Model RFT9739
Field-Mount Transmitter

Instruction Manual

Version 3 Transmitters

February 2000

Micro Motion

FISHER-ROSEMOUNT™ Managing The Process Better.™

Model RFT9739
Field-Mount Transmitter

Instruction Manual

Version 3 Transmitters

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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1 Before You Begin

1.1 About this manual

This instruction manual explains how to:
- Install the Micro Motion® Model RFT9739 field-mount transmitter for use with Micro Motion Coriolis flow sensors, including instructions for:
  - Transmitter mounting
  - Power-supply, sensor, and output wiring
- Initialize the transmitter
- Diagnose and troubleshoot problems with the transmitter

For information about Micro Motion sensors, see the appropriate sensor instruction manuals.

Instructions in this manual pertain to Version 3 transmitters. Do not use this manual for transmitters shipped before January 1996. To identify the transmitter version, see **Appendix F**, page 97.

1.2 About the transmitter

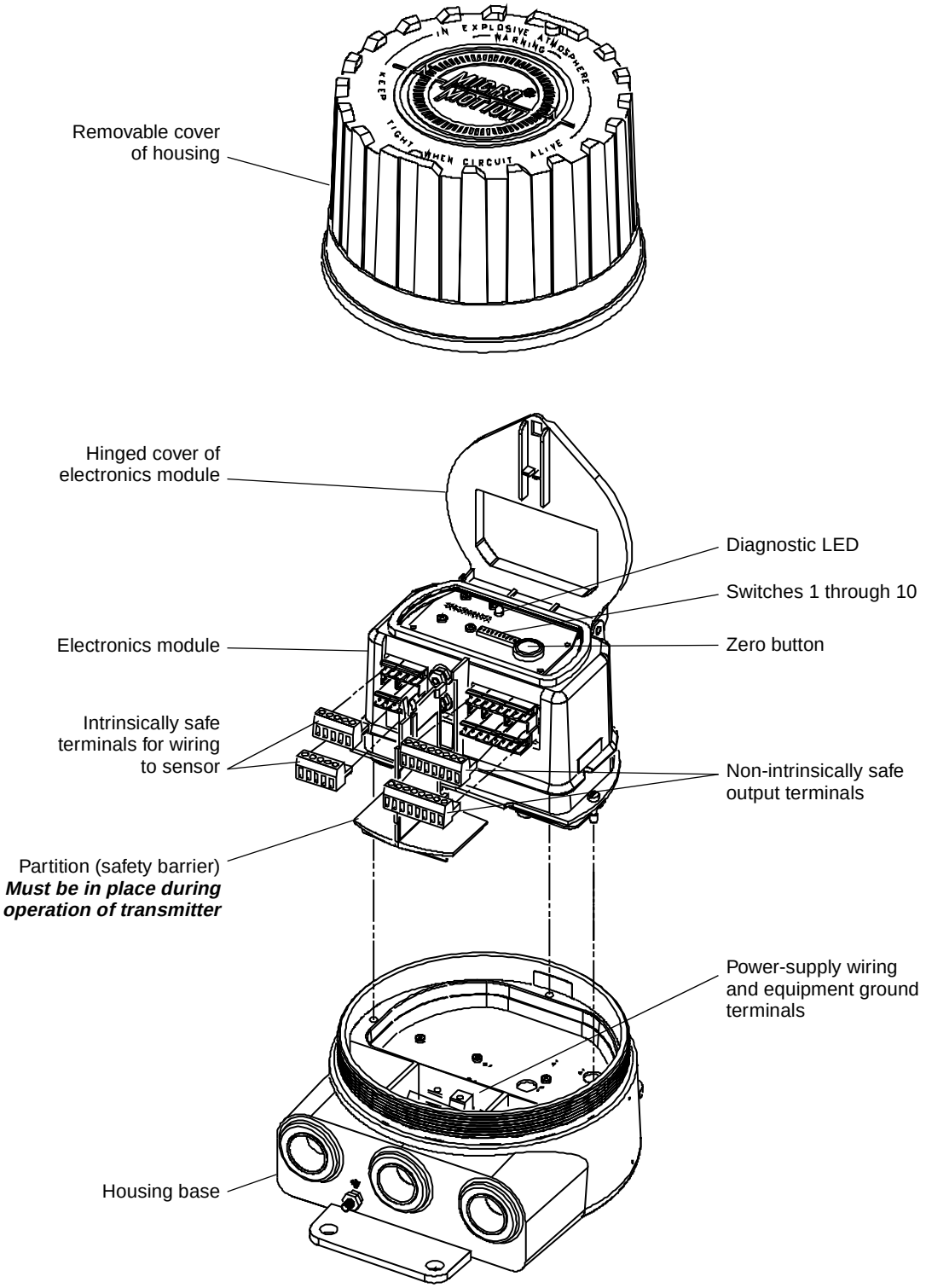
Micro Motion sensors and transmitters with enhanced EMI immunity comply with EMC directive 89/336/EEC and low-voltage directive 73/23/EEC, when properly installed in accordance with the guidelines and instructions in this manual.

The Model RFT9739 transmitter is a microprocessor-based transmitter for fluid process measurement. The transmitter works with Micro Motion sensors to measure mass or volume flow, density, and temperature.

An optional display is available, and comes installed on the removable housing cover. Scroll and Reset knobs on the cover enable the user to perform the following operations (see **Section 6.2**, page 51):
- View flow rate, density, temperature, mass and volume totals and inventory levels, and status messages
- Set the transmitter's flow totalizers
- Reset communication parameters
- Zero the flowmeter

Components of the transmitter are shown in **Figure 1-1**, page 2.

Figure 1-1. RFT9739 exploded view



2 Getting Started

2.1 Hazardous area installations

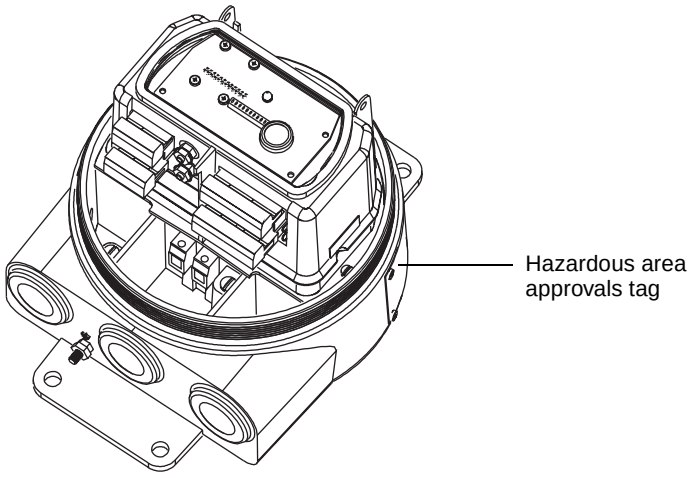
⚠ WARNING

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

- Install the transmitter in an environment that is compatible with the hazardous area specified on the approvals tag. See **Figure 2-1**.
- For intrinsically safe installations, use this document with Micro Motion UL, CSA, or SAA installation instructions.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

- Read the approvals tag before installing the RFT9739. The approvals tag is attached to the transmitter housing. See **Figure 2-1**.
- For a complete list of UL, CSA, SAA, and European approvals, see page 82.
- For intrinsically safe installations, use this manual with the appropriate Micro Motion intrinsically safe installation instructions:
  - *UL-D-IS Installation Instructions*
  - *CSA-D-IS Installation Instructions*
  - *SAA-D-IS Installation Instructions*
- In Europe, refer to standard EN60079-14 if national standards do not apply. To comply with CENELEC standards, see page 4.

Figure 2-1. Hazardous area approvals tag



Installations in Europe

To comply with CENELEC standards for hazardous area installations in Europe, adhere to the following CENELEC conditions for safe use.

Cable glands and conduit seals

- Use 3/4"-14 NPT cable glands or conduit fittings, rated flameproof for EEx d IIC areas and certified by an authorized test station. Flameproof glands supplied by Micro Motion meet these requirements.
- Conduit openings that are not used should be sealed with blanking plugs of type PLG 2.
- For installation in a nonhazardous area, cable glands or conduit fittings that do not carry a flameproof rating are acceptable.

Potential equalization

To achieve potential equalization, the RFT9739 ground conductor should be connected to the appropriate ground terminals within the hazardous area, using a potential equalizing line.

Output wiring

Nonintrinsically-safe connections between the RFT9739 and other devices may be made ***only*** to devices that maintain a voltage less than or equal to 250 V.

2.2 Configuration, calibration, and characterization

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

Configuration parameters include items such as flowmeter tag, measurement units, flow direction, damping values, slug flow parameters, and span values for the milliamp and frequency outputs. If requested at time of order, the transmitter is configured at the factory according to customer specifications.

Calibration accounts for an individual sensor's sensitivity to flow, density, and temperature. Field calibration is optional.

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

For configuration, calibration, or characterization procedures, see one of the following communications manuals:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

You can also use Fisher-Rosemount™ Asset Management Solutions (AMS) software for configuration, calibration, and characterization. For more information, see the AMS on-line help.

A basic software tree for the HART Communicator is shown in **Appendix D**, page 91.

2.3 Switch settings

Switches 1 through 10 on the electronics module control the following transmitter functions:

- Baud rate
- Stop bits and parity
- Data bits, communication protocol, and physical layer
- mA outputs
- Zeroing method
- Write-protection of transmitter configuration

Switches 1 through 10 are illustrated in **Figure 2-2**, and described in the following sections. Normally, switch settings do not require adjustment.

Security modes

Switches 1, 2, and 3 are security switches, which enable the user to disable flowmeter zeroing, disable resetting of totalizers, and write-protect all configuration and calibration parameters.

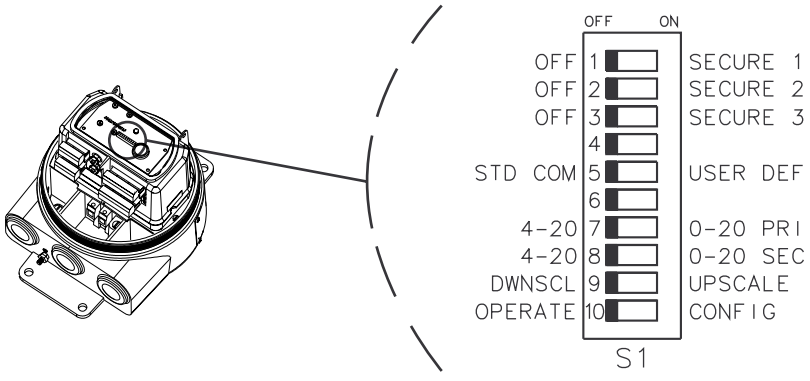
Switch settings enable any of eight possible security modes. Different modes determine which functions are disabled and whether configuration and calibration parameters are write-protected. The following functions can be disabled:

- Flowmeter zeroing using digital communications
- Flowmeter zeroing using the zero button and, if the transmitter has a display, the Scroll and Reset knobs
- Totalizer reset, with flow, using digital communications
- Totalizer reset, with flow, using the Scroll and Reset knobs, if the transmitter has a display
- Totalizer control, with zero flow, using digital communications
- Totalizer control, with zero flow, using the Scroll and Reset knobs, if the transmitter has a display
- Ability to change configuration or calibration factors

Table 2-1 lists the parameters that are write-protected and functions that are disabled for each security mode. Security modes 1 through 7 are entered immediately when switches 1 through 3 are set.

For information about security mode 8, see pages 6 through 8.

Figure 2-2. Switches



Switches 1 through 10 at left are shown in the OFF position.

Table 2-1. Security modes

Switch settings	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8*
Switch 1	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Switch 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Switch 3	OFF	ON	OFF	ON	OFF	ON	OFF	ON

Function/ parameter	Performed with	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
Flowmeter zeroing	Zero button or Reset knob		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
	HART or Modbus			Disabled	Disabled	Disabled			Disabled
Totalizer control, no flow	Scroll and Reset knobs		Disabled		Disabled	Disabled		Disabled	
	HART or Modbus			Disabled		Disabled	Disabled		
Totalizer control, with flow	Scroll and Reset knobs		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
	HART or Modbus			Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
Configuration and calibration parameters				Write-protected	Write-protected	Write-protected	Write-protected	Write-protected	Write-protected

**Changing the settings of switches 1, 2, and 3 does not immediately implement security mode 8. For more information about security mode 8, see pages 6 through 8.*

Security mode 8

When transmitter security is set for mode 8, the transmitter meets security requirements for custody transfer described in National Institute of Standards and Technology (NIST) Handbook 44.

Once the transmitter is configured for security mode 8, the security mode cannot be changed unless a master reset is performed. A master reset causes all configuration parameters to return to their default values, and ***requires complete characterization and reconfiguration of the transmitter.***

If the user attempts to enter a new security mode or change the transmitter configuration after entering security mode 8:
- Internal totalizers stop counting
- The frequency/pulse output goes to 0 Hz
- mA outputs go to 4 mA
- The optional display reads, "SECURITY BREACH; SENSOR OK"
- Custody transfer event registers record changes made to defined configuration and calibration parameters. (For a list of these parameters, see **Table 6-2**, page 56.)

The security breach continues, and totalizers and outputs remain inactive, until the transmitter is reconfigured for security mode 8, or until a master reset has been performed. Custody transfer event registers are not affected by a master reset.
- For information about event registers, see **Section 6.3**, page 56.
- To perform a master reset, see instructions in **Section 7.7**, page 74.

Milliamp output trim, milliamp output test, and frequency/pulse output test procedures cannot be performed after security mode 8 is entered. ***Before entering security mode 8,*** perform milliamp trim and/or test procedures, if necessary, as described in any of the following manuals or in AMS on-line help:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

To enter security mode 8:

1. Note the position of switch 5.
2. Set switch 10 to the ON position. The diagnostic LED on the transmitter electronics module flashes on 3 times and pauses, which indicates the transmitter is in the configuration mode.
3. Set switches 1, 2, and 3 to the ON position.
4. Set switches 4, 5, and 6 to the OFF position.
5. Locate the ZERO button on the transmitter electronics module.
6. Press and hold the ZERO button for five seconds. The diagnostic LED will remain on for two to three seconds to indicate security mode 8 has been entered.
7. Reset switch 5 to the desired position (as noted in Step 1).
8. Reset switch 10 to the OFF (OPERATE) position. The diagnostic LED flashes on once per second (25% on, 75% off), which indicates the transmitter is in the normal operating mode.
9. Leave switches 1, 2, and 3 in the ON position to remain in security mode 8.

To verify the transmitter is in security mode 8:

- If the transmitter has a display, use the Scroll knob to scroll through process variable screens to event register screens. If event register screens appear, the transmitter is in security mode 8. For more information about using the Scroll knob and transmitter display, see **Section 6.2**, page 51.
- If the transmitter does not have a display:
  1. Configure the transmitter.
  2. Wait until the diagnostic LED blinks ON once per second.
  3. Move switch 1, 2, or 3 to the OFF position.
  4. If the diagnostic LED blinks ON 4 times per second, the transmitter is in security mode 8.

To make changes to configuration or calibration parameters once security mode 8 is entered:

1. Set switches 1, 2, and 3 to the OFF position.
2. Make changes through digital communication or, if the transmitter has a display, with the Scroll and Reset knobs (see "Communication configuration mode," page 54). Custody transfer event registers record changes made to defined configuration and calibration parameters (see **Table 6-2**, page 56). For more information about digital communications, see the following instruction manuals or AMS on-line help:
   - *Using the HART Communicator with Micro Motion Transmitters*
   - *Using ProLink Software with Micro Motion Transmitters*
   - *Using Modbus Protocol with Micro Motion Transmitters*
3. Set switches 1, 2, and 3 to the ON position.

To reenter security mode 8:

If security mode 8 has been established previously, and the security mode has been temporarily changed, it is not necessary to use the ZERO button to reenter security mode 8. In such a case, resetting switches 1, 2, and 3 to the ON position will reenter security mode 8 immediately.

If a master reset has been performed, it is necessary to use the ZERO button method to reenter security mode 8. See procedure, page 7.

To change from security mode 8 to another security mode:

1. Perform a master reset (see **Section 7.7**, page 74, for master reset procedure).
2. Perform characterization and reconfiguration procedures as described in any of the following instruction manuals:
   - *Using the HART Communicator with Micro Motion Transmitters*
   - *Using ProLink Software with Micro Motion Transmitters*
   - *Using Modbus Protocol with Micro Motion Transmitters*
3. Set switches 1, 2, and 3 to the desired positions (see **Table 2-1**, page 6).

Communication settings

Switch 5 enables the user to choose the standard communication configuration or user-defined parameters. With switch 10 in the ON (CONFIG) position, switches 1 through 6 can be used for setting user-defined communication parameters.

Standard communication setting
To use the standard communication configuration, set switch 5 to the STD COMM position. Setting the switch in this position establishes the following communication parameters:
- HART protocol on the Bell 202 standard, at 1200 baud, on the primary mA output
- Modbus protocol in RTU mode, at 9600 baud, on the RS-485 output
- 1 stop bit, odd parity

For RFT9739 software versions 3.6 and later, if switch 5 is in the STD COMM position, and the RFT9739 has a display, an error message will appear on the display when an attempt is made to change the communication configuration using the RFT9739 display controls.

User-defined communication settings
To establish user-defined settings, set switches as instructed in **Table 2-2**, page 10. With switches 1 through 6, the user can set baud rate; stop bits and parity; data bits, protocol, and physical layer. The default settings are HART protocol, over RS-485, at 1200 baud, with 1 stop bit and odd parity.

Milliamp output scaling

Switches 7, 8, and 9 allow the user to choose 0-20 mA or 4-20 mA scaling for mA outputs, and upscale or downscale fault outputs.

Switch 7 defines the primary mA output scaling. Switch 8 defines the secondary mA output scaling. Either switch may be set in the 0-20 position or the 4-20 position.
- The mA outputs are NAMUR compliant when switches 7 and 8 are in the 4-20 position. See **Section 5.3**, page 27.
- Communication using the HART protocol over the primary mA output requires switch 7 to be set in the 4-20 position.
- If switch 7 is in the 0-20 mA position, communication may be lost if output is less than 2 mA. To re-establish communication, move switch 7 to the 4-20 mA position.

Switch 9 defines the RFT9739 fault outputs. Fault outputs can be set for downscale or upscale levels.
- If switch 9 is set to the DWNSCALE position, mA outputs go to 0 mA if they produce a 0-20 mA current, or to 0-2 mA if they produce a 4-20 mA current; the frequency/pulse output goes to 0 Hz.
- If switch 9 is set to the UPSCALE position, mA outputs go to 22-24 mA; the frequency/pulse output goes to 15-19 kHz.
- For more information, see "Fault outputs," page 65.

Table 2-2. Communications configuration

Instructions

Before beginning, make note of the positions of switches 1, 2, and 3. Then, for each setting:

1. Begin with switch 10 in the CONFIG position, and switches 1 through 6 in the OFF position. The LED flashes ON 3 times and pauses, which indicates the transmitter is in the communication configuration mode.
2. Set designated switches to the ON position as indicated below.
3. Press and hold the ZERO button for five seconds, until the LED remains ON for 3 seconds, which indicates the setting has been accepted by the transmitter.

When done:

1. Reset switches 1, 2, and 3 to the appropriate positions.
2. Set switch 5 to the USER DEFINED position.
3. Set switches 4 and 6 to the OFF position.
4. Set switch 10 to the OPERATE position.

Note

If switches 4, 5, 6, and 10 are left in the ON position after configuration, a master reset will occur the next time power to the transmitter is shut off and then restored. To avoid an unexpected master reset, make sure switches 4, 6, and 10 are left in the OFF position after configuration.

Baud rate	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
1200 baud		ON				ON
2400 baud		ON	ON			ON
4800 baud			ON			ON
9600 baud	ON		ON			ON
19,200 baud	ON	ON				ON
38,400 baud	ON					ON

Stop bits and parity	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
1 stop bit, no parity					ON	
1 stop bit, odd parity		ON			ON	
1 stop bit, even parity	ON	ON			ON	
2 stop bits, no parity			ON		ON	
2 stop bits, odd parity		ON	ON		ON	
2 stop bits, even parity	ON				ON	

Data bits, protocol, physical layer	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
HART on primary mA	ON		ON		ON	ON
HART on RS-485			ON		ON	ON
Modbus RTU mode (8 bits) on RS-485					ON	ON
Modbus ASCII mode (7 bits) on RS-485		ON			ON	ON
Modbus RTU mode (8 bits) on RS-485 and HART on primary mA	ON				ON	ON
Modbus ASCII mode (7 bits) on RS-485 and HART on primary mA	ON	ON			ON	ON

3 Transmitter Mounting

3.1 General guidelines

Follow these guidelines when installing the field-mount RFT9739 transmitter:

- Locate the transmitter where it is accessible for service and calibration.
- In hazardous areas, install the transmitter in a location that is specified in **Section 2.1**, page 3.
- Total length of cable from the sensor to the transmitter must not exceed 1000 feet (300 meters).
- Locate the transmitter where the ambient temperature remains between –22 and 131°F (–30 and 55°C). If the transmitter has a display, the display might become difficult to read below 14°F (–10°C).
- Mount the transmitter to a stable, flat surface or instrument pole.
- The cover of the transmitter housing requires 11½ inches (292 mm) clearance for removal. If the transmitter has a display, the cover requires 13 3/16 inches (335 mm) clearance.

The base of the transmitter has three ¾-inch NPT female conduit openings (see **Figure 3-1**, next page), which must remain sealed to keep the transmitter watertight.

⚠ CAUTION

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

To avoid risk of condensation or excessive moisture entering the transmitter housing, fully seal all conduit openings when installing the transmitter.

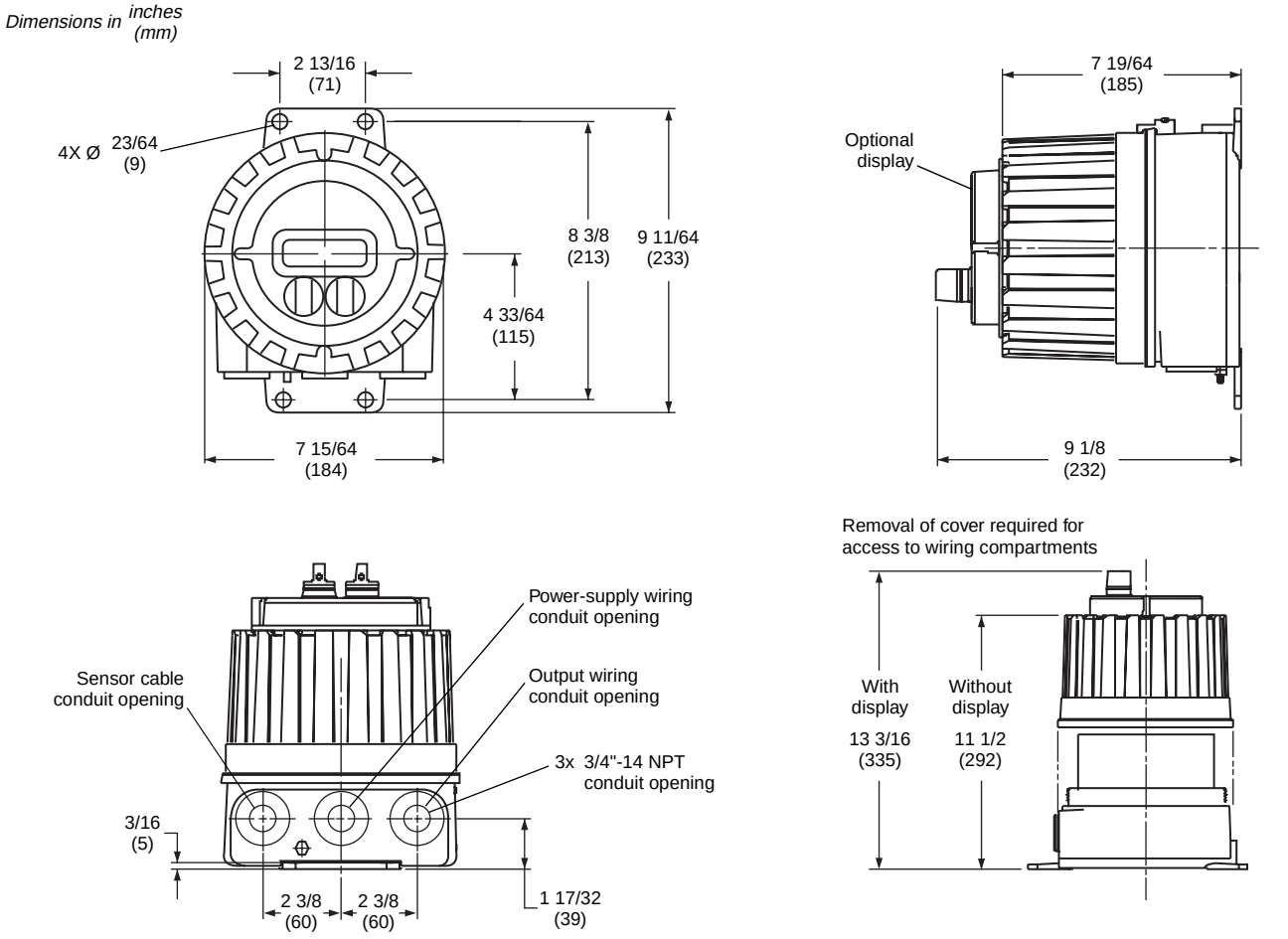
- Install conduit that allows a complete seal with the conduit openings.
- If possible, orient the transmitter with its conduit openings pointed downward. If this is not possible, seal the conduit to prevent condensation and other moisture from entering the housing.
- To comply with CENELEC standards for hazardous area installations in Europe:
  - Use cable glands or conduit fittings rated flameproof for EEx d IIC areas and certified by an authorized test station. Flameproof glands supplied by Micro Motion meet these requirements.
  - Conduit openings that are not used should be sealed with blanking plugs of type PLG 2.
  - For installation in a nonhazardous area, cable glands or conduit fittings that do not carry a flameproof rating are acceptable.
- If the transmitter has a display, the display will be right-side-up only if the transmitter is oriented with its conduit openings pointed downward.

3.2 Mounting to a wall

Follow these guidelines and refer to **Figure 3-1** to mount the transmitter to a wall or other flat, rigid surface.

- Use four 5/16-inch diameter (or M8) bolts and nuts to mount the transmitter to a wall or other flat, rigid surface. Use bolts and nuts that can withstand the process environment. Micro Motion does not supply bolts or nuts (such bolts and nuts are available as an option).
- To minimize stress on the housing, secure all four mounting bolts to the same structure, which should be flat and should not vibrate or move excessively. Do not secure bolts to separate girders, beams, or wall studs, which can move independently.

