Installation Manual
20001700, Rev CE
May 2015

Micro Motion® Model 1700 and 2700

Installation Manual

Micro Motion®

EMERSON™
Process Management

Safety messages

Safety messages are provided throughout this manual to protect personnel and equipment. Read each safety message carefully before proceeding to the next step.

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Contents

1 Planning

Topics covered in this chapter:

1.1 Meter components

The transmitter is one component of a Micro Motion device. The other major component is the sensor.

A third component, called the core processor, provides additional memory and processing functions.

1.2 Installation types

The transmitter was ordered and shipped for one of up to eight installation types. The fifth character of the transmitter model number indicates the installation type.

Figure 1-1: Installation type indication for Model 1700 and Model 2700 transmitters

1700R*********

2700R*********

The model number is located on the device tag on the side of the transmitter.

Table 1-1: Installation types for Model 1700 and Model 2700 transmitters

Model code	Description
R	Remote mount 4-wire
I	Integral

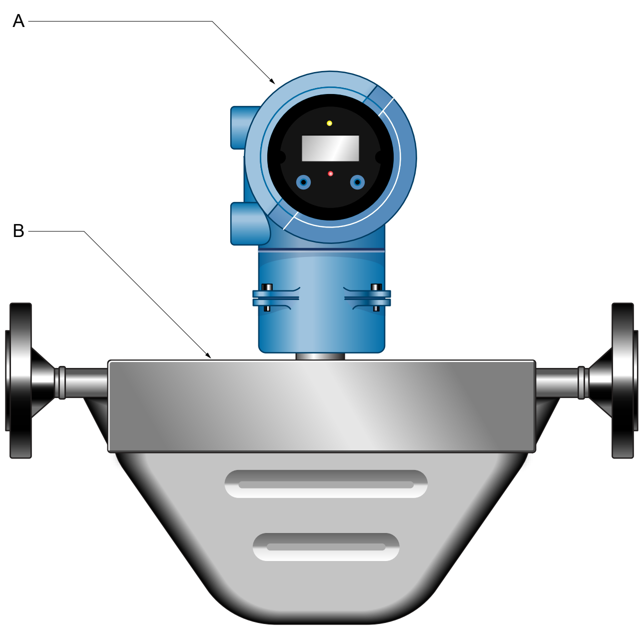
Table 1-1: Installation types for Model 1700 and Model 2700 transmitters *(continued)*

Model code	Description
E	Remote enhanced core processor (painted aluminum housing) with remote transmitter
C	Remote mount 9-wire (painted aluminum housing)
B	Remote core processor with remote transmitter
M	Remote mount 4-wire (stainless steel housing)
P	Remote mount 9-wire (stainless steel housing)
H(1)	Remote mount 4-wire (painted aluminum housing) for connecting to Compact Density Meter (CDM), Fork Density Meter (FDM), Fork Viscosity Meter (FVM)

(1) This option is only available with the Model 2700 FOUNDATION Fieldbus™ transmitter

Figure 1-2: Integral installation (model code I)

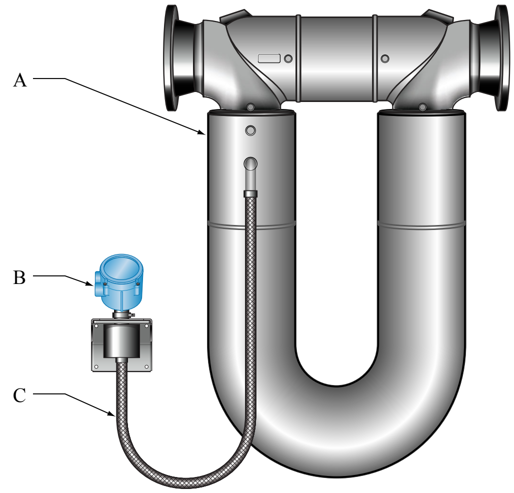
The transmitter is mounted directly to the sensor. Integral installations do not require separate transmitter installation. Power supply and I/O must be field wired to the transmitter.



A. Transmitter
B. Sensor

Figure 1-3: High-temperature meters with factory connection (model code I)

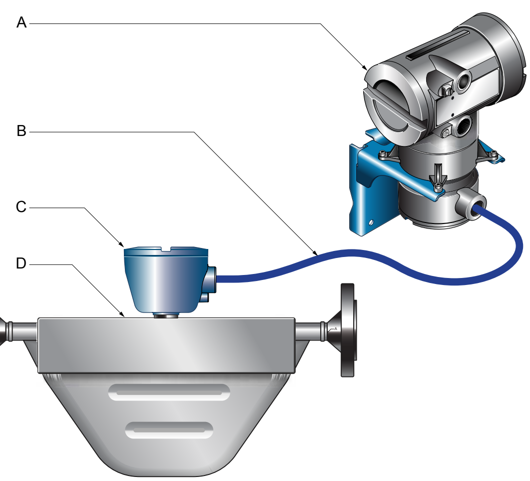
The transmitter is shipped with a flexible connection factory installed between the sensor and the transmitter. The transmitter must be dismounted from its shipping location (spot-welded to the sensor case) and then mounted separately. Power supply and I/O must be field wired to the transmitter.



A. *Sensor*
B. *Transmitter or core processor*
C. *Factory-installed flexible connection*

Figure 1-4: 4-wire remote installation for Coriolis meters (model code R or M)

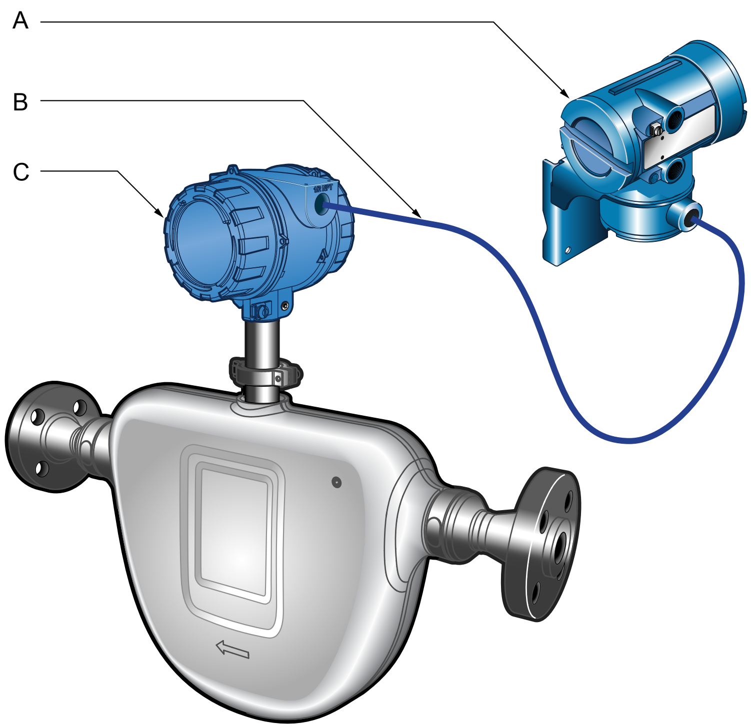
The transmitter is installed remotely from the sensor. The 4-wire connection between the sensor and transmitter must be field wired. Power supply and I/O must be field wired to the transmitter.



A. *Transmitter*
B. *Field-wired 4-wire connection*
C. *Core processor*
D. *Sensor*

Figure 1-5: 4-wire remote installation for density and viscosity meters (CDM, FDM, or FVM with fieldbus only)(model code H)

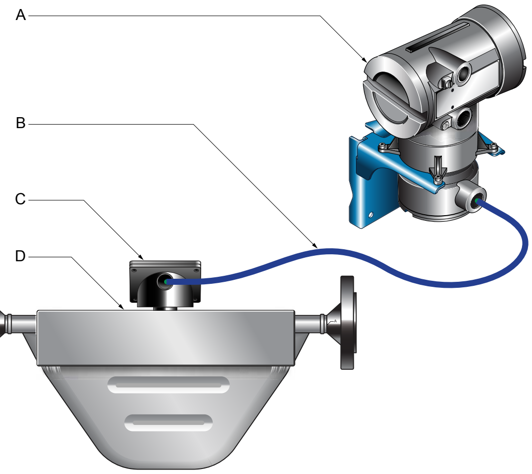
The transmitter is installed remotely from the Compact Density Meter (CDM), Fork Density Meter (FDM), or Fork Viscosity Meter (FVM). The 4-wire connection between the sensor and transmitter must be field wired. Power supply and I/O must be field wired to the transmitter.



A. Transmitter
B. Field-wired 4-wire connection
C. Meter electronics

Figure 1-6: 9-wire remote installation (model code P)

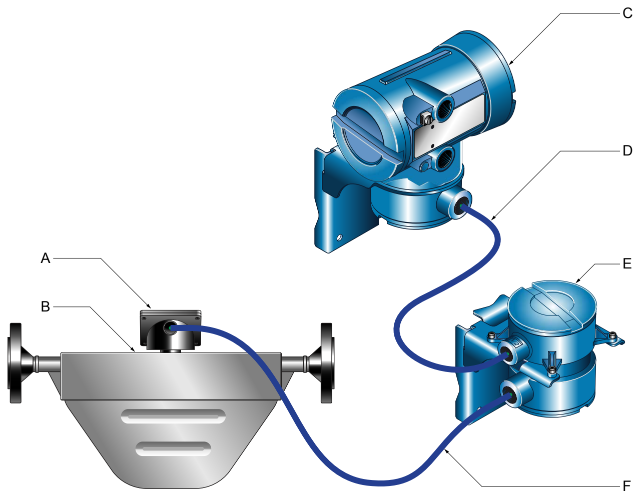
The transmitter and core processor are combined in a single unit that is installed remotely from the sensor. The 9-wire connection between the transmitter/core processor and the sensor must be field wired. Power supply and I/O must be field wired to the transmitter.



A. *Transmitter*
B. *Field-wired 9-wire connection*
C. *Junction box*
D. *Sensor*

Figure 1-7: Remote core processor with remote sensor installation (model code B or E)

The transmitter, core processor, and sensor are all mounted separately. The 4-wire connection between the transmitter and core processor must be field wired. The 9-wire connection between the core processor and the sensor must be field wired. Power supply and I/O must be field wired to the transmitter. This configuration is sometimes called double-hop.



A. Junction box
B. Sensor
C. Transmitter
D. Field-wired 4-wire connection
E. Core processor
F. Field-wired 9-wire connection

1.3 Maximum cable lengths between sensor and transmitter

The maximum cable length between the sensor and transmitter that are separately installed is determined by cable type.

Table 1-2: Maximum cable lengths between sensor and transmitter

Cable type	Wire gauge	Maximum length
Micro Motion 4-wire	Not applicable	• 1000 ft (300 m) without Ex-approval • 500 ft (150 m) with IIC rated sensors • 1000 ft (300 m) with IIB rated sensors
Micro Motion 9-wire	Not applicable	60 ft (20 m)
User-supplied 4-wire	VDC 22 AWG (0.35 mm^2)	300 ft (90 m)

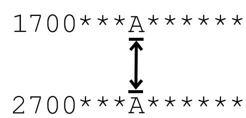
Table 1-2: Maximum cable lengths between sensor and transmitter *(continued)*

Cable type	Wire gauge	Maximum length
	VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
	VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
	RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

1.4 Output options

The transmitter was ordered and shipped for one of up to 10 output options. You must know your transmitter output option to correctly install the transmitter. The eighth character of the transmitter model number indicates the output option.

Figure 1-8: Output option indication for Model 1700 and Model 2700 transmitters



The model number is located on the device tag on the side of the transmitter.

Table 1-3: Output options for Model 1700 transmitters

Letter	Description
A	Analog outputs – one mA, one frequency, one RS-485
D	Intrinsically safe analog outputs – two mA, one frequency

Table 1-4: Output options for Model 2700 transmitters

Letter	Description
A	Analog outputs – one mA, one frequency, one RS-485
B	Configurable I/O channels (default configuration of two mA, one frequency)
C	Configurable I/O channels (custom configuration)
D	Intrinsically safe analog outputs – two mA, one frequency
E	Intrinsically safe Foundation fieldbus H1 with standard function blocks
G	PROFIBUS-PA
N	Non-incendive Foundation fieldbus H1 with standard function blcoks
2	WirelessHART – one mA, one frequency, one RS-485

Table 1-4: Output options for Model 2700 transmitters *(continued)*

Letter	Description
3	WirelessHART – one mA, two configurable I/O channels (custom configuration)
4	Intrinsically safe WirelessHART – two mA, one frequency

1.5 Environmental limits

Table 1-5: Environmental specifications

Type	Value
Ambient temperature limits	–40 to +140 °F (–40 to +60 °C)
Humidity limits	5 to 95% relative humidity, non-condensing at 140 °F (60 °C)
Vibration limits	Meets IEC 60068-2-6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g
EMI effects	Complies with EMC Directive 2004/108/EC per EN 61326 Industrial Complies with NAMUR NE-21 (22.08.2007)
Ambient temperature effect on analog outputs	On mA output: ±0.005% of span per °C

If possible, install the transmitter in a location that will prevent direct exposure to sunlight. The environmental limits for the transmitter may be further restricted by hazardous area approvals.

1.6 Hazardous area classifications

If you plan to mount the transmitter in a hazardous area:

- Verify that the transmitter has the appropriate hazardous area approval. Each transmitter has a hazardous area approval tag attached to the transmitter housing.
- Ensure that any cable used between the transmitter and the sensor meets the hazardous area requirements.

1.7 Power requirements

Self-switching AC/DC input, automatically recognizes supply voltage

- 85 to 265 VAC, 50/60 Hz, 6 watts typical, 11 watts maximum
- 18 to 100 VDC, 6 watts typical, 11 watts maximum

- Complies with low voltage directive 2006/95/EC per EN 61010-1 (IEC 61010-1) with amendment 2, and Installation (Overvoltage) Category II, Pollution Degree 2

Note

For DC power:

- Power requirements assume a single transmitter per cable.
- At startup, the power source must provide a minimum of 1.5 amps of short-term current per transmitter.
- Length and conductor diameter of the power cable must be sized to provide 18 VDC minimum at the power terminals, at a load current of 0.5 amps.

Figure 1-9: Cable sizing formula

$$M = 18\text{V} + (R \times L \times 0.5\text{A})$$

- *M: minimum supply voltage*
- *R: cable resistance*
- *L: cable length*

Table 1-6: Typical power cable resistance at 68 °F (20 °C)

Wire gauge	Resistance
14 AWG	0.0050 Ω/ft
16 AWG	0.0080 Ω/ft
18 AWG	0.0128 Ω/ft
20 AWG	0.0204 Ω/ft
2.5 mm^2	0.0136 Ω/m
1.5 mm^2	0.0228 Ω/m
1.0 mm^2	0.0340 Ω/m
0.75 mm^2	0.0460 Ω/m
0.50 mm^2	0.0680 Ω/m

1.8 Orientation

You can mount the transmitter in any orientation as long as the conduit openings do not point upward.

⚠ CAUTION!

Upward-facing conduit openings risk condensation moisture entering the transmitter housing, which could damage the transmitter.

1.9 Accessibility for maintenance

Mount the meter in a location and orientation that satisfies the following conditions:

- Allows sufficient clearance to open the transmitter housing cover. Micro Motion recommends 8–10 inches (200–250 mm) clearance at the rear of the transmitter.
- Provides clear access for installing cabling to the transmitter.

2 Mounting and sensor wiring for integral installations

Topics covered in this chapter:

- *Mounting and sensor wiring*
- *Rotate the transmitter on the sensor (optional)*
- *Rotate the user interface on the transmitter (optional)*
- *Ground the meter components*

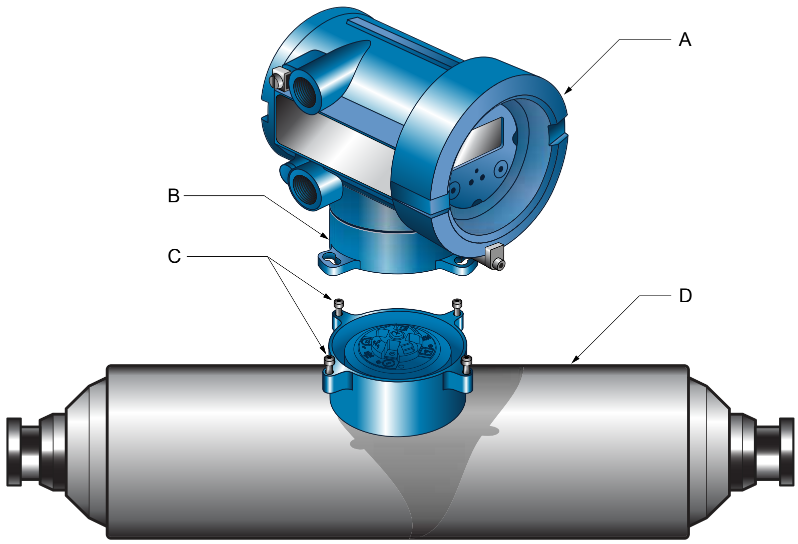
2.1 Mounting and sensor wiring

There are no separate mounting requirements for integral transmitters, and no need to connect wiring between the transmitter and the sensor.

2.2 Rotate the transmitter on the sensor (optional)

In integral installations, you can rotate the transmitter on the sensor up to 360º in 90º increments.

Figure 2-1: Components of an integral transmitter



A. Transmitter
B. Transition ring
C. Cap screws
D. Sensor

Procedure

1. Loosen each of the four cap screws (4 mm) that fasten the transmitter to the base.
2. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
3. Gently lift the transmitter straight up, disengaging it from the cap screws.

Important
Do not disconnect or damage the wires that connect the transmitter to the core processor.

4. Rotate the transmitter to the desired orientation.

Important
Do not pinch or stress the wires.

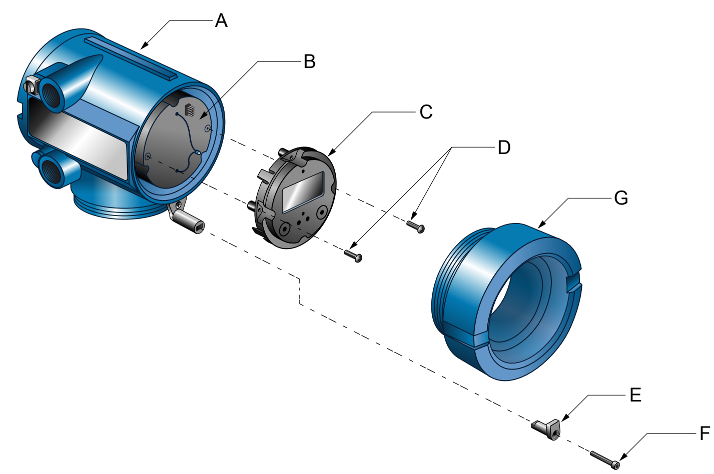
The slots on the transition ring should be aligned with the cap screws.

5. Gently lower the transmitter onto the base, inserting the cap screws into the slots.
6. Rotate the transmitter clockwise so that the cap screws are in the locked position.
7. Tighten the cap screws, torquing to 2.3 to 3.4 N-m.

2.3 Rotate the user interface on the transmitter (optional)

The user interface on the transmitter electronics module can be rotated 90º or 180° from the original position.

Figure 2-2: Display components



A. *Transmitter housing*
B. *Sub-bezel*
C. *Display module*
D. *Display screws*
E. *End-cap clamp*
F. *Cap screw*
G. *Display cover*

Notes

- When using the touch buttons, you must cover at least an 8 mm diameter circle over the surface above the touch button: using your thumb may be more effective because it has a greater surface area.
- When the housing cover is removed, the touch buttons do not function.

Procedure

1. Shut off power to the unit.
2. Remove the end-cap clamp by removing the cap screw.
3. Turn the display cover counterclockwise to remove it from the main enclosure.
4. Carefully loosen (and remove if necessary) the semicaptive display screws while holding the display module in place.
5. Carefully pull the display module out of the main enclosure until the sub-bezel pin terminals are disengaged from the display module.

Note

If the display pins come out of the board stack with the display module, remove the pins and reinstall them.

6. Rotate the display module to the desired position.
7. Insert the sub-bezel pin terminals into the display module pin holes to secure the display in its new position.
8. If you have removed the display screws, line them up with the matching holes on the sub-bezel, then reinsert and tighten them.
9. Place the display cover onto the main enclosure.
10. Turn the display cover clockwise until it is snug.
11. Replace the end-cap clamp by reinserting and tightening the cap screw.
12. Restore power to the transmitter.

2.4 Ground the meter components

In an integral installation, all components are grounded together.

Prerequisites

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

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

Procedure

Ground via the piping, if possible (see sensor documentation). If grounding via the piping is not possible, ground according to applicable local standards using the transmitter's internal or external ground screw.

Figure 2-3: Transmitter internal grounding screw

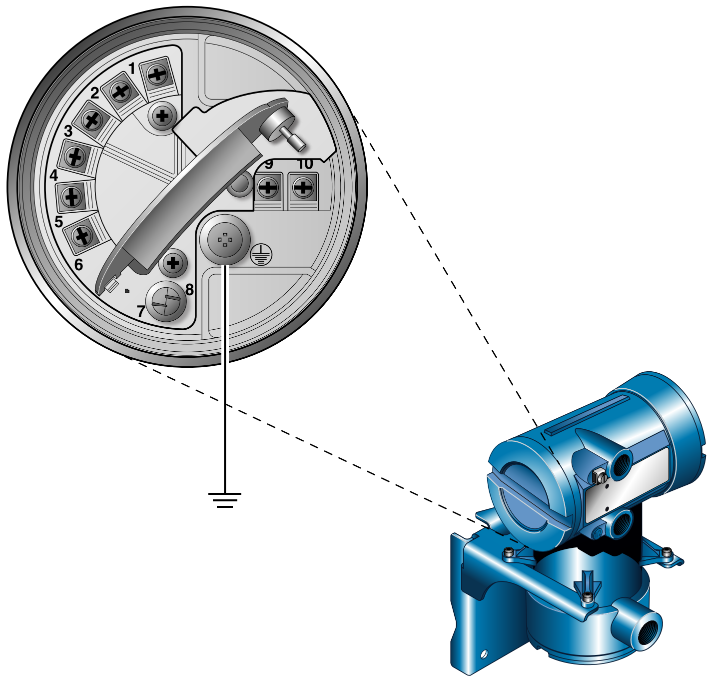
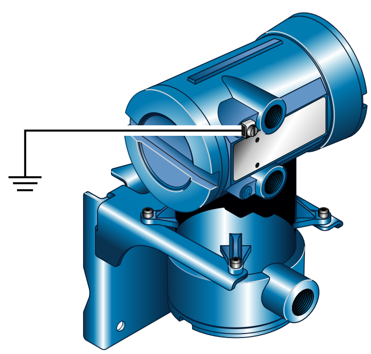


Figure 2-4: Transmitter external grounding screw



3 Mounting and sensor wiring for 4-wire remote installations

Topics covered in this chapter:

3.1 Mounting options

There are two options available for mounting the transmitter:

- Mount the transmitter to a wall or flat surface.
- Mount the transmitter to an instrument pole.

