Run a new batch and check again for an inaccurate rate or total</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>16. Contact Micro Motion</td>
</tr>
</tbody>
</table>
Troubleshooting continued

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 51 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate density reading.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Instructions</th>
<th>What to do next</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check for stable density reading at the transmitter</td>
<td>See page 54</td>
<td>• If the density reading is stable, go to step 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the density reading is not stable, go to step 3</td>
</tr>
<tr>
<td>2. Check for the proper density calibration factor</td>
<td>See page 53</td>
<td>• If the dens cal factor is correct, go to step 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the dens cal factor is incorrect, change it, then go to step 11</td>
</tr>
<tr>
<td>3. Check for faulty or improperly installed flowmeter wiring</td>
<td>See page 52</td>
<td>• If the flowmeter wiring is OK, go to step 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 11</td>
</tr>
<tr>
<td>4. Check for faulty or improperly installed grounding</td>
<td>See page 55</td>
<td>• If the grounding is OK, go to step 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the grounding is incorrect or faulty, fix it, then go to step 11</td>
</tr>
<tr>
<td>5. Check to see if the density reading is low or high</td>
<td>See page 54</td>
<td>• If the density reading is low, go to step 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the density reading is high, go to step 10</td>
</tr>
<tr>
<td>6. Run a quality check on the process fluid</td>
<td>Use your plant procedures</td>
<td>• If the product quality is OK, go to step 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the product quality is not OK, fix it, then go to step 11</td>
</tr>
<tr>
<td>7. If you checked the wiring in step 3, go to step 8, otherwise, check for faulty or improperly installed flowmeter wiring</td>
<td>See page 52</td>
<td>• If the flowmeter wiring is OK, go to step 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the flowmeter wiring is incorrect or faulty, fix or replace it, then go to step 11</td>
</tr>
<tr>
<td>8. Check for two-phase flow</td>
<td>See page 57</td>
<td>• If there is no two-phase flow, go to step 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If there is two-phase flow, fix the problem, then go to step 11</td>
</tr>
<tr>
<td>9. Check for vibration or crosstalk</td>
<td>See page 57</td>
<td>• If there is no vibration or crosstalk, go to step 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If there is vibration or crosstalk, eliminate it, then go to step 11</td>
</tr>
<tr>
<td>10. Check for plugging or build-up on the sensor flow tubes</td>
<td>See page 58</td>
<td>• If the tubes are not plugged, go to step 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If there is plugging or build-up, clear the tubes, then go to step 11</td>
</tr>
<tr>
<td>11. Check again for inaccurate density reading at the transmitter</td>
<td>See page 54</td>
<td>• If the reading is correct, you’ve solved the problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the reading is still wrong, start over at step 1 or go to step 12</td>
</tr>
<tr>
<td>12. Contact Micro Motion</td>
<td>Phone numbers are listed on page 46</td>
<td></td>
</tr>
</tbody>
</table>
Troubleshooting continued

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 51 or a transmitter with a display. Refer to the table below for the necessary steps to troubleshoot an inaccurate temperature reading.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Instructions</th>
<th>What to do next</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check for faulty or improperly installed flowmeter wiring</td>
<td>See page 52</td>
<td>• 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</td>
</tr>
<tr>
<td>2. Check for the proper temperature calibration factor</td>
<td>See page 53</td>
<td>• 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</td>
</tr>
<tr>
<td>3. Check again for inaccurate temperature reading at the transmitter</td>
<td>See page 54</td>
<td>• 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</td>
</tr>
<tr>
<td>4. Contact Micro Motion</td>
<td>Phone numbers are listed on page 46</td>
<td></td>
</tr>
</tbody>
</table>

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 the Model 3500 or 3700 display
• Use a HART Communicator, ProLink software, or AMS software
• Use a fieldbus or Profibus host controller

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.
Troubleshooting continued

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 the transmitter display, if it has one
- 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 tables on page 53.
      • 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.
Troubleshooting continued

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.
• Readings across wire pairs should be steady.