Figure 3-1. RFT9739 dimensions

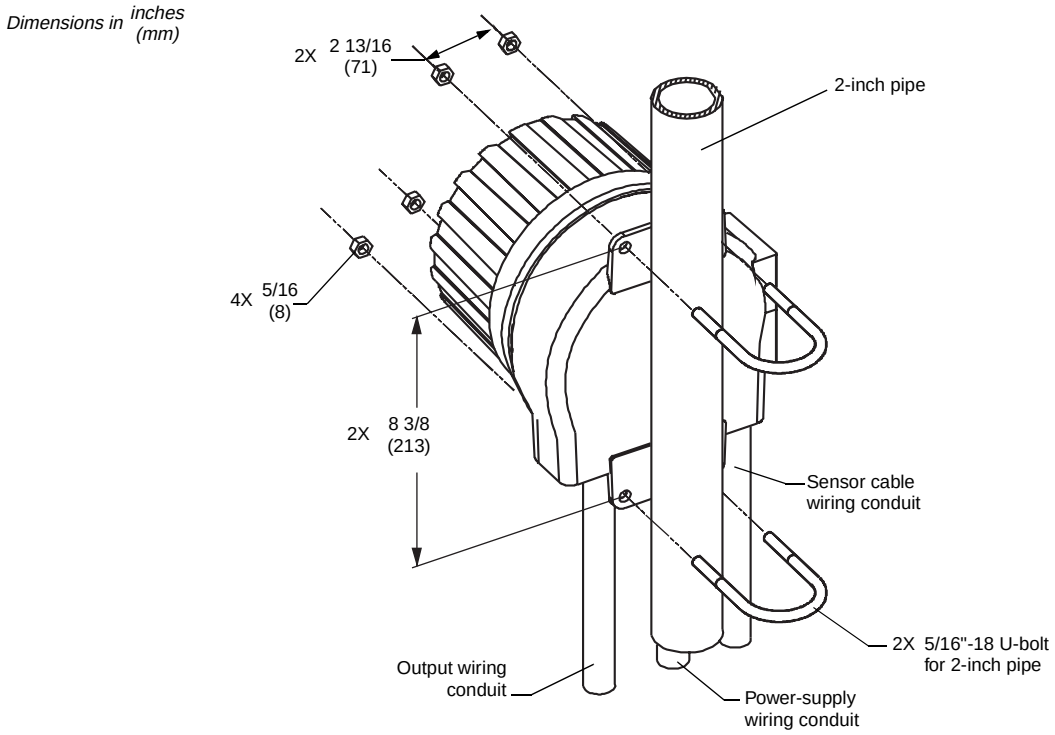


3.3 Mounting to an instrument pole

Follow these guidelines and refer to **Figure 3-2** to mount the transmitter to an instrument pole:

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, to mount the transmitter to a rigid instrument pole. Use U-bolts and nuts that can withstand the process environment. Micro Motion does not supply U-bolts or nuts.
- The instrument pole should extend at least 12 inches (305 mm) from a rigid base, and be no more than 2 inches (50.8 mm) in diameter.

Figure 3-2. Instrument-pole mounting



4 Power-Supply and Sensor Wiring

4.1 General guidelines

⚠ WARNING

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

Sensor wiring is intrinsically safe.

- Keep intrinsically safe sensor wiring separated from power-supply wiring and output wiring.
- For intrinsically safe sensor installations, use this document with Micro Motion UL, CSA, or SAA installation instructions.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.
- Make sure the safety barrier partition is in place before operating the transmitter.

⚠ CAUTION

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

To avoid risk of condensation or excessive moisture in the junction box or transmitter housing:
- Seal all conduit openings.
- Install drip legs in cable or conduit.
- Ensure integrity of gaskets and O-rings, and fully tighten all covers.

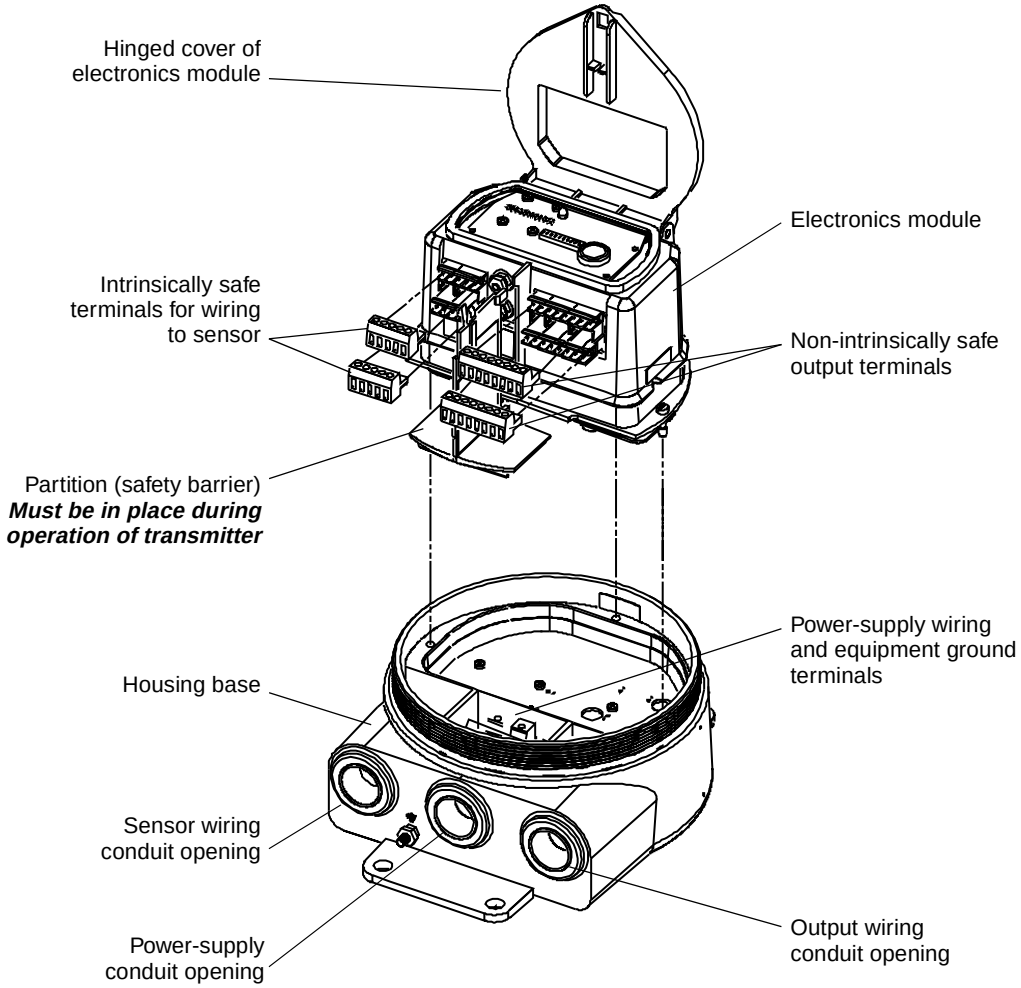
A removable partition on the electronics module keeps intrinsically safe wiring to the sensor separated from nonintrinsically safe output wiring. The module has a hinged, clear plastic cover. To access power-supply wiring terminals, unlatch the cover of the module, then remove the partition.

- **Figure 4-1**, page 16, shows the locations of the terminals for wiring to the sensor, output wiring terminals, and power-supply wiring terminals.
- Terminal blocks may be unplugged from the module for easier installation of wiring.
- Install cable and wiring to meet local code requirements.
- A switch may be installed in the power-supply line. For compliance with low-voltage directive 73/23/EEC, a switch in close proximity to the transmitter is required for AC-powered transmitters.
- Do not install AC power cable or unfiltered DC power cable in the same conduit or cable tray as sensor cable or output wiring.

The base of the transmitter has three ¾-inch NPT female conduit openings, indicated in **Figure 4-1**, which must remain sealed to keep the transmitter watertight.

- Use conduit that allows a complete seal with the conduit openings.
- If possible, orient the transmitter with its conduit openings pointed downward. Seal the conduit to prevent condensation and other moisture from entering the housing.
- To comply with requirements for explosion-proof installations approved by UL or CSA, install approved explosion-proof conduit seals on all three conduit openings.
- To comply with CENELEC requirements for installations in Europe, see page 17.

Figure 4-1. RFT9739 exploded view



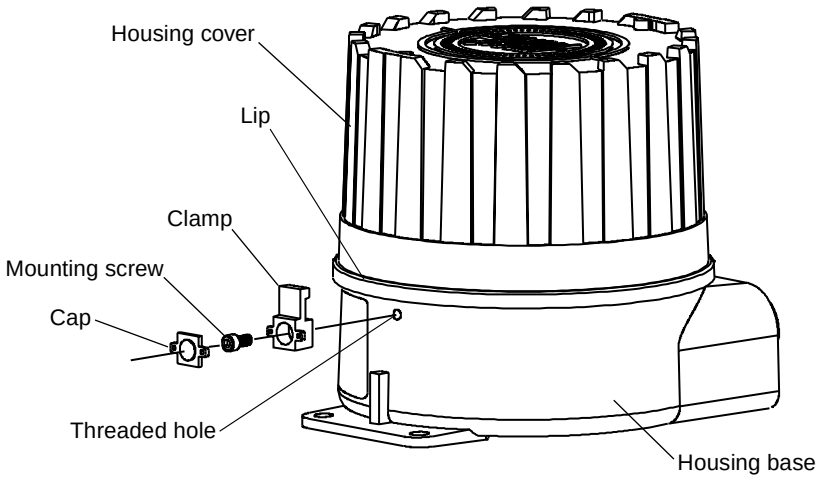
Installations in Europe

To comply with CENELEC standards for hazardous area installations in Europe, adhere to the following CENELEC conditions for safe use:

- Use 3/4"-14 NPT cable glands or conduit fittings, rated flameproof for EEx d IIC areas and certified by an authorized test station. Flameproof glands supplied by Micro Motion meet these requirements.
- Conduit openings that are not used should be sealed with blanking plugs of type PLG 2.
- For installation in a nonhazardous area, cable glands or conduit fittings that do not carry a flameproof rating are acceptable.

A CENELEC-compliant RFT9739 includes a lockout clamp on the transmitter housing. See **Figure 4-2**. The clamp adds secondary protection against accessing the power-supply terminals, and is required to meet CENELEC standards.

Figure 4-2. Lockout clamp for CENELEC transmitters



4.2 Power supply and grounding

⚠ CAUTION

Incorrect voltage, or installation with power supply on, will cause transmitter damage or failure.

- Turn off power before installing transmitter.
- Match power-supply voltage with voltage indicated in transmitter power terminals compartment.

Power-supply options

The AC transmitter accepts an 85 to 250 VAC power supply. The DC transmitter accepts a 12 to 30 VDC power supply.

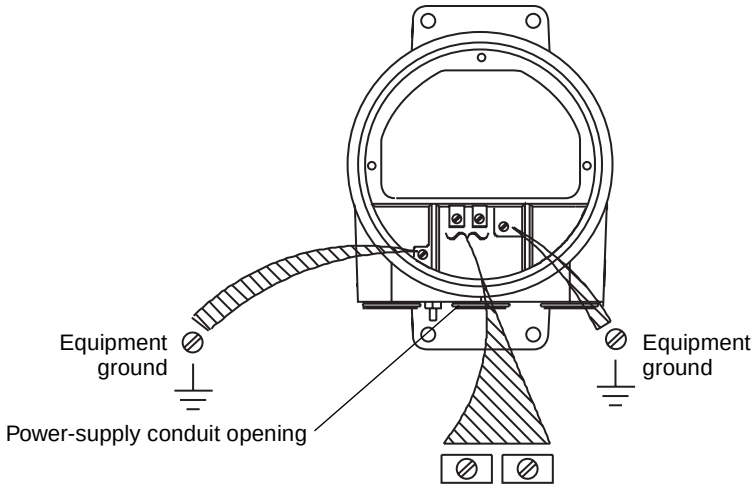
- A label inside the power-supply wiring compartment indicates the correct power-supply voltage.
- **Figure 4-3** (next page) shows the location of power-supply wiring terminals in the base of the transmitter housing.
- A lockout clamp on the transmitter housing (see **Figure 4-2**, page 17) provides secondary protection against accessing the power-supply terminals, and is required by CENELEC.

Wiring

To install power-supply wiring, follow these steps:

1. To access power-supply wiring, unlatch the hinged cover of the module, then remove the partition that separates intrinsically safe sensor wiring from non-intrinsically safe output wiring.
2. Make input power connections at the two labeled terminals, as indicated in **Figure 4-3** (next page). The power supply terminals are labeled as follows:
   - If the terminals are labeled "L" (line) and "N" (neutral), install an 85 to 250 VAC power supply.
   - If the terminals are labeled "+" (positive) and "–" (negative), install a 12 to 30 VDC power supply.
3. Ground the transmitter as instructed on page 19.

Figure 4-3. Power-supply wiring terminals



Transmitter power rating	Terminal labels	
85-250 VAC 50/60 Hz	L	N
12-30 VDC	+	–

Grounding

⚠ WARNING

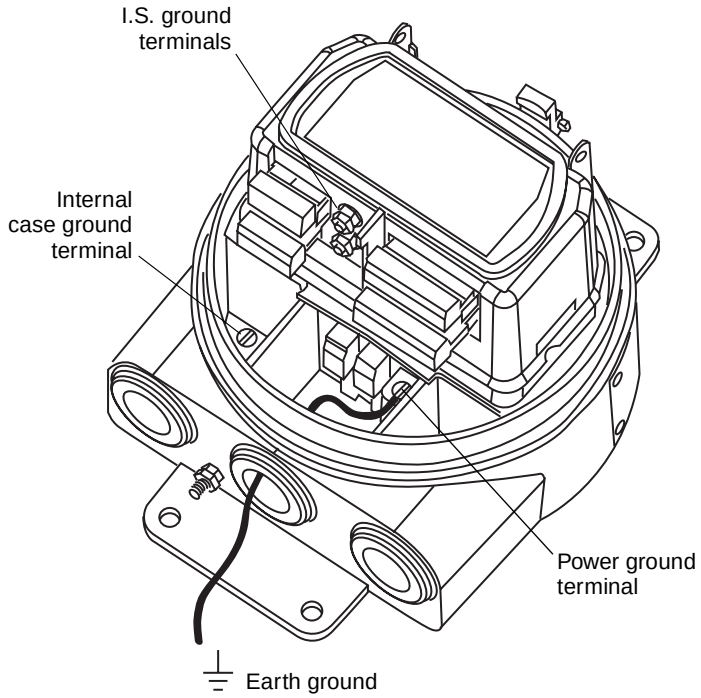
Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion.

- The transmitter must be properly grounded.
- Follow the instructions below to ground the transmitter.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

To ensure proper grounding:

- If the installation must comply with UL, CSA, or SAA standards, refer to the instructions in one of the following Micro Motion documents:
  - *UL-D-IS Installation Instructions*
  - *CSA-D-IS Installation Instructions*
  - *SAA-D-IS Installation Instructions*
- In most installations, install grounding as illustrated in **Figure 4-4a** (next page).
- For installations in Europe, and to comply with CENELEC standards, install grounding as illustrated in **Figure 4-4b** (next page).
- To achieve potential equalization and comply with CENELEC standards for hazardous area installations in Europe, the RFT9739 external ground terminal (see **Figure 4-4b**) should be connected to the appropriate ground terminals within the hazardous area, using a potential equalizing line.

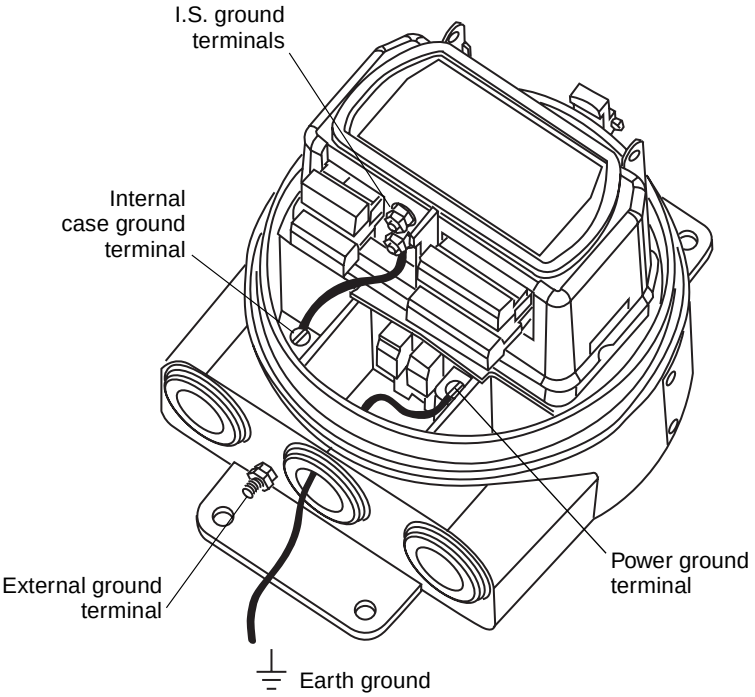
Figure 4-4a. Grounding detail — typical



If national standards are not in effect, adhere to these guidelines for grounding:

- Use copper wire, 14 AWG (2.5 mm²) or larger wire size.
- Keep all ground leads as short as possible, less than 1 ohm impedance.
- Connect I.S. ground terminals directly to internal case ground terminal.
- Connect ground lead from power ground terminal directly to earth ground.
- Follow plant standards, instead of this standard, if a separate high-integrity intrinsically safe ground scheme is used.

Figure 4-4b. Grounding detail — European installations



If national standards are not in effect, adhere to these guidelines for grounding:

- Use copper wire, 14 AWG (2.5 mm²) or larger wire size.
- Keep all ground leads as short as possible, less than 1 ohm impedance.
- A factory-installed ground wire, connecting the I.S. ground and internal case-ground terminals, must remain in place.
- Connect ground lead from power ground terminal directly to earth ground.
- Follow plant standards, instead of this standard, if a separate high-integrity intrinsically safe ground scheme is used.
- To achieve potential equalization and comply with CENELEC standards for hazardous area installations in Europe, connect the external ground terminal to the appropriate ground terminals within the hazardous area, using a potential equalizing line.
- For hazardous area installation in Europe, use standard EN 60079-14 as a guideline.

4.3 Sensor wiring

The instructions in this section explain how to connect a fully prepared Micro Motion flowmeter cable to the RFT9739 and a sensor. The sensor can be a Micro Motion ELITE, F-Series, Model D, DT, or DL sensor.

- The procedure for preparing Micro Motion flowmeter cable and cable glands is described in the instructions that are shipped with the cable.
- Install cable and wiring to meet local code requirements.
- Use Micro Motion color-coded cable.
- Total length of cable from the sensor to the transmitter must not exceed 1000 feet (300 meters).

Cable connections to sensor and transmitter

⚠ WARNING

Operating the transmitter without covers in place exposes electrical hazards that can cause property damage, injury, or death.

Make sure the safety barrier partition, electronics module cover, and housing cover are securely in place before operating the transmitter.

⚠ CAUTION

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

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

- Seal all conduit openings.
- Install drip legs in conduit or cable.
- Ensure integrity of gaskets and O-rings, and fully tighten all housing covers.

⚠ CAUTION

Improper installation of cable or conduit could cause inaccurate measurements or flowmeter failure.

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields.

The wiring procedure is the same for the sensor and transmitter. Refer to the hazard statements on page 21 and the wiring diagrams below and on page 23, and follow these steps:

1. 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 sensor junction box.
   - At the transmitter, connect wiring to the transmitter's intrinsically safe terminals for sensor wiring, as numbered in **Table 4-1**. Transmitter terminal blocks can be unplugged for easier connection of wiring.

2. Locate the wires by color as indicated in **Table 4-1**.

3. Tighten the screws to hold the wires in place.

4. Tightly close the sensor junction-box cover and transmitter housing. On an ELITE sensor junction box, tighten all four cover screws.

Table 4-1. Terminal designations

Wire color	Sensor terminal	Transmitter terminal	Function
Black*	No connection	0	Drain wires*
Brown	1	1	Drive +
Red	2	2	Drive –
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff –

**Combined drain wires from brown/red, green/white, and gray/blue pairs, and yellow/orange/violet triplet.*

Figure 4-5. Wiring to ELITE® CMF sensors

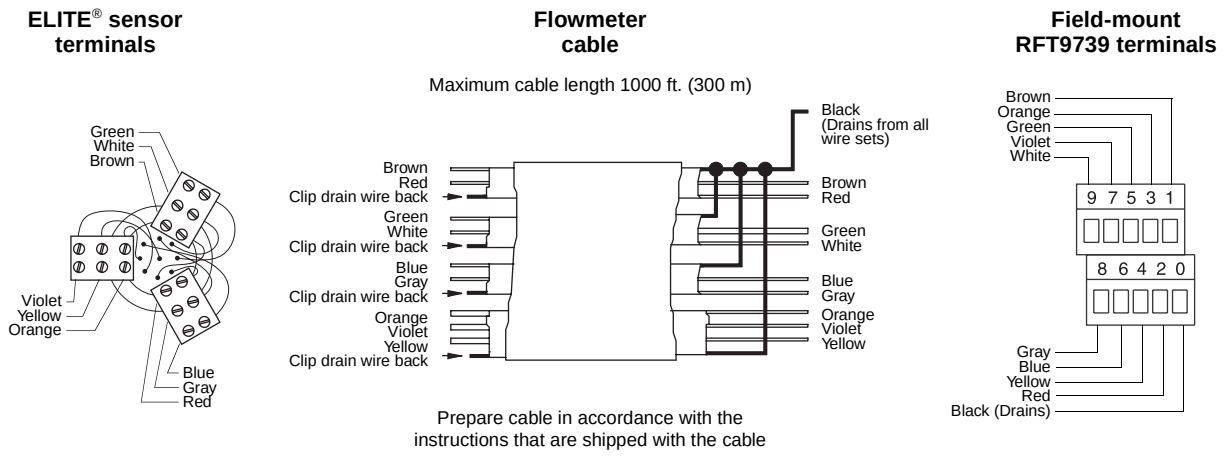


Figure 4-6. Wiring to F-Series, Model D, and DL sensors

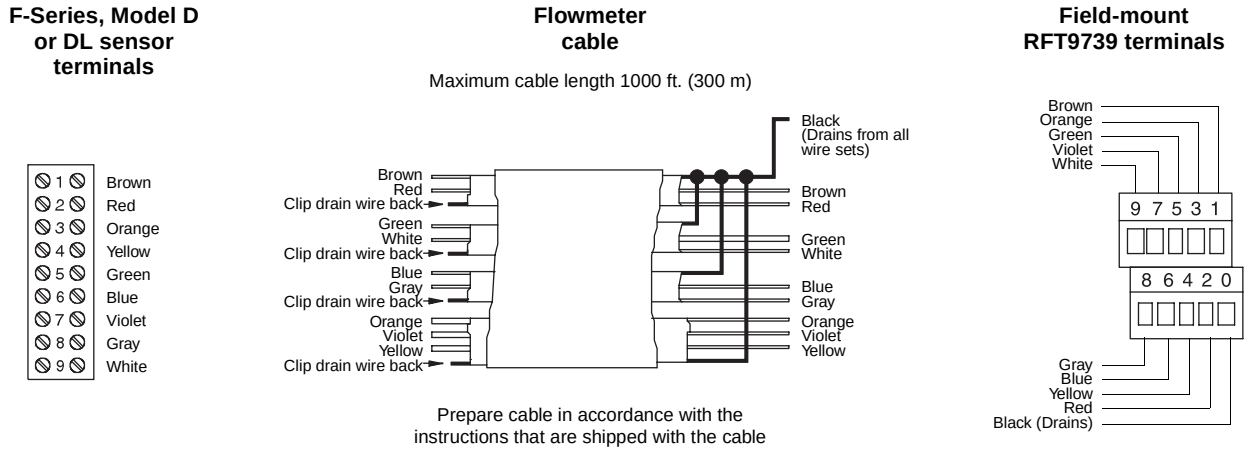
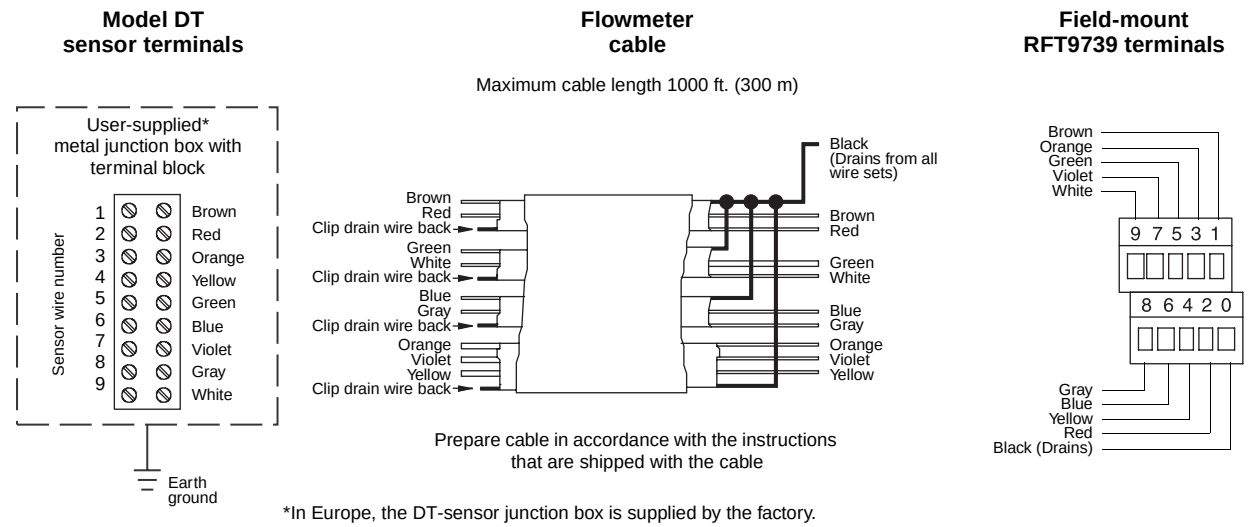


Figure 4-7. Wiring to Model DT sensors



*In Europe, the DT-sensor junction box is supplied by the factory.

5 Output Wiring

5.1 General guidelines

⚠ WARNING

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

Output wiring is not intrinsically safe.
- Keep output wiring separated from power-supply wiring and intrinsically safe sensor wiring.
- Follow all output wiring instructions to ensure transmitter and any connected devices will operate correctly.
- Make sure the safety barrier partition is in place before operating the transmitter.