3.1.1 Mount the transmitter to a wall

Prerequisites

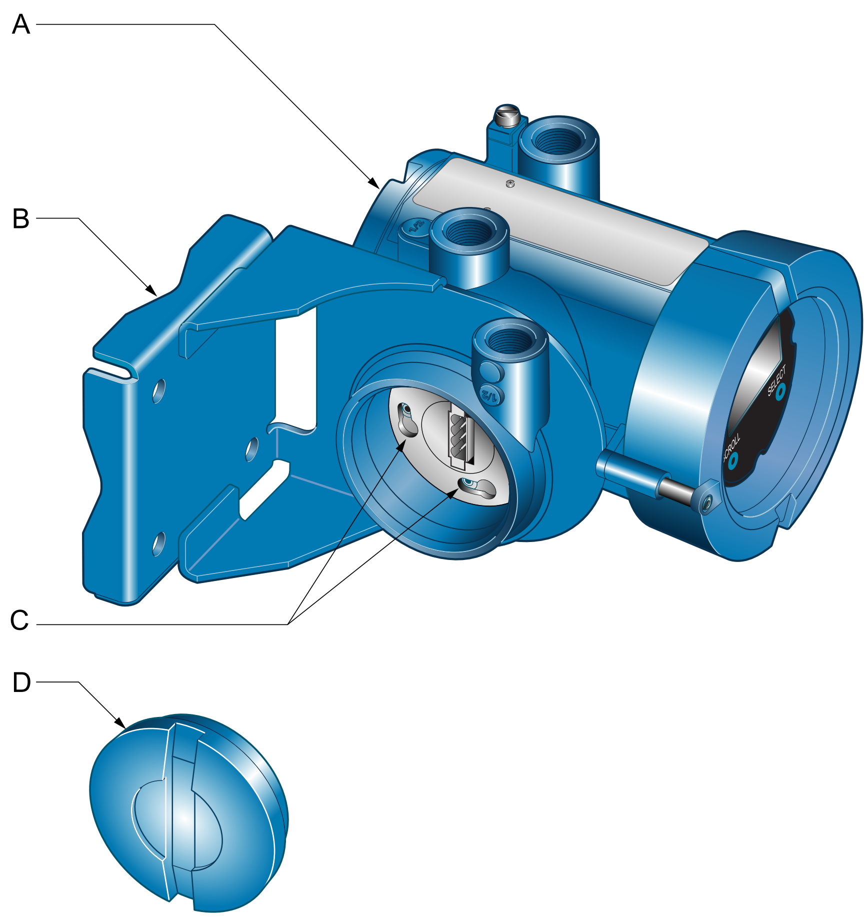
- Micro Motion recommends the use of 5/16-18 (8 mm–1.25) fasteners that can withstand the process environment. Micro Motion does not supply bolts or nuts as part of the standard offering (general purpose bolts and nuts are available as an option).
- Ensure that the surface is flat and rigid, does not vibrate, or move excessively.
- Confirm that you have the necessary tools, and the mounting kit shipped with the transmitter.

Procedure

1. If desired, re-orient the transmitter on the mounting bracket.

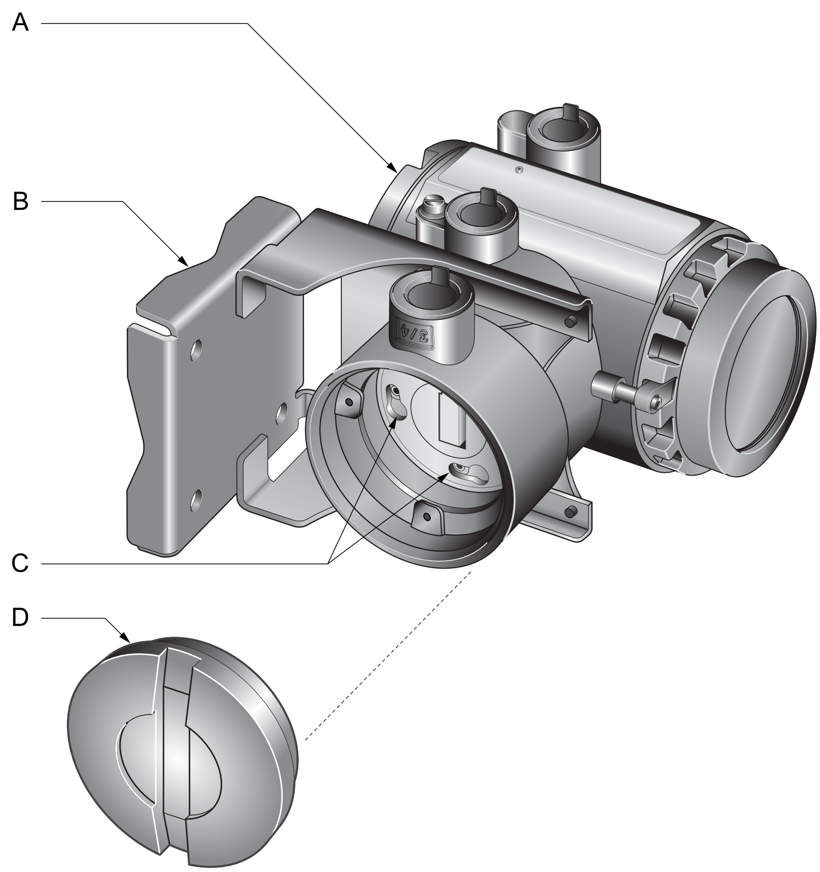
   a. Remove the junction end-cap from the junction housing.
   b. Loosen each of the four cap screws (4 mm).
   c. Rotate the bracket so that the transmitter is oriented as desired.
   d. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).
   e. Replace the junction end-cap.

Figure 3-1: Components of 4-wire remote mount transmitter (aluminum housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

Figure 3-2: Components of a 4-wire remote mount transmitter (stainless steel housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

2. Attach the mounting bracket to the wall.

3.1.2 Mount the transmitter to an instrument pole

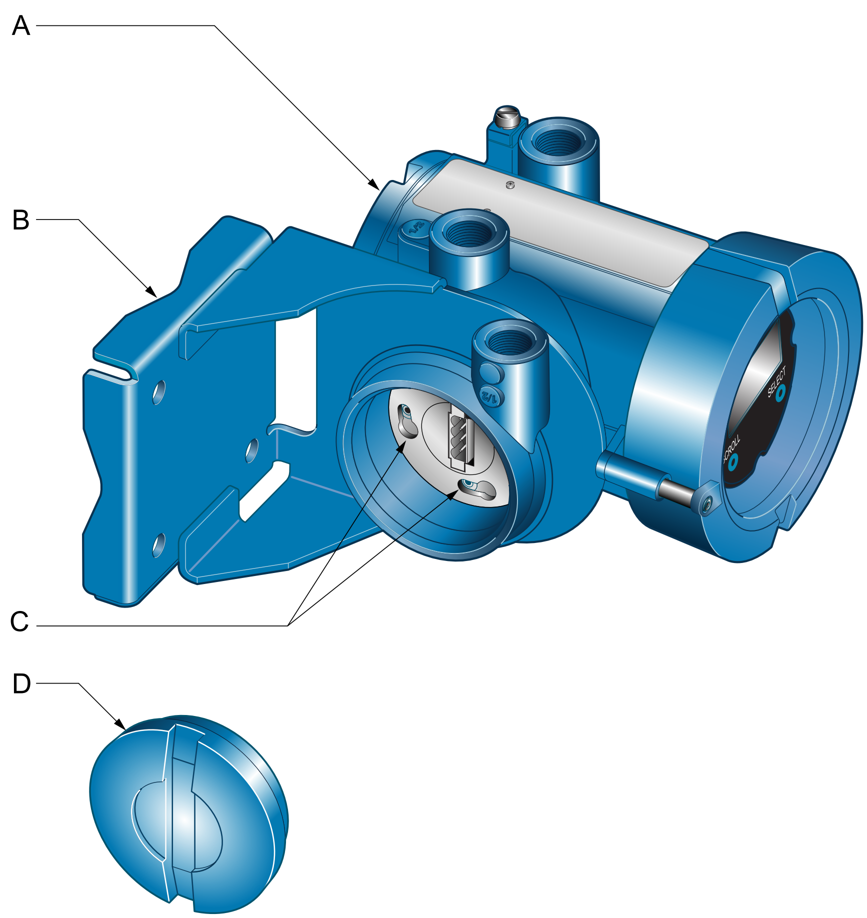
Prerequisites

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, that can withstand the process environment. Micro Motion does not supply U-bolts or nuts (appropriate bolts and nuts are available as an option).
- Ensure the instrument pole extends at least 12 inches (305 mm) from a rigid base, and is no more than 2 inches (50.8 mm) in diameter.

Procedure

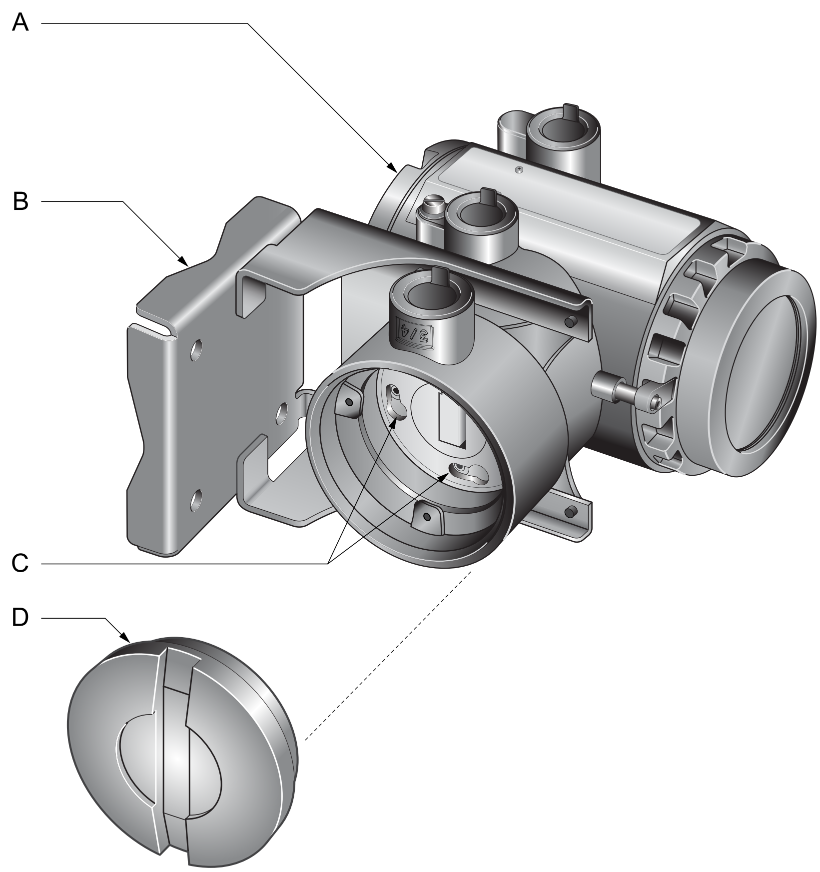
1. If desired, re-orient the transmitter on the mounting bracket.
    a. Remove the junction end-cap from the junction housing.
    b. Loosen each of the four cap screws (4 mm).
    c. Rotate the bracket so that the transmitter is oriented as desired.
    d. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).
    e. Replace the junction end-cap.

Figure 3-3: Components of 4-wire remote mount transmitter (aluminum housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

Figure 3-4: Components of a 4-wire remote mount transmitter (stainless steel housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

2. Attach the mounting bracket to an instrument pole.

3.2 Prepare the 4-wire cable

Important

For user-supplied cable glands, the gland must be capable of terminating the drain wires.

Note

If you are installing unshielded cable in continuous metallic conduit with 360º termination shielding, you only need to prepare the cable – you do not need to perform the shielding procedure.

Figure 3-5: 4-wire cable preparation

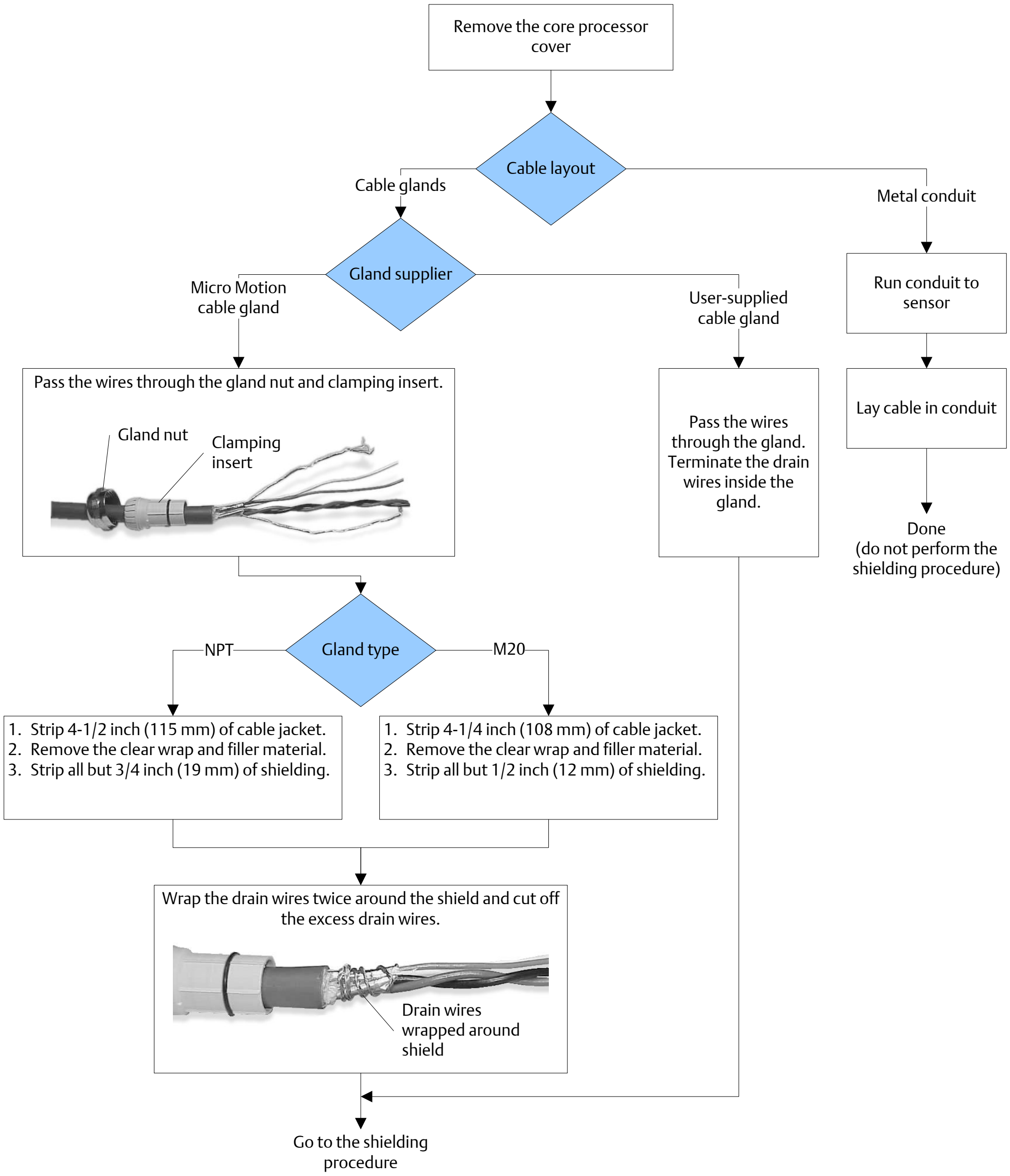
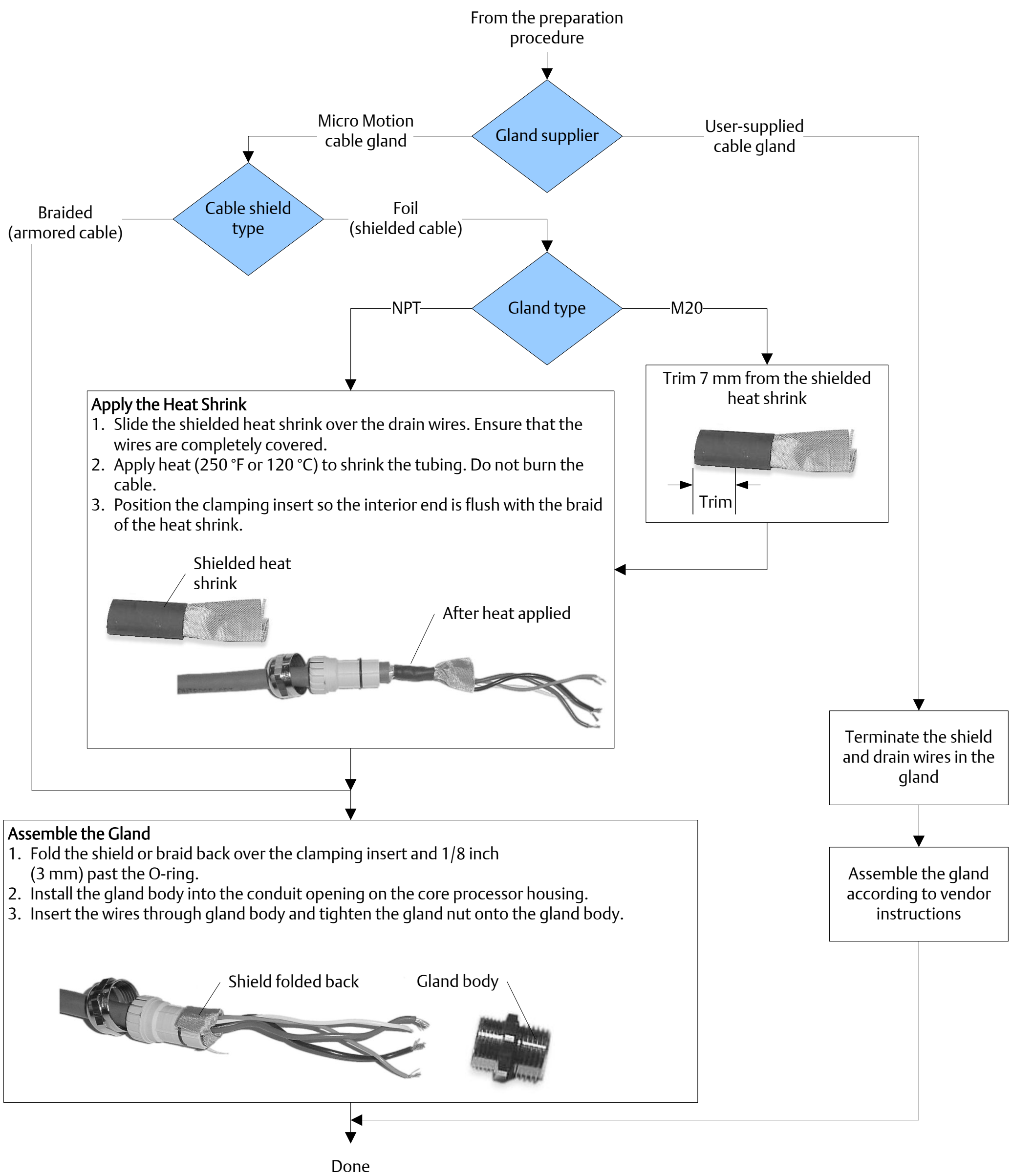


Figure 3-6: 4-wire cable shielding



3.2.1 4-wire cable types and usage

Micro Motion offers two types of 4-wire cable: shielded and armored. Both types contain shield drain wires.

The 4-wire cable supplied by Micro Motion consists of one pair of red and black 18 AWG (0.75 mm^2) wires for the VDC connection, and one pair of white and green 22 AWG (0.35 mm^2) wires for the RS-485 connection.

User-supplied 4-wire cable must meet the following requirements:

- Twisted pair construction.
- Applicable hazardous area requirements, if the core processor is installed in a hazardous area.
- Wire gauge appropriate for the cable length between the core processor and the transmitter.

Table 3-1: Wire gauge

Wire gauge	Maximum cable length
VDC 22 AWG (0.35 mm^2)	300 ft (90 m)
VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

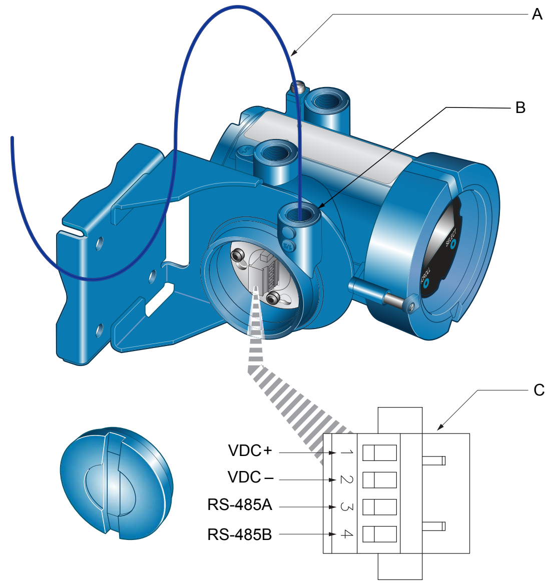
3.3 Wire the transmitter to the sensor

1. Connect the cable to the sensor-mounted core processor as described in the sensor documentation.
2. Feed the wires from the sensor through the conduit opening on the transmitter.
3. Connect wires to the appropriate terminals on the mating connector.

Tip

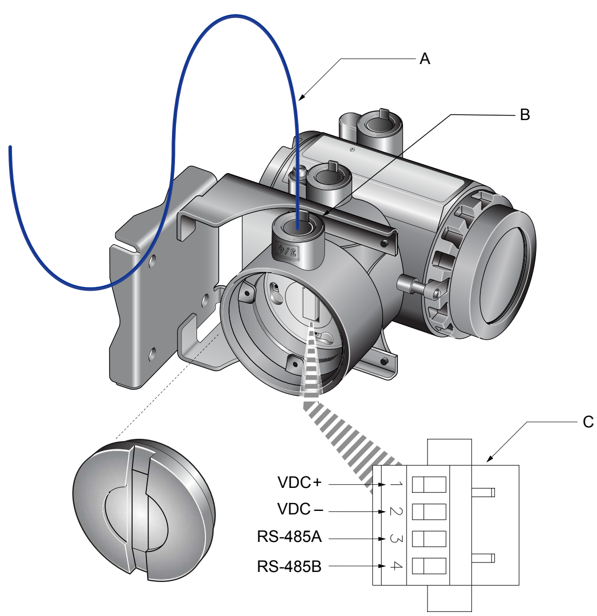
You may find it easier to unplug the mating connector to connect the wires. If you do so, remember to firmly reseat the mating connector and tighten the mating connector screws so that the mating connector cannot accidentally come loose.