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

Checking the calibration factors
Check or change the flow, density, or temperature calibration factors at the transmitter. The temperature cal factor is for the RFT9739, Model 1700, 2700, 3500, 3700, and 5300 only. If necessary, refer to the instruction manual (or on-line help for software) for the method you choose.
• Use the Model 3500 or 3700 display
• Use a HART Communicator, ProLink software, or AMS software
• Use the host controller

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.
Troubleshooting continued

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 3500 or 3700 display
- Use a HART Communicator, ProLink software, or AMS software
- Use the host controller

In almost all 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 46. 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 46.

If the transmitter is a Model 1700, 2700, 3500 or 3700, you can use the display to view drive gain.

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.
**Troubleshooting continued**

*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**

![Cross-section of externally shielded cable](image)

**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 if the joints in the pipeline are ground-bonded. If the sensor is not grounded via the piping, connect a ground wire to the internal or external grounding screw, which is located on the core processor or 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 mm²) or larger wire size for grounding.
- Keep all ground leads as short as possible, 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 wiring compartments
Note that the following will help reduce the risk of getting moisture in the sensor junction box: If possible, install wiring with the conduit openings pointed down to reduce the risk of condensation or moisture in the housing. Otherwise, install drip legs on the cable or conduit. All wiring compartments must be sealed to prevent a short circuit. A short would result in measurement error or flowmeter failure. The CMF400 has a junction box and a booster amplifier housing.
• Do not open the CMF400 booster amplifier housing while the booster amplifier is energized. See the warning statement below.
• Replace all covers and seal all openings before applying power to a CMF400 sensor.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
</table>

**Explosion Hazard**
In a hazardous area:
• Do not open booster amplifier housing cover while booster amplifier is energized.
• Wait at least 30 minutes after power is shut off before opening.

Open the junction box or core processor (and, for a CMF400, the booster amplifier housing) to check for moisture. If moisture is present, dry out the junction box or housing. Do not use contact cleaner. Follow these guidelines to avoid risk of condensation or moisture from accumulating:
• Ensure integrity of gaskets and O-rings.
• Grease all O-rings before sealing.
• Seal all conduit openings.
• Install drip legs in conduit or cable.

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 46.
Troubleshooting continued

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 46.

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 13.) 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.
**Troubleshooting continued**

**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 54).

- 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.

**Checking the density reading.** View the flowmeter density 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
Purge Fittings

Keeping purge fittings sealed

If the sensor has purge fittings, they should remain sealed at all times. After a purge plug is removed, the sensor case should be purged with dry nitrogen or argon, and resealed. See Case purging procedure, page 61.

Purging the case protects internal components. Before Micro Motion ships a sensor from the factory, it purges the sensor case. If you never loosen or remove the fittings, you do not have to be concerned about them.

For more information, contact the Micro Motion Customer Service Department:
• In the U.S.A., phone 1-800-522-MASS (1-800-522-6277)
• In Canada and Latin America, phone (303) 530-8400
• In Asia, phone (65) 6770-8155
• In the U.K., phone 0800 - 966 180 (toll free)
• Outside the U.K., phone +31 (0) 318 495 670
• Or visit our website at www.micromotion.com.

Using purge fittings

The primary reason for having purge fittings is to monitor pressure inside the sensor case. Some users, such as those measuring highly volatile fluids, install a pressure transmitter across the sensor purge fittings. A control device, connected to the pressure transmitter, shuts down the process if a change in pressure is detected. This provides additional protection should a rupture occur inside the sensor.
Removing a purge plug

If you remove a purge plug from the sensor case, it is necessary to re-purge the case.

⚠️ WARNING

Removing a purge plug will require the sensor case to be re-purged with a dry inert gas. Improper pressurization could result in serious personal injury.

Follow all instructions for re-purging the sensor case. See Case purging procedure, below.

⚠️ WARNING

Explosion hazard

The CMF400 has drain plugs, which look similar to purge fittings. The drain plugs must remain sealed at all times.

Do not remove or damage CMF400 drain plugs.
**Purge Fittings continued**

**Case purging procedure**

Read all instructions before performing the case purging procedure. It is not necessary to perform this procedure unless a purge plug has been removed.