A removable partition on the RFT9739 electronics module keeps intrinsically safe wiring to the sensor separated from nonintrinsically safe output wiring. Use the upper and lower blocks on the right side of the partition for output wiring connections. **Figure 5-1** and **Table 5-1** (next page) describe terminal designations for the output terminals. Terminal blocks can be unplugged from the module for easier installation of wiring.
- The RFT9739 has separate conduit openings for power-supply wiring and output wiring.
- To avoid possible electrical interference, do not install output wiring in the same conduit or cable tray as sensor cable or power-supply wiring.
- Use individually shielded pairs of 22 AWG (0.3 mm²) or larger wires for connections between the RFT9739 and any peripheral device.
- Shields and/or drain wires must be terminated outside the transmitter housing, or left floating, as required by the installation.
- To comply with CENELEC standards for hazardous area installations in Europe, nonintrinsically-safe connections between the RFT9739 and other devices may ***only*** be made to devices that maintain a voltage less than or equal to 250 V.

5.2 Maximum wire length

Currently, there is no system for accurately estimating the maximum length of wire between the RFT9739 and a connected peripheral device.

Most applications will be able to use wire lengths up to 500 feet for 22 AWG wire (150 meters for 0.3 mm² wire), 50 feet for 28 AWG wire (15 meters for 0.1 mm² wire), between the transmitter and any peripheral device. However, these distances are estimates only.

Prior to commissioning the transmitter, a loop-test is recommended as a means for determining whether or not output signals are being received correctly at the receiving device.

Figure 5-1. Output terminals

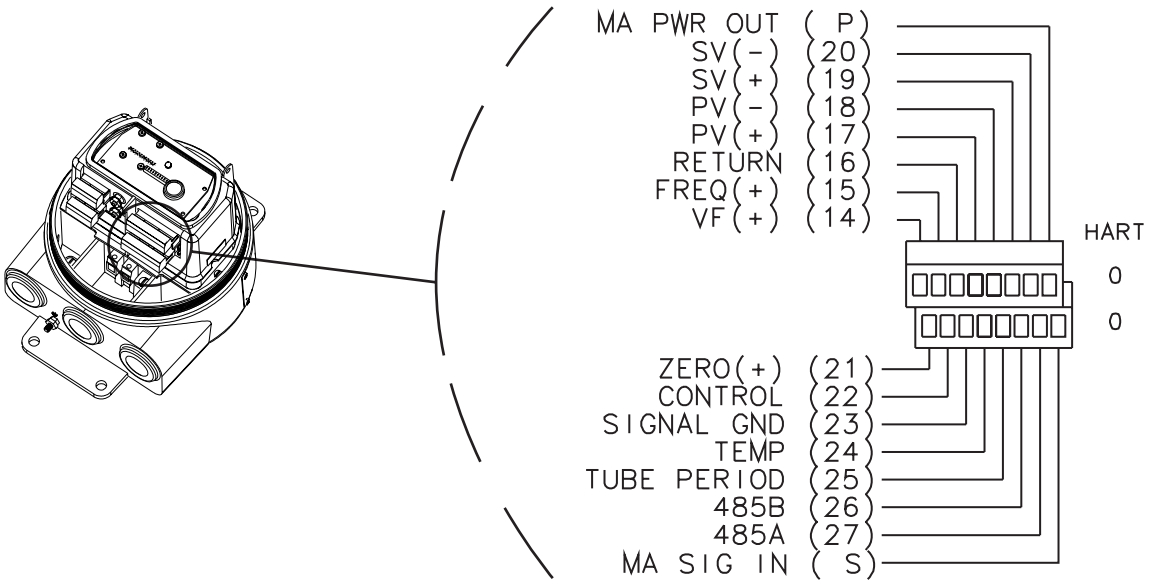


Table 5-1. Output wiring terminal designations

Terminal	Function
14	Frequency output, DC supply voltage
15 and 16	Frequency/pulse output
17 and 18	Primary variable (PV) mA output
19 and 20	Secondary variable (SV) mA output
21 and 16	Remote zero input
22 and 16	Control output
23	Signal ground
24 and 23	Temperature output
25 and 23	Tube period output
26 and 27	RS-485 I/O
P	DC power to pressure or DP transmitter
S	mA input from pressure or DP transmitter
HART	Communicator hookup loops, same as PV mA output circuit

5.3 Primary and secondary mA outputs

The RFT9739 primary and secondary mA output signals can be independently configured, and can represent flow, density, temperature, event 1 or event 2. With a pressure transmitter, the primary and secondary output signals can also represent pressure. For information on configuring mA outputs for events, see any of the following manuals or AMS on-line help:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

The mA outputs can produce a user-selected 0-20 or 4-20 mA current. (See "Milliamp output scaling," page 9).

- When configured to produce 4-20 mA current, the mA output loop can supply loop-powered process indicators.
- ***For transmitters with software version 3.8 or higher,*** when configured to produce 4-20 mA current, the mA outputs are compliant with the NAMUR NE43 standard. (All RFT9739 transmitters shipped after November 1999 have software version 3.8 or higher.)

⚠ CAUTION

Milliamp output range has changed.

When configured for 4-20 mA, milliamp outputs will not output live signals between 2.0 and 3.8 mA, or between 20.5 and 22 mA.

Systems that rely on milliamp output signals in the ranges listed above might not perform as expected. For RFT9739 transmitters shipped after November 1999, outputs will saturate at 3.8 and 20.5 mA, unlike previous versions of these instruments.

Reconfigure systems as necessary.

In compliance with the NAMUR NE43 standard:

- 4-20 mA outputs will produce a live signal from 3.8 to 20.5 mA.
- 4-20 mA outputs will not produce a signal between 2.0 and 3.8 mA, or between 20.5 and 22 mA.
- 4-20 mA output performance is illustrated in **Figure 5-2**.

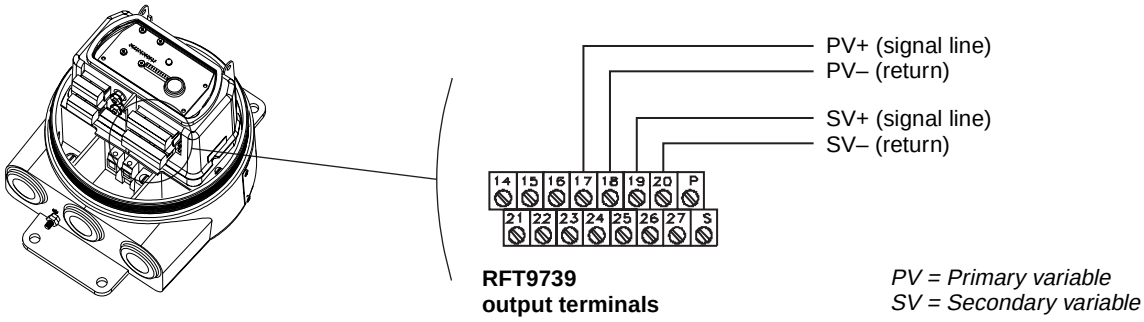
Figure 5-2. 4-20 mA output performance



Use RFT9739 terminals 17 and 18 for the primary mA output. Use terminals 19 and 20 for the secondary mA output. See **Figure 5-3**.

- Primary and secondary mA output loops are isolated and floating. Additional grounding will result in optimum performance, and optimum HART communication on the primary mA output. Ensure that mA output loops are grounded properly, either at the transmitter end, or at the external device.
- The maximum allowable length for mA signal wiring is determined by measuring resistance over the signal wires and through the receiver device. Total loop resistance must not exceed 1000 ohms.
- The primary mA output must be set to the 4-20 mA mode for the Bell 202 physical layer. The Bell 202 layer will not work with the primary mA output configured as a 0-20 mA output.
- The mA output cannot be converted from active to passive.

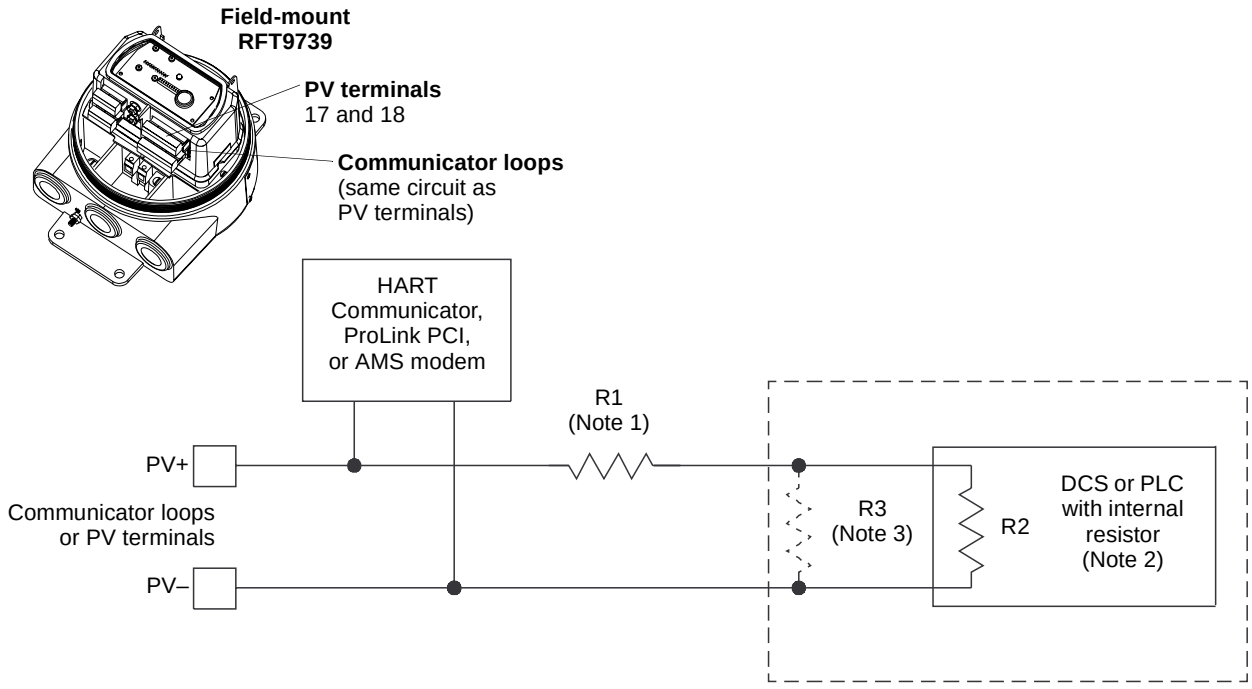
Figure 5-3. Primary and secondary mA output wiring



Connections for HART® communication devices

Figure 5-4 illustrates how to connect a HART Communicator, the ProLink PC-Interface adaptor, or an AMS serial modem to the RFT9739 for digital communication over the primary mA output. For information about using the HART Communicator or ProLink program, see the appropriate instruction manual. For AMS software, use the AMS on-line help:

Figure 5-4. HART® Communicator, ProLink® PC-Interface, and AMS modem connections



1. If necessary, add resistance in the loop by installing resistor R1. SMART FAMILY® devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms, regardless of the communication setup.

⚠ CAUTION

Connecting a HART device to the RFT9739 primary variable milliamp output loop could cause transmitter output error.

If the primary variable (PV) analog output is being used for flow control, connecting a HART device to the output loop could cause the transmitter 4-20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART device to the RFT9739 primary variable milliamp output loop.

2. The DCS or PLC must be configured for an active milliamp signal.
3. Resistor R3 is required if the DCS or PLC does not have an internal resistor.

5.4 Frequency/pulse output

The RFT9739 frequency/pulse output represents the flow rate or flow total, independent of the primary and secondary mA outputs. The frequency/pulse output can be used with any Micro Motion peripheral device except the DMS Density Monitoring System and the PI 4-20 Process Indicator, which do not have frequency inputs.

The frequency/pulse output can be configured to provide any one of the following:

- Mass flow rate
- Volume flow rate
- Mass flow total
- Volume flow total

Mass flow total and volume flow total are not available with some RFT9739 transmitters shipped prior to 1998.

Use RFT9739 terminals 15 and 16 for the frequency/pulse output. The frequency/pulse output, control output, and external zero input share terminal 16 as a common return. See **Figure 5-5**, page 31.

- The frequency/pulse output loop is isolated and floating from other circuits except the control output and external-zero input circuits. Ensure that the frequency/pulse output loop is grounded properly, either at the transmitter end, or at the external device.
- The frequency output circuit uses a 2.2 kohm resistor tied to a 15-volt source that limits the current to 7 mA. The output circuit is rated to 30 VDC, with 0.1 ampere maximum sinking capability, when used in the open collector mode. Open collector mode is described on page 33.
- Transmitter output is a nominal +15 V square wave, unloaded. Any load will decrease the peak voltage level.
- Output impedance is 2.2 kohm.
- For use with receivers other than Micro Motion peripheral devices, check the instruction manual for the receiver to make sure its input-voltage and electrical-current ratings match the RFT9739 frequency/pulse output ratings.

Default configuration

When the RFT9739 is shipped from the factory, the frequency/pulse output is internally powered by an isolated 15-volt source via a 2.2 kohm pull-up resistor. This internal current is limited to approximately 7 mA. See **Figure 5-5**.

Configuration for increased current

In some applications, it might be necessary to increase the current in the frequency/pulse output circuit. See **Section 5.2**, page 25. For increased current, add a 1 to 3 kohm resistor across terminals 14 and 15, as illustrated in **Figure 5-6**.

Figure 5-5. Frequency/pulse output wiring

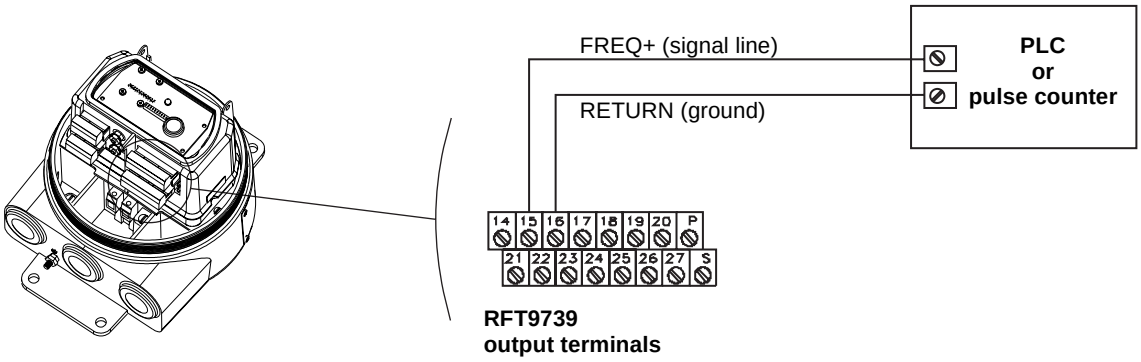
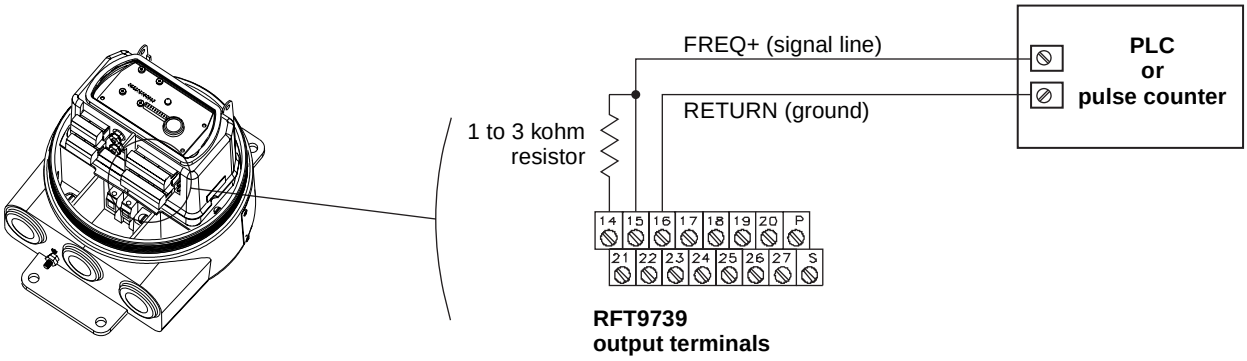


Figure 5-6. Frequency/pulse output wiring for increased current



Configuration for constant current

Applications with high capacitance loading will benefit by wiring the frequency/pulse output circuit to maintain a constant current source of 50 mA for any load between 0 and 220 ohms. This configuration renders the control output circuit inoperable.

For constant current, add a jumper across terminals 14 and 15, and a 100 to 250 ohm resistor at the PLC or pulse-counter end of the cable, as illustrated in **Figure 5-7**.

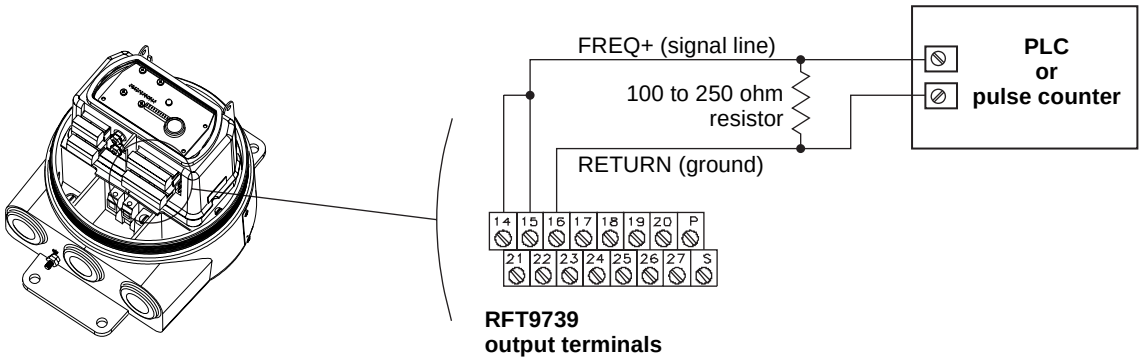
⚠ CAUTION

Adding a jumper across terminals 14 and 15 renders the control output circuit inoperable.

Do not attempt to use the control output circuit after you add a jumper across terminals 14 and 15.

The control output can be reconfigured to function properly, independent of this frequency/pulse wiring procedure. See "Control output in open collector mode," page 36.

Figure 5-7. Frequency/pulse output wiring for constant current



Configuration for open collector mode

The RFT9739 provides current to the frequency/pulse output circuit. In applications where this current must be permanently suspended, and for receiving devices that require input voltage higher than approximately 10 volts, the frequency/pulse output circuit can be used in open collector mode.

To configure the output for open collector mode, a resistor must be clipped as described below. ***This procedure will permanently alter the transmitter and cannot be reversed.***

- Clip resistor R14 (R1 on models with enhanced EMI immunity) and add an external DC power supply and a pull-up resistor. See **Figure 5-8**.
- The pull-up resistor must be of sufficient value to limit loop current to less than 0.1 ampere, depending on the total loop resistance at the transmitter.
- Resistor R14 (R1) is located on the RFT9739 output board, behind the output terminal blocks, as illustrated in **Figure 5-9**. To access resistor R14 (R1), unplug the output terminal blocks from the transmitter.

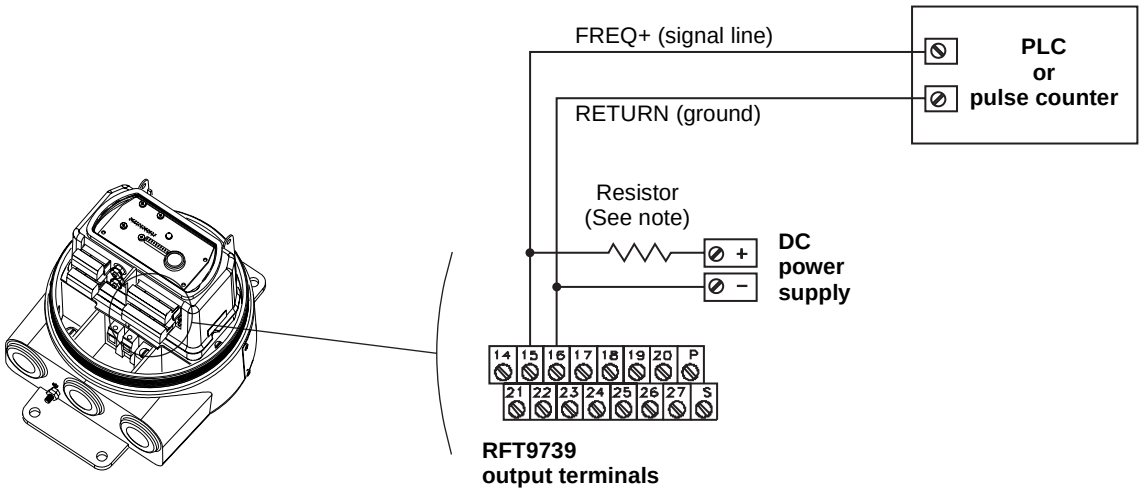
⚠ CAUTION

Clipping resistor R14 or R1 will eliminate the internal voltage source from the transmitter.

After clipping resistor R14 or R1, an external power supply is required to use the transmitter's frequency/pulse output.

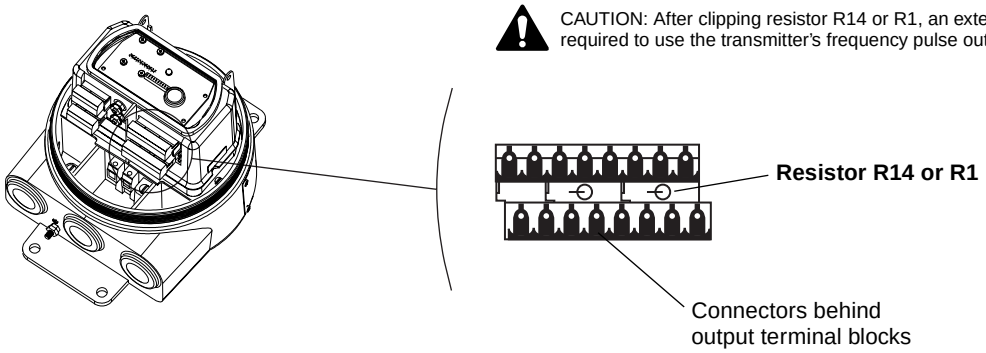
Before permanently altering any equipment, contact the Micro Motion Customer Service:
- In the U.S.A., phone 1-800-522-6277
- Outside the U.S.A., phone 303-530-8400
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

Figure 5-8. Frequency/pulse output wiring for open collector mode



Resistor must be of sufficient value to limit loop current to less than 0.1 ampere, depending on total loop resistance.

Figure 5-9. Location of resistor R14 (R1) on output board



5.5 Control output

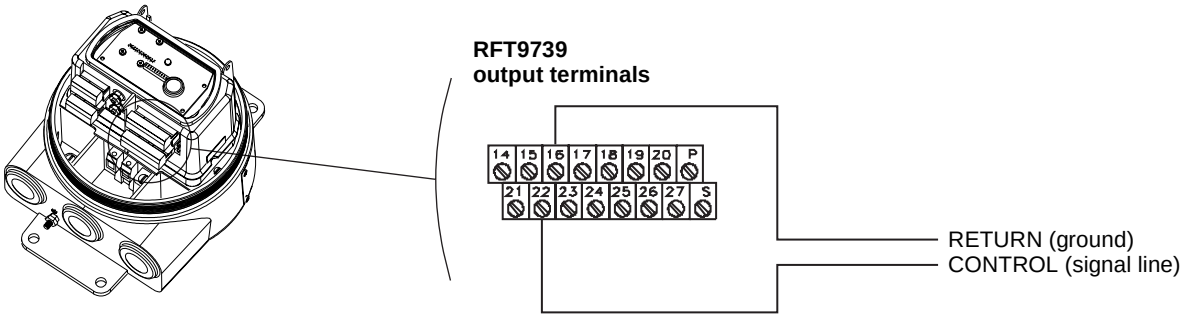
The control output can indicate flow direction, transmitter zeroing in progress, pressure input failure, faults, event 1 or event 2. For information on configuring the control output for events, see any of the following manuals or AMS on-line help:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

Use RFT9739 terminals 22 and 16 for the control output. The control output, frequency/pulse output, and external zero input share terminal 16 as a common return. See **Figure 5-10**.

- When configured to indicate flow direction, the output is high (+15 V) when indicating forward flow, and low (0 V) when indicating reverse flow.
- When configured to indicate transmitter zeroing in progress, the output is low (0 V) when zeroing is in progress and high (+15 V) at all other times.
- When configured to indicate faults, the output is low (0 V) when a fault condition exists and high (+15 V) during normal operation.
- When configured to indicate event 1 or event 2, the output switches ON (0 V) or OFF (+15 V) when the flow rate, flow total, density, temperature, or pressure of the process fluid achieves a programmed setpoint.
- The output circuit is rated to 30 VDC, with 0.1 ampere maximum sinking capability, when used in open collector mode. Open collector mode is described on page 36.
- Transmitter output is nominal 0 or +15 V, unloaded.
- Output impedance is 2.2 kohm.

Figure 5-10. Control output wiring



Control output in open collector mode

The RFT9739 provides current to the control output circuit. In applications where this current must be permanently suspended, and for receiving devices that require input voltage higher than approximately 10 volts, the control output circuit can be used in open collector mode.

If the frequency/pulse output is configured for constant current (see "Configuration for open collector mode," page 33), the control output is rendered inoperable. To reconfigure the control output to function properly, independent of this frequency/pulse output configuration, the control output circuit can be configured for open collector mode.

To configure the control output for open collector mode, a resistor must be clipped as described below. ***This procedure will permanently alter the transmitter and cannot be reversed.***

- Clip resistor R15 (R2 on models with enhanced EMI immunity) and add an external DC power supply and a pull-up resistor. See **Figure 5-11**, page 37.
- The pull-up resistor must be of sufficient value to limit loop current to less than 0.1 ampere, depending on the total loop resistance at the transmitter.
- Resistor R15 (R2) is located on the RFT9739 output board, behind the output terminal blocks, as illustrated in **Figure 5-12**, page 37. To access resistor R15 (R2), unplug the output terminal blocks from the transmitter.