Figure 3-7: Wiring path for transmitters with aluminum housing



A. 4-wire cable
B. Transmitter conduit opening
C. Mating connector

Figure 3-8: Wiring path for transmitters with stainless steel housing

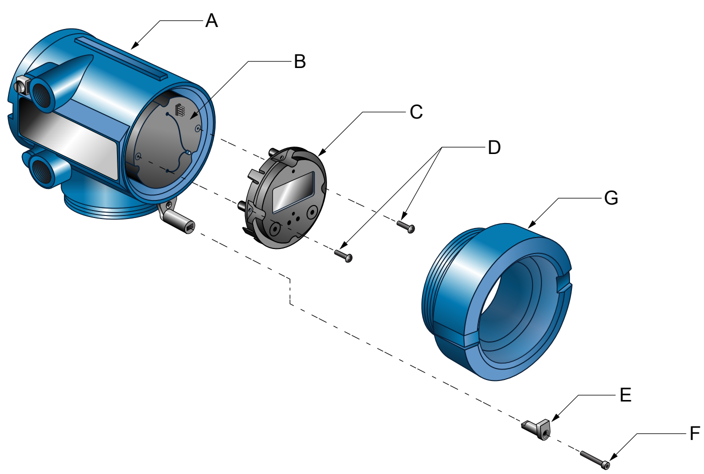


A. 4-wire cable
B. Transmitter conduit opening
C. Mating connector

3.4 Rotate the user interface on the transmitter (optional)

The user interface on the transmitter electronics module can be rotated 90º or 180° from the original position.

Figure 3-9: Display components



A. Transmitter housing
B. Sub-bezel
C. Display module
D. Display screws
E. End-cap clamp
F. Cap screw
G. Display cover

Procedure

1. Shut off power to the unit.
2. Remove the end-cap clamp by removing the cap screw.
3. Turn the display cover counterclockwise to remove it from the main enclosure.
4. Carefully loosen (and remove if necessary) the semicaptive display screws while holding the display module in place.
5. Carefully pull the display module out of the main enclosure until the sub-bezel pin terminals are disengaged from the display module.

Note
If the display pins come out of the board stack with the display module, remove the pins and reinstall them.

6. Rotate the display module to the desired position.

7. Insert the sub-bezel pin terminals into the display module pin holes to secure the display in its new position.
8. If you have removed the display screws, line them up with the matching holes on the sub-bezel, then reinsert and tighten them.
9. Place the display cover onto the main enclosure.
10. Turn the display cover clockwise until it is snug.
11. Replace the end-cap clamp by reinserting and tightening the cap screw.
12. Restore power to the transmitter.

3.5 Ground the meter components

In 4-wire remote installations, the transmitter and sensor are grounded separately.

Prerequisites

⚠ CAUTION!

Improper grounding could cause inaccurate measurements or meter failure.

Note
For hazardous area installations in Europe, refer to standard EN 60079-14 or national standards.

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

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

Procedure

1. Ground the sensor according to the instructions in the sensor documentation.
2. Ground the transmitter according to applicable local standards, using the transmitter's internal or external ground screw.

Figure 3-10: Transmitter internal grounding screw

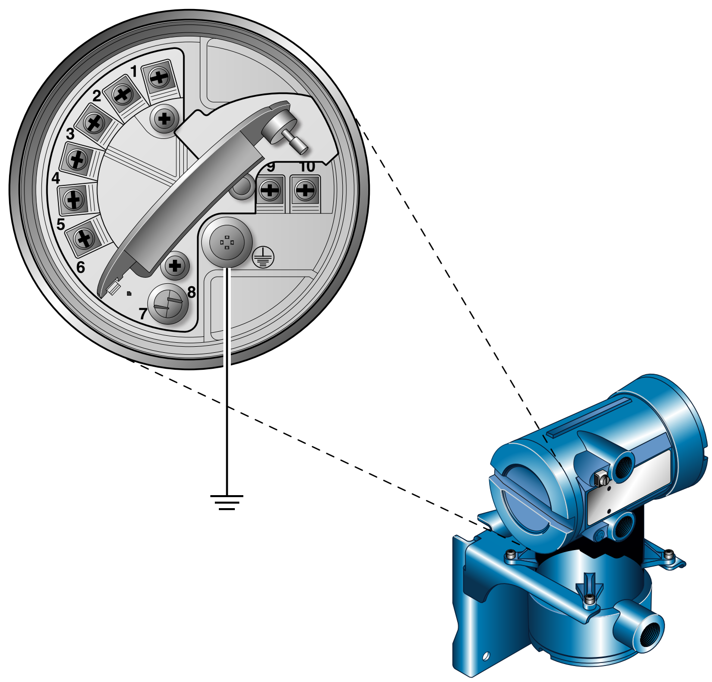
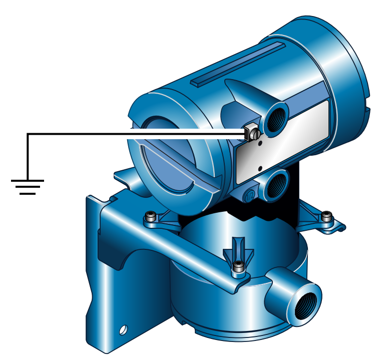


Figure 3-11: Transmitter external grounding screw



4 Mounting and sensor wiring for 9-wire remote installations

Topics covered in this chapter:

4.1 Mounting options

There are two options available for mounting the transmitter:

- Mount the transmitter to a wall or flat surface.
- Mount the transmitter to an instrument pole.

4.1.1 Mount the transmitter to a wall

Prerequisites

- Micro Motion recommends the use of 5/16-18 (8 mm–1.25) fasteners that can withstand the process environment. Micro Motion does not supply bolts or nuts as part of the standard offering (general purpose bolts and nuts are available as an option).
- Ensure that the surface is flat and rigid, does not vibrate, or move excessively.
- Confirm that you have the necessary tools, and the mounting kit shipped with the transmitter.

Procedure

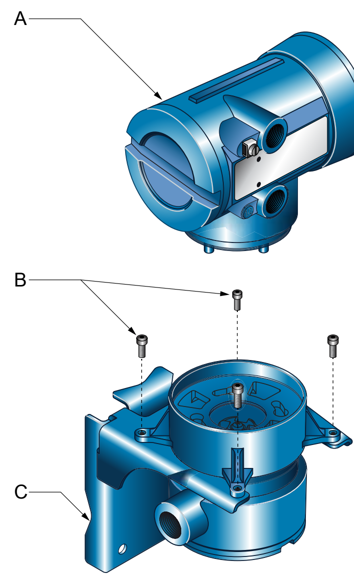
1. If desired, re-orient the transmitter on the mounting bracket.

   a. Loosen each of the four cap screws (4 mm).

   b. Rotate the bracket so that the transmitter is oriented as desired.

   c. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).

Figure 4-1: Components of 9-wire remote mount transmitter



A. Transmitter
B. Cap screws
C. Mounting bracket

2. Attach the mounting bracket to the wall.

4.1.2 Mount the transmitter to an instrument pole

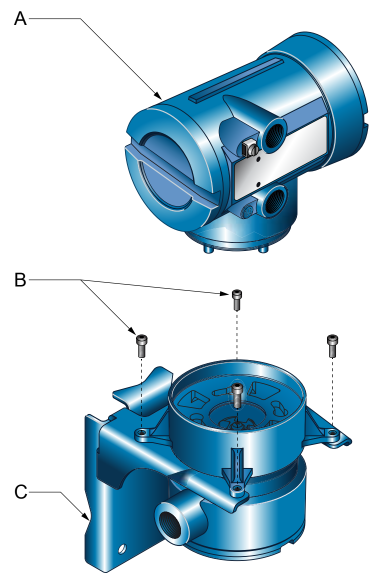
Prerequisites

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, that can withstand the process environment. Micro Motion does not supply U-bolts or nuts (appropriate bolts and nuts are available as an option).
- Ensure the instrument pole extends at least 12 inches (305 mm) from a rigid base, and is no more than 2 inches (50.8 mm) in diameter.

Procedure

1. If desired, re-orient the transmitter on the mounting bracket.
   a. Loosen each of the four cap screws (4 mm).
   b. Rotate the bracket so that the transmitter is oriented as desired.
   c. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).

Figure 4-2: Components of 9-wire remote mount transmitter



A. Transmitter
B. Cap screws
C. Mounting bracket

2. Attach the mounting bracket to an instrument pole.

4.2 Prepare the 9-wire cable

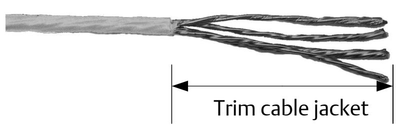
Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. The type of cable you are using determines how you will prepare the cable.

Perform the cable preparation procedure appropriate for your cable type.

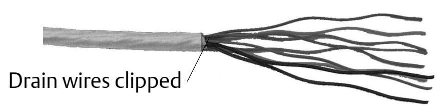
Figure 4-3: Preparing jacketed cable

Prepare jacketed cable at the sensor end

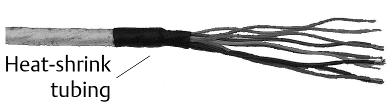
1. Trim 4 ½ inches (115 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.



4. Identify the drain wires in the cable. Clip off each drain wire as close as possible to the cable jacket.



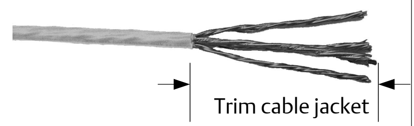
5. Slide the 1 ½ inch (40 mm) heat-shrink tubing over the wires and cable jacket. The tubing should completely cover the clipped ends of the drain wires.



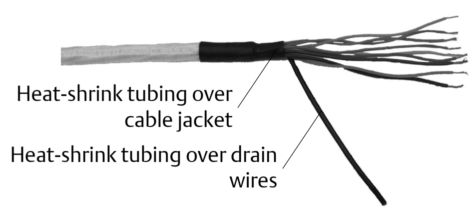
6. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
7. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

Prepare jacketed cable at the transmitter end

1. Trim 4 inches (100 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.



4. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
5. Slide the 3-inch (75 mm) heat-shrink tubing over the drain wires. Push the tubing as close as possible to the cable jacket.
6. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable jacket.

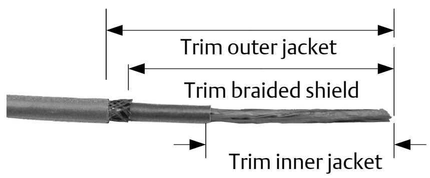


7. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
8. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

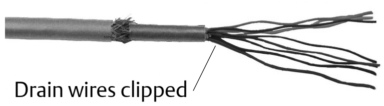
Figure 4-4: Preparing shielded or armored cable

Prepare shielded or armored cable at the sensor end

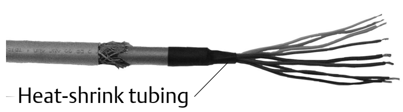
1. Without cutting the shield, strip 7 inches (175 mm) of outer jacket.
2. Strip 6 ½ inches (165 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 ½ inches (115 mm) of inner jacket.



5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable. Clip each drain wire as close as possible to the cable jacket.



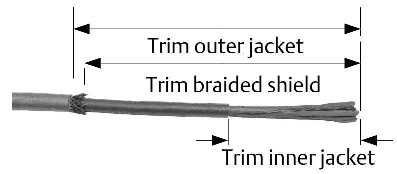
8. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover the clipped ends of the drain wires.



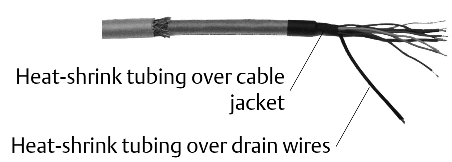
9. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
10. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

Prepare shielded or armored cable at the transmitter end

1. Without cutting the shield, strip 9 inches (225 mm) of cable jacket.
2. Strip 8 ½ inches (215 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 inches (100 mm) of inner jacket.



5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
8. Slide the 3-inch (75 mm) long heat-shrink tubing over the drain wires. Push the tubing as close as possible to the inner jacket.
9. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable iacket.



10. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
11. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

4.2.1 Micro Motion 9-wire cable types and usage

Cable types

Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. Note the following differences between the cable types:

- Armored cable provides mechanical protection for the cable wires.
- Jacketed cable has a smaller bend radius than shielded or armored cable.
- If ATEX compliance is required, the different cable types have different installation requirements.

Cable jacket types

All cable types can be ordered with a PVC jacket or Teflon® FEP jacket. Teflon FEP is required for the following installation types:

- All installations that include a T-series sensor.
- All installations with a cable length of 250 ft (75 m) or greater, a nominal flow less than 20 percent, and ambient temperature changes greater than +68 °F (+20 °C).

Table 4-1: Cable jacket material and temperature ranges

	Handling temperature		Operating temperature	
Cable jacket material	**Low limit**	**High limit**	**Low limit**	**High limit**
PVC	–4 °F (–20 °C)	+194 °F (+90 °C)	–40 °F (–40 °C)	+221 °F (+105 °C)
Teflon FEP	–40 °F (–40 °C)	+194 °F (+90 °C)	–76 °F (–60 °C)	+302 °F (+150 °C)

Cable bend radii

Table 4-2: Bend radii of jacketed cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	**Under dynamic load**
PVC	0.415 inches (10 mm)	3–1/8 inches (80 mm)	6–1/4 inches (159 mm)
Teflon FEP	0.340 inches (9 mm)	2–5/8 inches (67 mm)	5–1/8 inches (131 mm)

Table 4-3: Bend radii of shielded cable

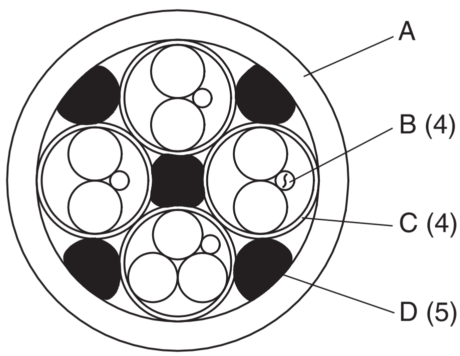
Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	**Under dynamic load**
PVC	0.2 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.425 inches (11 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

Table 4-4: Bend radii of armored cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	Under dynamic load
PVC	0.525 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.340 inches (9 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

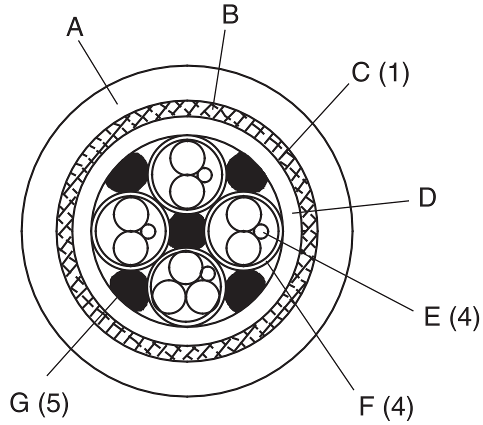
Cable illustrations

Figure 4-5: Cross-section view of jacketed cable



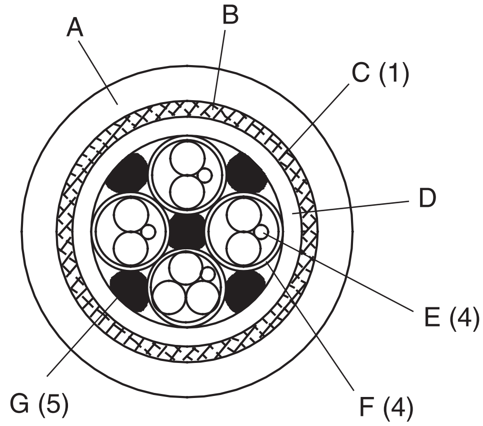
A. *Outer jacket*
B. *Drain wire (4 total)*
C. *Foil shield (4 total)*
D. *Filler (5 total)*

Figure 4-6: Cross-section view of shielded cable



A. *Outer jacket*
B. *Tin-plated copper braided shield*
C. *Foil shield (1 total)*
D. *Inner jacket*
E. *Drain wire (4 total)*
F. *Foil shield (4 total)*
G. *Filler (5 total)*

Figure 4-7: Cross-section view of armored cable



A. *Outer jacket*
B. *Stainless steel braided shield*
C. *Foil shield (1 total)*
D. *Inner jacket*
E. *Drain wire (4 total)*
F. *Foil shield (4 total)*
G. *Filler (5 total)*

4.3 Wire the transmitter to the sensor using jacketed cable

Prerequisites

For ATEX installations, the jacketed cable must be installed inside a user-supplied sealed metallic conduit that provides 360° termination shielding for the enclosed cable.

⚠ CAUTION!

Sensor wiring is intrinsically safe. To keep sensor wiring intrinsically safe, keep the sensor wiring separated from power supply wiring and output wiring.

⚠ CAUTION!

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Procedure

1. Run the cable through the conduit. Do not install 9-wire cable and power cable in the same conduit.
2. To prevent conduit connectors from seizing in the threads of the conduit openings, apply a conductive anti-galling compound to the threads, or wrap threads with PTFE tape two to three layers deep.

   Wrap the tape in the opposite direction that the male threads will turn when inserted into the female conduit opening.
3. Remove the junction box cover and core processor end-cap.
4. At both the sensor and transmitter, do the following:

   a. Connect a male conduit connector and waterproof seal to the conduit opening for 9-wire.

   b. Pass the cable through the conduit opening for the 9-wire cable.

   c. Insert the stripped end of each wire into the corresponding terminal at the sensor and transmitter ends, matching by color (see *Table 4-5*). No bare wires should remain exposed.

   Note

   For ELITE®, H-Series, T-Series, and some F-Series sensors, match the wire to the terminal by the color identified on the inside of the sensor junction box cover.

Table 4-5: Sensor and transmitter terminal designations

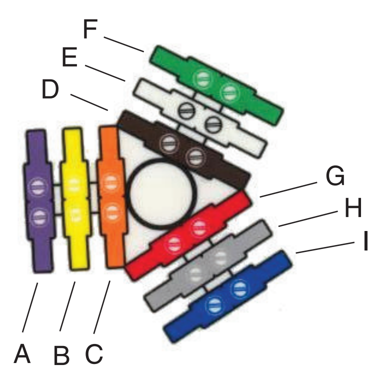
Wire color	Sensor terminal	Transmitter terminal	Function
Black	No connection	0	Drain wires
Brown	1	1	Drive +
Red	2	2	Drive –
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff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

d. Tighten the screws to hold the wire in place.

e. Ensure integrity of gaskets, grease all O-rings, then replace the junction box and transmitter housing covers and tighten all screws, as required.

4.3.1 Sensor and transmitter terminals

Figure 4-8: All ELITE, H-Series, and T-Series sensor, and 2005 or newer F-Series sensor terminals



A. Violet
B. Yellow
C. Orange
D. Brown
E. White
F. Green
G. Red
H. Gray
I. Blue

Figure 4-9: All Model D and Model DL, and pre-2005 F-Series sensor terminals

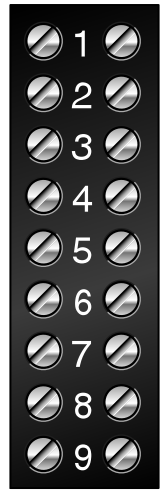
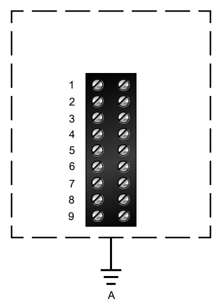
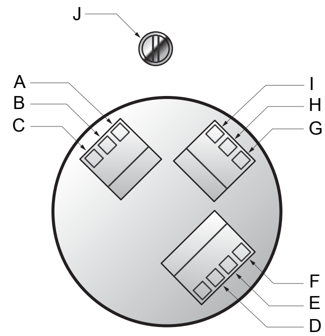


Figure 4-10: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. Earth ground

Figure 4-11: Transmitter terminals



A. *Brown*
B. *Violet*
C. *Yellow*
D. *Orange*
E. *Gray*
F. *Blue*
G. *White*
H. *Green*
I. *Red*
J. *Ground screw (black)*

4.4 Wire the transmitter to the sensor using shielded or armored cable

Prerequisites

For ATEX installations, shielded or armored cable must be installed with cable glands, at both the sensor and transmitter ends. Cable glands that meet ATEX requirements can be purchased from Micro Motion. Cable glands from other vendors can be used.

⚠ CAUTION!

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

Install cable glands in the 9-wire conduit opening in the transmitter housing and the sensor junction box. Ensure that the cable drain wires and shields do not make contact with the junction box or the transmitter housing. Improper installation of cable or cable glands could cause inaccurate measurements or flow meter failure.

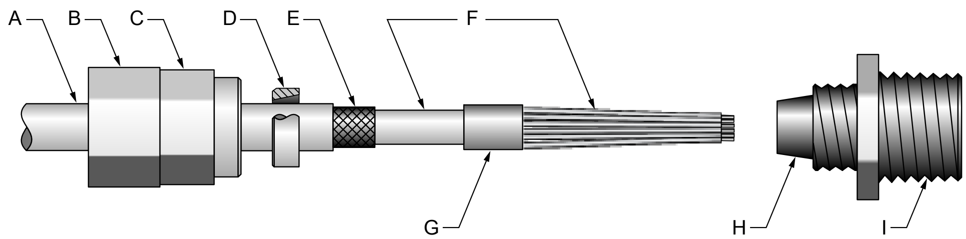
⚠ **CAUTION!**

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Procedure

1. Identify the components of the cable gland and cable (see *Figure 4-12*).

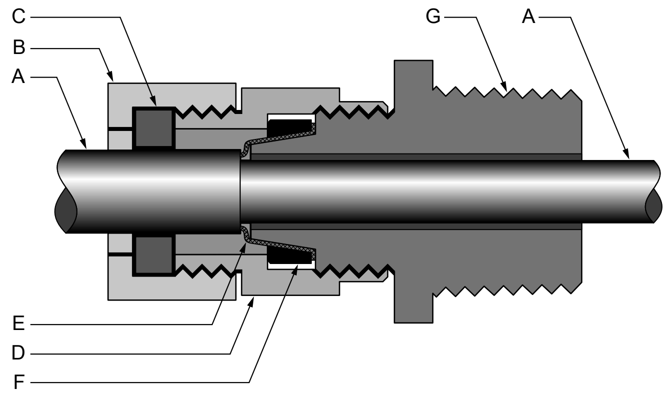
Figure 4-12: Cable gland and cable (exploded view)



A. Cable
B. Sealing nut
C. Compression nut
D. Brass compression ring
E. Braided shield
F. Cable
G. Tape or heat-shrink tubing
H. Clamp seat (shown as integral to nipple)
I. Nipple

2. Unscrew the nipple from the compression nut.
3. Screw the nipple into the conduit opening for the 9-wire cable. Tighten it to one turn past hand-tight.
4. Slide the compression ring, compression nut, and sealing nut onto the cable. Make sure the compression ring is oriented so the taper will mate properly with the tapered end of the nipple.
5. Pass the cable end through the nipple so the braided shield slides over the tapered end of the nipple.
6. Slide the compression ring over the braided shield.
7. Screw the compression nut onto the nipple. Tighten the sealing nut and compression nut by hand to ensure that the compression ring traps the braided shield.
8. Use a 25-mm (1-inch) wrench to tighten the sealing nut and compression nut to 20–25 foot-pounds (27–34 N-m) of torque. See *Figure 4-13* for an illustration of a complete cable gland assembly.