1. Shut down the process, or set control devices for manual operation.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performing the purge procedure while the flowmeter is operating could affect measurement accuracy, resulting in inaccurate flow signals.</td>
</tr>
<tr>
<td>Before performing the case purging procedure, shut down the process, or set control devices for manual operation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removing a purge plug will require the sensor case to be re-purged with a dry inert gas. Improper pressurization could result in serious personal injury.</td>
</tr>
<tr>
<td>Follow all instructions for re-purging the sensor case. See Case purging procedure, below.</td>
</tr>
</tbody>
</table>

2. Remove both purge plugs from the sensor case. If purge lines are being used, open the valve in the purge lines.

3. Connect the supply of dry, inert gas to the inlet purge connection or open inlet purge line. Leave the outlet connection open. Exercise caution to avoid introducing dirt, moisture, rust, or other contaminants into the sensor case.

4. Make sure there is a tight seal between the inlet connection and sensor case, so air cannot be drawn by suction into the case or purge line.

5. The purge time is the amount of time required for full exchange of atmosphere to inert gas. For each sensor size, the purge time is different. Refer to the table below. If purge lines are being used, increase the purge time to fill the additional volume of the purge line.

6. Avoid pressurizing the sensor case. At the appropriate time, shut off the gas supply, then immediately seal the purge outlet and inlet connections. If pressure inside the case elevates above atmospheric pressure during operation, the flowmeter density calibration will be inaccurate.
### Time required to purge ELITE® sensor cases

<table>
<thead>
<tr>
<th>Sensor model</th>
<th>Purge rate cubic ft/hr (l/hr)</th>
<th>Time minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMF010</td>
<td>20 (566)</td>
<td>1</td>
</tr>
<tr>
<td>CMF025</td>
<td>20 (566)</td>
<td>1</td>
</tr>
<tr>
<td>CMF050</td>
<td>20 (566)</td>
<td>2</td>
</tr>
<tr>
<td>CMF100</td>
<td>20 (566)</td>
<td>5</td>
</tr>
<tr>
<td>CMF200</td>
<td>20 (566)</td>
<td>12</td>
</tr>
<tr>
<td>CMF300</td>
<td>20 (566)</td>
<td>30</td>
</tr>
</tbody>
</table>

*If purge lines are being used, increase purge time to fill the additional volume.
**Rupture Disks**

*Keeping the rupture disks sealed*  
If the sensor has rupture disks, they are installed in the sensor purge fitting openings. The rupture disks should remain installed at all times. If you remove a rupture disk from the sensor case, it is necessary to re-purge the case. See Appendix A, page 59.

For more information, contact the Micro Motion Customer Service Department:
- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
- In Canada and Latin America, phone (303) 530-8400
- In Asia, phone (65) 6770-8155
- In the U.K., phone 0800 - 966 180 (toll free)
- Outside the U.K., phone +31 (0) 318 495 670
- Or visit our website at [www.micromotion.com](http://www.micromotion.com).

**Rupture disk**

![Rupture disk diagram](image)
Rupture Disks continued

Using the rupture disks

The primary reason for having rupture disks is to vent process fluid from inside the sensor case, should the sensor flow tube rupture in a high-pressure application. Some users, such as those measuring high-pressure gases, connect a pipeline to the rupture disk fittings, to help contain escaping process fluid. This provides additional protection should a rupture occur.

⚠️ WARNING

Pressure Relief Zone.

Escaping high-pressure fluid can cause severe injury or death.

Stay clear of rupture disk pressure-relief area.

Removing a rupture disk

The rupture disks are installed in the sensor purge fitting openings. If you remove a rupture disk from the sensor case, it is necessary to re-purge the case. See Case purging procedure, page 61, for instructions.

⚠️ WARNING

Removing a rupture disk will require the sensor case to be re-purged with a dry inert gas. Improper pressurization could result in serious personal injury.

Follow all instructions for re-purging the sensor case. See Case purging procedure, page 61.
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)
• In Canada and Latin America, phone (303) 530-8400
• In Asia, phone (65) 6770-8155
• In the U.K., phone 0800 - 966 180 (toll free)
• Outside the U.K., phone +31 (0) 318 495 670
• Or visit our website at www.micromotion.com.

Label number 1003972

For additional information, see Removing a purge plug and Case purging procedure, page 61.

Label number 3002734

For additional information, see Appendix B, page 63.
Label Maintenance and Replacement continued

Label number 3600460

(label inside core processor housing)

Label number 3005784

Label number 3100436
Appendix D

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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