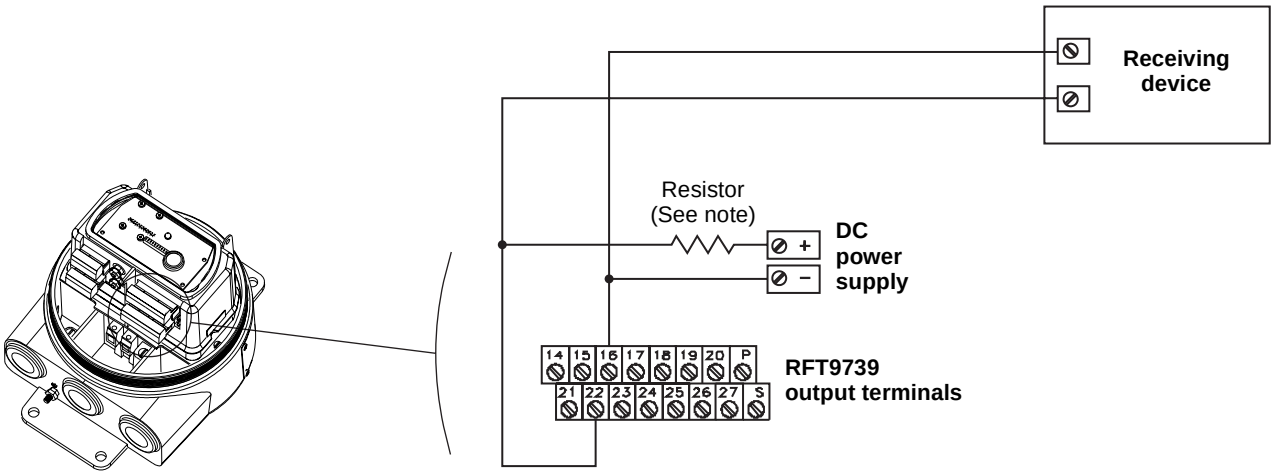
⚠ CAUTION

Clipping resistor R15 or R2 will eliminate the internal voltage source from the transmitter.

After clipping resistor R15 or R2, an external power supply is required to use the transmitter's control output.

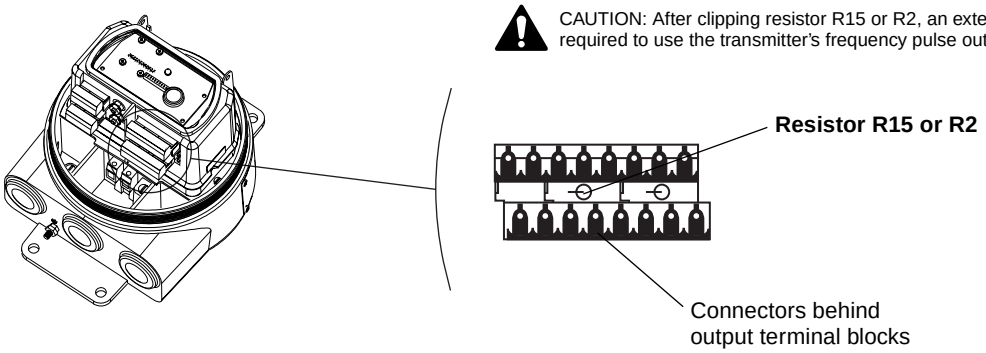
Before permanently altering any equipment, contact the Micro Motion Customer Service:
- In the U.S.A., phone 1-800-522-6277
- Outside the U.S.A., phone 303-530-8400
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

Figure 5-11. Control output wiring for open collector mode



Resistor must be of sufficient value to limit loop current to less than 0.1 ampere, depending on total loop resistance.

Figure 5-12. Location of resistor R15 (R2) on output board



CAUTION: After clipping resistor R15 or R2, an external power supply is required to use the transmitter's frequency pulse output. See page 36.

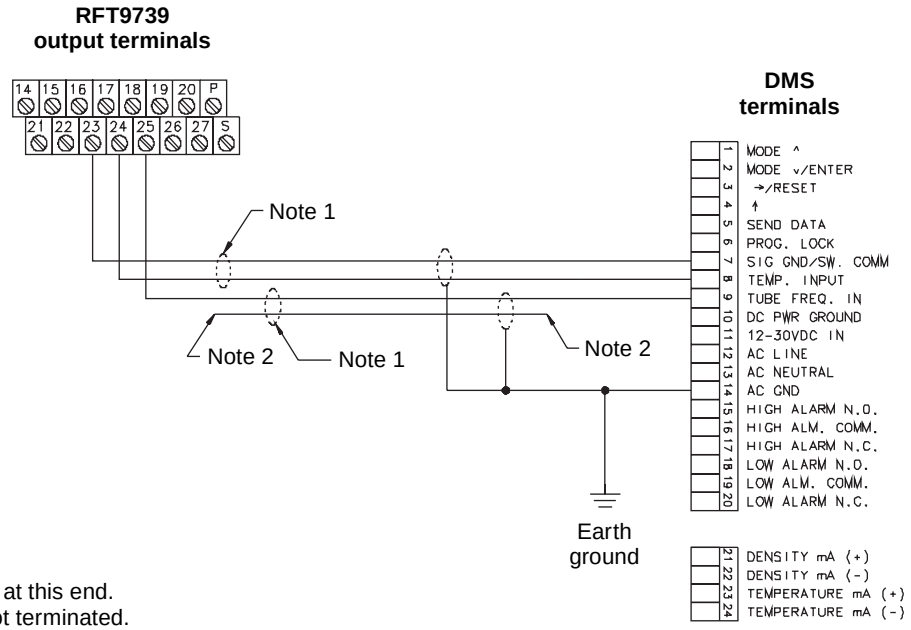
5.6 Peripheral device wiring

The wiring diagrams listed in **Table 5-2** illustrate connections from the transmitter to Micro Motion peripheral devices.

Table 5-2. Peripheral wiring diagrams

Micro Motion peripheral device	Figure	Page
DMS Density Monitoring System	5-13	38
DRT Digital Rate Totalizer with LED display	5-14a	39
DRT Digital Rate Totalizer with LCD display	5-14b	39
FMS-3 Flow Monitoring System with LED display	5-15a	40
FMS-3 Flow Monitoring System with LCD display	5-15b	40
NFC Net Flow Computer	5-16	41
NOC Net Oil Computer with AC power supply	5-17a	42
NOC Net Oil Computer with DC power supply	5-17b	42
Model 3300 Discrete Controller with screw/solder terminals	5-18a	43
Model 3300 Discrete Controller with I/O cable	5-18b	43
Model 3350 Discrete Controller	5-19	43

Figure 5-13. Wiring to DMS



1. Clip shields at this end.
2. This wire not terminated.

Figure 5-14a. Wiring to DRT with LED

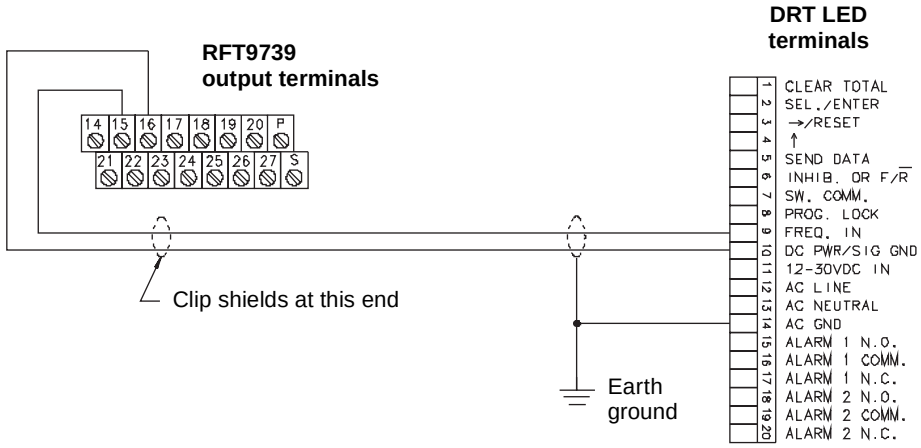


Figure 5-14b. Wiring to DRT with LCD

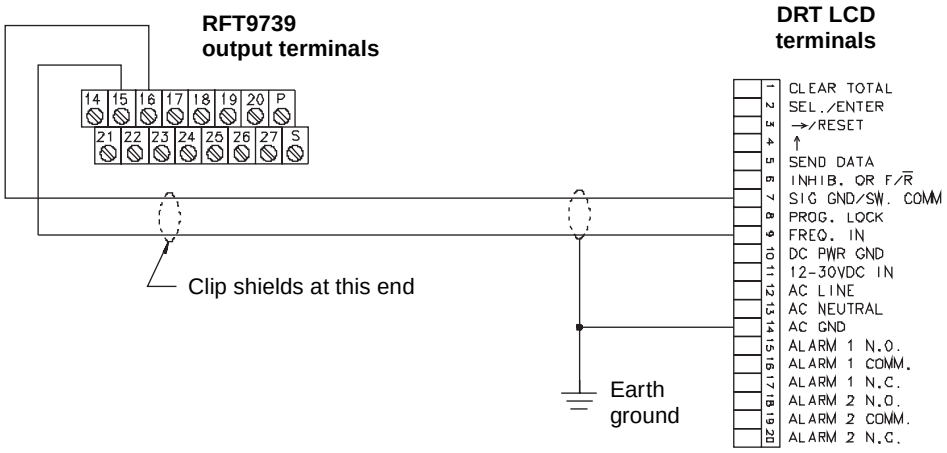


Figure 5-15a. Wiring to FMS-3 with LED

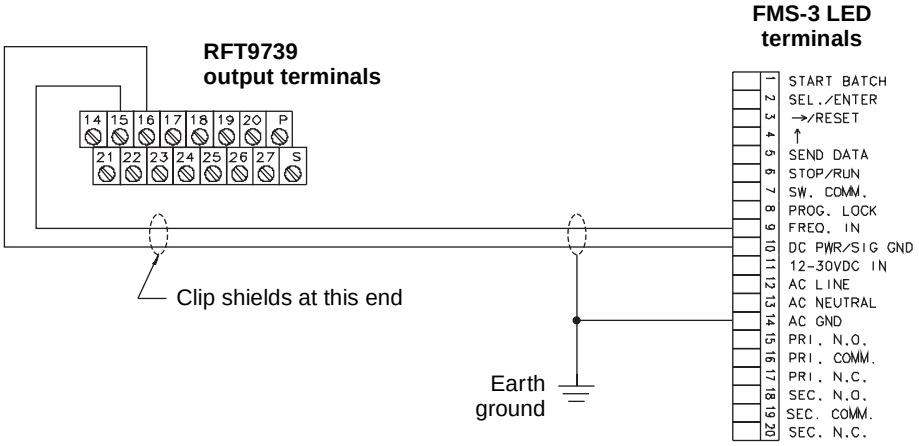


Figure 5-15b. Wiring to FMS-3 with LCD

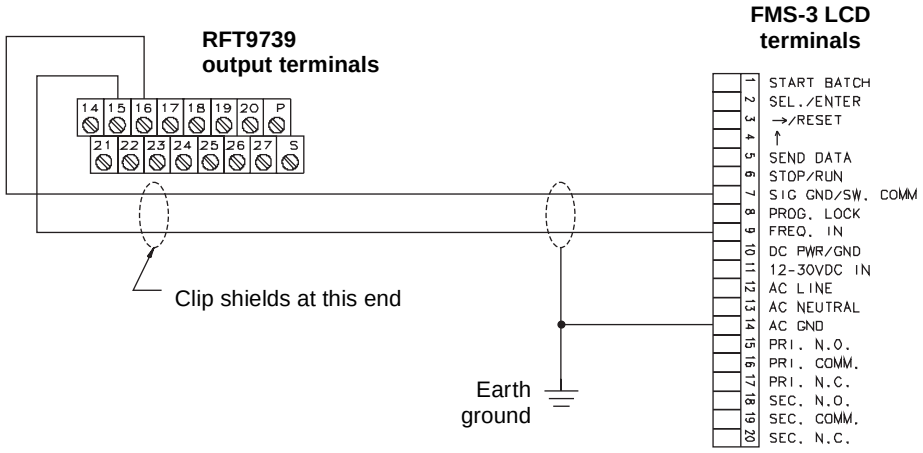
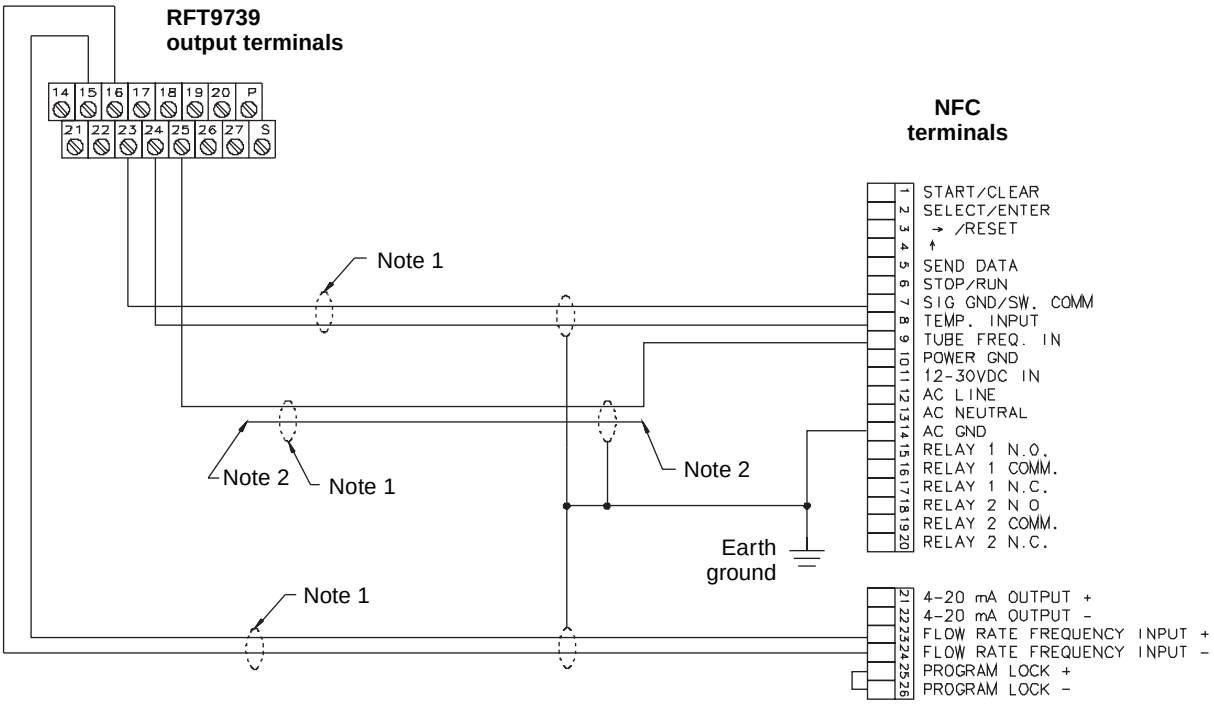
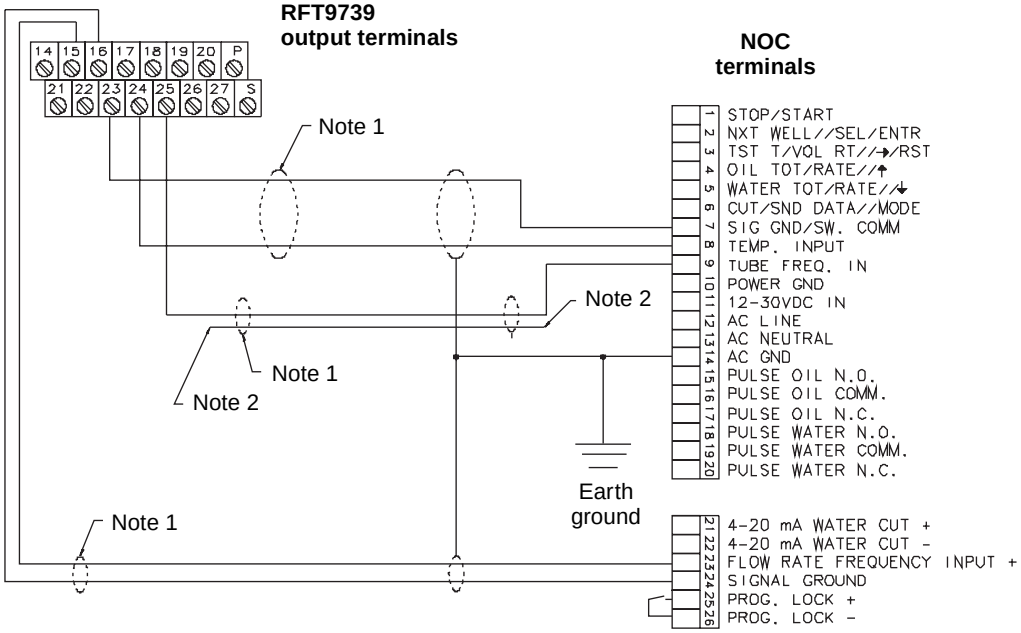


Figure 5-16. Wiring to NFC



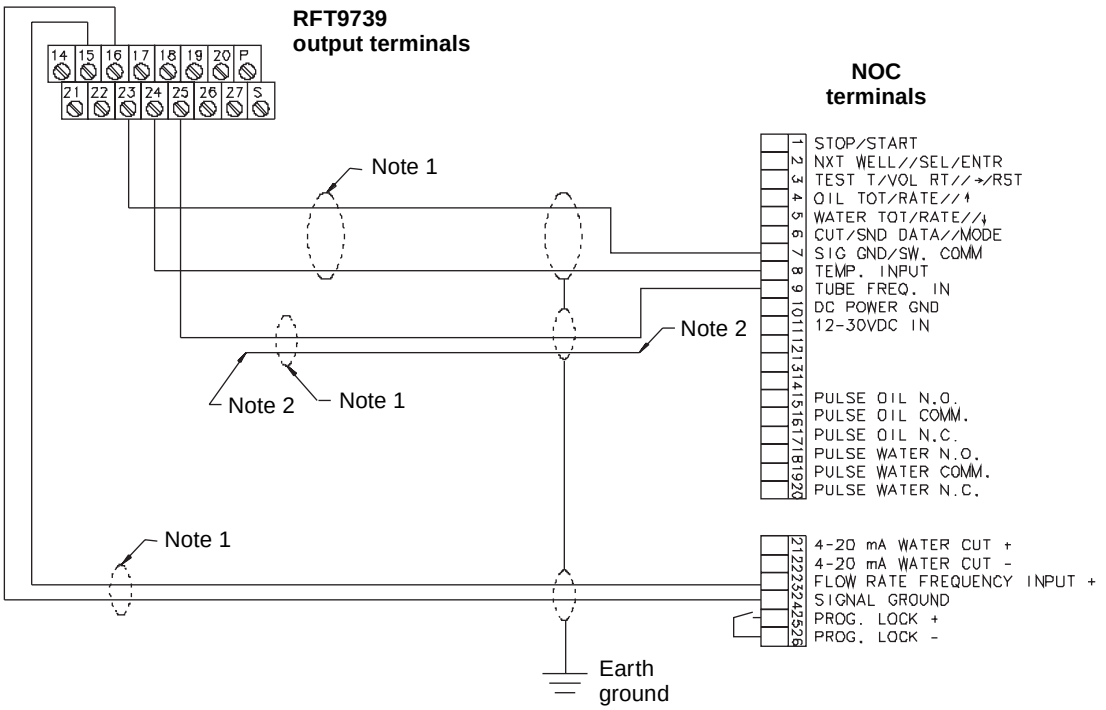
1. Clip shields at this end.
2. This wire not terminated.

Figure 5-17a. Wiring to AC-powered NOC



1. Clip shields at this end.
2. This wire not terminated.

Figure 5-17b. Wiring to DC-powered NOC



1. Clip shields at this end.
2. This wire not terminated.

Output Wiring *continued*

Figure 5-18a. Wiring to Model 3300 with screw-type or solder-tail terminals

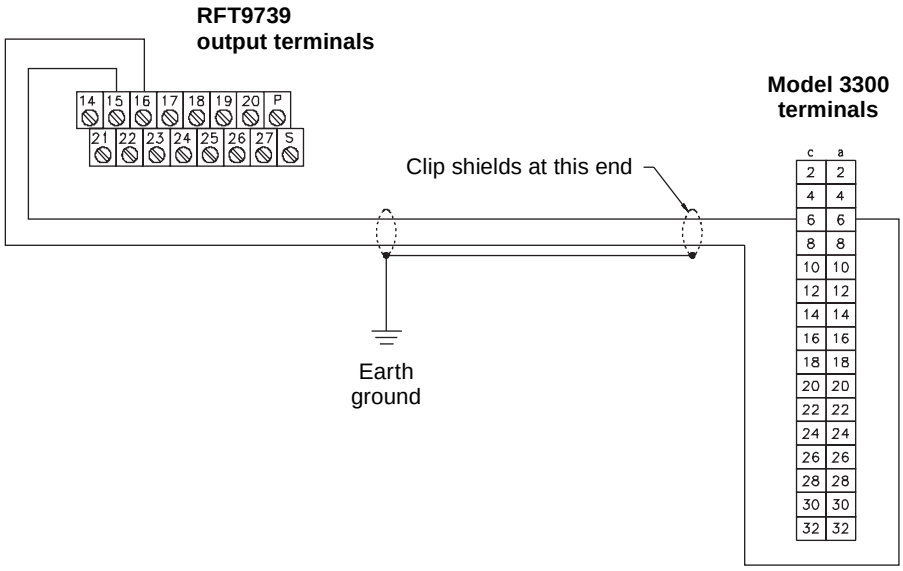


Figure 5-18b. Wiring to Model 3300 with I/O cable

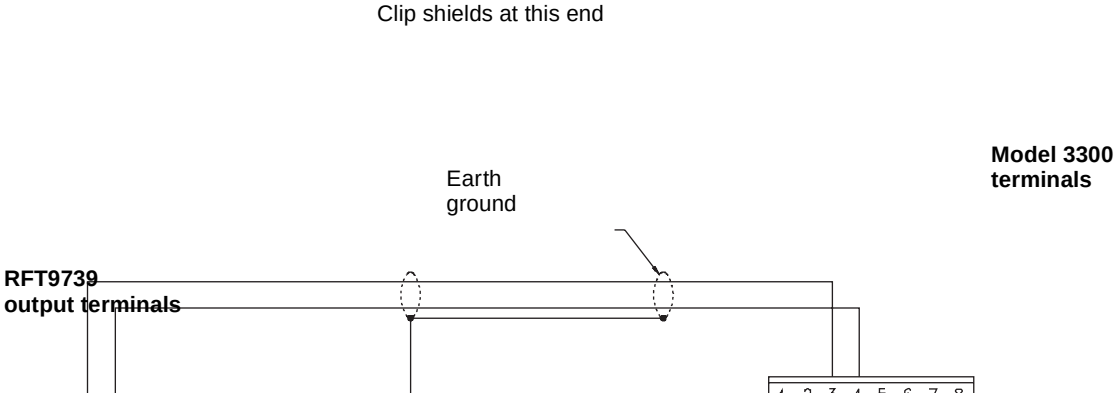
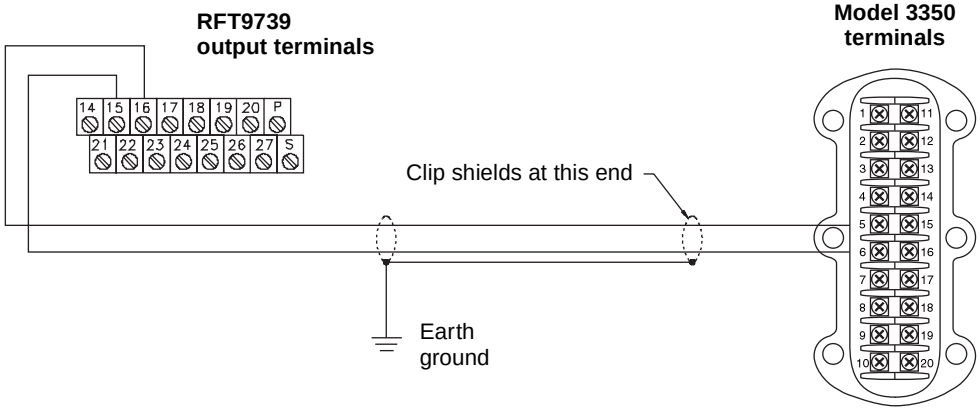


Figure 5-19. Wiring to Model 3350



5.7 Pressure transmitter wiring

⚠ WARNING

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

Pressure transmitter wiring is not intrinsically safe.
- Keep pressure transmitter wiring separated from power-supply wiring, intrinsically safe sensor wiring, and any other intrinsically safe wiring.
- Make sure the safety barrier partition is in place before operating the transmitter.

The RFT9739 accepts input signals from a pressure transmitter for pressure compensation.
- If a pressure transmitter connected to a host controller measures gauge pressure at the sensor input, the RFT9739 can compensate for the pressure effect on the sensor. Pressure compensation is required only for sensor models listed in **Table 5-3**.
- Instructions for wiring the RFT9739 to a pressure transmitter are provided below. Instructions for configuring the RFT9739 for pressure compensation are provided in the following instruction manuals and in the AMS on-line help:
  - *Using the HART Communicator with Micro Motion Transmitters*
  - *Using ProLink Software with Micro Motion Transmitters*
  - *Using Modbus Protocol with Micro Motion Transmitters*

The RFT9739 pressure input terminals (P and S) are intended for use with a pressure transmitter, and should not be connected to a control system.

If the RFT9739 is configured for pressure compensation, flowmeter measurement will not be compensated for pressure during a pressure input failure. If the signal from the pressure transmitter fails, both of the following occur:
- The RFT9739 continues to operate in non-fault mode.
- A "Pressure Input Failure" message is shown on the transmitter display (if it has one), a HART Communicator with the latest memory module, ProLink software version 2.4 or higher, or AMS software.

Table 5-3. Sensors affected by pressure

ELITE	F-Series	Model D and DL
CMF025 (density only)	F025 (density only)	D300 standard model
CMF050 (density only)	F050	D300 Tefzel® model
CMF100	F100	D600
CMF200	F200	DL100
CMF300		DL200
CMF400		

If the pressure transmitter requires a power supply less than or equal to 11.75 V, the RFT9739 can power the pressure transmitter. Use RFT9739 terminals P and S. Terminal P (MA PWR OUT) is the power output to the pressure transmitter, and terminal S (MA SIG IN) is the signal input to the RFT9739, as shown in **Figure 5-20a**.

If the pressure transmitter requires a power supply greater than 11.75 V, or if other loop devices are required, an external source can power the pressure transmitter. Use RFT9739 terminals S and 23. Terminal S (MA SIG IN) is the signal input to the RFT9739, and terminal 23 (SIGNAL GND) is the return, as shown in **Figure 5-20b**.

If digital communication between the pressure transmitter and the RFT9739 is required, use RFT9739 terminals 17 (PV+) and 18 (PV–), as shown in **Figure 5-20c**, page 46.