Figure 4-13: Cross-section of assembled cable gland with cable



A. Cable
B. Sealing nut
C. Seal
D. Compression nut
E. Braided shield
F. Brass compression ring
G. Nipple

9. Remove the junction box cover and core processor end-cap.
10. At both the sensor and transmitter, connect the cable according to the following procedure:

    a. Insert the stripped end of each wire into the corresponding terminal at the sensor and transmitter ends, matching by color (see *Table 4-6*). No bare wires should remain exposed.

Note

For ELITE®, H-Series, T-Series, and some F-Series sensors, match the wire to the terminal by the color identified on the inside of the sensor junction box cover.

Table 4-6: Sensor and transmitter 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 –

Table 4-6: Sensor and transmitter terminal designations *(continued)*

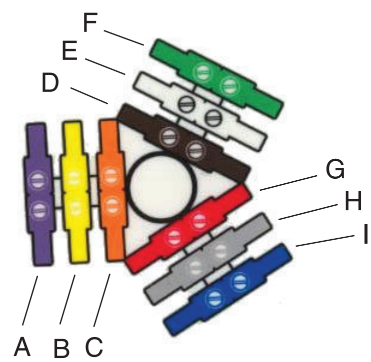
Wire color	Sensor terminal	Transmitter terminal	Function
White	9	9	Left pickoff –

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

c. Ensure integrity of gaskets, grease all O-rings, then replace the junction box and transmitter housing covers and tighten all screws, as required.

4.4.1 Sensor and transmitter terminals

Figure 4-14: All ELITE, H-Series, and T-Series sensor, and 2005 or newer F-Series sensor terminals



A. *Violet*
B. *Yellow*
C. *Orange*
D. *Brown*
E. *White*
F. *Green*
G. *Red*
H. *Gray*
I. *Blue*

Figure 4-15: All Model D and Model DL, and pre-2005 F-Series sensor terminals

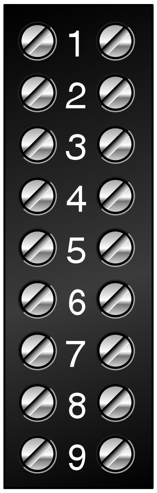
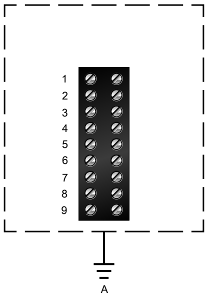
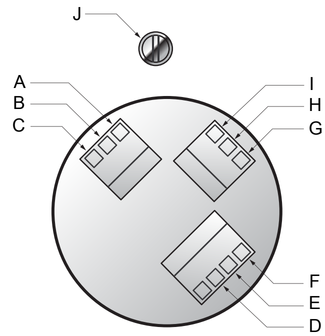


Figure 4-16: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. *Earth ground*

Figure 4-17: Transmitter terminals

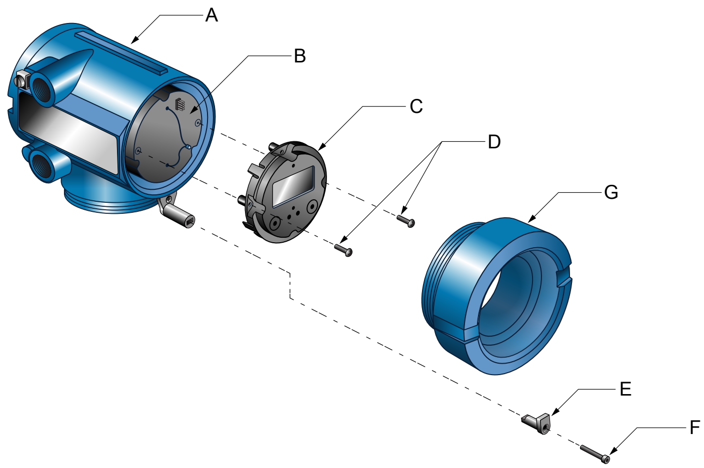


A. *Brown*
B. *Violet*
C. *Yellow*
D. *Orange*
E. *Gray*
F. *Blue*
G. *White*
H. *Green*
I. *Red*
J. *Ground screw (black)*

4.5 Rotate the user interface on the transmitter (optional)

The user interface on the transmitter electronics module can be rotated 90º or 180° from the original position.

Figure 4-18: Display components



A. Transmitter housing
B. Sub-bezel
C. Display module
D. Display screws
E. End-cap clamp
F. Cap screw
G. Display cover

Procedure

1. Shut off power to the unit.
2. Remove the end-cap clamp by removing the cap screw.
3. Turn the display cover counterclockwise to remove it from the main enclosure.
4. Carefully loosen (and remove if necessary) the semicaptive display screws while holding the display module in place.
5. Carefully pull the display module out of the main enclosure until the sub-bezel pin terminals are disengaged from the display module.

   Note
   If the display pins come out of the board stack with the display module, remove the pins and reinstall them.

6. Rotate the display module to the desired position.
7. Insert the sub-bezel pin terminals into the display module pin holes to secure the display in its new position.
8. If you have removed the display screws, line them up with the matching holes on the sub-bezel, then reinsert and tighten them.
9. Place the display cover onto the main enclosure.
10. Turn the display cover clockwise until it is snug.

11. Replace the end-cap clamp by reinserting and tightening the cap screw.
12. Restore power to the transmitter.

4.6 Ground the meter components

In 9-wire remote installations, the transmitter/core processor assembly and sensor are grounded separately.

Prerequisites

⚠ CAUTION!

Improper grounding could cause inaccurate measurements or meter failure.

Note
For hazardous area installations in Europe, refer to standard EN 60079-14 or national standards.

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

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

Procedure

1. Ground the sensor according to the instructions in the sensor documentation.
2. Ground the transmitter/core processor assembly according to applicable local standards, using the transmitter's internal ground screw or the transmitter's external ground screw.

Figure 4-19: Transmitter internal ground screw

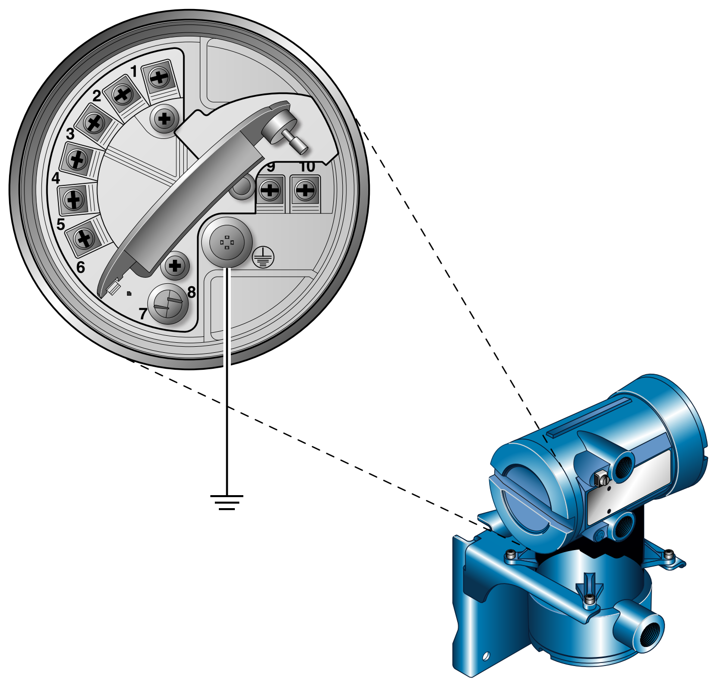
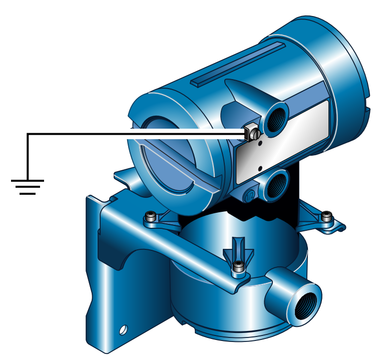


Figure 4-20: Transmitter external ground screw



5 Mounting and sensor wiring for remote core processor with remote sensor installations

Topics covered in this chapter:

5.1 Mounting options

There are two options available for mounting the transmitter:

- Mount the transmitter to a wall or flat surface.
- Mount the transmitter to an instrument pole.

5.1.1 Mount the transmitter to a wall

Prerequisites

- Micro Motion recommends the use of 5/16-18 (8 mm–1.25) fasteners that can withstand the process environment. Micro Motion does not supply bolts or nuts as part of the standard offering (general purpose bolts and nuts are available as an option).
- Ensure that the surface is flat and rigid, does not vibrate, or move excessively.
- Confirm that you have the necessary tools, and the mounting kit shipped with the transmitter.

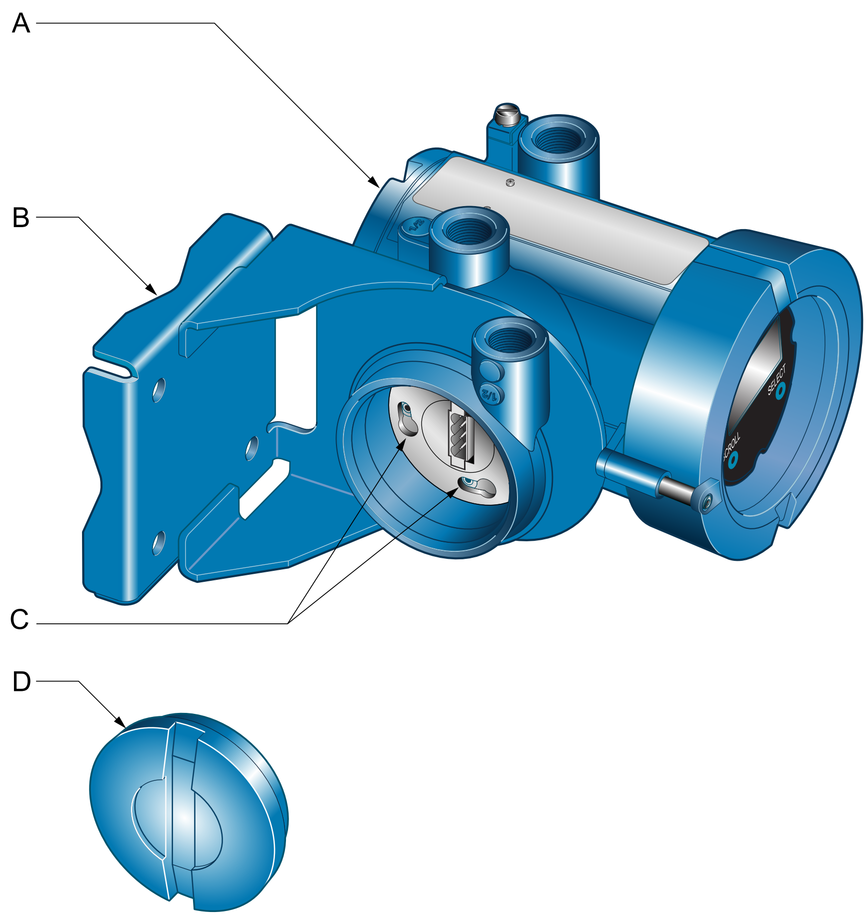
Procedure

1. If desired, re-orient the transmitter on the mounting bracket.

    a. Remove the junction end-cap from the junction housing.

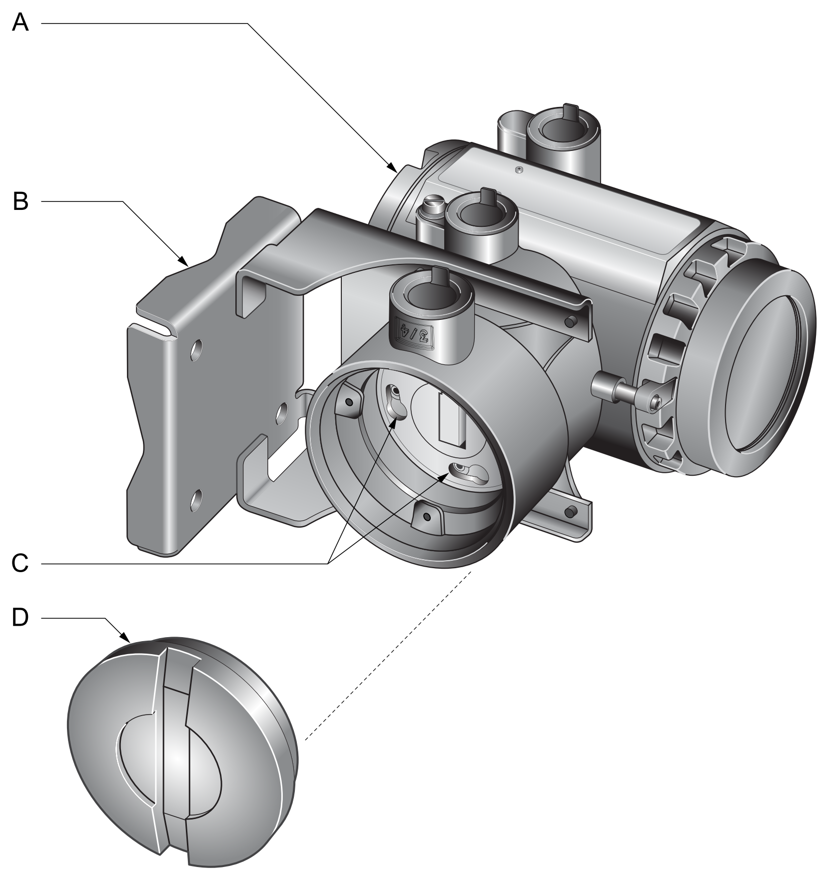
b. Loosen each of the four cap screws (4 mm).
c. Rotate the bracket so that the transmitter is oriented as desired.
d. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).
e. Replace the junction end-cap.

Figure 5-1: Components of 4-wire remote mount transmitter (aluminum housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

Figure 5-2: Components of a 4-wire remote mount transmitter (stainless steel housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

2. Attach the mounting bracket to the wall.

5.1.2 Mount the transmitter to an instrument pole

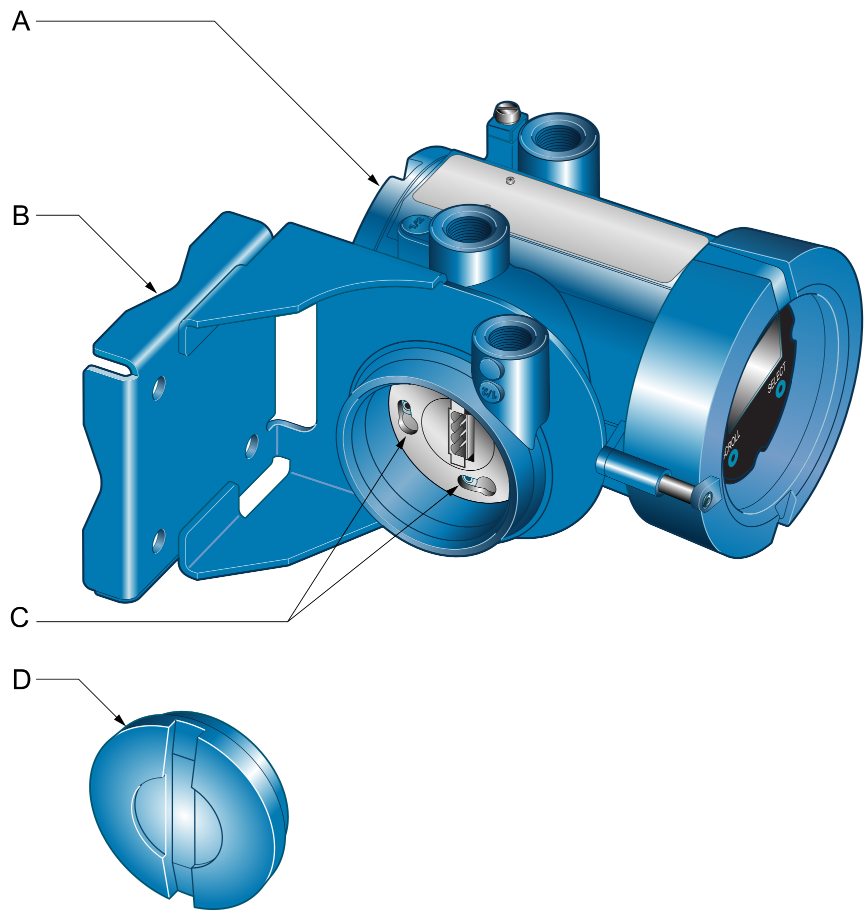
Prerequisites

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, that can withstand the process environment. Micro Motion does not supply U-bolts or nuts (appropriate bolts and nuts are available as an option).
- Ensure the instrument pole extends at least 12 inches (305 mm) from a rigid base, and is no more than 2 inches (50.8 mm) in diameter.

Procedure

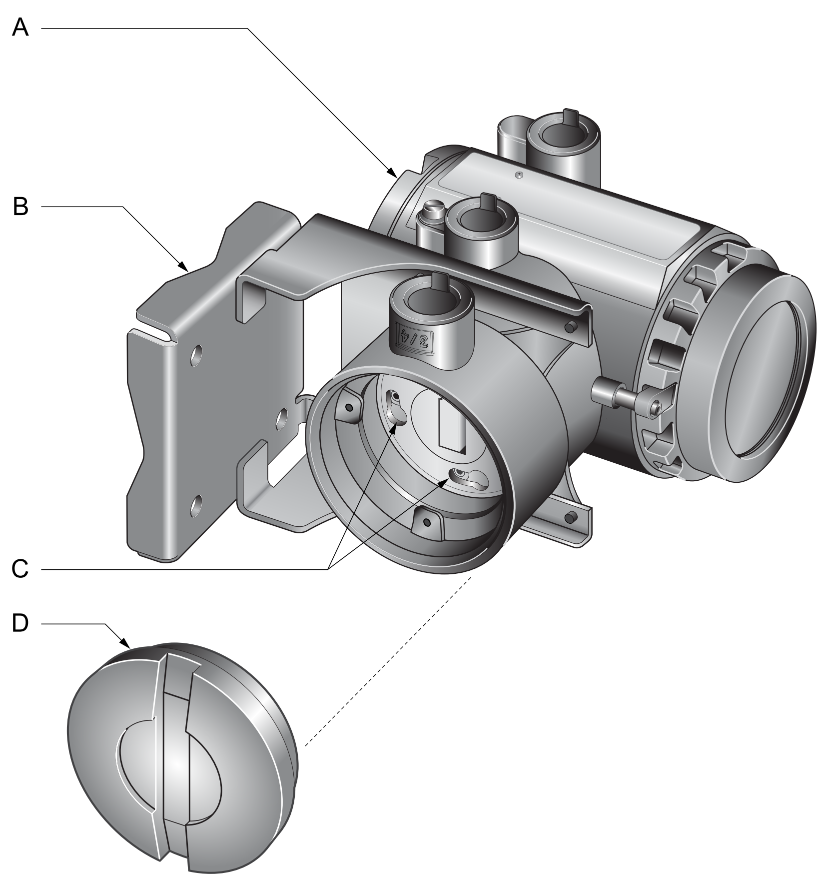
1. If desired, re-orient the transmitter on the mounting bracket.
    a. Remove the junction end-cap from the junction housing.
    b. Loosen each of the four cap screws (4 mm).
    c. Rotate the bracket so that the transmitter is oriented as desired.
    d. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).
    e. Replace the junction end-cap.

Figure 5-3: Components of 4-wire remote mount transmitter (aluminum housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

Figure 5-4: Components of a 4-wire remote mount transmitter (stainless steel housing)



A. Transmitter
B. Mounting bracket
C. Cap screws
D. End-cap

2. Attach the mounting bracket to an instrument pole.

5.2 Mount the remote core processor

This procedure is required only for remote core processor with remote transmitter installations.

Prerequisites

For mounting the remote core processor to a wall:

- Micro Motion recommends the use of 5/16-18 (8 mm–1.25) fasteners that can withstand the process environment. Micro Motion does not supply bolts or nuts as part of the standard offering (general purpose bolts and nuts are available as an option).
- Ensure that the surface is flat and rigid, does not vibrate, or move excessively.
- Confirm that you have the necessary tools, and the mounting kit shipped with the transmitter.

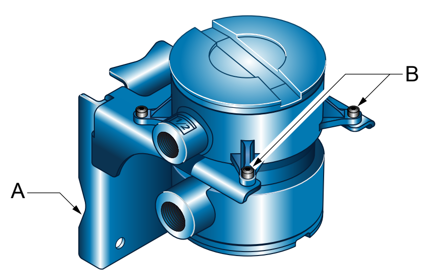
For mounting the remote core processor to an instrument pole:

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, that can withstand the process environment. Micro Motion does not supply U-bolts or nuts (appropriate bolts and nuts are available as an option).
- Ensure the instrument pole extends at least 12 inches (305 mm) from a rigid base, and is no more than 2 inches (50.8 mm) in diameter.

Procedure

1. If desired, reorient the core processor housing on the bracket.
   a. Loosen each of the four cap screws (4 mm).
   b. Rotate the bracket so that the core processor is oriented as desired.
   c. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).

Figure 5-5: Components of a remote core processor



A. Mounting bracket
B. Cap screws

2. Attach the mounting bracket to an instrument pole or wall.

5.3 Prepare the 4-wire cable

Important
For user-supplied cable glands, the gland must be capable of terminating the drain wires.

Note

If you are installing unshielded cable in continuous metallic conduit with 360º termination shielding, you only need to prepare the cable – you do not need to perform the shielding procedure.