Figure 5-20a. Wiring to pressure transmitter — analog input

WARNING: Pressure transmitter wiring is not intrinsically safe

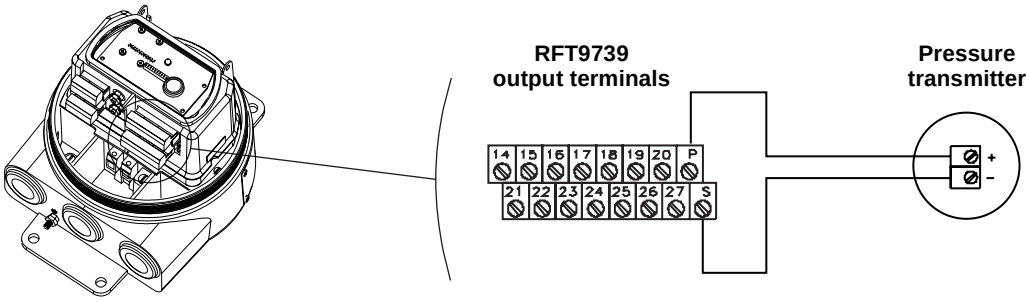
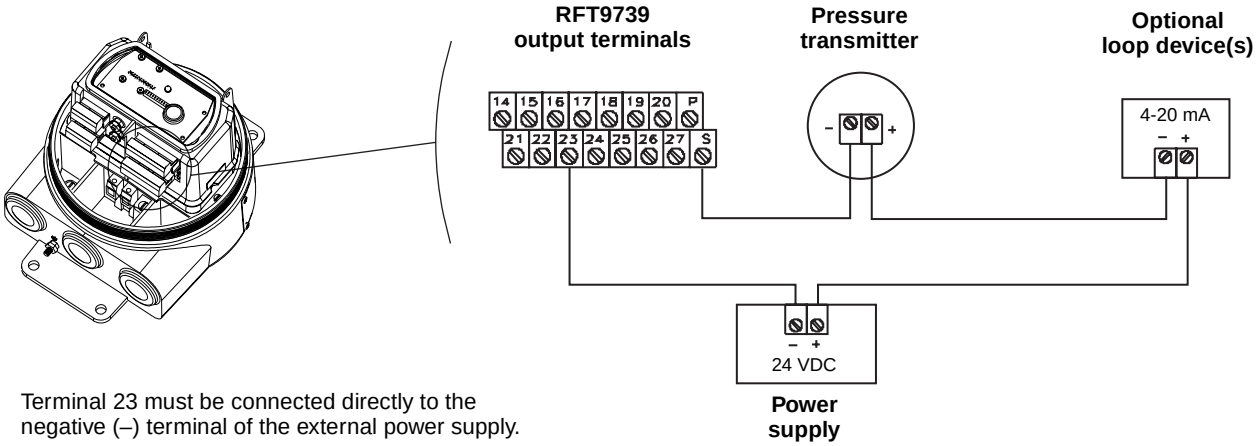


Figure 5-20b. Wiring to pressure transmitter — external power, analog input

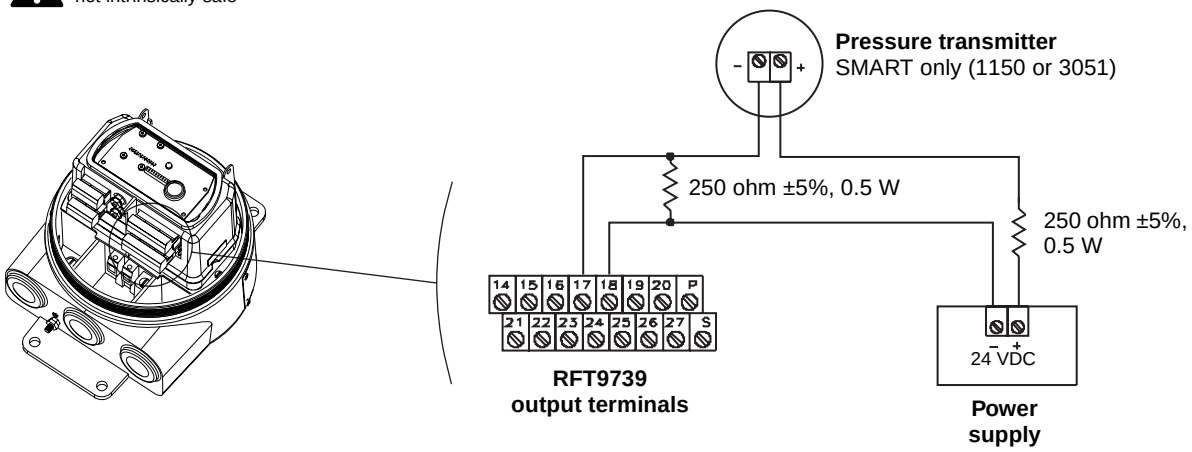
WARNING: Pressure transmitter wiring is not intrinsically safe



Terminal 23 must be connected directly to the negative (–) terminal of the external power supply.

Figure 5-20c. Wiring to pressure transmitter — digital communications

WARNING: Pressure transmitter wiring is not intrinsically safe



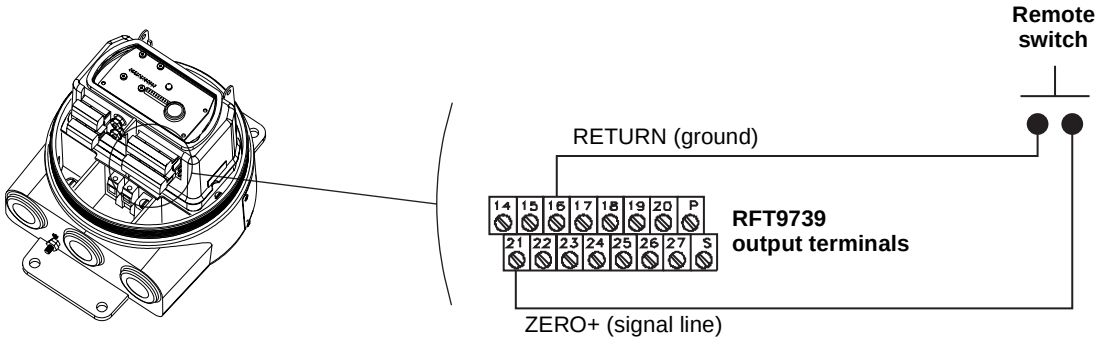
5.8 Remote-zero switch

The transmitter can be configured to allow transmitter zeroing from an external switch. The switch must be a momentary-type contact, normally open, and must carry 1 mA of current in the closed position. The open circuit voltage is 5 VDC.

Use terminals 21 and 16 for the remote switch. The remote-switch input, frequency/pulse output, and control output share terminal 16 as a common return. See **Figure 5-21**.

Section 6.4, page 57, describes the flowmeter zeroing procedure.

Figure 5-21. Wiring to remote-zero switch



5.9 RS-485 multidrop network

The RFT9739 can be configured to communicate for any one of the following options:

- HART protocol over the RS-485 standard
- HART protocol over the Bell 202 standard
- Modbus protocol over the RS-485 standard
- Modbus protocol over the RS-485 standard and HART protocol over the Bell 202 standard

For communications configuration instructions, see "Communication settings," page 9. For Bell 202 network wiring, see **Section 5.10**, page 48.

Multiple transmitters can participate in an RS-485 multidrop network that uses HART or Modbus protocol.

- Under HART protocol, an almost unlimited number of transmitters can participate in the network. Each transmitter must have a unique tag name. If polling addresses are used, up to 16 transmitters can have unique polling addresses from 0 to 15.
- Under Modbus protocol, up to 247 transmitters can participate in the network. Each transmitter must have a unique polling address from 1 to 247.

To connect the transmitter to an RS-485 network, use RFT9739 terminals 27 and 26. **Figure 5-22** shows how to connect one RFT9739 or multiple RFT9739 transmitters to a host controller for RS-485 serial communication.

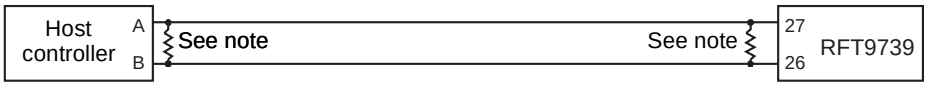
- Install twisted-pair, shielded cable, consisting of 24 AWG (0.25 mm²) or larger wire, between the RFT9739 and an RS-485 communication device. Maximum cable length is 4000 feet (1200 meters).
- Some installations require a 120-ohm, ½-watt resistor at both ends of the network cable to reduce electrical reflections.

For information on communication protocol requirements for implementing an RS-485 network, phone the Micro Motion Customer Service Department:

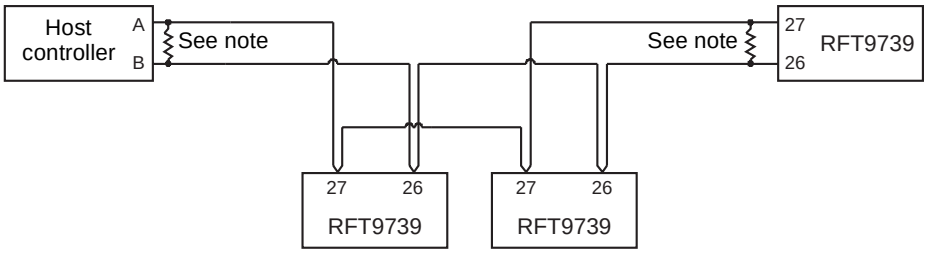
- In the U.S.A., phone 1-800-522-6277, 24 hours
- Outside the U.S.A., phone 303-530-8400, 24 hours
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

Figure 5-22. RS-485 wiring

One RFT9739 and a host controller



Multiple RFT9739s and a host controller



For long-distance communication, or if noise from an external source interferes with the signal, install 120-ohm ½-watt resistors across terminals of both end devices.

5.10 Bell 202 multidrop network

The RFT9739 can be configured to communicate for any one of the following options:

- HART protocol over the RS-485 standard
- HART protocol over the Bell 202 standard
- Modbus protocol over the RS-485 standard
- Modbus protocol over the RS-485 standard and HART protocol over the Bell 202 standard

For communications configuration instructions, see "Communication settings," page 9. For RS-485 network wiring, see **Section 5.9**, page 47.

Devices in a Bell 202 multidrop network communicate by sending and receiving signals to and from one another. HART protocol supports up to 15 transmitters in a Bell 202 multidrop network. The actual maximum number depends upon the type of transmitters, the method of installation, and other external factors. Other Rosemount SMART FAMILY transmitters can also participate in a HART-compatible network.

- A Bell 202 multidrop network uses twisted-pair wire, and allows only digital communication. Digital communication requires a sample rate of 2 to 31 seconds at 1200 baud.
- A HART Communicator or other HART-compatible control system can communicate with any device in the network over the same 2-wire pair.

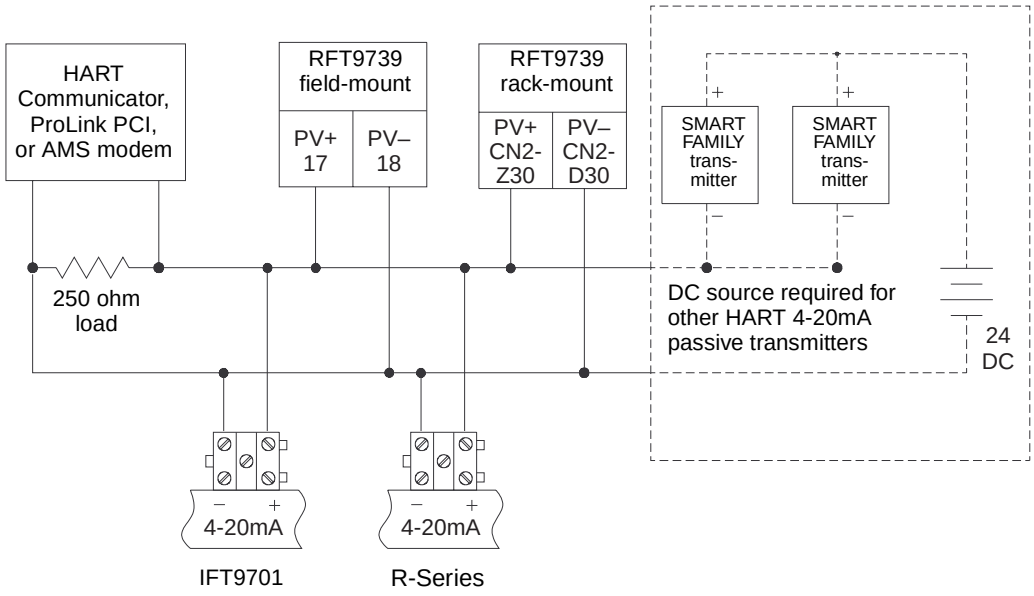
Using multiple transmitters in a HART-compatible network requires assigning a unique address from 1 to 15 to each transmitter.

- Assigning an address of 1 to 15 to the transmitter causes the primary mA output to remain at a constant 4 mA level.
- The primary mA output must produce a 4-20 mA current for the Bell 202 physical layer. The Bell 202 layer will not work with the primary mA output configured as a 0-20 mA output when the current output is 0 mA.

To connect the transmitter to a Bell 202 network, use RFT9739 terminals 17 and 18. See **Figure 5-23**.

- SMART FAMILY devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms.
- Connect the mA outputs from each transmitter together so they terminate at a common load resistor, with at least 250 ohms impedance, installed in series.

Figure 5-23. Typical HART® network wiring



For optimum HART communication, make sure the output loop is single-point grounded to instrument grade ground.

6 Startup

6.1 Initialization

After wiring has been connected, power can be supplied to the transmitter. During initialization, the diagnostic LED on the electronics module remains on continuously, while the transmitter performs a self-diagnostic. After initialization is completed, the LED blinks ON once per second to indicate proper operation of the transmitter.

For DC-powered transmitters, at startup, the transmitter power source must provide a minimum of 1.6 ampere of inrush current at a minimum of 12 volts at the transmitter's power input terminals.

Initialization with display

If the transmitter has a display, during initialization the display will show, sequentially:
1. All pixels on
2. All pixels off
3. All eights
4. All pixels off
5. Copyright notification

After the self-test is complete, one of ten possible process variable screens, such as the one depicted below, appears:

```
INV:       38450.5
GRAMS:         Msg
```

If the flowmeter is operating properly, the blinking "Msg" (message) indicator appears in the bottom right corner of the screen to indicate power has been cycled.
- To clear the "Msg" indicator, repeatedly rotate the Scroll knob until the display reads "Sensor OK *POWER / RESET*".
- To clear the message, rotate the Scroll knob.

If the message does not clear, or if error messages appear, refer to **Section 7.4**, page 68, which provides an overview of diagnostic and error messages.

6.2 Using the optional display

The optional RFT9739 display enables the user to:
- View process variables, flow totals and inventory levels, and status messages (see page 52)
- Set communication parameters (see page 54)
- Zero the flowmeter (see page 57)
- Reset the transmitter's flow totalizers (see page 60)

Use the Scroll and Reset knobs to operate the display.

Adjusting the sight window

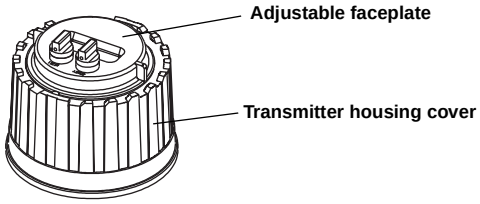
The sight window in the transmitter housing cover enables the user to view the LCD on the electronics module inside the housing. After the cover has been put in place, the sight window might not be properly aligned for viewing the display. To align the sight window, rotate the adjustable faceplate in either direction until the entire display is visible.

Micro Motion recommends mounting the transmitter with its conduit openings pointed downward. In such installations, the sight window will be properly aligned when it is directly above the Scroll and Reset knobs.

⚠ CAUTION

Rotating the transmitter housing cover or adjustable faceplate could cause the display to change, the flowmeter to be zeroed, or totalizers to be reset.

Rotating the transmitter cover actuates the Scroll and Reset knobs, which will affect the screen that is displayed, and could zero the flowmeter or reset the transmitter flow totalizers.



- Do not rotate the transmitter housing cover or adjust the faceplate while RATE, TOT, or INV screens are displayed.
- Security settings that prevent the use of scroll and reset knobs also prevent this situation from occurring. See **Section 2.3**, page 5.

Process variables mode

After power to the transmitter is turned off and on, or "cycled," the transmitter is in the process variables mode. The first screen that appears is the last process variable screen that was viewed before power was cycled. In the process variables mode, each screen indicates the value and measurement unit for a process variable.

As the user scrolls through the process variable screens, they appear in the order listed in **Table 6-1**, page 53.

Table 6-1. Display screens

Screen	Process variable	Abbreviation in upper left corner of screen
1	Mass flow rate	(RATE)
2	Volume flow rate	(RATE)
3	Density	(DENS)
4	Temperature	(TEMP)
5	Mass total[1]	(TOT)
6	Volume total[1]	(TOT)
7	Mass inventory[1]	(INV)
8	Volume inventory[1]	(INV)
9	Differential pressure or gauge pressure[2]	(DP) or (P)
10	Configuration event register[3]	(CONFIG REG)
11	Calibration event register[3]	(CALIBRATE REG)
12	Display test[3]	(DISPLAY TEST)
13	Message (if any)	– –

[1] While reading total (TOT) or inventory (INV) screens, use the unit of measure in the lower left corner to distinguish between mass and volume.

[2] Screen appears only when transmitter is configured to indicate pressure.

*[3] Screen appears only when transmitter is configured for security mode 8. See **Section 2.3**, page 5, for information about security modes.*

When displaying total (TOT) or inventory (INV) screens, display resolution is 10 places, including the decimal point. The position of the decimal point is fixed, and depends on the flow calibration factor and units of measure. If totalizers exceed the maximum display capability, the display reads "*********". Clear the message with the Reset knob.

If a message exists, the blinking "Msg" (message) indicator appears in the bottom right corner of each screen, indicating any of the following conditions:
- Power to the transmitter has been cycled.
- The flowmeter has been zeroed.
- An error condition exists.

To read a message, scroll past all process variable screens to the message screen (see **Table 6-1**). Uncorrected status conditions remain in the message queue. Other messages are cleared when the Scroll knob is used to scroll past the message screen to the flow rate screen.

If power to the transmitter has been cycled and the transmitter is operating properly, the message reads "Sensor OK *POWER/RESET*".

For more information about messages, refer to **Section 7.4**, page 68.

Communication configuration mode

Switch 5 on the transmitter electronics module allows the user to select the standard communication configuration or establish a user-defined configuration. The communication configuration mode allows the user to configure the transmitter's digital output using the display and the Scroll and Reset knobs.

- If switch 5 is in the USER DEFINED position (see **Section 2.3**, page 5), enter the communication configuration mode from any process variable screen by rotating and holding the Scroll knob, then rotating the Reset knob. In the communication configuration mode, "M1", "M2", or "M3" appears in the upper left corner of the screen.
- For RFT9739 software versions 3.6 and later, if switch 5 is in the STD COMM position, an error message will be displayed if an attempt is made to change the communication configuration using the RFT9739 display controls.
- Hardware switches can also be used for configuring the transmitter's digital communication output. For more information about using hardware switches, see **Section 2.3**, page 5.

M1 — Baud rate
To set the baud rate:

1. Rotate and release the Scroll knob to view each baud rate option. Choose from 1200, 2400, 4800, 9600, 19200, or 38400 baud.

2. Rotate and hold the Reset knob to select the displayed baud rate. Release the Reset knob when the display stops flashing.

3. When the selected baud rate flashes again, rotate and release the Reset knob to move to the M2 screen.

M2 — S=Stop bits, P=Parity
To set the stop bits and parity:

1. Rotate and release the Scroll knob to view each stop bit (S) option. Choose 1 stop bit or 2 stop bits.

2. Rotate and hold the Reset knob to select the displayed stop bit. Release the Reset knob when the display stops flashing.

3. When the selected stop bit flashes again, rotate and release the Reset knob to move to the parity (P) options.

4. Rotate and release the Scroll knob to view each parity (P) option. Choose from odd parity (O), even parity (E), or no parity (N). HART protocol requires odd parity; Modbus protocol requires odd parity, even parity, or no parity, depending on the host controller.

5. Rotate and hold the Reset knob to select the displayed parity. Release the Reset knob when the display stops flashing.

6. When the selected parity flashes again, rotate the Reset knob to move to the M3 screen.

M3 — Data bits, protocol, and physical layer

The M3 screen enables selection of 7-bit or 8-bit mode for Modbus protocol, or 8-bit mode for HART protocol.

- The HART protocol can use either the Bell 202 or RS-485 physical layer.
- Using HART protocol over the primary mA output requires the Bell 202 physical layer.

⚠ CAUTION

Changing the protocol or data bits will cause the process to shut down and the transmitter to initialize as described on page 51, which could result in switching of flow loop control devices.

Set control devices for manual operation before changing the communications protocol.

To set the data bits and protocol:

1. Rotate and release the Scroll knob to view each data bits (D) option. Choose from 7 data bits or 8 data bits. HART protocol requires 8 data bits; Modbus protocol requires 7 data bits for ASCII mode or 8 data bits for RTU mode.

2. Rotate and hold the Reset knob to select the displayed data bits. Release the Reset knob when the display stops flashing.

3. When the selected data bits flashes again, rotate and release the Reset knob to move to the protocol and physical layer options.

4. Rotate and release the Scroll knob to view each protocol/physical layer option. Choose from the following:
   - HART protocol over the Bell 202 physical layer (HART/202)
   - HART protocol over the RS-485 physical layer (HART/485)
   - Modbus protocol over the RS-485 physical layer (Modbus/485)
   - Modbus protocol over the RS-485 physical layer and HART protocol over the Bell 202 physical layer (Modbus/202)

5. Rotate and hold the Reset knob to select the displayed protocol/physical layer. Release the Reset knob when the display stops flashing.

6. When the selected protocol/physical layer flashes again, rotate and release the Reset knob to restart the transmitter. If the protocol/physical layer was not changed, the transmitter will not restart, and display will return to the process variable screen.

6.3 Custody transfer event registers

Event registers are provided for security requirements for custody transfer applications. When the transmitter is configured for security mode 8 (see **Section 2.3**, page 5), the transmitter meets security requirements for custody transfer described in National Institute of Standards and Technology (NIST) Handbook 44.

Custody transfer event registers record one change for each change "session." A change session begins when the transmitter is taken out of security mode 8, and ends when security mode 8 is reentered. To begin a change session, set switches 1, 2, and 3 to the OFF position. A change session ends when switches 1, 2, and 3 are reset to the ON position. After a change session is ended, security event registers will increase by one (1) if any of the parameters listed in **Table 6-2** have been changed.

- Each register will increase up to 999, then roll over to zero.
- Custody transfer event registers cannot be reset.

View the security event registers using any of the following methods:

- With the RFT9739 display. If the transmitter has a display, event registers can be viewed from the CONFIG REG and CALIBRATE REG screens when the transmitter is configured for security mode 8.
- With a HART Communicator.
- With a HART-compatible or Modbus-compatible master controller.
- With ProLink software version 2.3 or higher. Refer to on-line help for instructions.
- With AMS software. Refer to on-line help for instructions.

Table 6-2. Parameters that affect event registers

Configuration register	
Mass flow cutoff	Primary mA output trim
Flow damping	Secondary mA output trim
Volume flow cutoff	Primary mA output assignment
Flow direction	Secondary mA output assignment
Primary mA scaling factors	Control output assignment
Secondary mA scaling factors	Master reset
Calibration register	
Mass flow units	Density calibration factors
Volume flow units	• Density A and Density B
Auto zero calibration	• K1, K2, and FD
Density calibration	• Density temperature coefficient
Flow calibration factor	Pressure compensation factors
Meter factors	• Flow factor
Frequency output scaling factors	• Density factor
• Frequency	• Flow calibration pressure
• Rate	

6.4 Flowmeter zeroing

> **⚠ CAUTION**
>
> **Failure to zero the flowmeter at initial startup could cause the transmitter to produce inaccurate signals.**
>
> Zero the flowmeter before putting the flowmeter in operation.

Flowmeter zeroing establishes flowmeter response to zero flow and sets a baseline for flow measurement.

Zeroing procedure

To zero the transmitter, follow these steps:

1. Prepare the flowmeter for zeroing:
   a. Install the sensor according to the sensor instruction manual.
   b. Apply power to the transmitter, then allow it to warm up for at least 30 minutes.
   c. Ensure the transmitter is in a security mode that allows flowmeter zeroing (see "Security modes," page 5).
   d. Run the process fluid to be measured through the sensor until the sensor temperature reading approximates the normal process operating temperature.
   e. Ensure that the sensor is completely filled with fluid.
2. Close the shutoff valve downstream from the sensor.
3. Ensure zero flow through the sensor.

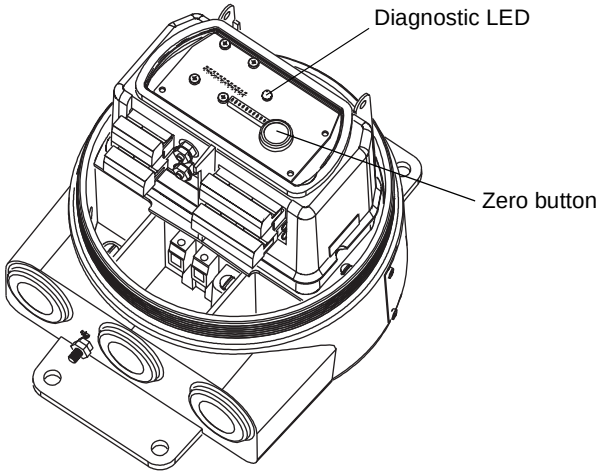
> **⚠ CAUTION**
>
> **Flow through the sensor during flowmeter zeroing will result in an inaccurate zero setting.**
>
> Make sure the sensor tubes are completely full and fluid flow through the sensor is completely stopped during flowmeter zeroing.

4. Zero the transmitter in any of five ways:
   - Press and hold the ZERO button for at least ten seconds or until the LED remains on continuously. **Figure 6-1**, page 58, shows the location of the button on the electronics module.
   - If the transmitter has a display, use the Scroll knob to advance to the mass flow rate screen or volume flow rate screen, then rotate and hold the Reset knob for at least ten seconds. (In the rate screens, "RATE" appears in the upper left corner of the screen.)
   - An external contact closure can be used for transmitter zeroing. (Refer to **Section 5.8**, page 46, for wiring instructions.) Close the contact for at least ten seconds.
   - Issue an auto zero command using a HART Communicator, a HART-compatible or Modbus-compatible master controller, or the ProLink software program.
   - Issue a "zero trim" command with the AMS program.

During transmitter zeroing, the diagnostic LED remains on continuously. See **Figure 6-1**. If the transmitter has a display, it reads "Sensor OK CAL IN PROGRESS". (It might be necessary to scroll through the process variable screens more than once to view this message.) The default zero time will range from 20 to 90 seconds, depending on the sensor.

After the zeroing procedure has been completed, the LED again blinks ON once per second to indicate normal operation. If the transmitter has a display, the mass flow rate or volume flow rate screen reappears, and the blinking "Msg" (message) indicator appears in the lower right corner. To clear the message indicator, scroll to the message screen, which should read "Sensor OK *ERROR CLEARED*".

Figure 6-1. Diagnostic LED and zero button



Diagnosing zero failure

If zeroing fails, the LED blinks ON four times per second to indicate an error condition. If the transmitter has a display, the blinking "Msg" (message) indicator appears. The message screen will indicate the zero failure with a message such as "*ZERO ERROR*", "*ZERO TOO HIGH*", or "*ZERO TOO LOW*".

An error condition could indicate:
- Flow of fluid during transmitter zeroing
- Partially empty flow tubes
- An improperly mounted sensor

To clear a zeroing error, cycle power to the transmitter, ensure that the tubes are full and the flow has stopped, and rezero again.

Additional information about flowmeter zeroing

Flowmeter zeroing can be disabled using the transmitter's security modes. **Table 6-3** describes how RFT9739 security modes 1 through 8 affect flowmeter zeroing. Refer to **Section 2.3**, page 5, for more information about security modes.

The transmitter has a programmable zeroing time (number of measurement cycles), and enables the user to set the standard deviation limits. For more information, see any of the following instruction manuals:
- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

Table 6-3. Effect of security modes on flowmeter zeroing

Performed with	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
Reset knob		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
HART or Modbus device			Disabled	Disabled	Disabled			Disabled

6.5 Totalizer control

The transmitter's mass totalizer and volume totalizer can be started, stopped, and reset using any of the following:
- A HART Communicator
- ProLink software version 2.4 or higher
- A Modbus device
- AMS software

In addition, the totalizer can be reset using the Scroll and Reset knobs on the transmitter housing cover, if the RFT9739 has a display.

⚠ WARNING

When the totalizers are stopped, the frequency/pulse output is disabled.

If the frequency/pulse output is used for process control, failure to set control devices for manual operation could affect process control.

- Before stopping the totalizers, set process control devices for manual operation.
- To enable the frequency/pulse output, restart the totalizers.

Totalizer functions can be disabled, depending on the RFT9739 security mode. See **Table 6-4**.

Mass and volume totalizers cannot be reset independently. When one totalizer is reset, the other is also reset. To reset the transmitter's mass totalizer and volume totalizer using the Scroll and Reset knobs:

1. Use the Scroll knob to view the process variable screens until either totalizer screen appears. (In the totalizer screens, "TOT" appears in the upper left corner.)
2. Rotate and hold the Reset knob until the screen is blank, then release.

Table 6-4. Effect of security modes on totalizer control

Flow condition	Performed with	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
No flow	Scroll and Reset knobs		Disabled		Disabled	Disabled		Disabled	
	HART or Modbus device			Disabled		Disabled	Disabled		
With flow	Scroll and Reset knobs		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
	HART or Modbus device			Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

Resetting the totalizer has no effect on the mass or volume inventory.
*For more information about security modes, refer to **Section 2.3**, page 5.*

6.6 Process measurement

⚠ WARNING

Operating the transmitter without covers in place exposes electrical hazards that can cause property damage, injury, or death.

Make sure the safety barrier partition, electronics module cover, and housing cover are securely in place before operating the transmitter.

After flowmeter zeroing has been completed as described in **Section 6.4**, page 57, the flowmeter is ready for process measurement.

7 Troubleshooting

7.1 General guidelines

Troubleshooting a Micro Motion flowmeter is performed in two parts:

1. Tests of wiring integrity
2. Observation of the transmitter's diagnostic tools, which include the diagnostic LED, diagnostic messages, and fault output levels

⚠ CAUTION

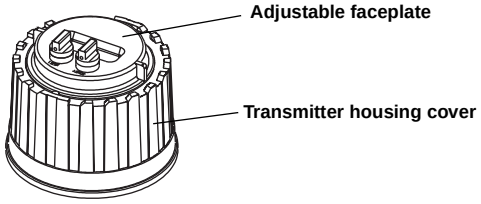
During troubleshooting, the transmitter could produce inaccurate flow signals.

Set control devices for manual operation while troubleshooting the flowmeter.

⚠ CAUTION

Rotating the transmitter housing cover or adjustable faceplate could cause the display to change, the flowmeter to be zeroed, or totalizers to be reset.

Rotating the transmitter cover actuates the Scroll and Reset knobs, which will affect the screen that is displayed, and could zero the flowmeter or reset the transmitter flow totalizers.



- Do not rotate the transmitter housing cover or adjust the faceplate while RATE, TOT, or INV screens are displayed.
- Security settings that prevent the use of scroll and reset knobs also prevent this situation from occurring. For information about security modes, see **Section 2.3**, page 5.

Follow these general guidelines when troubleshooting a Micro Motion flowmeter:

- Before beginning the diagnostic process, become familiar with this instruction manual and with the instruction manual for the sensor.
- While troubleshooting a problem, leave the sensor in place, if possible. Problems often result from the specific environment in which the sensor operates.
- Check all signals under both flow and no-flow conditions. This procedure will minimize the possibility of overlooking some causes or symptoms.

7.2 Transmitter diagnostic tools

In some situations, troubleshooting requires use of the transmitter's diagnostic tools, which include the diagnostic LED, diagnostic messages, and fault output levels. The diagnostic LED and communicator hookup loops are shown in **Figure 7-1**.

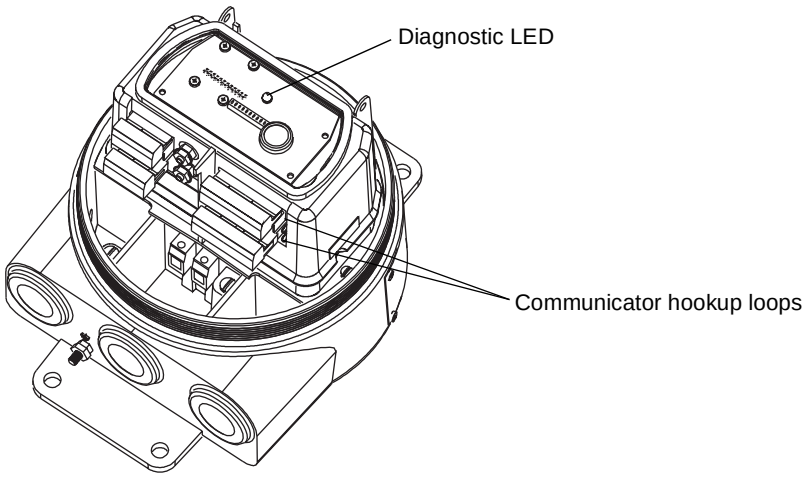
Diagnostic LED

Table 7-1 describes the transmitter operating conditions indicated by the diagnostic LED.

Table 7-1. Conditions indicated by diagnostic LED

Diagnostic LED does this:	Condition
Blinks ON once per second (25% ON, 75% OFF)	Normal operation
Remains ON continuously	Startup and initialization, zero in progress
Blinks ON three times, then OFF for 1 second	Communication configuration mode (switch 10 in ON position)
Blinks OFF once per second (75% ON, 25% OFF)	Slug flow (density below or above user-defined limits)
Blinks ON 4 times per second	Fault condition

Figure 7-1. Diagnostic LED and communicator loops



Fault outputs

The RFT9739 has downscale and upscale fault outputs. (See "Milliamp output scaling," page 9.) Fault output levels are listed in **Table 7-2**.

Table 7-2. Fault output levels

Output	Operating condition	Downscale	Upscale
0-20 mA	Alarm	0 mA	22 mA
	EPROM, RAM, or RTI error; transmitter failure	0 mA	24 mA
4-20 mA	Alarm	2 mA	22 mA
	EPROM, RAM, or RTI error; transmitter failure	0 mA	24 mA
Frequency/pulse	Alarm	0 Hz	15 kHz
	EPROM, RAM, or RTI error; transmitter failure	0 Hz	19 kHz

Diagnostic messages

The transmitter provides diagnostic messages, which can be viewed on the display of a HART Communicator, or in the Status window of the ProLink software program. Messages are described in the following instruction manuals, and in AMS on-line help:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

Use a HART Communicator with the latest memory module, a Modbus host controller, or ProLink software version 2.3 or higher, to view the following parameters:

- Drive gain
- Tube frequency
- Left and right pickoff voltages
- "Live zero"

If the transmitter has a display:

- Many of the messages that can be read with a HART Communicator, the ProLink program, or AMS software can be read from the transmitter display. These messages are described in **Section 7.5**, page 73.
- Modbus host controllers use status bits as diagnostic messages.
- In the event of a display readback failure while using a HART Communicator, the ProLink program, a Modbus host controller, or AMS software, cycle power to the transmitter (turn power OFF, then ON).

7.3 Interrogation with a HART® device

Connect a HART Communicator to the communicator hookup loops indicated in **Figure 7-1**, or use the ProLink or AMS programs to communicate with the transmitter.

- If the HART Communicator does not offer RFT9739 "Dev v4" as a device description, the communicator memory module needs to be upgraded.
- Use ProLink software version 2.3 or higher.
- Contact the Micro Motion Customer Service Department to upgrade your HART Communicator or ProLink program:
  - 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

Figure 7-2 (next page) explains how to connect a HART Communicator, the ProLink PC Interface adaptor, or the AMS serial modem to the RFT9739. For more information, see the HART Communicator or ProLink software instruction manual, or AMS on-line help.

Fault detection indicates an interruption in the functional integrity of the sensor and the electronics, including the sensor pickoff coils, drive coil, and RTD. Faults, such as a short or an open circuit, are detected by the HART device.

The transmitter runs continuous self-diagnostics. If these diagnostics reveal a failure, the HART device displays an error message. Self-testing allows the transmitter to check its own circuitry.

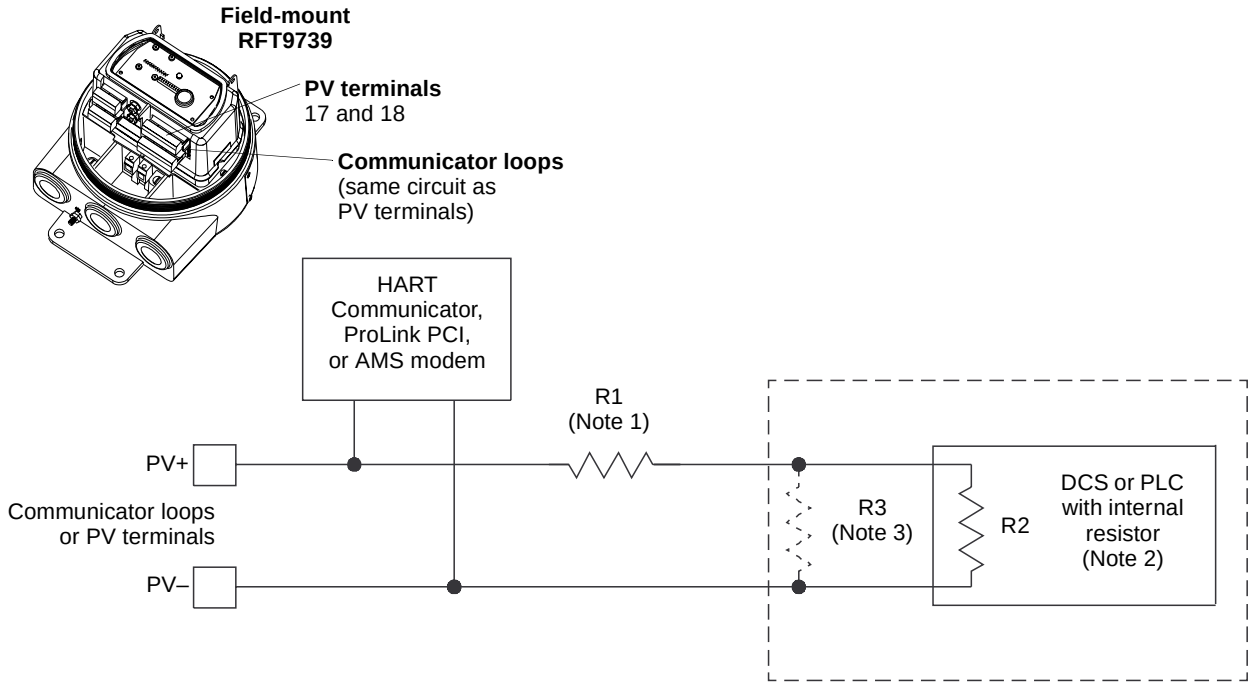
The transmitter works with a Micro Motion flow sensor to provide flow information. Therefore, many of the troubleshooting checks pertain only to the sensor. However, a HART Communicator, the ProLink program, and AMS software enable the user to perform other tests:

- Performing an *mA output test* forces the transmitter to produce a user-specified current output of 0 to 22 mA.
- Performing a *frequency/pulse output test* forces the transmitter to produce a user-specified frequency output between 0.1 and 15,000 Hz.
- Performing an *mA output trim* allows adjustment of the primary and secondary mA outputs against a highly accurate external standard such as a digital multimeter (DMM) or receiving device.

Perform mA trim and/or test procedures, if necessary, as described in the HART Communicator or ProLink software instruction manuals, or in AMS on-line help.

- If the transmitter is in security mode 8, mA output test, mA output trim, and frequency/pulse output test procedures cannot be performed. For more information, see "Security mode 8," page 6.
- If the transmitter is in fault condition, an mA output test cannot be performed.
- If the transmitter is not properly connected to a sensor, or if the sensor is in fault condition, an mA output test cannot be performed.

Figure 7-2. HART® Communicator, ProLink® PC-Interface, and AMS modem connections



1. If necessary, add resistance in the loop by installing resistor R1. SMART FAMILY devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms, regardless of the communication setup.

⚠ CAUTION

Connecting a HART device to the RFT9739 primary variable milliamp output loop could cause transmitter output error.

If the primary variable (PV) analog output is being used for flow control, connecting a HART device to the output loop could cause the transmitter 4-20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART device to the RFT9739 primary variable milliamp output loop.

2. The DCS or PLC must be configured for an active milliamp signal.
3. Resistor R3 is required if the DCS or PLC does not have an internal resistor.

7.4 Troubleshooting using the transmitter display

If the transmitter has a display, use the message screen and refer to the following sections to troubleshoot the flowmeter:
- Overrange and sensor error messages
- Transmitter failure messages
- Slug flow and output saturated messages
- Informational messages

Not configured

After the user performs a master reset, the message display reads "NOT CONFIGURED", indicating the flowmeter requires complete characterization and reconfiguration. Use a HART Communicator or the ProLink program to configure the transmitter. To perform a master reset, see **Section 7.8**, page 76.

Transmitter failure messages

If a transmitter failure occurs, the display produces one of the following messages:
- "Xmtr Failed"
- "(E)eprom Error"
- "RAM Error"
- "RTI Error"

Table 7-3 describes transmitter failure messages.

⚠ CAUTION

Transmitter failures are critical, and could cause unintentional switching of process control devices.

The transmitter does not have any parts that are serviceable by the user. If a transmitter failure is indicated, 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

Table 7-3. Using transmitter failure messages

Message	Condition	Corrective action
Xmtr Failed	Transmitter hardware failure	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
(E)EPROM error	EPROM checksum failure	
RAM Error	RAM diagnostic failure	
RTI Error	Real-time interrupt failure	

Overrange and sensor error messages

If a sensor failure occurs, if the sensor cable is faulty, or if measured flow, measured temperature, or measured density go outside the sensor limits, the display produces one of the following messages:

- "Sensor Error"
- "Drive Overrng"
- "Input Overrange"
- "Temp Overrange"
- "Dens Overrng"

To interpret overrange and sensor error messages, use the transmitter's fault output levels, a digital multimeter (DMM) or other reference device, and refer to **Table 7-4** for corrective actions.

Unplug terminal blocks from the transmitter electronics module to check circuits.

Slug flow

Programmed slug flow limits enable transmitter outputs and the display to indicate conditions such as slug flow (gas slugs in a liquid flow stream). Such conditions adversely affect sensor performance by causing erratic vibration of the flow tubes, which in turn causes the transmitter to produce inaccurate flow signals.

If the user programs slug limits, a slug flow condition causes the following to occur:

1. The message display reads "SLUG FLOW".
2. The frequency/pulse output goes to 0 Hz.
3. mA outputs indicating flow rate go to the level that represents zero flow.

The flowmeter resumes normal operation when liquid fills the flow tubes and when density stabilizes within the programmed slug flow limits.

The user can also program a slug duration, from 0 to 60 seconds, into the configuration of an RFT9739. If process density goes outside a slug flow limit, flow outputs hold their last measured value for the period of time established as the slug duration.

Table 7-5 summarizes possible slug flow errors and lists typical corrective actions.

Output saturated messages

If an output variable exceeds its upper range limit, the display message reads "Freq Overrange", "mA 1 Saturated" or "mA 2 Saturated". The message can mean the output variable has exceeded appropriate limits for the process, or can mean the user needs to change measurement units.

Table 7-5 summarizes possible output saturated messages and lists typical corrective actions.

Table 7-4. Using overrange and sensor error messages

Instructions

1. Turn off power to the transmitter.
2. Unplug terminal blocks from transmitter electronics module to check circuits

Message	Other symptoms	Causes	Corrective actions
Drive Overrng or Input Overrange	• Transmitter produces fault outputs • At the transmitter, DMM indicates open or short circuit from red wire to brown wire • At the sensor, DMM indicates open or short circuit from red wire to brown wire	• Flow rate outside sensor limit • Faulty cable • Open or short drive coil in sensor	• Fill sensor with process fluid • Bring flow rate within sensor limit • Monitor flow rate • If open or short at transmitter, reconnect wiring or repair cable • If open or short at sensor, return sensor to Micro Motion
	• Transmitter produces fault outputs • At the transmitter, DMM indicates open or short circuit from green wire to white wire • At the sensor, DMM indicates open or short circuit from green wire to white wire	• Flow rate outside sensor limit • Faulty cable • Open or short left pickoff in sensor	
Sensor Error	• Transmitter produces fault outputs • At the transmitter, DMM indicates open or short circuit from blue wire to gray wire • At the sensor, DMM indicates open or short circuit from blue wire to gray wire	• Faulty cable • Open or short right pickoff in sensor	• If open or short at transmitter, reconnect wiring or repair cable • If open or short at sensor, return sensor to Micro Motion
	Transmitter produces fault outputs	• Moisture in sensor case	• Replace conduit and/or conduit seals • Repair cable • Return sensor to Micro Motion
Drive Overrng or Dens Overrng	Transmitter produces fault outputs	• Inappropriate density factors • Process density > 5.0000 g/cc • Severely erratic or complete cessation of flow tube vibration due to gas slugs or solids in process fluid • Plugged flow tube	• Calibrate for density • Correct density factors • Monitor density • Bring density within sensor limit • Purge flow tubes with steam, water, or purging chemical
Temp Overrange	• Transmitter produces fault outputs • At the transmitter, DMM indicates open or short circuit from yellow wire to orange wire • At the sensor, DMM indicates open or short circuit from yellow wire to orange wire	• Temperature outside sensor limit • Faulty cable • Open or short lead length compensator	• Bring temperature within sensor limit • Monitor temperature • If open or short at transmitter, reconnect wiring or repair cable • If open or short at sensor, return sensor to Micro Motion
	• Transmitter produces fault outputs • At the transmitter, DMM indicates open or short circuit from violet wire to yellow wire • At the sensor, DMM indicates open or short circuit from violet wire to yellow wire	• Faulty cable • Open or short RTD in sensor	

Table 7-5. Using slug flow and output saturated messages

Message	Condition	Corrective action(s)
Slug flow	• Gas slugs causing process density to go below low slug flow limit • Solids causing process density to go above high slug flow limit	• Monitor density • Enter new slug flow limits • Enter new slug duration
Freq overrange	Flow rate driving output from terminals 15 (FREQ+) and 16 (RETURN) to 0 or 15 kHz	• Change flow measurement units • Rescale frequency/pulse output • Reduce flow rate
mA 1 saturated	Output from terminals 17 (PV+) and 18 (PV–) = 0, 3.8, or 20.5 mA	• Change value of variable at 20 mA • Alter fluid process
mA 2 saturated	Output from terminals 19 (SV+) and 20 (SV–) = 0, 3.8, or 20.5 mA	

Informational messages

Information messages are described below. **Table 7-6** summarizes informational messages and lists typical corrective actions.

Power Reset indicates a power failure, brownout, or power cycle has interrupted operation of the transmitter. The transmitter has a nonvolatile memory, which remains intact despite power interruptions.

Cal in Progress indicates flowmeter zeroing in progress or density calibration in progress.

Zero Too Noisy indicates mechanical noise has prevented the transmitter from setting an accurate zero flow offset during transmitter zeroing.

Zero Too High or Zero Too Low indicates flow was not completely shut off during sensor zeroing, so the transmitter has calculated a zero flow offset that is too great to allow accurate flow measurement. Zero Too Low indicates the zero flow offset is negative.

Burst Mode indicates the user has configured the transmitter to send data in burst mode while operating under HART protocol. In burst mode, the transmitter sends data at regular intervals.

mA 1 Fixed or mA 2 Fixed indicates one of several conditions:
- The mA output trim or test was not completed. The output remains fixed at the assigned level until the user completes the output trim or test procedure.
- The user has assigned a polling address other than 0 to the transmitter for Bell 202 communication. The output remains fixed at 4 mA until the user assigns the transmitter a polling address of 0.

Event 1 On or Event 2 On switches ON if an event tied to an RFT9739 output switches the output ON.
- With mass or volume total assigned to the event, the event switches ON and OFF according to the low or high configuration of the alarm. With a LOW alarm, the event switches ON when the user resets the totalizer. With a HIGH alarm, the event switches OFF when the user resets the totalizer.
- With flow, density, temperature, or pressure assigned to the event, the event switches OFF or ON whenever the process variable crosses the setpoint.

Security Breach indicates the transmitter security mode has been changed from security mode 8. Clear the message by reentering security mode 8 or by performing a master reset.

Error Cleared indicates a previous message has been cleared.

Table 7-6. Using informational messages

Message	Condition	Corrective action(s)
Power Reset	• Power failure • Brownout • Power cycling	Check accuracy of totalizers
Cal in Progress	• Flowmeter zeroing in progress • Density calibration in progress	• If Cal in Progress disappears, no action • If Cal in Progress reappears after zeroing is completed: - Check flowmeter cable - Eliminate noise, then rezero or recalibrate
Zero Too Noisy	Mechanical noise prevented accurate zero flow setting during auto zero	Eliminate mechanical noise, if possible, then rezero
Zero Too High	Flow not completely shut off during auto zero	Completely shut off flow, then rezero
Zero Too Low	Moisture in sensor junction box caused zero drift	Ensure interior of junction box is completely dry, then rezero
Burst Mode	Transmitter configured to send data in burst mode under HART protocol	Switch burst mode OFF
mA 1 Fixed	Communication failure during test or trim of mA output from terminals 17 (PV+) and 18 (PV–)	Complete trim or test
	Polling address of 1 to 15 assigned to RFT9739 for HART in Bell 202	• Change polling address to zero (0) • Use RS-485 communication standard
mA 2 Fixed	Communication failure during test or trim of output from terminals 19 (SV+) and 20 (SV–)	Complete trim or test
Event 1 On	Event (alarm) 1 is ON	• If totalizer assigned: - Low alarm switches event ON at totalizer reset - High alarm switches event OFF at totalizer reset • If other variable assigned, event switches ON/OFF when variable crosses setpoint
Event 2 On	Event (alarm) 2 is ON	
Security Breach	Security mode changed from mode 8	• Re-enter security mode 8 • Perform master reset

7.5 Power supply

Check for specified power at the transmitter terminals.
- If the transmitter power terminals are labeled "L" (line) and "N" (neutral), the transmitter accepts an 85-250 VAC power supply.
- If the transmitter power terminals are labeled "+" (positive) and "–" (negative), the transmitter accepts a 12-30 VDC power supply.
- Check all fuses.

7.6 Wiring

For transmitter wiring instructions, refer to **Chapter 4**, "Power-Supply and Sensor Wiring," page 15; and **Chapter 5**, "Output Wiring," page 25.

Wiring problems are often incorrectly diagnosed as a faulty sensor. At initial startup of the transmitter, always check the following:
1. Proper sensor cable, and use of shielded pairs
2. Proper wire termination
   a. Wires on correct terminals
   b. Wires making good connections at transmitter terminals
   c. Wires making good connections at the sensor terminals
   d. Wires properly connected at any intermediate terminal junction, such as the user-supplied junction box between a Model DT sensor and transmitter

If a fault condition is indicated, follow these instructions:
1. Disconnect the transmitter's power supply.
2. Unplug the terminal blocks from the transmitter electronics module.
3. Use a digital multimeter (DMM) to measure resistance between wire pairs at the transmitter terminals:
   - Drive coil, check terminals 1 and 2 (brown and red)
   - Left pickoff coil, check terminals 5 and 9 (green and white)
   - Right pickoff coil, check terminals 6 and 8 (blue and gray)
   - RTD, check RFT9739 terminals 3 and 7 (yellow and violet)
4. If the measured resistance is outside the range listed in **Table 7-7**, repeat the measurements at the sensor terminals.
5. Reinsert the terminal blocks and restore power to the transmitter.
6. Use the DMM to troubleshoot the flowmeter.

Table 7-7. Normal resistance for flowmeter circuits

Notes
- 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 terminals 6 and 8 (right pickoff) should be within 10% of resistance across terminals 5 and 9 (left pickoff).
- Resistance values depend on the sensor model and date of manufacture.

Circuit	Wire colors	Sensor terminals	Nominal resistance range
Drive coil	Brown to red	1 to 2	8 to 2650 Ω
Left pickoff	Green to white	5 to 9	15.9 to 300 Ω
Right pickoff	Blue to gray	6 to 8	15.9 to 300 Ω
Temperature sensor	Orange to violet	3 to 7	100 Ω at 0°C + 0.38675 Ω per °C
Lead length compensator	Yellow to violet	4 to 7	100 Ω at 0°C + 0.38675 Ω per °C

7.7 Master reset

⚠ CAUTION

All configuration data will be lost by performing a master reset.

Before performing a master reset, 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

Use the switches on the transmitter electronics module to perform a master reset. A master reset causes communication options to default to the setup used by HART Communicators, causes all other configuration options to return to their default values, and ***requires complete characterization and reconfiguration of the transmitter.***

Table 7-8 lists master reset defaults for characterization and configuration variables.

To perform a master reset:
1. Note the position of switch 5.
2. Shut off power to the transmitter.
3. Set switches 1, 2, and 3 to the OFF position.
4. Set switches 4, 5, 6, and 10 to the ON position.
5. Restore power. Wait until the diagnostic LED blinks ON three times followed by a 1-second pause.
6. Set switches 4, 6, and 10 to the OFF position.
7. Return switch 5 to its original position.
8. Shut off power to the transmitter. Wait 30 seconds.
9. Restore power.