Figure 5-6: 4-wire cable preparation

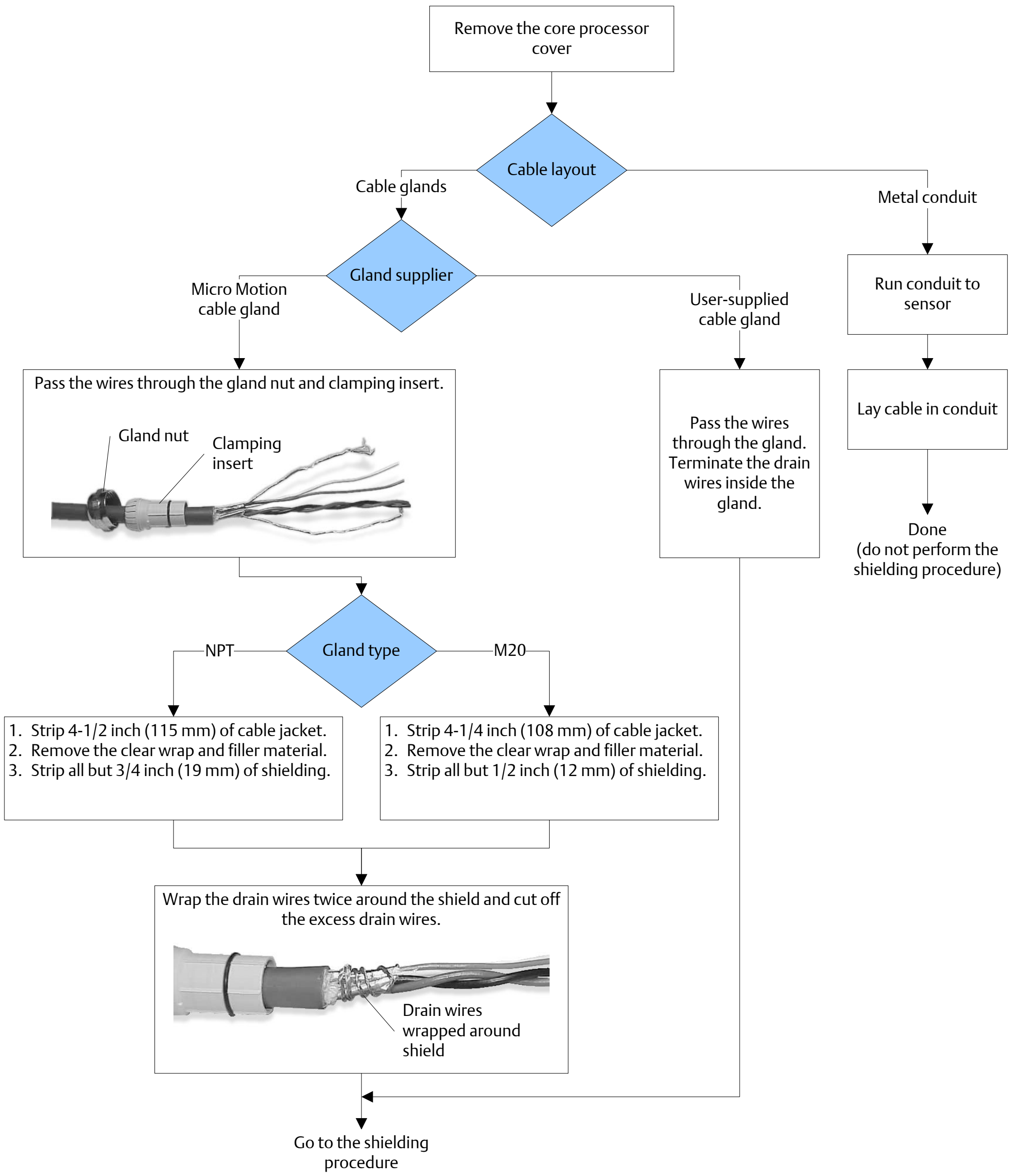
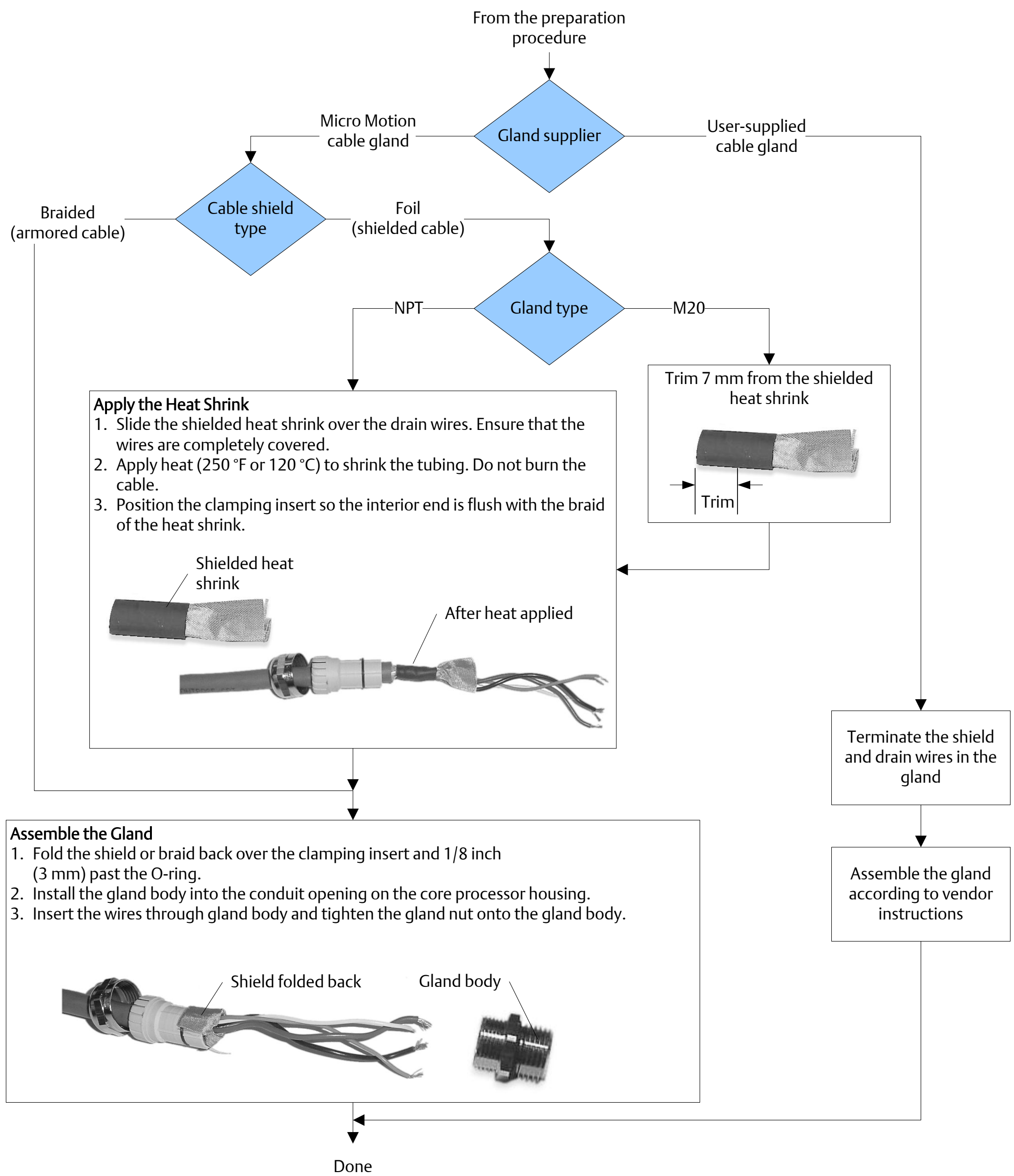


Figure 5-7: 4-wire cable shielding



5.3.1 4-wire cable types and usage

Micro Motion offers two types of 4-wire cable: shielded and armored. Both types contain shield drain wires.

The 4-wire cable supplied by Micro Motion consists of one pair of red and black 18 AWG (0.75 mm^2) wires for the VDC connection, and one pair of white and green 22 AWG (0.35 mm^2) wires for the RS-485 connection.

User-supplied 4-wire cable must meet the following requirements:

- Twisted pair construction.
- Applicable hazardous area requirements, if the core processor is installed in a hazardous area.
- Wire gauge appropriate for the cable length between the core processor and the transmitter.

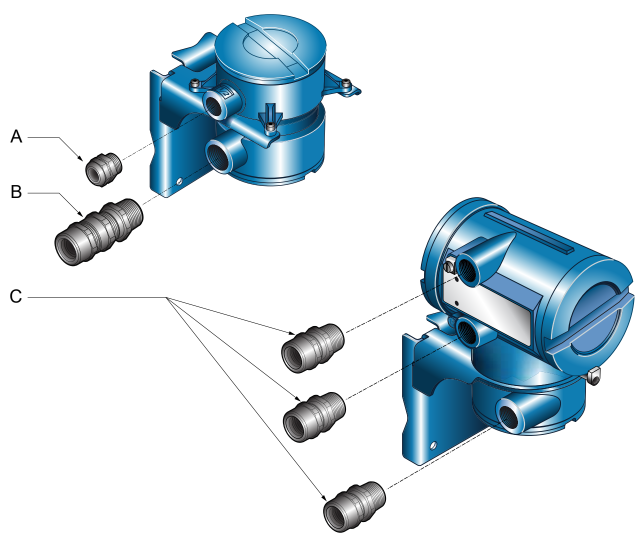
Table 5-1: Wire gauge

Wire gauge	Maximum cable length
VDC 22 AWG (0.35 mm^2)	300 ft (90 m)
VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

5.4 Wire the transmitter to the remote core processor

1. If you are installing a Micro Motion-supplied cable gland at the core processor housing, identify the cable gland to use for the 4-wire cable conduit opening.

Figure 5-8: Cable gland identification



A. Cable gland used with 4-wire conduit opening
B. 3/4"–14 NPT cable gland used with 9-wire conduit opening
C. 1/2"–14 NPT or M20x1.5 cable glands used with transmitter

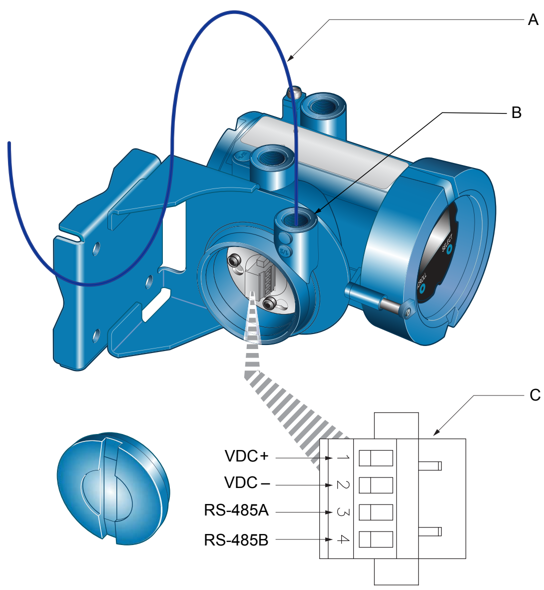
2. Connect the cable to the core processor as described in the sensor documentation.

3. Feed the wires from the remote core processor through the conduit opening.
4. Connect wires to the appropriate terminals on the mating connector.

Tip

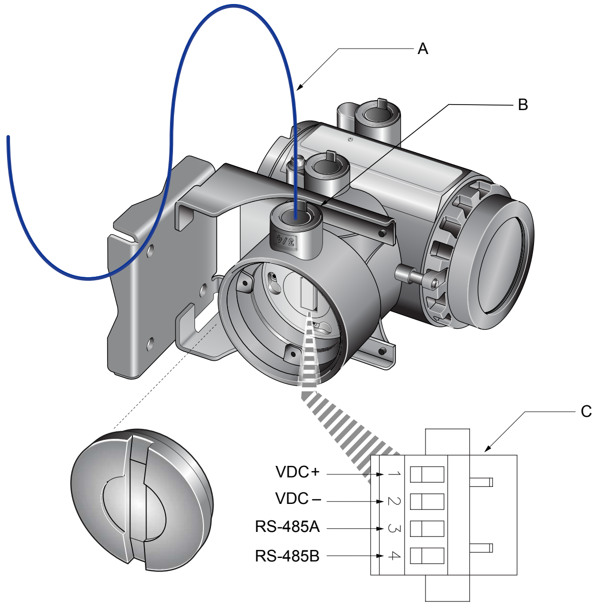
You may find it easier to unplug the mating connector to connect the wires. If you do so, remember to firmly reseat the mating connector and tighten the mating connector screws so that the mating connector cannot accidentally come loose.

Figure 5-9: Wiring path for transmitters with aluminum housing



A. 4-wire cable
B. Transmitter conduit opening
C. Mating connector

Figure 5-10: Wiring path for transmitters with stainless steel housing



A. 4-wire cable
B. Transmitter conduit opening
C. Mating connector

5.5 Prepare the 9-wire cable

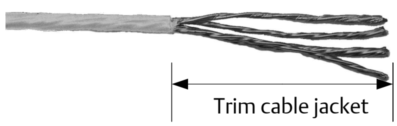
Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. The type of cable you are using determines how you will prepare the cable.

Perform the cable preparation procedure appropriate for your cable type.

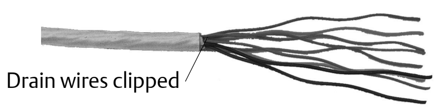
Figure 5-11: Preparing jacketed cable

Prepare jacketed cable at the sensor end

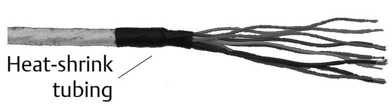
1. Trim 4 ½ inches (115 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.



4. Identify the drain wires in the cable. Clip off each drain wire as close as possible to the cable jacket.



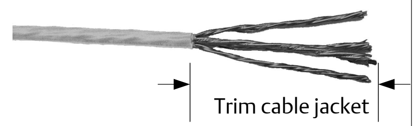
5. Slide the 1 ½ inch (40 mm) heat-shrink tubing over the wires and cable jacket. The tubing should completely cover the clipped ends of the drain wires.



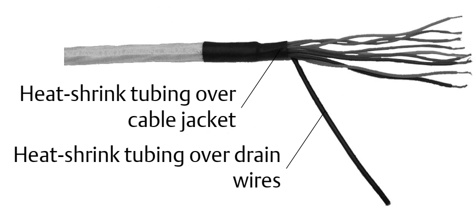
6. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
7. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

Prepare jacketed cable at the transmitter end

1. Trim 4 inches (100 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.



4. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
5. Slide the 3-inch (75 mm) heat-shrink tubing over the drain wires. Push the tubing as close as possible to the cable jacket.
6. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable jacket.

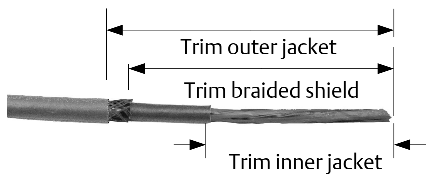


7. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
8. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

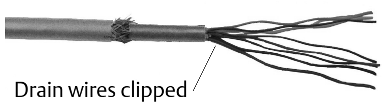
Figure 5-12: Preparing shielded or armored cable

Prepare shielded or armored cable at the sensor end

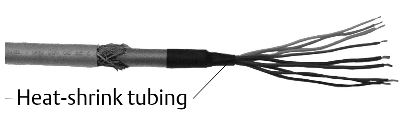
1. Without cutting the shield, strip 7 inches (175 mm) of outer jacket.
2. Strip 6 ½ inches (165 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 ½ inches (115 mm) of inner jacket.



5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable. Clip each drain wire as close as possible to the cable jacket.



8. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover the clipped ends of the drain wires.

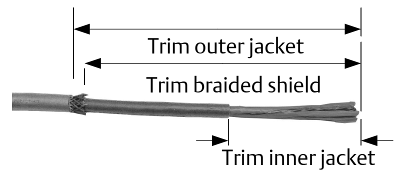


9. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).

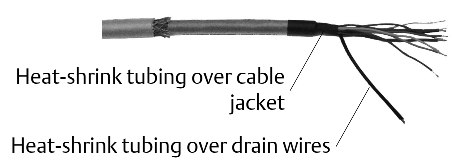
10. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

Prepare shielded or armored cable at the transmitter end

1. Without cutting the shield, strip 9 inches (225 mm) of cable jacket.
2. Strip 8 ½ inches (215 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 inches (100 mm) of inner jacket.



5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
8. Slide the 3-inch (75 mm) long heat-shrink tubing over the drain wires. Push the tubing as close as possible to the inner jacket.
9. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable iacket.



10. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).

11. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

5.5.1 9-wire cable types and usage

Cable types

Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. Note the following differences between the cable types:

- Armored cable provides mechanical protection for the cable wires.
- Jacketed cable has a smaller bend radius than shielded or armored cable.
- If ATEX compliance is required, the different cable types have different installation requirements.

Cable jacket types

All cable types can be ordered with a PVC jacket or Teflon® FEP jacket. Teflon FEP is required for the following installation types:

- All installations that include a T-series sensor.
- All installations with a cable length of 250 ft (75 m) or greater, a nominal flow less than 20 percent, and ambient temperature changes greater than +68 °F (+20 °C).

Table 5-2: Cable jacket material and temperature ranges

	Handling temperature		Operating temperature	
Cable jacket material	**Low limit**	**High limit**	**Low limit**	**High limit**
PVC	–4 °F (–20 °C)	+194 °F (+90 °C)	–40 °F (–40 °C)	+221 °F (+105 °C)
Teflon FEP	–40 °F (–40 °C)	+194 °F (+90 °C)	–76 °F (–60 °C)	+302 °F (+150 °C)

Cable bend radii

Table 5-3: Bend radii of jacketed cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	**Under dynamic load**
PVC	0.415 inches (10 mm)	3–1/8 inches (80 mm)	6–1/4 inches (159 mm)
Teflon FEP	0.340 inches (9 mm)	2–5/8 inches (67 mm)	5–1/8 inches (131 mm)

Table 5-4: Bend radii of shielded cable

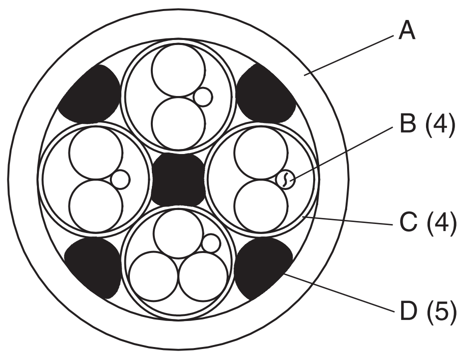
Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	**Under dynamic load**
PVC	0.2 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.425 inches (11 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

Table 5-5: Bend radii of armored cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	Under dynamic load
PVC	0.525 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.340 inches (9 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

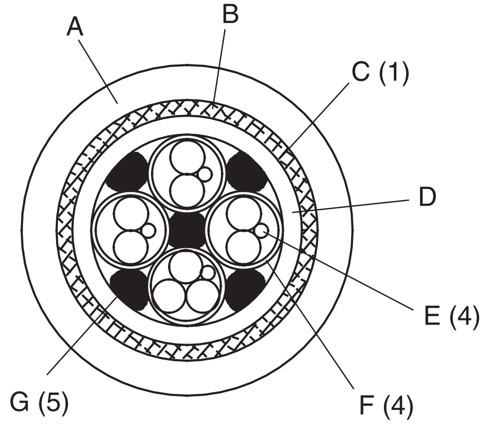
Cable illustrations

Figure 5-13: Cross-section view of jacketed cable



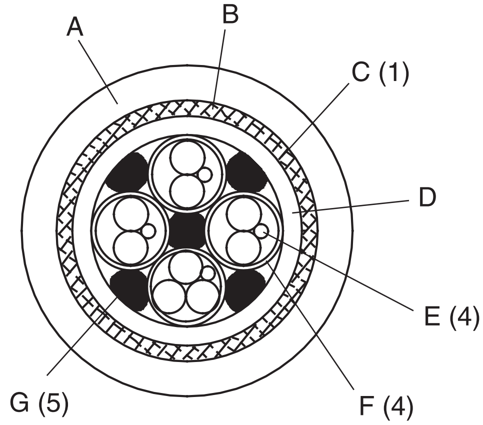
A. *Outer jacket*
B. *Drain wire (4 total)*
C. *Foil shield (4 total)*
D. *Filler (5 total)*

Figure 5-14: Cross-section view of shielded cable



A. *Outer jacket*
B. *Tin-plated copper braided shield*
C. *Foil shield (1 total)*
D. *Inner jacket*
E. *Drain wire (4 total)*
F. *Foil shield (4 total)*
G. *Filler (5 total)*

Figure 5-15: Cross-section view of armored cable



A. *Outer jacket*
B. *Stainless steel braided shield*
C. *Foil shield (1 total)*
D. *Inner jacket*
E. *Drain wire (4 total)*
F. *Foil shield (4 total)*
G. *Filler (5 total)*

5.6 Wire the remote core processor to the sensor using jacketed cable

Prerequisites

For ATEX installations, the jacketed cable must be installed inside a user-supplied sealed metallic conduit that provides 360° termination shielding for the enclosed cable.

⚠ CAUTION!

Sensor wiring is intrinsically safe. To keep sensor wiring intrinsically safe, keep the sensor wiring separated from power supply wiring and output wiring.

⚠ CAUTION!

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Procedure

1. Run the cable through the conduit. Do not install 9-wire cable and power cable in the same conduit.
2. To prevent conduit connectors from seizing in the threads of the conduit openings, apply a conductive anti-galling compound to the threads, or wrap threads with PTFE tape two to three layers deep.

   Wrap the tape in the opposite direction that the male threads will turn when inserted into the female conduit opening.
3. Remove the junction box cover and core processor end-cap.
4. At both the sensor and transmitter, do the following:

   a. Connect a male conduit connector and waterproof seal to the conduit opening for 9-wire.

   b. Pass the cable through the conduit opening for the 9-wire cable.

   c. Insert the stripped end of each wire into the corresponding terminal at the sensor and transmitter ends, matching by color. No bare wires should remain exposed.

Table 5-6: Sensor and remote core processor terminal designations

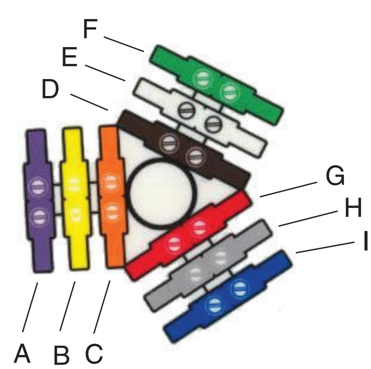
Wire color	Sensor terminal	Remote core processor terminal	Function
Black	No connection	Ground screw (see note)	Drain wires
Brown	1	1	Drive +
Red	2	2	Drive –
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff –

d. Tighten the screws to hold the wire in place.

e. Ensure integrity of gaskets, grease all O-rings, then replace the junction-box and transmitter housing covers and tighten all screws, as required.

5.6.1 Sensor and remote core processor terminals

Figure 5-16: All ELITE, H-Series, and T-Series sensor, and 2005 or newer F-Series sensor terminals



A. Violet
B. Yellow
C. Orange
D. Brown
E. White
F. Green
G. Red
H. Gray
I. Blue

Figure 5-17: All Model D and Model DL, and pre-2005 F-Series sensor terminals

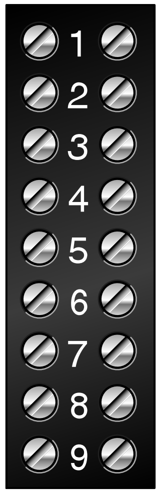
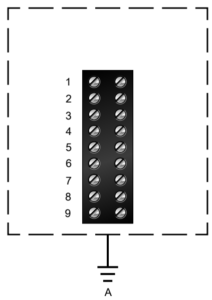
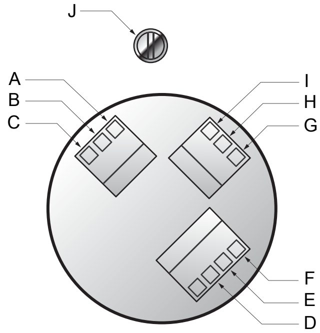


Figure 5-18: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. Earth ground

Figure 5-19: Remote core processor terminals



A. *Brown*
B. *Violet*
C. *Yellow*
D. *Orange*
E. *Gray*
F. *Blue*
G. *White*
H. *Green*
I. *Red*
J. *Ground screw (black)*

5.7 Wire the remote core processor to the sensor using shielded or armored cable

Prerequisites

For ATEX installations, shielded or armored cable must be installed with cable glands, at both the sensor and remote core processor ends. Cable glands that meet ATEX requirements can be purchased from Micro Motion. Cable glands from other vendors can be used.

⚠ **CAUTION!**

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ **CAUTION!**

Install cable glands in the 9-wire conduit opening in the transmitter housing and the sensor junction box. Ensure that the cable drain wires and shields do not make contact with the junction box or the transmitter housing. Improper installation of cable or cable glands could cause inaccurate measurements or flow meter failure.

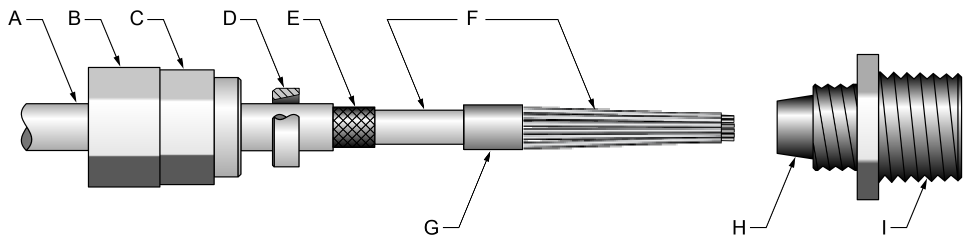
⚠ CAUTION!

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Procedure

1. Identify the components of the cable gland and cable.

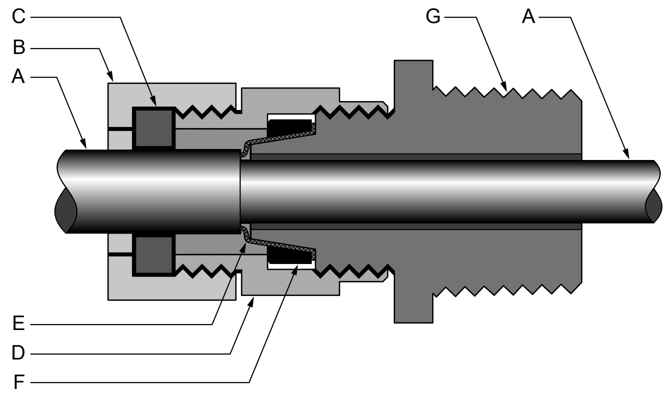
Figure 5-20: Cable gland and cable (exploded view)



A. Cable
B. Sealing nut
C. Compression nut
D. Brass compression ring
E. Braided shield
F. Cable
G. Tape or heat-shrink tubing
H. Clamp seat (shown as integral to nipple)
I. Nipple

2. Unscrew the nipple from the compression nut.
3. Screw the nipple into the conduit opening for the 9-wire cable. Tighten it to one turn past hand-tight.
4. Slide the compression ring, compression nut, and sealing nut onto the cable. Make sure the compression ring is oriented so the taper will mate properly with the tapered end of the nipple.
5. Pass the cable end through the nipple so the braided shield slides over the tapered end of the nipple.
6. Slide the compression ring over the braided shield.
7. Screw the compression nut onto the nipple. Tighten the sealing nut and compression nut by hand to ensure that the compression ring traps the braided shield.
8. Use a 25-mm (1-inch) wrench to tighten the sealing nut and compression nut to 20–25 foot-pounds (27–34 N-m) of torque.

Figure 5-21: Cross-section of assembled cable gland with cable



A. Cable
B. Sealing nut
C. Seal
D. Compression nut
E. Braided shield
F. Brass compression ring
G. Nipple

9. Remove the junction box cover and remote core processor end-cap.
10. At both the sensor and remote core processor, connect the cable according to the following procedure:

    a. Insert the stripped end of each wire into the corresponding terminal at the sensor and remote core processor ends, matching by color. No bare wires should remain exposed.

Table 5-7: Sensor and remote core processor terminal designations

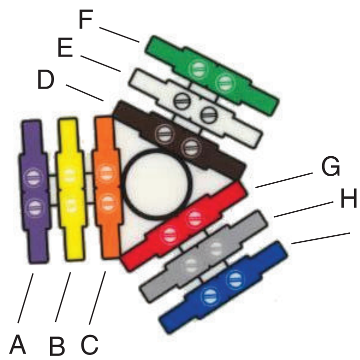
Wire color	Sensor terminal	Remote core processor terminal	Function
Black	No connection	Ground screw (see notes)	Drain wires
Brown	1	1	Drive +
Red	2	2	Drive –
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff –

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

c. Ensure integrity of gaskets, grease all O-rings, then replace the junction box cover and remote core processor end-cap and tighten all screws, as required.

5.7.1 Sensor and remote core processor terminals

Figure 5-22: All ELITE, H-Series, and T-Series sensor, and 2005 or newer F-Series sensor terminals



A. *Violet*
B. *Yellow*
C. *Orange*
D. *Brown*
E. *White*
F. *Green*
G. *Red*
H. *Gray*
I. *Blue*

Figure 5-23: All Model D and Model DL, and pre-2005 F-Series sensor terminals

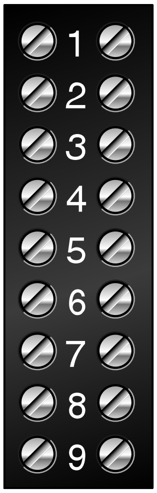
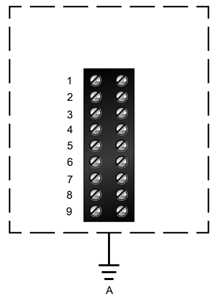
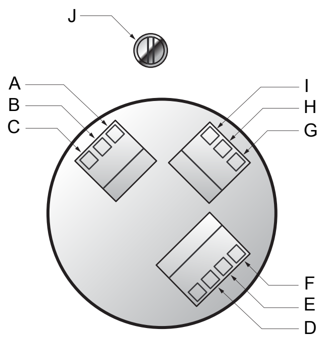


Figure 5-24: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. *Earth ground*

Figure 5-25: Remote core processor terminals

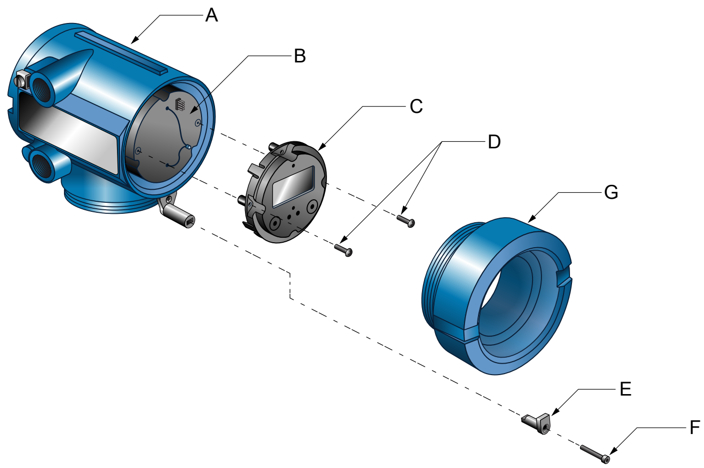


A. *Brown*
B. *Violet*
C. *Yellow*
D. *Orange*
E. *Gray*
F. *Blue*
G. *White*
H. *Green*
I. *Red*
J. *Ground screw (black)*

5.8 Rotate the user interface on the transmitter (optional)

The user interface on the transmitter electronics module can be rotated 90º or 180° from the original position.

Figure 5-26: Display components



A. Transmitter housing
B. Sub-bezel
C. Display module
D. Display screws
E. End-cap clamp
F. Cap screw
G. Display cover

Procedure

1. Shut off power to the unit.
2. Remove the end-cap clamp by removing the cap screw.
3. Turn the display cover counterclockwise to remove it from the main enclosure.
4. Carefully loosen (and remove if necessary) the semicaptive display screws while holding the display module in place.
5. Carefully pull the display module out of the main enclosure until the sub-bezel pin terminals are disengaged from the display module.

Note
If the display pins come out of the board stack with the display module, remove the pins and reinstall them.

6. Rotate the display module to the desired position.
7. Insert the sub-bezel pin terminals into the display module pin holes to secure the display in its new position.
8. If you have removed the display screws, line them up with the matching holes on the sub-bezel, then reinsert and tighten them.
9. Place the display cover onto the main enclosure.
10. Turn the display cover clockwise until it is snug.

11. Replace the end-cap clamp by reinserting and tightening the cap screw.
12. Restore power to the transmitter.

5.9 Ground the meter components

In a remote core processor with remote sensor installation, the transmitter, remote core processor, and sensor are all grounded separately.

Prerequisites

⚠ CAUTION!

Improper grounding could cause inaccurate measurements or meter failure.

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

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

Procedure

1. Ground the sensor according to the instructions in the sensor documentation.
2. Ground the transmitter according to applicable local standards, using the transmitter's internal or external ground screw.

Figure 5-27: Transmitter internal grounding screw

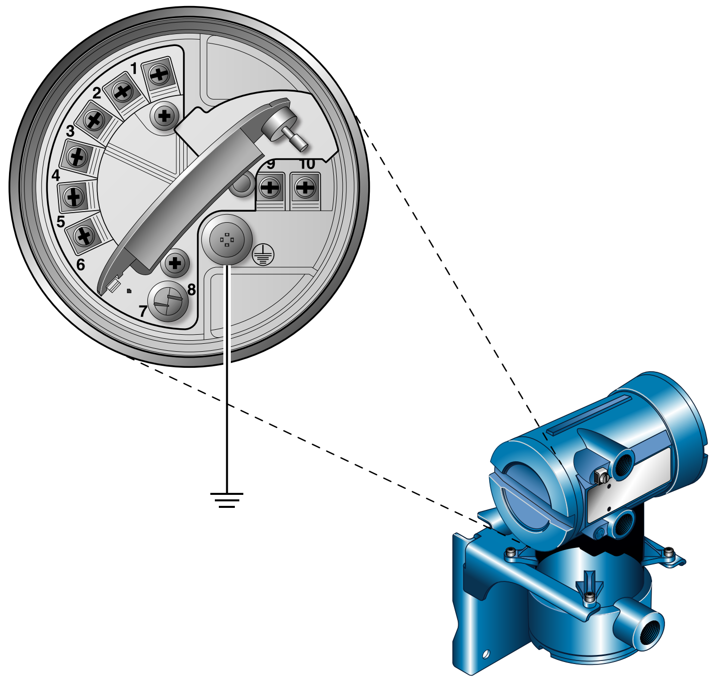
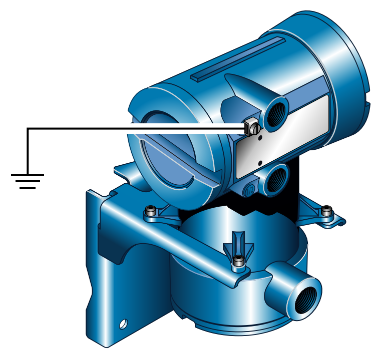
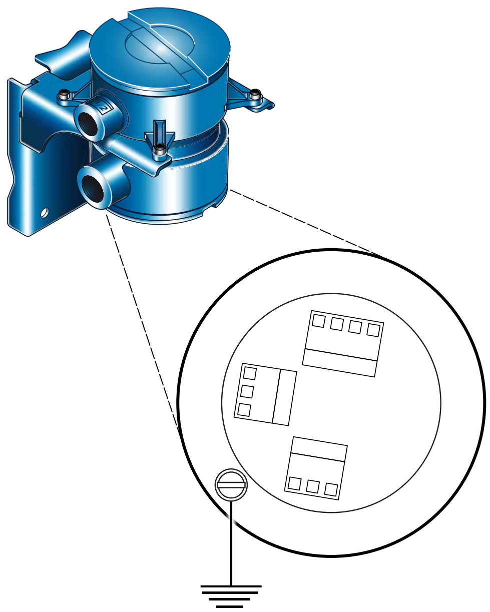


Figure 5-28: Transmitter external grounding screw



3. Ground the remote core processor according to applicable local standards, using the remote core processor's internal ground screw.

Figure 5-29: Remote core processor internal ground screw



6 Wiring the power supply

6.1 Wire the power supply

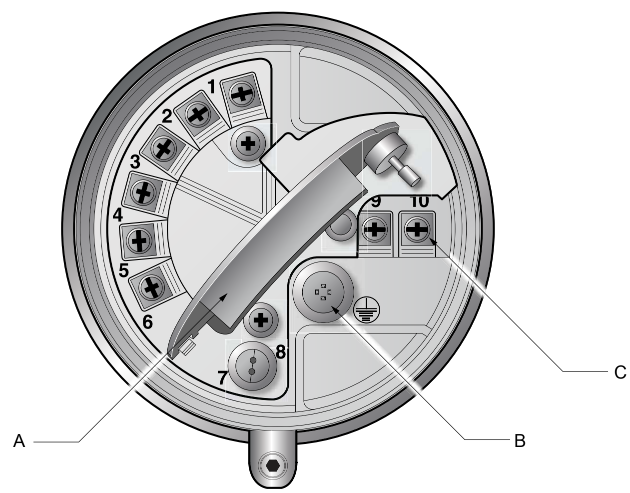
A user-supplied switch may be installed in the power supply line. For compliance with low-voltage directive 2006/95/EC (European installations), a switch in close proximity to the transmitter is required.

Procedure

1. Remove the transmitter housing cover.
2. Open the warning flap.
3. Connect the power supply wires to terminals 9 and 10.

   Terminate the positive (line) wire on terminal 10 and the return (neutral) wire on terminal 9.

Figure 6-1: Power supply wiring terminals



A. Warning flap
B. Equipment ground
C. Power supply wiring terminals (9 and 10)

4. Ground the power supply using the equipment ground, also under the warning flap.

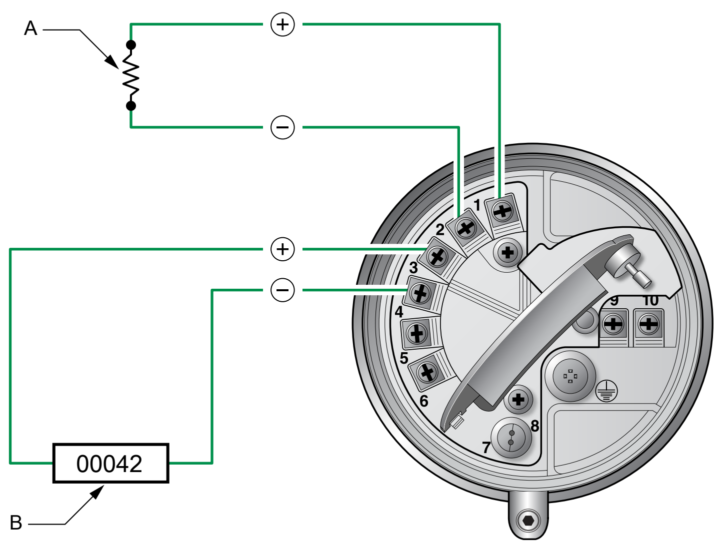
7 I/O wiring for Model 1700 and Model 2700 transmitters with analog outputs

Topics covered in this chapter:

- *Basic analog wiring*
- *HART/analog single loop wiring*
- *RS-485 point-to-point wiring*
- *HART multidrop wiring*

7.1 Basic analog wiring

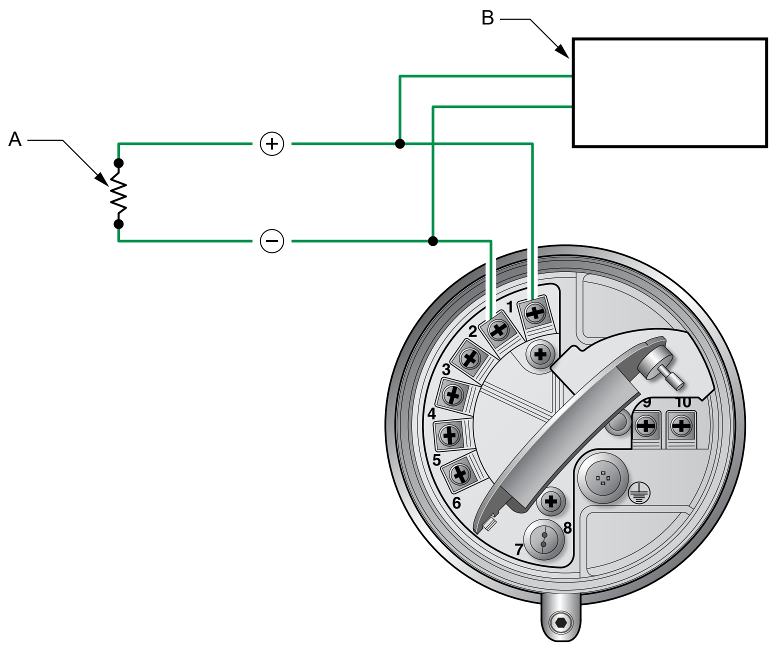
Figure 7-1: Basic analog wiring



A. *mA output loop (820 Ω maximum loop resistance)*
B. *Frequency receiving device (output voltage level is +24 VDC ± 3%, with a 2.2 kΩ pull-up resistor)*

7.2 HART/analog single loop wiring

Figure 7-2: HART/analog single loop wiring



A. 820 Ω maximum loop resistance
B. HART-compatible host or controller

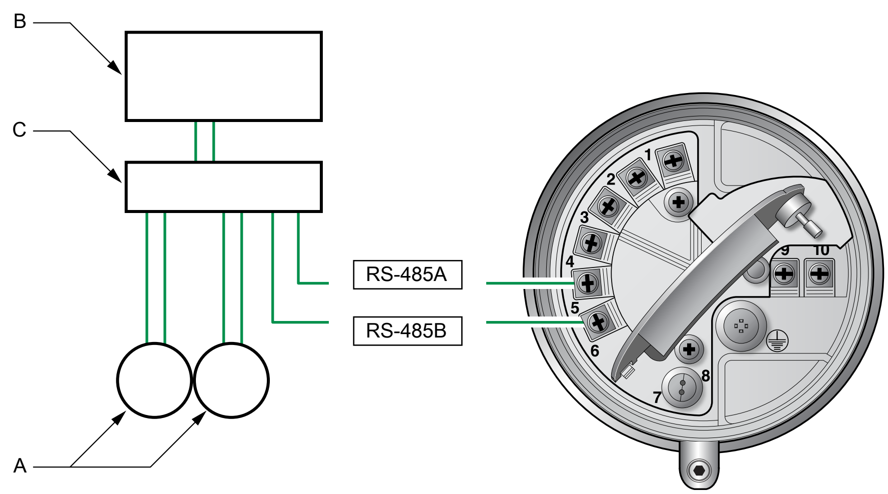
Note

For HART communications:

- 600 Ω maximum loop resistance
- 250 Ω minimum loop resistance

7.3 RS-485 point-to-point wiring

Figure 7-3: RS-485 point-to-point wiring



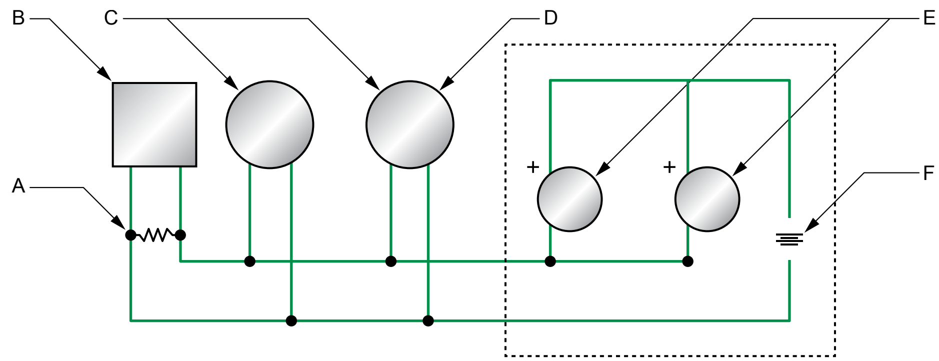
A. Other devices
B. Primary controller
C. Multiplexer

7.4 HART multidrop wiring

Tip

For optimum HART communication, single-point ground the output loop to an instrument-grade ground.