If switches are left in the ON position, another master reset will occur the next time power to the transmitter is shut off and then restored. ***To avoid an unintentional master reset***, set switches 4, 6, and 10 to the OFF position after performing a master reset.

After the user performs a master reset, the diagnostic LED on the electronics module blinks ON four times per second until the user characterizes the transmitter to the sensor. To characterize the sensor and configure the transmitter, use a HART communicator, the ProLink program, or a Modbus host. For more information, see **Section 2.2**, page 4. After characterization is completed, the LED blinks ON once per second to indicate normal operation.

If the transmitter has a display, the blinking "Msg" indicator appears in the lower right corner to indicate the presence of a status message. If the user scrolls to the message screen, it reads "NOT CONFIGURED", indicating the transmitter memory contains default variables. After characterization is completed, the message screen reads "Sensor OK *ERROR CLEARED*", and the transmitter is ready for normal operation.

Table 7-8. Default values after a master reset

Characterization variables

	Default		Default
Flow calibration factor	1.00005.13	Mass flow factor	1.0
Density		Volume flow factor	1.0
Density A	0.0000 g/cc	Density factor	1.0
K1 density constant	5000.00	Pressure	
Density B	1.0000 g/cc	Pressure polling	No
K2 density constant	50000.00	Field device tag	DP CELL!
Density temperature coefficient	4.44% per 100°C	Pressure input at 4 mA	0.00 psi
FD density constant	0.000	Pressure input at 20 mA	1000.00 psi
Temperature calibration factor	1.00000T0000.0	Pressure correction for flow	0.00% per psi
		Pressure correction for density	0.00 g/cc per psi
		Flow calibration pressure	0.00 psi

Measurement units

	Default		Default
Mass flow unit	g/sec	Temperature unit	°C
Volume flow unit	l/sec	Pressure unit	psi
Density unit	g/cc		

Field device variables

	Default		Default
Mass flow cutoff	0.00 g/sec	Low slug flow limit	0.0000 g/cc
Volume flow cutoff	0.0000 l/sec	High slug flow limit	5.0000 g/cc
Flow direction	Forward only	Internal damping on density	2.00 sec
Internal damping on flow	0.80 sec	Internal damping on temperature	4.00 sec

Transmitter output variables

	Default		Default
Primary mA output variable	Mass flow	Frequency/pulse output variable	Mass flow
Upper range value	160.00 g/sec	Frequency	10000.00 Hz
Lower range value	–160.00 g/sec	Rate	15000.00 g/sec
Added damping	0.00 sec	Maximum pulse width	0.50 sec
Secondary mA output variable	Temperature	Control output	Flow direction
Upper range value	450.00°C	Slug duration	1.00 sec
Lower range value	–240.00°C	Polling address	0
Added damping	0.00 sec	Burst mode	Off

Device information

	Default		Default
Transmitter tag name	M. RESET	Sensor model	Unknown
Description	CONFIGURE XMTR	Sensor flow tube material	Unknown
Message	MASTER RESET - ALL DATA DESTROYED	Sensor flange type	Unknown
		Sensor flow tube liner material	None
Date	01/JAN/1995		

Communication settings

	Default with switch 5* set to STD COMM	Default with switch 5* set to USER DEF
Stop bits and parity	1 stop bit, odd parity	1 stop bit, odd parity
Protocol, physical layer, baud rate	HART Bell 202 on primary mA at 1200 baud, and Modbus RTU on RS-485 at 9600 baud	HART on RS-485 at 1200 baud

For information about switches and switch settings, see **Section 2.3, page 5.*

7.8 Additional information about troubleshooting

For more information about troubleshooting the RFT9739 transmitter, see any of the following instruction manuals or AMS on-line help:

- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

7.9 Customer service

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

Appendix
A

RFT9739 Specifications

Performance specifications

Sensor model		Mass flow accuracy*
ELITE	liquid	±0.10% ± [(zero stability / flow rate) x 100]% of rate
	gas	±0.50% ± [(zero stability / flow rate) x 100]% of rate
F-Series	liquid	±0.20% ± [(zero stability / flow rate) x 100]% of rate
	gas	±0.70% ± [(zero stability / flow rate) x 100]% of rate
D (except DH38), DT and DL	liquid	±0.15% ± [(zero stability / flow rate) x 100]% of rate
	gas	±0.65% ± [(zero stability / flow rate) x 100]% of rate
DH38	liquid	±0.15% ± [(zero stability / flow rate) x 100]% of rate
	gas	±0.50% ± [(zero stability / flow rate) x 100]% of rate

Sensor model		Mass flow repeatability*
ELITE	liquid	±0.05% ± [½(zero stability / flow rate) x 100]% of rate
	gas	±0.25% ± [(zero stability / flow rate) x 100]% of rate
F-Series	liquid	±0.10% ± [½(zero stability / flow rate) x 100]% of rate
	gas	±0.35% ± [(zero stability / flow rate) x 100]% of rate
D (except DH38), DT and DL	liquid	±0.05% ± [½(zero stability / flow rate) x 100]% of rate
	gas	±0.30% ± [(zero stability / flow rate) x 100]% of rate
DH38	liquid	±0.05% ± [½(zero stability / flow rate) x 100]% of rate
	gas	±0.25% ± [(zero stability / flow rate) x 100]% of rate

		Density accuracy		Density repeatability	
Sensor model		***g/cc***	***kg/m³***	***g/cc***	***kg/m³***
ELITE (except CMF010P)	liquid only	±0.0005	±0.5	±0.0002	±0.2
ELITE CMF010P	liquid only	±0.002	±2.0	±0.001	±1.0
F-Series	liquid only	±0.002	±2.0	±0.001	±1.0
D6, D12, D25, D40, DH100, DH150	liquid only	±0.002	±2.0	±0.001	±1.0
DH6, DH12, DH38	liquid only	±0.004	±4.0	±0.002	±2.0
D65, DL65, DT65, D100, DT100, D150, DT150, DH300	liquid only	±0.001	±1.0	±0.0005	±0.5
D300, D600, DL100, DL200	liquid only	±0.0005	±0.5	±0.002	±2.0

Sensor model	Temperature accuracy	Temperature repeatability
All sensors	±1°C ± 0.5% of reading in °C	±0.02°C

** 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. For values of zero stability, refer to product specifications for each sensor.*

Functional specifications

Output Signals

Analog

Two independently configured analog outputs, designated as primary and secondary, can represent mass or volumetric flow rate, density, temperature, event 1 or event 2. These outputs cannot be changed from active to passive. With a pressure transmitter, outputs can also provide indication for pressure. Internally powered, can be selected as 4-20 mA or 0-20 mA current outputs. Galvanically isolated to ±50 VDC, 1000 ohm load limit. Out-of-range capability: 0-22 mA on 0-20 mA output; 3.8-20.5 mA on 4-20 mA output.

Milliamp (mA) output rangeability

Flow

Maximum span determined by sensor specifications.
Range limit determined by sensor maximum rate.
Minimum recommended span (% of nominal flow range):

ELITE sensors	2.5%
F-Series sensors	10%
D, DT, and DL sensors	10%
D300 and D600 sensors	5%
High-pressure (DH) sensors	20% typical

Density

Range limit	0 to 5 g/cc (0 to 5000 kg/m³)
Minimum span	0.05 g/cc (50 kg/m³)

Temperature

Range limit	–400 to 842°F (–240 to 450°C)
Minimum span	36°F (20°C)

Frequency

One frequency/pulse output can be configured to indicate mass flow rate, volumetric flow rate, mass total (inventory), or volume total (inventory), independent of analog outputs. Internally powered, 0-15 V square wave, unloaded; 2.2 kohm impedance at 15 V, galvanically isolated to ±50 VDC. In open collector configuration: sinking capability, 0.1 amps in "on" condition (0 volt level), 30 VDC compliance in "off" condition. Signal can be scaled up to 10,000 Hz. Out-of-range capability to 15,000 Hz. Programmable pulse width for low frequencies.

Control

One control output can represent flow direction, fault alarm, zero in progress, event 1 or event 2. Internally powered, digital level, 0 or 15 V, 2.2 kohm pull-up, galvanically isolated to ±50 VDC. In open collector configuration: sinking capability, 0.1 amps in "on" condition (0 volt level), 30 VDC compliance in "off" condition.

Communication

Switch allows selection of preset or user-defined settings.

- Default preset-settings: HART protocol over Bell 202, on the primary mA output, 1200 baud; Modbus protocol in RTU mode, on the RS-485 output, 9600 baud; 1 stop bit, odd parity.
- Default user-defined settings: HART protocol, on the RS-485 output, 1200 baud, 1 stop bit, odd parity.

Bell 202 signal is superimposed on primary variable mA output, and is available for host system interface. Frequency 1.2 and 2.2 kHz, amplitude 0.8 V peak-to-peak, 1200 baud. Requires 250 to 1000 ohms load resistance.

RS-485 signal is a ±5 V square wave referenced to transmitter ground. Baud rates between 1200 baud and 38.4 kilobaud can be selected.

Additional outputs

Sensor frequency

For use with Micro Motion peripheral devices, 8 V peak-to-peak at sensor natural frequency, referenced to sensor ground, 10 kohm output impedance.

Sensor temperature

For use with Micro Motion peripheral devices, 5 mV/°C, referenced to signal ground, 10 kohm output impedance.

API gravity

API gravity references to 60°F (15°C). Uses correlation based on API equation 2540 for Generalized Petroleum Products.

Accuracy of corrected density calculation relative to API-2540 from 0 to 300°F:

Process fluid	***g/cc***	***kg/m³***	***°API***
Diesel, heater, and fuel oils	±0.0005	±0.5	±0.2
Jet fuels, kerosenes, and solvents	±0.002	±2.0	±0.5
Crude oils and JP4	±0.004	±4.0	±1.0
Lube oils	±0.01	±10	±2.0
Gasoline and naphthenes	±0.02	±20	±5.0

Minimum 4-20 mA span: 10°API

Standard volume

Outputs standard volume at 60°F or 15°C for Generalized Petroleum Products when °API is selected as density unit of measure. Accuracy of standard volume measurements depends on accuracies of mass flow rate, density, temperature and temperature-corrected °API calculation, and can be estimated using the root mean square method. Standard volume accuracy of ±0.5% of rate is typically attainable for Generalized Petroleum Products such as fuel oils, jet fuels, and kerosenes.

Pressure compensation
The analog input can accept a signal from a pressure transmitter for pressure compensation of flow and density. Range, 0-25 mA. Can be used to power independent pressure or differential pressure transmitter. Voltage sourcing capability, 15 V. Input impedance, 100 ohms.

Low-flow cutoff
Flow values below the low-flow cutoff cause digital and frequency outputs to default to zero flow levels. Each mA output may be configured for an additional low-flow cutoff.

Slug-flow limits
Transmitter senses density outside limits. Flow output remains at last measured value, for a programmed time of 0 to 60 seconds, before defaulting to zero flow.

Damping
Wide range of programmed filter time constants for damping on flow, density, and temperature. Additional damping may be applied to mA outputs.

Fault indication
Faults can be indicated by user-selected downscale (0-2 mA, 0 Hz) or upscale (22-24 mA, 15-19 kHz) output levels. The control output can also be configured to indicate a fault condition at 0 V.

Output testing
Output testing can be conducted with a HART Communicator, the ProLink program, a Modbus host, or AMS software.

Current source
Transmitter can produce a user-specified current between 0 and 22 mA on a 0-20 mA output, or between 2 and 22 mA on a 4-20 mA output.

Frequency source
Transmitter can produce a user-specified frequency between 0.1 and 15,000 Hz.

Local display (optional)
Display is a 2-line, 16-character, alphanumeric liquid crystal display (LCD). Using the transmitter's scroll function, the user can view flow rate, density, temperature, mass and volume totals and inventory levels, and status messages on the LCD. A reset button allows the user to reset the transmitter's flow totalizers and communication parameters, and perform the flowmeter zeroing procedure.

Power supply options and fuses

85 to 250 VAC, 48 to 62 Hz, 10 watts typical, 15 watts maximum, fused with IEC 127-3 400mA/250V, time-lag, subminiature. All AC-powered RFT9739 transmitters comply with low-voltage directive 73/23/EEC per IEC 1010-1 with Amendment 2.

12 to 30 VDC, 7 watts typical, 14 watts maximum, fused with IEC 127-3 1.6A/125V, time-lag, subminiature. At startup, transmitter power source must provide a minimum of 1.6 amperes of short-term current at a minimum of 12 volts at the transmitter's power input terminals.

Environmental limits

Ambient temperature limits

Without display

Operating:	–22 to 131°F (–30 to 55°C)
Storage:	–40 to 176°F (–40 to 80°C)

With optional display

Operating:	14 to 131°F (–10 to 55°C)
Storage:	–4 to 158°F (–20 to 70°C)

Humidity limits

Meets SAMA PMC 31.1-1980

Vibration limits

Meets SAMA PMC 31.1-1980, Condition 2

Environmental effects

EMI effect

Field-mount RFT9739 transmitters with enhanced EMI immunity meet the requirements of the EMC directive 89/336/EEC per EN 50081-1 (January 1992) and EN 50082-2 (March 1995) when operated at nominal rated flow measurement range. Enhanced EMI immunity is required for transmitters installed in the European Community after 1 January 1996. For specific EMC effects within the EC, the Technical EMC file may be reviewed at Fisher-Rosemount Veenendaal.

All RFT9739 transmitters meet the requirements of SAMA PMC 33.1 (October 1978), Class 1, A, B, C (0.6% span) at nominal flow rate. All RFT9739 transmitters meet the recommendations of ANSI/IEEE C62.41 (1991) for surge and EFT.

To meet the above specifications, the transmitter must be installed with an approved Micro Motion sensor, and the sensor cable must be either doubly shielded with full contact glands, or installed in continuous, fully bonded metallic conduit. The transmitter and sensor must be directly connected to a low-impedance (less than 1 ohm) earth ground. Transmitter outputs must be run in standard twisted-pair, shielded instrument wire.

Ambient temperature effect on transmitter

On mA outputs:	±0.005% of span/°C
On temperature output:	±0.01°C/°C
On mA input:	±0.01% of span/°C

Hazardous area classifications

When properly installed with an approved sensor, the RFT9739 field-mount transmitter can be installed in the following areas:

Without display

UL and CSA
Transmitter: Class I, Div. 1, Groups C and D. Class II, Div. 1, Groups E, F, and G explosion proof when installed with approved conduit seals. Otherwise, Class I, Div. 2, Groups A, B, C, and D.

Outputs: Provides nonincendive sensor outputs for use in Class I, Div. 2, Groups A, B, C, and D; or intrinsically safe sensor outputs for use in Class I, Div. 1, Groups C and D, or Class II, Div. 1, Groups E, F, and G.

UL Division 2 nonincendive parameters for analog and frequency outputs for transmitters without or with a display are listed below.

CENELEC
EEx d [ib] IIC T6 flameproof when installed with approved cable glands. Connections to sensor are intrinsically safe in [EEx ib] IIC areas.

SAA
Exd [ib] IIC T4 IP66

With optional display

UL and CSA
Transmitter: Class I, Div. 2, Groups A, B, C, and D.

Outputs: Provides nonincendive sensor outputs for use in Class I, Div. 2, Groups A, B, C, and D; or intrinsically safe sensor outputs for use in Class I, Div. 1, Groups C and D, or Class II, Div. 1, Groups E, F, and G.

UL Division 2 nonincendive parameters for analog and frequency outputs for transmitters without or with a display are listed below.

CENELEC
Safe area only. Connections to sensor are intrinsically safe in [EEx ib] IIC areas.

SAA
Ex [ib] IIC IP66

UL Division 2 nonincendive parameters

Parameter	**Analog output** (Terminals 17-18, 19-20)	**Frequency/pulse output** (Terminals 14-16)
V_{OC}	36.5 V	16 V
I_{SC}	22 mA	51 mA
C_a	0.135 µf	1.5 µf
L_a	100 mH	37 mH

Physical specifications

Housing
NEMA 4X (IP65) epoxy polyester painted cast aluminum

Weight
12.5 lb (5.7 kg)

Appendix
B Ordering Information

RFT9739 model number matrix

Code	Transmitter model
RFT9739	RFT9739 transmitter

Code	Housing options
E	Field mount, without display, NEMA 4X, explosion-proof
D	Field mount, with display, NEMA 4X

Code	Power supply
4	85 to 250 VAC
5	20 to 30 VDC

Code	Configuration
S	Standard
E	Enhanced EMI immunity (CE compliant) — requires installation with Micro Motion cable type CPLTJ or CFEPJ installed in conduit, or type CPLTS, CPLTA, CFEPS, or CFEPA installed with approved cable glands

Code	Approval
M	Micro Motion standard — no approvals
U	UL intrinsically safe — U.S.A. approvals agency
C	CSA — Canadian approvals agency
B	CENELEC intrinsically safe sensor outputs — European standards organization
F	CENELEC intrinsically safe sensor outputs/flameproof transmitter — European standards organization; not available with housing code D
S	SAA — Australian approvals agency; not available with Model DL65, D600, or DT sensors

Code	Glands
	Available with approval codes M, C, B, F, and S *Available with approval code U only with housing code D*
A	No fittings or glands
	Available only with approval code U and housing code E
J	1X explosion-proof seal fitting (any cable)
K	3X explosion-proof seal fitting (any cable)
	Available only with approval code B (non-EExd)
B	1X gland, nickel-plated brass (7-12.5 mm)
C	3X gland, nickel-plated brass (7-12.5 mm)
	Available only with approval code F (flameproof EExd) and housing code E
D	1X gland, nickel-plated brass (8-12 mm/10.5-16 mm)
E	1X gland, SS (8-12 mm/10.5-16 mm)
F	3X gland, nickel-plated brass (8-12 mm/10.5-16 mm)
G	3X gland, SS (8-12 mm/10.5-16 mm)

Micro Motion instruction manuals

Sensors

- ELITE® Sensor Instruction Manual
- R-Series Flowmeter Instruction Manual
- R-Series Flowmeter with FOUNDATION™ fieldbus
- T-Series Flowmeter Instruction Manual
- F-Series Sensor Instruction Manual
- Model D and DT Sensors Instruction Manual
- Model DL Sensor Instruction Manual

Transmitters

- ALTUS™ Installation Manual
- ALTUS™ Detailed Setup Manual
- ALTUS™ Density Applications Manual
- ALTUS™ Net Oil Computer Manual
- Installing Relays for the ALTUS™ Applications Platform
- RFT9739 Field-Mount Transmitter Instruction Manual
- RFT9739 Rack-Mount Transmitter Instruction Manual
- IFT9701 Transmitter Instruction Manual
- Model 5300 Transmitter with FOUNDATION™ fieldbus
- RFT9709 Transmitter Instruction Manual
- RFT9712 Remote Flow Transmitter Instruction Manual

Communications

- Using ProLink® Software with Micro Motion® Transmitters
- Using the HART® Communicator with Micro Motion® Transmitters
- Using Modbus® Protocol with Micro Motion® Transmitters
- RFT9739 Transmitter-Specific Command Specification
- RFT9709 Transmitter-Specific Command Specification
- RFT9712 Transmitter-Specific Command Specification

Peripheral products

- DMS Density Monitoring System Instruction Manual
- DRT Digital Rate Totalizer LCD Instruction Manual
- DRT Digital Rate Totalizer LED Instruction Manual
- FMS-3 Flow Monitoring System LCD Instruction Manual
- FMS-3 Flow Monitoring System LED Instruction Manual
- NFC Net Flow Computer Instruction Manual
- NOC Net Oil Computer Instruction Manual
- PI 4-20 Process Indicator

Wiring instructions

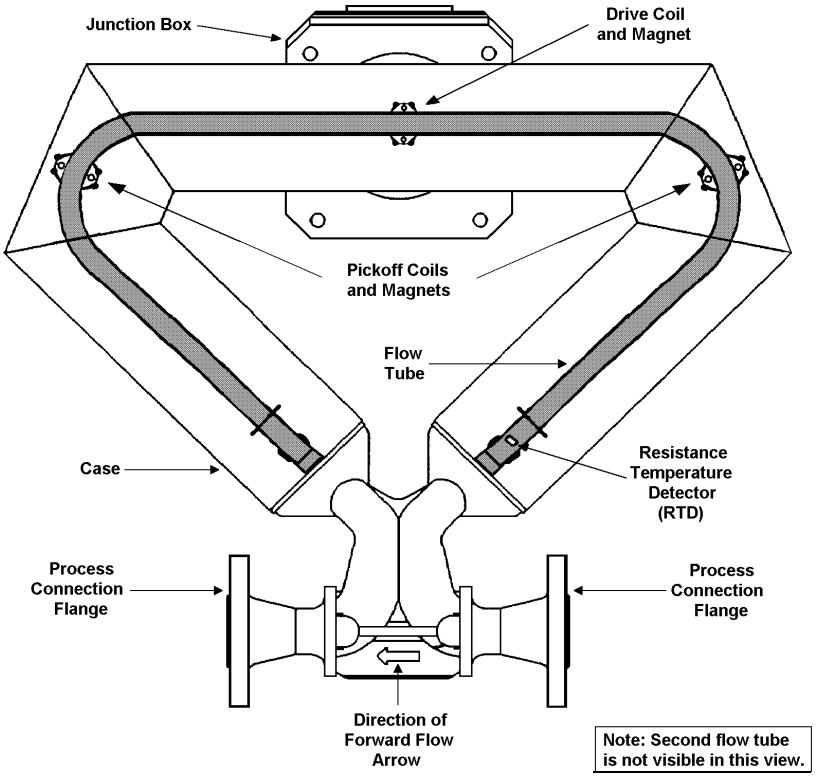
- 9-Wire Flowmeter Cable Preparation and Installation
- Cable Gland Assembly Instructions
- UL-D-IS Installation Instructions
- CSA-D-IS Installation Instructions
- SAA-D-IS Installation Instructions
- Power-Supply Wiring for the D600 Sensor
- Input Signal Wiring for Peripheral Devices

Appendix
C

Theory of Operation

The flow tubes of the Coriolis mass flow sensor are driven to vibrate at their natural frequency by a magnet and drive coil attached to the apex of the bent tubes (see **Figure C-1**). An AC drive control amplifier circuit in the transmitter reinforces the signal from the sensor's left velocity pickoff coil to generate the drive coil voltage. The amplitude of this drive coil voltage is continuously adjusted by the circuit to maintain a constant, low amplitude of flow tube displacement, minimizing stress to the tube assembly.

Figure C-1.
Coriolis mass flow sensor



Mass flow measurement

The vibrating motion of the flow tube, combined with the momentum of the fluid flowing through the tubes, induces a Coriolis force that causes each flow tube to twist in proportion to the rate of mass flow through the tube during each vibrational cycle. Since one leg of the flow tube lags behind the other leg during this twisting motion, the signals from sensors on the two tube legs can be compared electronically to determine the amount of twist. The transmitter measures the time delay between the left and right pickoff signals using precision circuitry and a high frequency crystal controlled clock. This "delta time" value is digitally filtered to reduce noise and improve the measurement resolution.

Delta time is multiplied by the flow calibration factor to determine the mass flow rate. Since temperature affects flow tube stiffness, the amount of twist produced by the Coriolis force will be affected by the flow tube temperature. The measured flow rate is continuously adjusted by the transmitter, which monitors the output of a platinum element resistance temperature detector (RTD) attached to the outside surface of the flow tube. The transmitter measures the sensor temperature using a three-wire RTD bridge amplifier circuit. The voltage out of the amplifier is converted to a frequency and is digitized by a counter read by the microprocessor.

Density measurement

The Coriolis mass flow sensor also functions as a vibrating tube density meter. The natural frequency of the tube assembly is a function of tube stiffness, tube geometry, and the mass of the fluid the tube contains. Therefore, fluid density can be derived from a measurement of tube frequency.

The transmitter measures the time period of each vibrational cycle using a high-frequency clock. This measurement is digitally filtered, and density is calculated using the density calibration factors for the sensor after compensating the sensed natural frequency for known changes in the tube stiffness due to operating temperature. The transmitter calculates volumetric flow by dividing the measured mass flow by the measured density.

API gravity

If °API is selected as the density unit, the transmitter calculates standard volume for Generalized Petroleum Products according to API-2540. The transmitter calculates volume flow and volume total at 60°F or 15°C, depending on the temperature unit:

- If degrees Fahrenheit or degrees Rankine is selected as the temperature unit, the transmitter calculates volume at 60°F.
- If degrees Celsius or Kelvin is selected as the temperature unit, the transmitter calculates volume at 15°C.

From the operating density (fluid density at line conditions) and operating temperature of a given petroleum fluid, the standard density (density at 60°F or 15°C) can be determined directly from API thermal expansion tables, or by using API equation API-2540:

$$\rho_o = \rho_s * exp[-\alpha\Delta T(1 + 0.8\alpha\Delta T)]$$

where:

ρ_o = operating density
ρ_s = standard density
ΔT = temperature difference from base (standard) temperature
α = $K_0/(\rho_s)^2 + K_1/\rho_s$, where K_0 and K_1 are constants

The equation is iterative, and requires significant calculation time to generate one reading. The transmitter software contains a simplification of this correlation to maximize sampling frequency of the measurement. Accuracy of the Micro Motion correlation is ±0.0005 g/cc (±0.5 kg/m^3) relative to the API-2540 equation. After temperature correction to 60°F (15°C), the density is converted to °API by the following expression:

Degrees API = (141.5/standard specific gravity) – 131.5

The K_0 and K_1 terms in the API-2540 equation are constants characteristic of different types of Generalized Petroleum Products. Separate API tables exist for crude oils, distillates, gasolines, lube oils, and other products. The correlation in the RFT9739 is based on the API constants for Generalized Petroleum Products from 2 to 95°API over an operating temperature range of 0 to 300°F. As fluid density or operating temperature extends beyond these values, the RFT9739 correlation error will increase. Density calibration must be performed in units of g/cc for the API correlation to be correct.

API standard volume

If °API is selected as the density unit, the RFT9739 automatically calculates standard volume at 60°F or at 15°C based on the following expression:

Standard volume = mass flow/standard density

Accuracy of standard volume measurement is based on the accuracies of the following factors:

- Mass rate measurement
- Operating density measurement
- Temperature measurement
- RFT9739 correlation to API tables

The accuracy of each factor varies based on the process operating conditions and fluid that is being measured. For Generalized Petroleum Products, standard volume will be accurate within ±0.5% of the flow rate. Because the temperature correction correlations for density are based on API equations, the RFT9739 standard volume output can be used only for Generalized Petroleum Products or materials that exhibit the same thermal expansion characteristics as Generalized Petroleum Products.

Pressure compensation

A pressure transmitter can be connected to the RFT9739 for pressure compensation. The RFT9739 or an external source can supply power to the pressure transmitter.