Figure 7-4: HART multidrop wiring



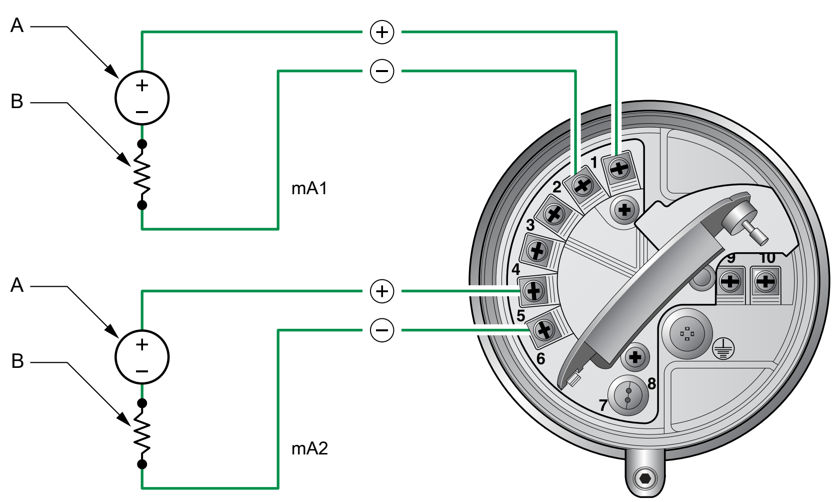
A. 250–600 Ω resistance
B. HART-compatible host or controller
C. HART-compatible transmitters
D. Model 1700 or Model 2700 transmitter
E. SMART FAMILY™ transmitters
F. 24 VDC loop power supply required for passive transmitters

8 I/O wiring for Model 1700 and Model 2700 transmitters with intrinsically safe outputs

Topics covered in this chapter:

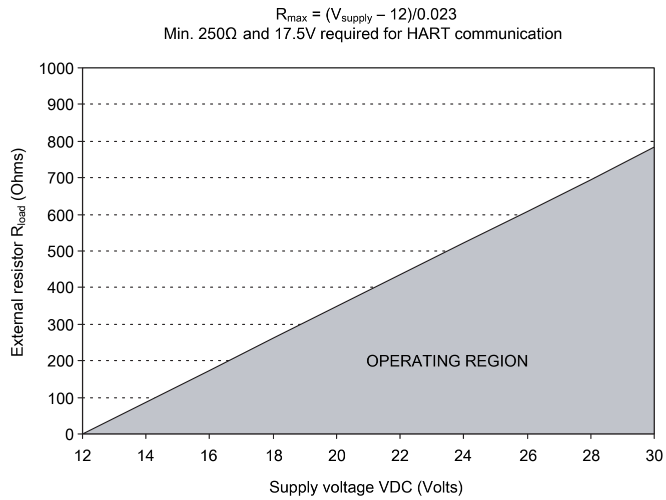
8.1 Safe area mA output wiring

Figure 8-1: Safe area mA output wiring



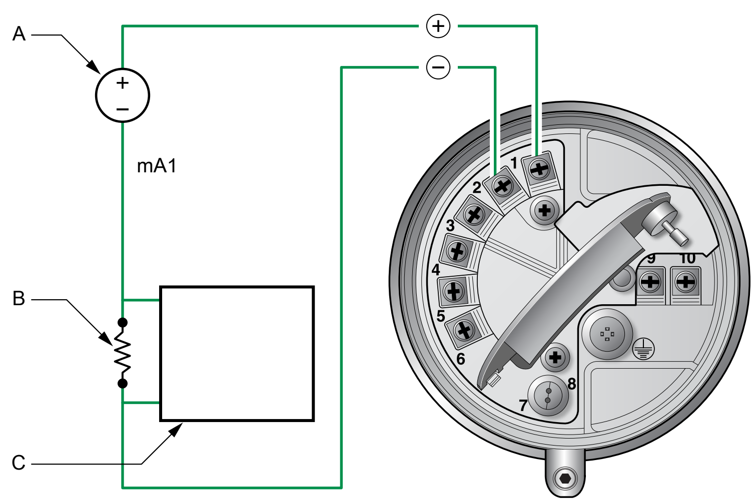
A. *External DC power supply (VDC)*
B. *R_{load}*

Figure 8-2: Safe area mA output load resistance values



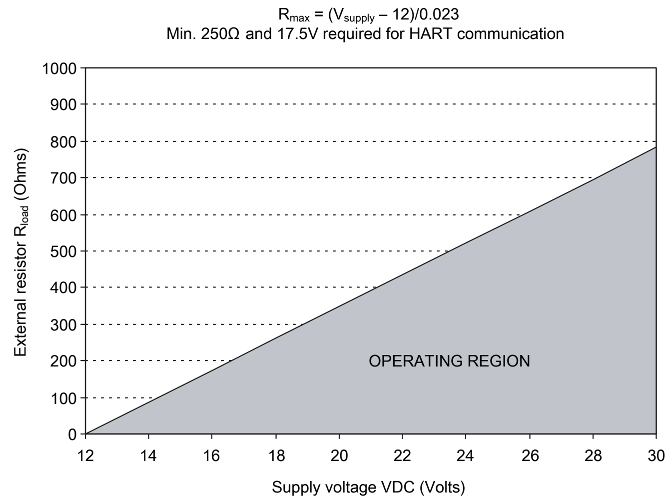
8.2 Safe area HART/analog single-loop wiring

Figure 8-3: Safe area HART/analog single-loop wiring



A. External DC power supply (VDC)
B. R_{load} (250–600 Ω resistance)
C. HART-compatible host or controller

Figure 8-4: Safe area mA output load resistance values

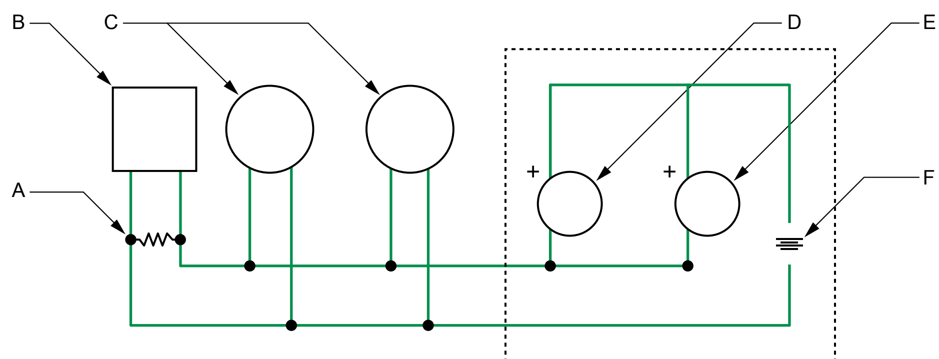


8.3 Safe area HART multidrop wiring

Tip

For optimum HART communication, single-point ground the output loop to an instrument-grade ground.

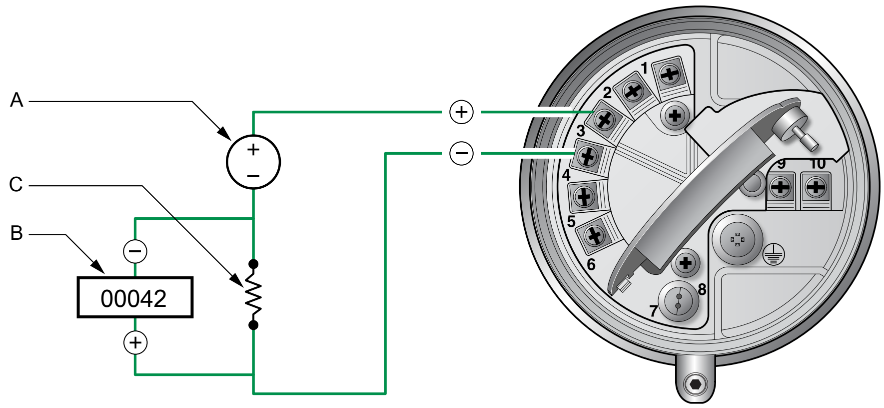
Figure 8-5: Safe area HART multidrop wiring



A. *250–600 Ω resistance*
B. *HART-compatible host or controller*
C. *HART-compatible transmitters*
D. *Model 1700 or Model 2700 transmitter with intrinsically safe outputs*
E. *SMART FAMILY transmitter*
F. *24 VDC loop power supply required for HART 4–20 mA passive transmitters*

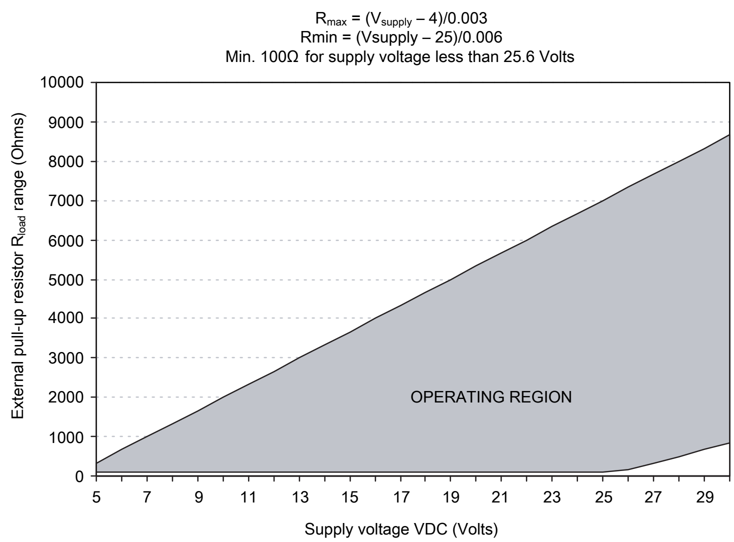
8.4 Safe area frequency output/discrete output wiring

Figure 8-6: Safe area frequency output/discrete output wiring



A. *External DC power supply (VDC)*
B. *Counter*
C. *R_{load}*

Figure 8-7: Safe area frequency output/discrete output load resistance values



8.5 Hazardous area wiring

Information provided about I.S. barriers is intended as an overview. Application-specific or product-specific questions should be addressed to the barrier manufacturer or Micro Motion.

⚠ DANGER!

Hazardous voltage can cause severe injury or death. Shut off the power before wiring transmitter outputs.

⚠ DANGER!

Improper wiring in a hazardous environment can cause an explosion. Install the transmitter only in an area that complies with the hazardous classification tag on the transmitter.

Table 8-1: Safety parameters

Parameter	4–20 mA	Frequency/discrete
Voltage (U_i)	30 V	30 V
Current (I_i)	300 mA	100 mA
Power (P_i)	1.0 W	0.75 W
Capacitance (C_i)	0.0005 μF	0.0005 μF
Inductance (L_i)	0.0 mH	0.0 mH

Voltage The transmitter's safety parameters require the selected barrier's open-circuit voltage to be limited to less than 30 VDC (V_{max} = 30 VDC). This voltage is the combination of the maximum safety barrier voltage (typically 28 VDC) plus an additional 2 VDC for HART communications when communicating in the hazardous area.

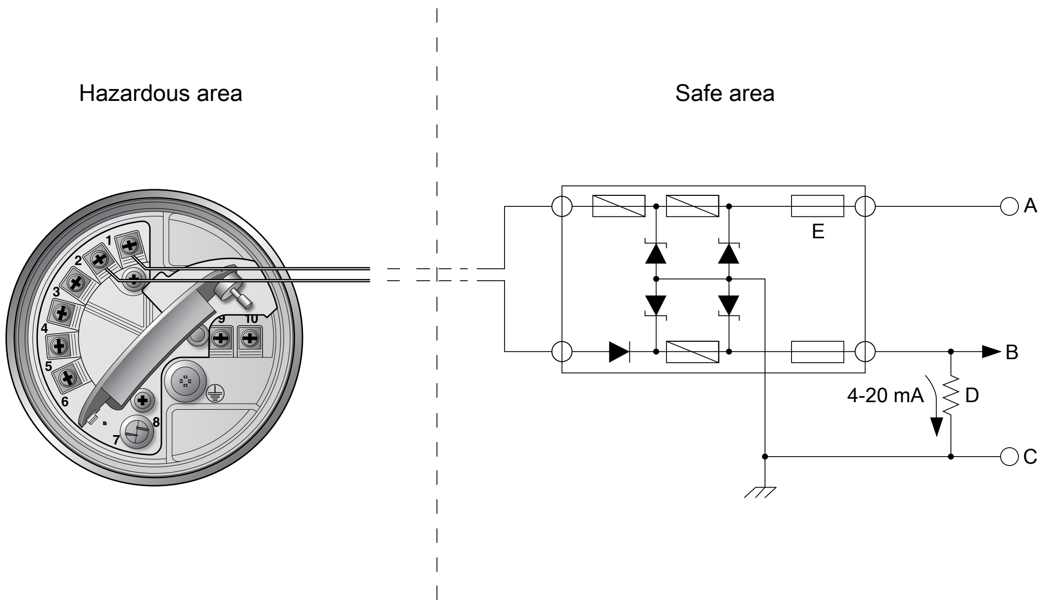
Current The transmitter's safety parameters require the selected barrier's short-circuit currents to sum to less than 300 mA (I_{max} = 300 mA) for the milliamp outputs and 100 mA (I_{max} = 100 mA) for the frequency/discrete output.

Capacitance The capacitance (C_i) of the transmitter is 0.0005 μF. This value added to the wire capacitance (C_{cable}) must be lower than the maximum allowable capacitance (C_o) specified by the I.S. barrier. Use the following equation to calculate the maximum length of the cable between the transmitter and the barrier: $C_i + C_{cable} \leq C_o$

Inductance The inductance (L_i) of the transmitter is 0.0 mH. This value plus the field wiring inductance (L_{cable}), must be lower than the maximum allowable inductance (L_o) specified by the I.S. barrier. The following equation can then be used to calculate the maximum cable length between the transmitter and the barrier: $L_i + L_{cable} \leq L_o$

8.5.1 Hazardous area mA output wiring

Figure 8-8: Hazardous area mA output wiring

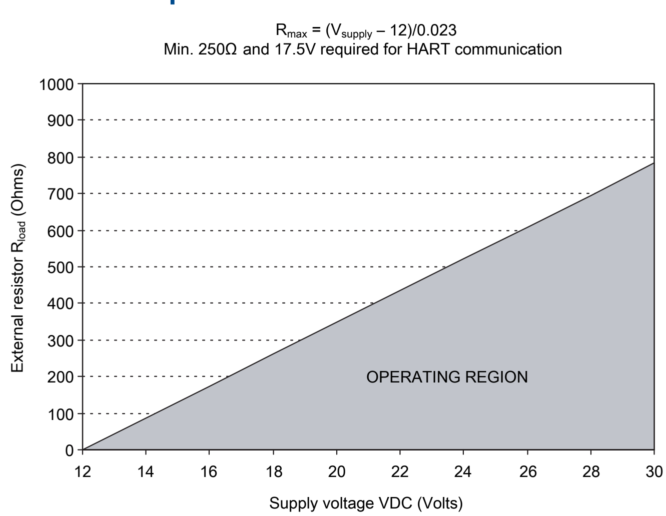


A. V_{in}
B. V_{out}
C. Ground
D. R_{load}
E. $R_{barrier}$

Note

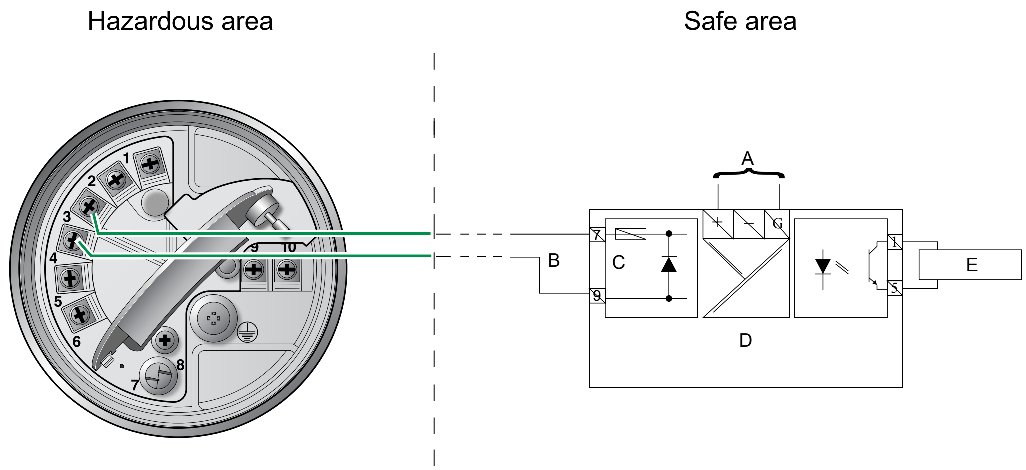
Add R_{load} and $R_{barrier}$ to determine V_{in}.

Figure 8-9: Safe area mA output load resistance values



8.5.2 Hazardous area frequency/discrete output wiring using galvanic isolator

Figure 8-10: Hazardous area frequency/discrete output wiring using galvanic isolator



- A. *External power supply*
- B. *V_{out}*
- C. *R_{load}*
- D. *Galvanic isolator (see note)*
- E. *Counter*

Note

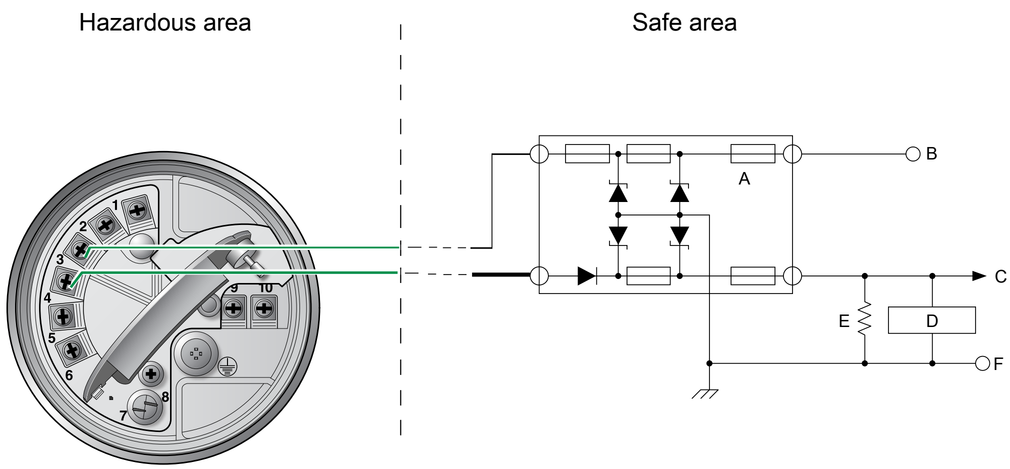
The galvanic isolator shown here has an internal 1000 Ω resistor used for sensing current:

- *ON > 2.1 mA*
- *OFF < 1.2 mA*

These current switching levels comply with DIN19234 (NAMUR)/DIN EN 60947-5-6/IEC 60947-5-6.

8.5.3 Hazardous area frequency/discrete output wiring using barrier with external load resistance

Figure 8-11: Hazardous area frequency/discrete output wiring using barrier with external load resistance

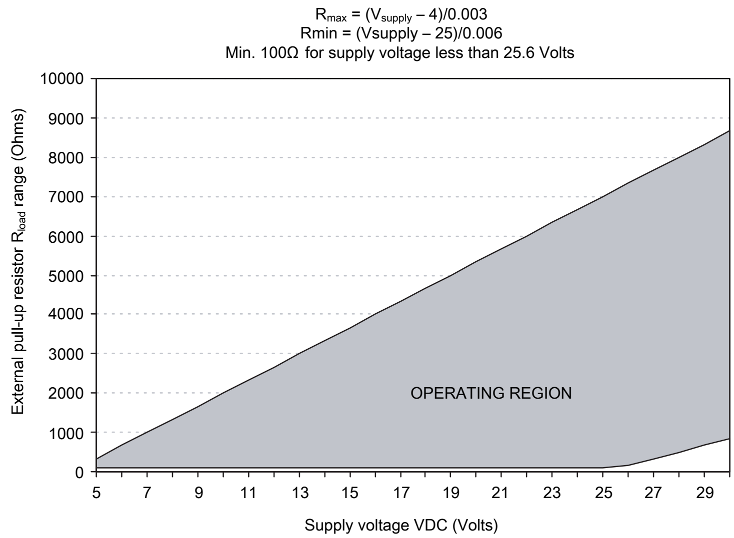


A. $R_{barrier}$
B. V_{in}
C. V_{out}
D. Counter
E. R_{load}
F. Ground

Note

Add $R_{barrier}$ and R_{load} to determine V_{in}.

Figure 8-12: Safe area frequency output/discrete output load resistance values



9 I/O wiring for Model 2700 transmitters with configurable input/outputs

Topics covered in this chapter:

9.1 Channel configuration

The six wiring terminals are divided into three pairs, and called Channels A, B, and C. Channel A is terminals 1 and 2; Channel B is terminals 3 and 4; Channel C is terminals 5 and 6. Variable assignments are governed by channel configuration.

Table 9-1: Channel configuration

Channel	Terminals	Configuration options	Power
A	1, 2	mA output with HART/Bell202	Internal
B	3, 4	mA output (default)	Internal
		Frequency output	Internal or external
		Discrete output	Internal or external
C	5, 6	Frequency output (default)	Internal or external
		Discrete output	Internal or external
		Discrete input	Internal or external

Notes

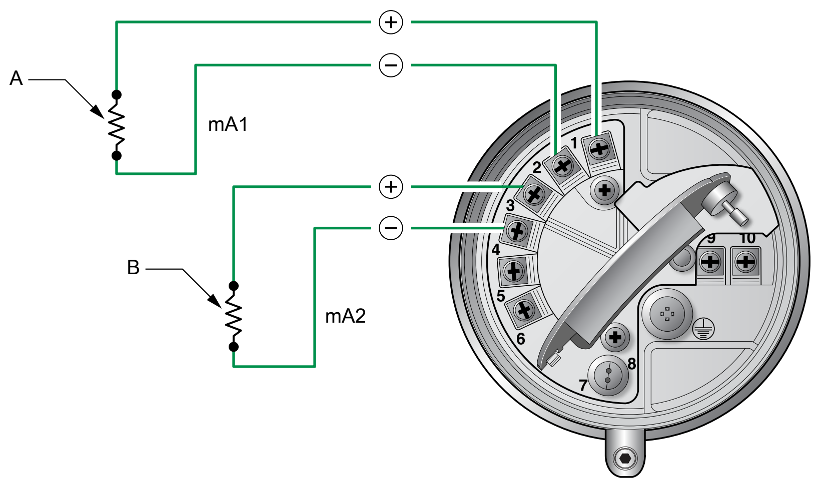
- For Channel A, the Bell 202 signal is superimposed on the mA output.
- You must provide power to the outputs when a channel is set to external power.
- When both Channel B and Channel C are configured for frequency output (dual pulse), frequency output 2 is generated from the same signal that is sent to the first frequency output. Frequency output 2 is electrically isolated but not independent.

- You cannot configure the combination of Channel B as discrete output and Channel C as frequency output.

9.2 mA/HART wiring

9.2.1 Basic mA output wiring

Figure 9-1: Basic mA output wiring



A. 820 Ω maximum loop resistance
B. 420 Ω maximum loop resistance

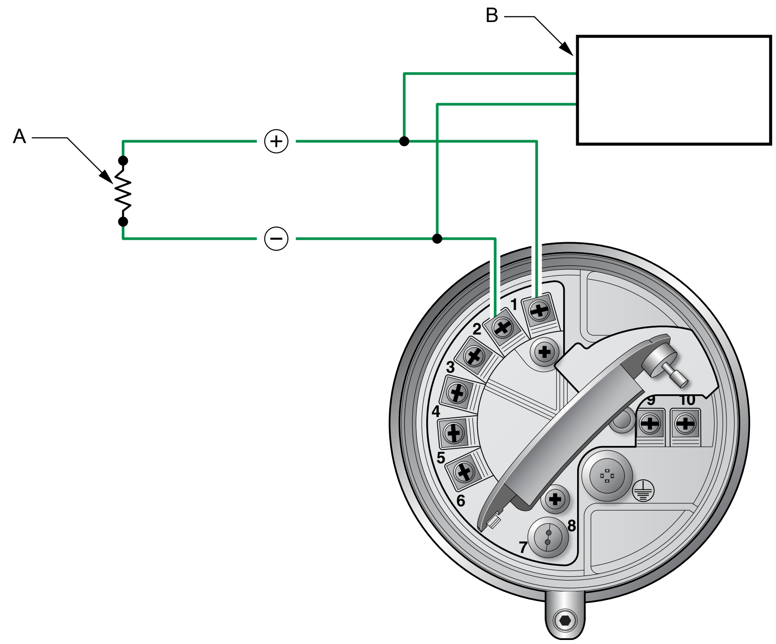
9.2.2 HART/analog single loop wiring

Note

For HART communications:

- 600 Ω maximum loop resistance
- 250 Ω minimum loop resistance

Figure 9-2: HART/analog single loop wiring



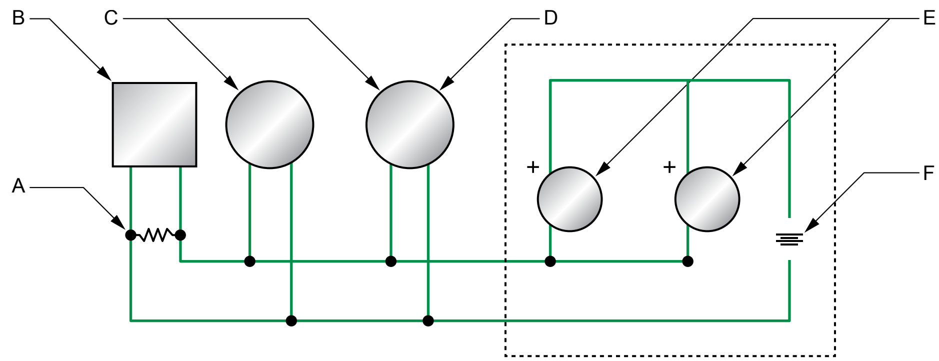
A. 820 Ω maximum loop resistance
B. HART-compatible host or controller

9.2.3 HART multidrop wiring

Tip

For optimum HART communication, single-point ground the output loop to an instrument-grade ground.