If the input is configured to indicate gauge pressure, the transmitter uses the pressure input to account for effects of pressure on the flow tubes of certain sensors. Not all sensors are affected by pressure. In this mode, the pressure effect is calculated as the percent change in the flow rate per psi change in pressure and/or the amount of change in density, in g/cc, per psi change in pressure.

Output variables

Measured variables can be output in a variety of ways from the RFT9739. Mass or volume flow rate can be output as an isolated 4-20 or 0-20 mA signal over either of two sets of output terminals. Alternatively, either mA output can be configured to indicate temperature, density, pressure, event 1 or event 2.

Mass or volume flow pulses from the isolated frequency output terminals can be scaled to 10,000 Hz for compatibility with PLCs, batch controllers, and totalizers.

All measured variables, including totalizers for batch and inventory, can be accessed digitally. The transmitter can use the Bell 202 physical layer at 1200 baud superimposed on the primary mA signal and/or the RS-485 physical layer at 1200 baud to 38.4 kilobaud. The transmitter can use HART protocol over the Bell 202 or RS-485 physical layer, Modbus protocol over the RS-485 physical layer, or HART over the Bell 202 layer and Modbus over the RS-485 layer.

A logic output can be programmed to indicate the flow direction, a fault alarm, or a zero in progress condition. The transmitter operational status is also indicated on the transmitter display.

Appendix
D

HART® Communicator Menu Trees

Figure D-1. On-line menu

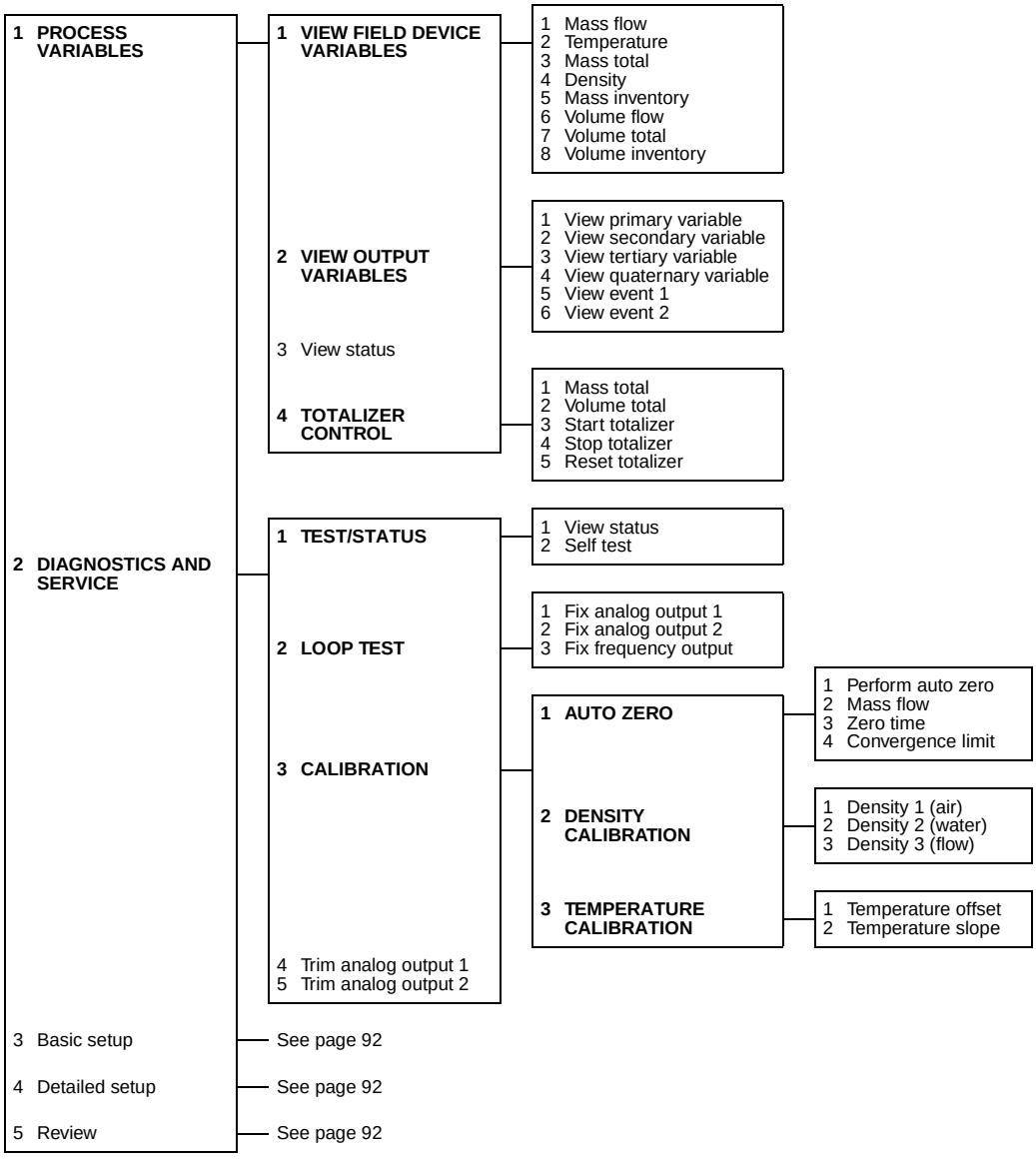
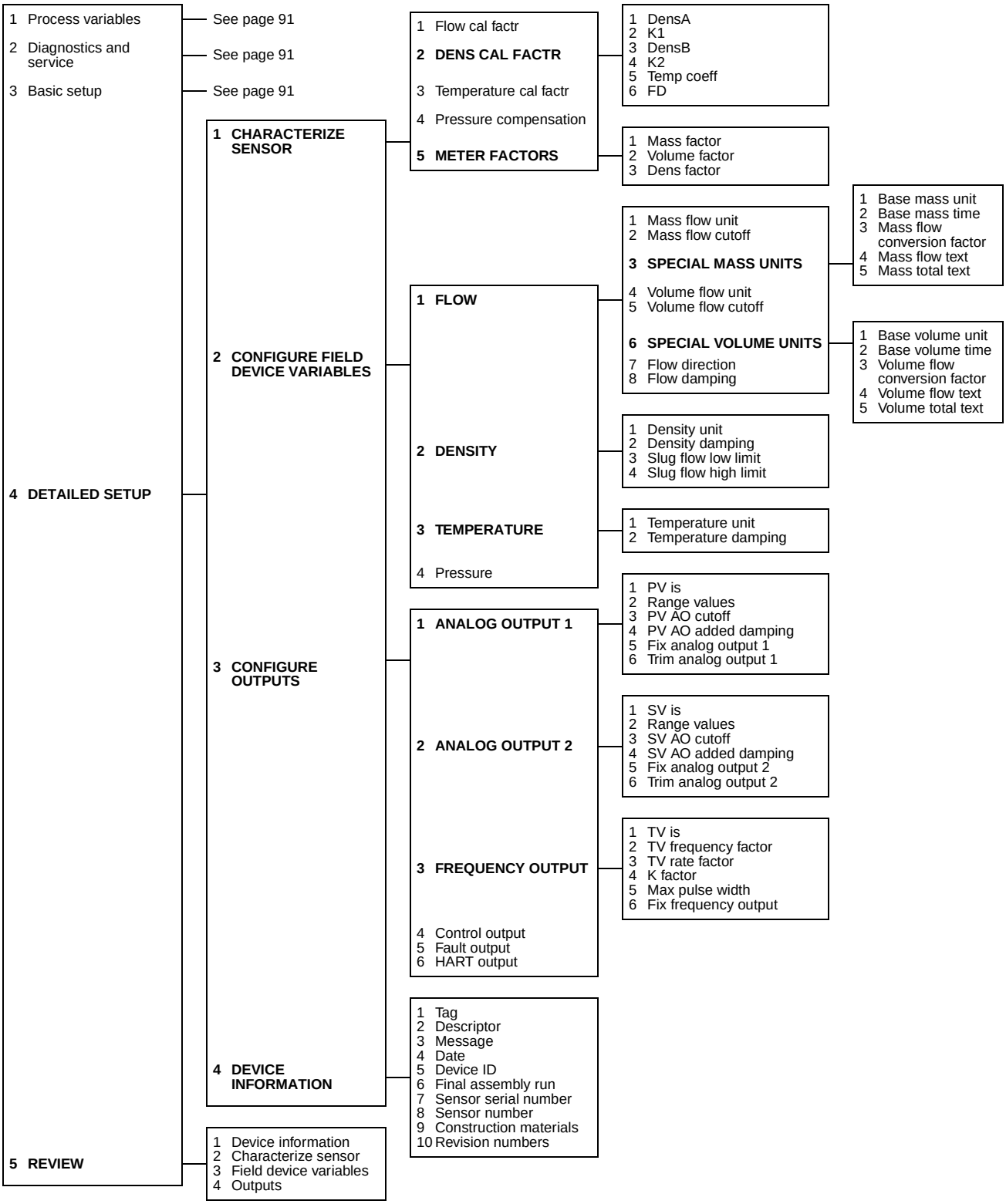


Figure D-1. On-line menu *continued*



Fast key

The *fast key* code is a sequence of numerical button presses that corresponds to a specific menu option. Compare the fast key sequences in the table below with the menu options in the menu trees on pages 91 and 92.

Function/variable	Fast-key sequence
Analog output 1	4, 3, 1
Analog output 2	4, 3, 2
Analog 1 range values	3, 3
Analog 2 range values	3, 5
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Basic setup	3
Calibration	2, 3
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Control output	4, 3, 4
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Density calibration procedure	2, 3, 2
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Field device variables	4, 2
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Fix analog output 1	2, 2, 1
Fix analog output 2	2, 2, 2
Fix frequency output	2, 2, 3
Flow calibration factor	4, 1, 1
Flow variables	4, 2, 1
Frequency factor	3, 6
Frequency output	4, 3, 3
HART output	4, 3, 6
Loop test	2, 2
Mass flow variables	4, 2, 1
Mass total	1, 4, 1
Output variables	4, 3
Perform auto zero	2, 3, 1, 1

Function/variable	Fast-key sequence
Polling address	4, 3, 6, 1
Pressure compensation	4, 1, 5
Pressure unit	4, 2, 4
Primary variable	1, 2, 1
Primary variable unit	3, 2
Process variables	1
Quarternary variable	1, 2, 4
Range values	3
Rate factor	3, 7
Reset totalizer	1, 4, 5
Review	5
Revision numbers	4, 4
Secondary variable	1, 2, 2
Secondary variable unit	3, 4
Self test	2, 1, 2
Sensor serial number	4, 4, 7
Sensor model	4, 4, 8
Start totalizer	1, 4, 3
Status	1, 3
Stop totalizer	1, 4, 4
Tag	3, 1
Temperature calibration factors	4, 1, 3
Temperature calibration procedure	2, 3, 4
Temperature variables	4, 2, 3
Tertiary variable	1, 2, 3
Tertiary variable frequency factor	3, 6
Tertiary variable rate factor	3, 7
Test/status	2, 1
Totalizer control	1, 4
Trim analog output 1	2, 4
Trim analog output 2	2, 5
Volume flow variables	4, 2, 1
Volume total	1, 4, 2

Appendix
E

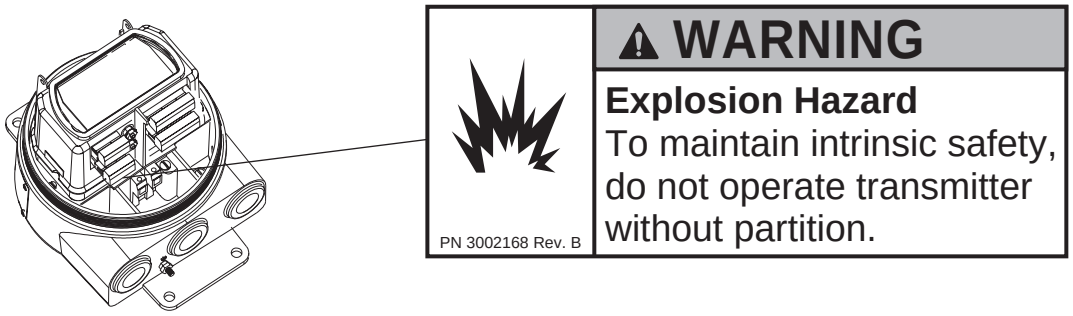
Label Maintenance and Replacement

Maintaining and replacing labels

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

Contact Micro Motion for replacement labels:
- In the U.S.A., phone 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

Figure E-1. Label number 3002168



For additional information, see **Section 4.1**, page 15.

Appendix
F

Transmitter Version Identification

To identify a Version 3 RFT9739 field-mount transmitter:

1. Unscrew the cover from the base of the transmitter's explosion-proof housing.

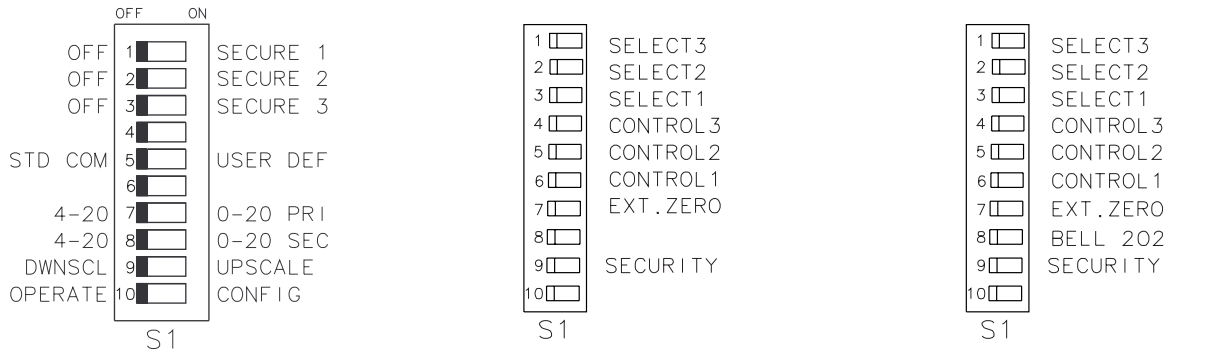
2. Inside the transmitter is an electronics module, which has terminal blocks for intrinsically safe and non-intrinsically safe wiring connections. A Version 3 transmitter has an electronics module that is different than older versions. Earlier versions of the module have switches labeled SELECT, CONTROL, and EXT.ZERO. A module for a Version 3 transmitter does not have these labels. For comparison, refer to **Figure F-1**.

Although an examination of the electronics module can determine whether the RFT9739 is a Version 3 transmitter, it does not identify the software version. To identify the transmitter's software version:

1. When shipped from the factory, a sticker affixed to the module identifies the transmitter software version.

2. If the identification sticker has been removed, use a HART Communicator, the ProLink program, or the AMS program to identify the RFT9739 software version. See one of the following communications manuals or AMS on-line help for instructions:
   - *Using the HART Communicator with Micro Motion Transmitters*
   - *Using ProLink Software with Micro Motion Transmitters*
   - *Using Modbus Protocol with Micro Motion Transmitters*

Figure F-1. Switches on RFT9739 transmitters



Appendix
G

Replacing Older Transmitters

Step 1 Disconnecting the old transmitter

⚠ WARNING

Hazardous voltage can cause severe injury or death.

Shut off power before disconnecting the transmitter.

⚠ CAUTION

Process control will stop when the transmitter is disconnected.

Set control devices for manual operation before disconnecting the transmitter.

Follow these steps to wire the RFT9739 in place of the old transmitter:

a. Shut off power to the transmitter.

b. Open the transmitter wiring compartment covers. ***Do not disconnect wires from the transmitter yet.*** Wires will need to be moved from the old transmitter terminals to the appropriate terminals on the RFT9739 transmitter. Make note of which terminals the wires are connected to ***before removing them from the old transmitter.***
   • **Figure G-1** shows the location of terminals on a Model RFT9739
   • **Figure G-2** shows the location of terminals on a Model RE-01
   • **Figure G-3** shows the location of terminals on a Model RFT9712

c. Detach wires from the old transmitter, then remove the transmitter.

d. Proceed to Step 2, page 100.

Step 2 Determining type of RTD in the sensor

Determine whether the sensor has a platinum or copper RTD (resistance temperature detector). The type of RTD determines how the transmitter and sensor must be wired and configured.

All sensors shipped after October 1986 have ***platinum*** RTDs. For older sensors, or if the date of manufacture is not known, follow these steps to determine the sensor's RTD type:

a. Identify the sensor serial number on the tag that is attached to the outside of the sensor case.
   - If the sensor serial number is higher than 87263, the sensor has a ***platinum*** RTD. Go to Step 3, page 101, if the sensor serial number is higher than 87263.
   - If the serial number is 87263 or lower, check resistance values as described below.

b. If the sensor and transmitter were properly wired with Micro Motion color-coded cable, the orange and violet wires provide temperature detection. These wires were connected to RE-01 terminals 3 and 9, or RFT9712 terminals 3 and 7. The yellow or shield wire from the orange/violet pair, which was connected to RE-01 terminal 6, or RFT9712 terminal 4, or RFT9729 terminal CN1-12d, provides temperature lead length compensation.

   Use a digital multimeter (DMM) to check resistance between the orange, violet, and yellow wires. Refer to **Table G-1** to determine the sensor's RTD type. Contact the Micro Motion Customer Service Department for further assistance:
   - 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

c. Proceed to Step 3, page 101.

Table G-1. Resistance values for determining RTD type

Wire colors	Resistance if RTD is platinum	Resistance if RTD is copper	Resistance if RTD is open
Violet to orange	110 Ω at ambient temperature (70°F)	Open (infinite resistance)	Open (infinite resistance)
Violet to yellow	110 Ω at ambient temperature (70°F)	110 Ω at ambient temperature (70°F)	Open (infinite resistance)
Orange to yellow	0-10 Ω	Open (infinite resistance)	—

Step 3 **Installing the RFT9739 transmitter**

⚠ WARNING

Hazardous voltage can cause severe injury or death.

Shut off power before disconnecting the transmitter.

Follow these instructions to mount and wire the new RFT9739 transmitter:

a. Mount the RFT9739 transmitter in accordance with the instructions in **Chapter 3**.

b. Connect power-supply wiring and ground wires to the RFT9739 transmitter in accordance with the instructions in **Chapter 4**.

c. Connect the flowmeter and output wiring from the old transmitter to the appropriate terminals on the RFT9739 transmitter.
   - **Figure G-1** shows the terminals on a Model RFT9739
   - Refer to **Figure G-2** and **Table G-2** for a Model RE-01
   - Refer to **Figure G-3** and **Table G-3** for a Model RFT9712

d. If the sensor has a copper RTD, temperature lead length compensation is necessary for proper operation.
   - Connect the orange and yellow wires at the sensor end, to sensor terminal 4.
   - Alternatively, if the sensor is not easily accessible, and the cable that connects the sensor and transmitter is 50 feet (15 meters) or less, install a jumper between RFT9739 transmitter terminals 3 and 4.

e. Proceed to Step 4, page 104.

Figure G-1. RFT9739 terminals

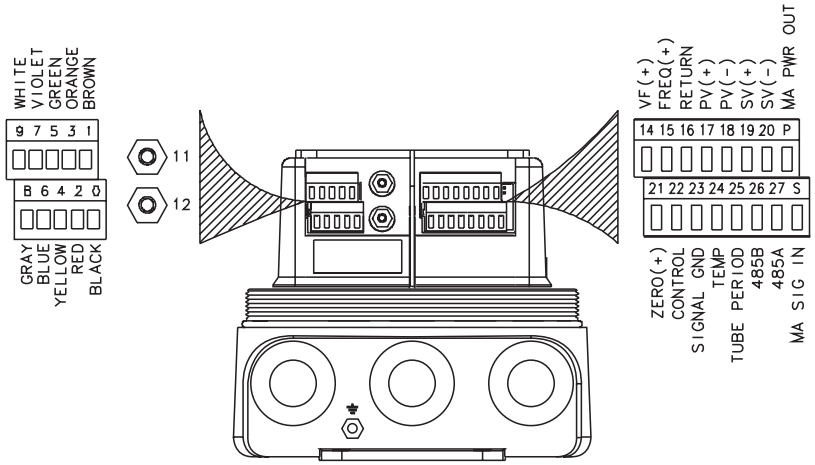


Figure G-2. RE-01 Remote Electronics Unit terminals

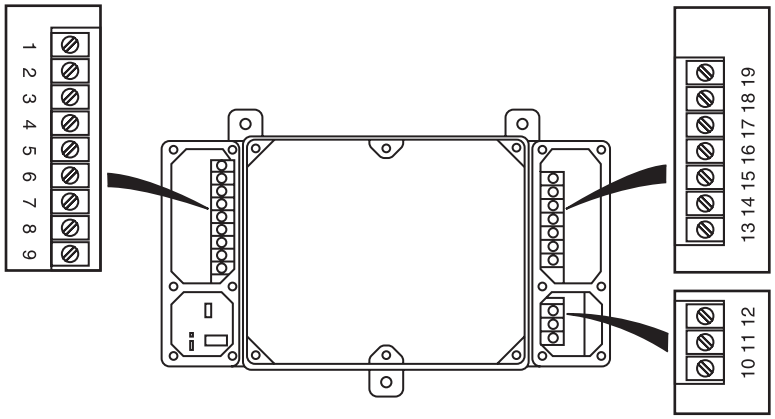


Table G-2. RE-01 to RFT9739 terminal conversions

Take the wire from RE-01 terminal number:	...and connect it to RFT9739 terminal number:	Wire color (Micro Motion color-coded cable)	Function
1	1	Brown	Drive +
2	2	Red	Drive –
3	3	Orange	Temperature –
4	No connection	—	—
5	No connection	—	—
6	4	Yellow[1]	Temperature lead length compensation
7	5	Green	Left pickoff +
8	6	Blue	Right pickoff +
9	7	Violet	Temperature +
10 11 12	See RFT9739 power-supply wiring and grounding instructions (**Chapter 4**)		
13	23	—	Signal ground
14	14	—	VF +
15	No connection	—	—
16	18	—	PV –
17	17	—	PV +
18	16	—	Return
19	15	—	Freq +

[1] *Shield wire from orange/violet pair.*

Figure G-3. RFT9712 Remote Flow Transmitter terminals

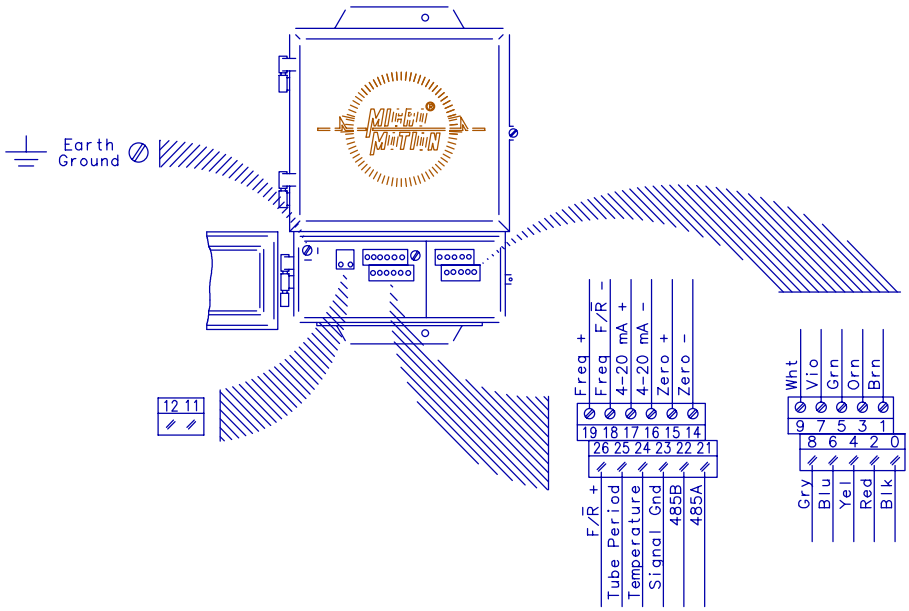


Table G-3. RFT9712 to RFT9739 terminal conversions

Take the wire from RFT9712 terminal number:	...and connect it to RFT9739 terminal number:	Wire color (Micro Motion color-coded cable)	Function
0	0	Black[1]	Shields
1	1	Brown	Drive +
2	2	Red	Drive –
3	3	Orange	Temperature –
4	4	Yellow[2]	Shield (Temperature lead length compensation)
5	5	Green	Left pickoff +
6	6	Blue	Right pickoff +
7	7	Violet	Temperature +
8	8	Gray	Right pickoff –
9	9	White	Left pickoff –
10 11 12	See RFT9739 power-supply wiring and grounding instructions (**Chapter 4**)		
14	16	—	Return
15	21	—	Zero +
16	18	—	PV –
17	17	—	PV +
18	16	—	Return
19	15	—	Freq +
21	27	—	485A
22	26	—	485B
23	23	—	Signal ground
24	24	—	Temperature
25	25	—	Tube period
26	22	—	Control

[1]Combined shields from brown/red, green/white, and gray/blue pairs
[2]Shield wire from orange/violet pair.

Step 4 Characterizing sensors with copper RTDs

⚠ CAUTION

Failure to characterize a sensor with a copper RTD will cause measurement error.

If the sensor has a copper RTD, the flow calibration factor programmed into the transmitter must be modified to ensure accurate flow measurement.

Replace the second decimal point in the flow calibration factor with the letter "c".

Example:

Calibration factor with platinum RTD: 63.1905.13
Calibration factor with copper RTD: 63.1905c13

Use the procedures in one of the following manuals to characterize the sensor for flow, or see AMS on-line help:
- *Using the HART Communicator with Micro Motion Transmitters*
- *Using ProLink Software with Micro Motion Transmitters*
- *Using Modbus Protocol with Micro Motion Transmitters*

When entering the flow calibration factor, replace the second decimal point with the letter "C", if the sensor has a copper RTD, as shown in the example above. If the sensor has a platinum RTD, do not use a letter in place of the decimal point.

Appendix
H

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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Visit us on the Internet at www.micromotion.com

Micro Motion Europe
Groeneveldselaan 8
3903 AZ Veenendaal
The Netherlands
Tel +31 (0) 318 549 549
Fax +31 (0) 318 549 559

Micro Motion Asia
1 Pandan Crescent
Singapore 128461
Republic of Singapore
Tel (65) 777-8211
Fax (65) 770-8003

Micro Motion Inc. USA
Worldwide Headquarters
7070 Winchester Circle
Boulder, Colorado 80301
Tel (303) 530-8400
(800) 522-6277
Fax (303) 530-8459

Micro Motion Japan
Shinagawa NF Bldg. 5F
1-2-5, Higashi Shinagawa
Shinagawa-ku
Tokyo 140-0002 Japan
Tel (81) 3 5769-6803
Fax (81) 3 5769-6843

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P/N 3002190, Rev. F (2/00)

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