Figure 9-3: HART multidrop wiring

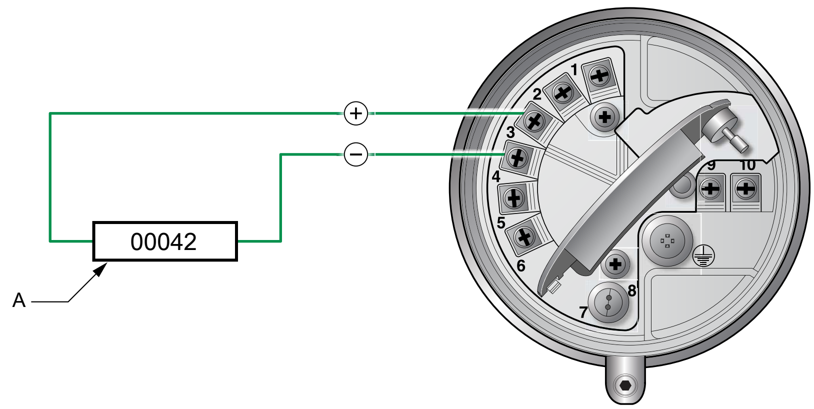


A. 250–600 Ω resistance
B. HART-compatible host or controller
C. HART-compatible transmitters
D. Model 2700 configurable I/O transmitter (internally powered outputs)
E. SMART FAMILY transmitters
F. 24 VDC loop power supply required for HART 4–20 mA passive transmitters

9.3 Frequency output wiring

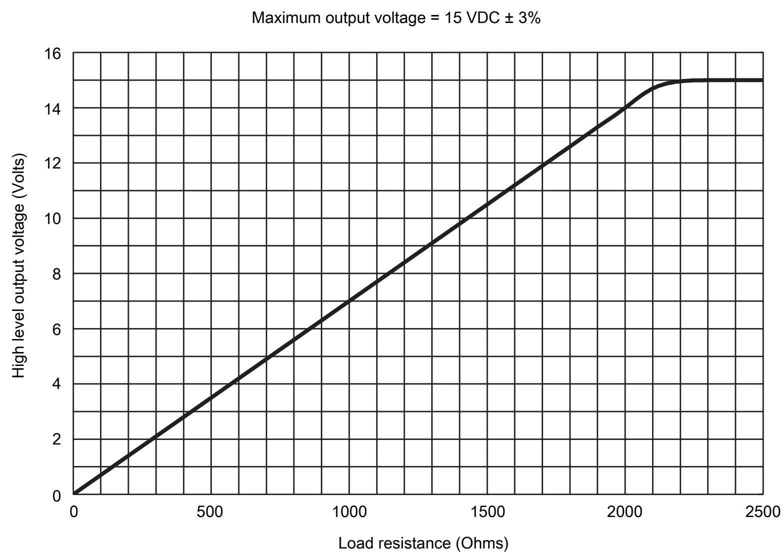
9.3.1 Internally powered frequency output wiring on Channel B

Figure 9-4: Internally powered frequency output wiring on Channel B



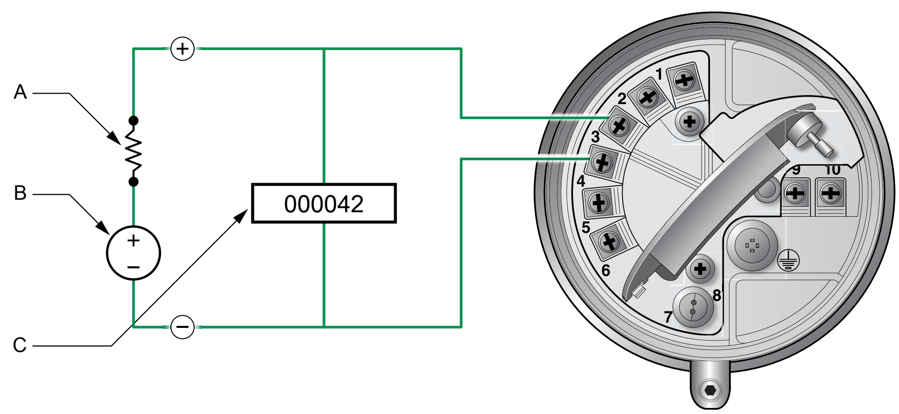
A. Counter

Figure 9-5: Output voltage versus load resistance



9.3.2 Externally powered frequency output wiring on Channel B

Figure 9-6: Externally powered frequency output wiring on Channel B

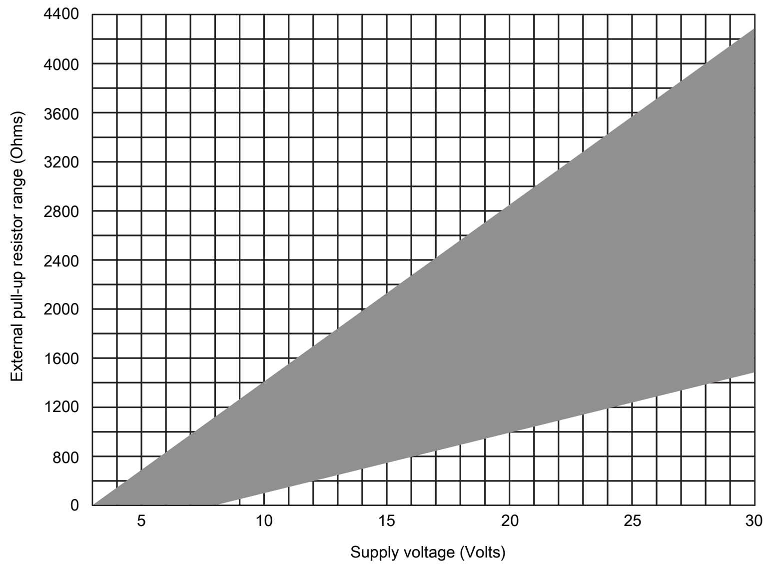


A. Pull-up resistor
B. External DC power supply (3–30 VDC)
C. Counter

⚠ **CAUTION!**

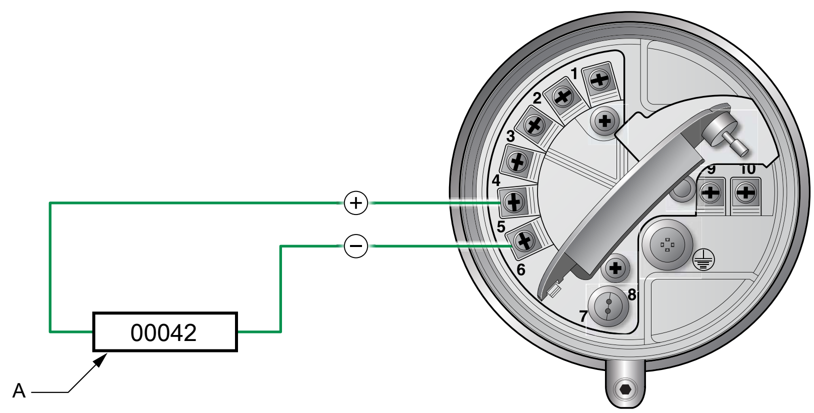
Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

Figure 9-7: Recommended pull-up resistor versus supply voltage



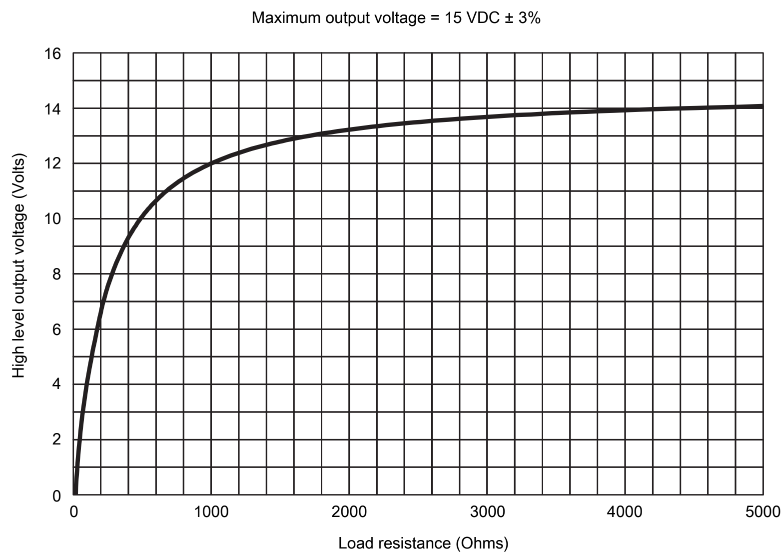
9.3.3 Internally powered frequency output wiring on Channel C

Figure 9-8: Internally powered frequency output wiring on Channel C



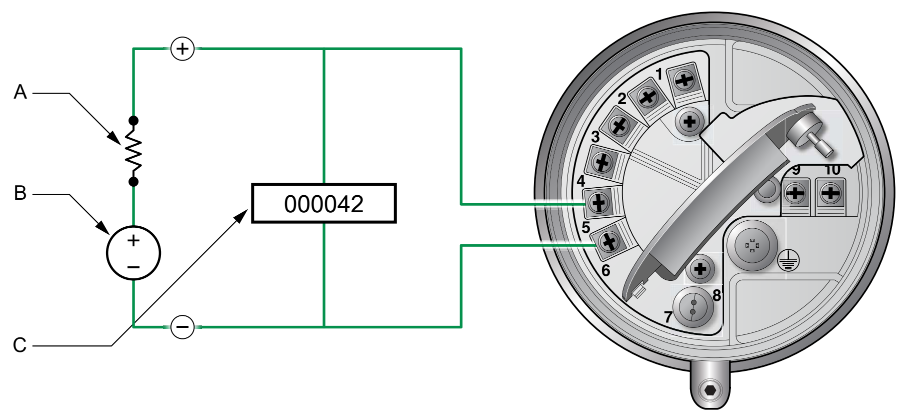
A. Counter

Figure 9-9: Output voltage versus load resistance



9.3.4 Externally powered frequency output wiring on Channel C

Figure 9-10: Externally powered frequency output wiring on Channel C

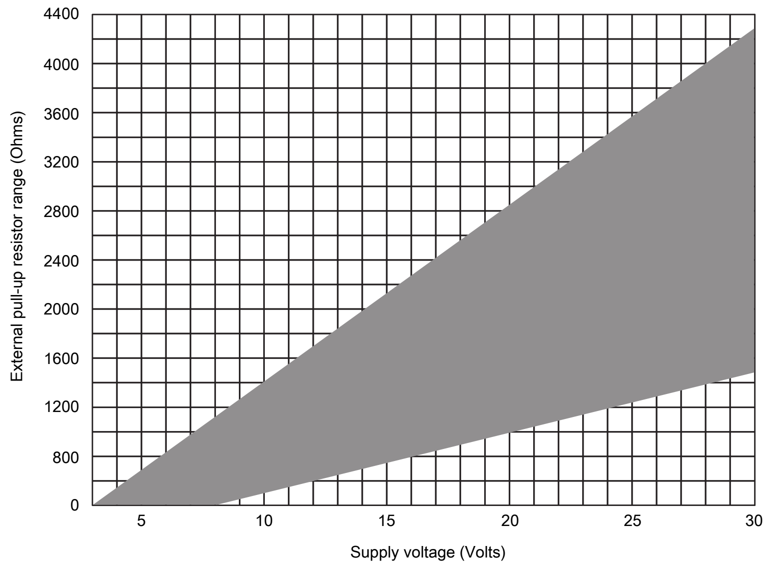


A. Pull-up resistor
B. External DC power supply (3–30 VDC)
C. Counter

⚠ CAUTION!

Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

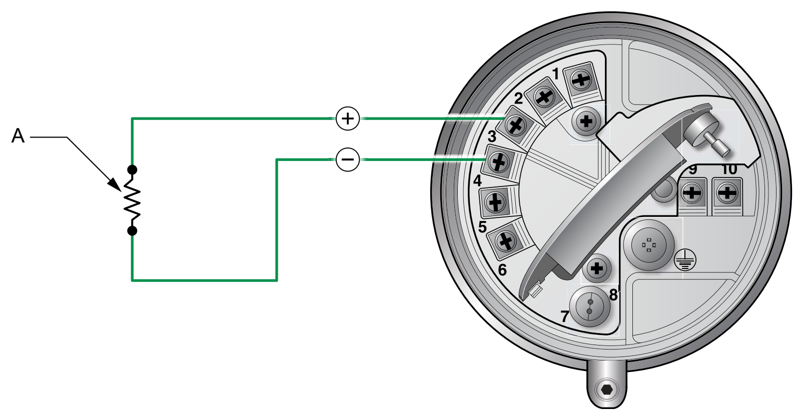
Figure 9-11: Recommended pull-up resistor versus supply voltage



9.4 Discrete output wiring

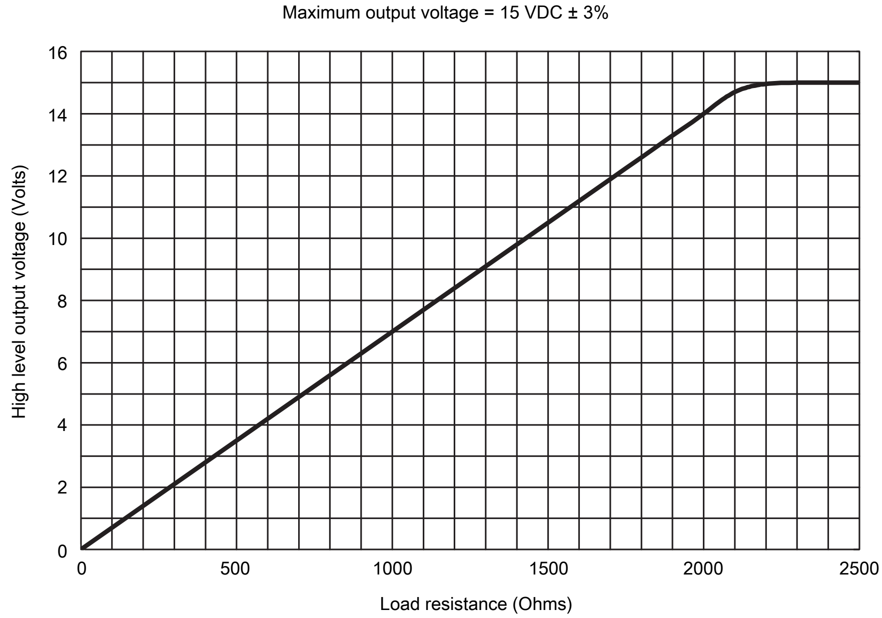
9.4.1 Internally powered discrete output wiring on Channel B

Figure 9-12: Internally powered discrete output wiring on Channel B



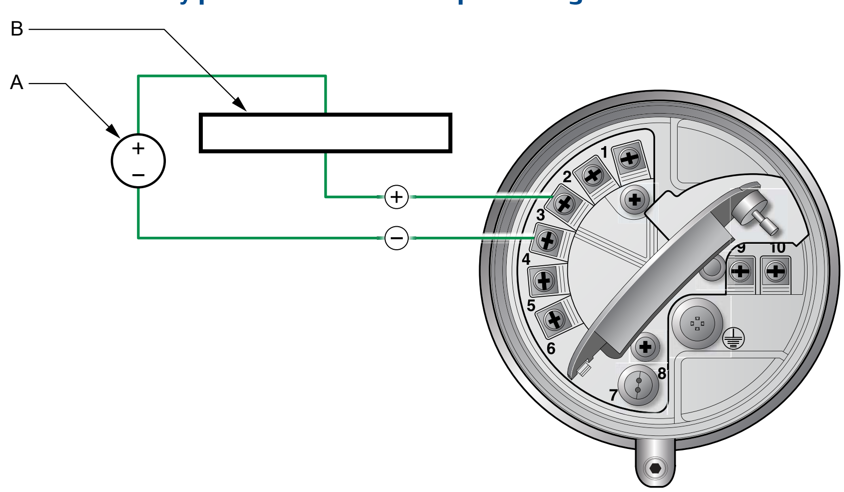
A. Total load

Figure 9-13: Output voltage versus load resistance



9.4.2 Externally powered discrete output wiring on Channel B

Figure 9-14: Externally powered discrete output wiring on Channel B

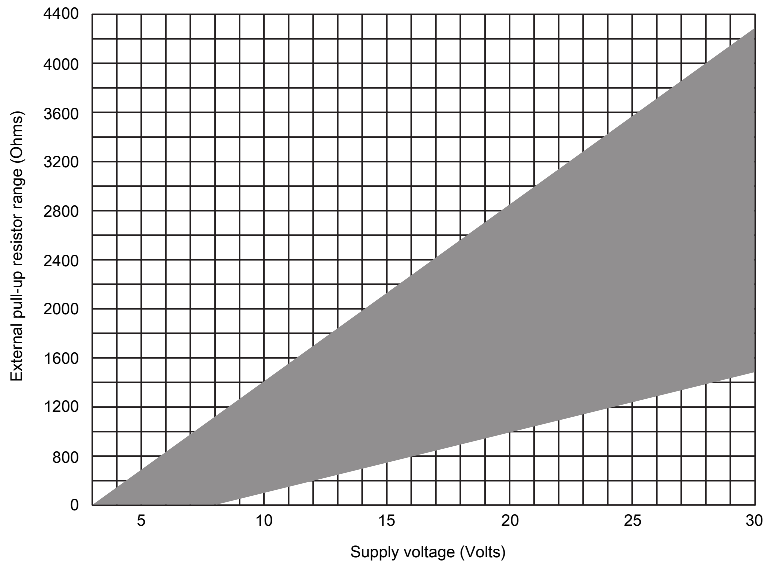


A. External DC power supply (3–30 VDC)
B. Pull-up resistor or DC relay

⚠ CAUTION!

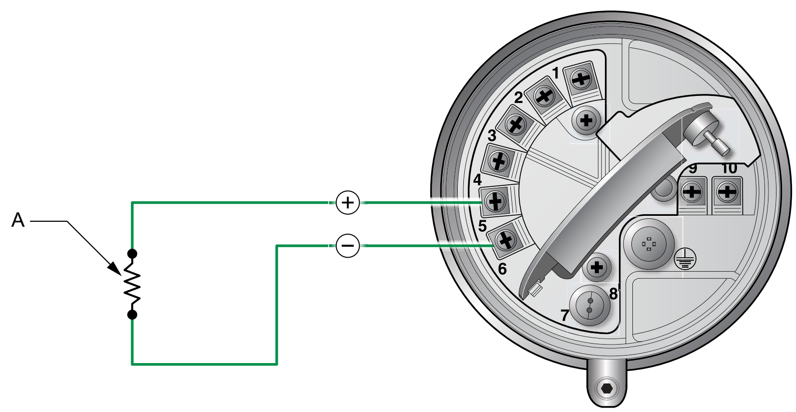
Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

Figure 9-15: Recommended pull-up resistor versus supply voltage



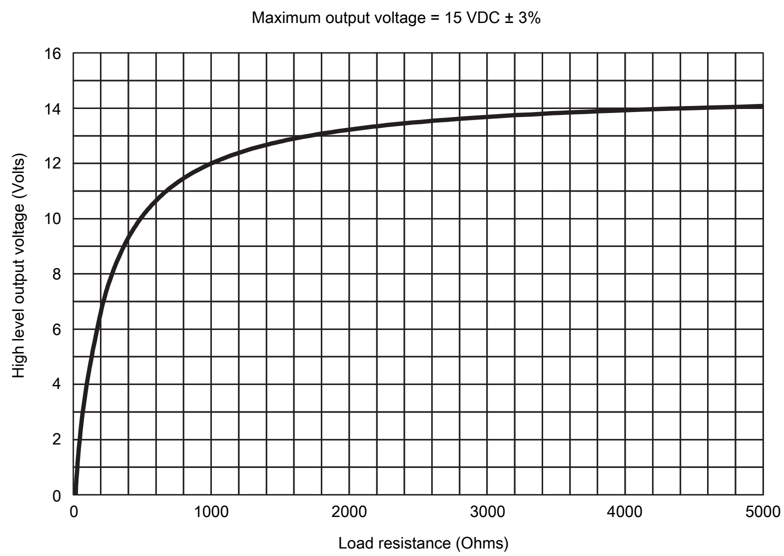
9.4.3 Internally powered discrete output wiring on Channel C

Figure 9-16: Internally powered discrete output wiring on Channel C



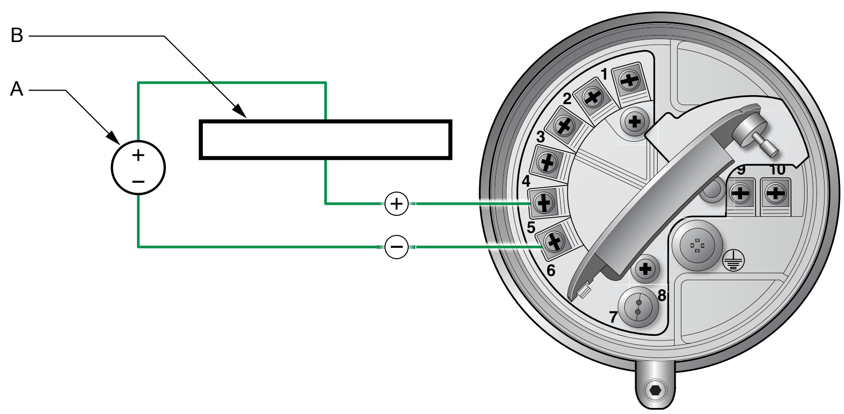
A. Total load

Figure 9-17: Output voltage versus load resistance



9.4.4 Externally powered discrete output wiring on Channel C

Figure 9-18: Externally powered discrete output wiring on Channel C

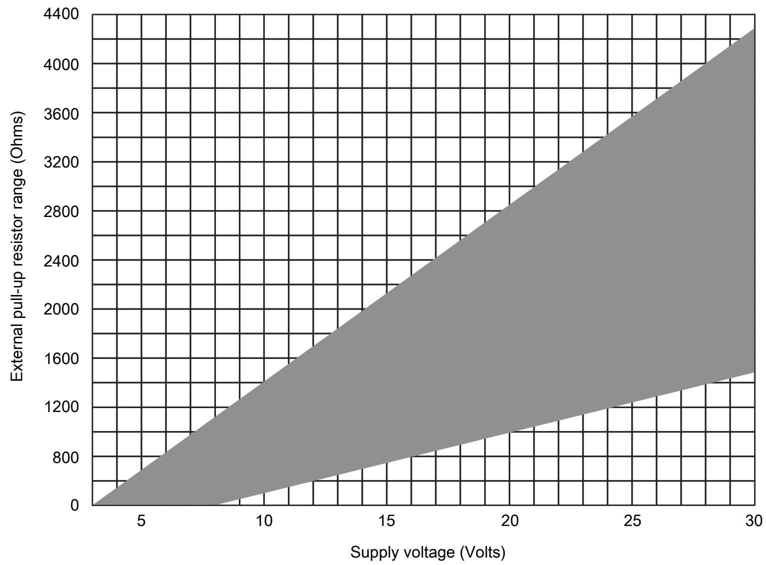


A. External DC power supply (3–30 VDC)
B. Pull-up resistor or DC relay

⚠ CAUTION!

Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

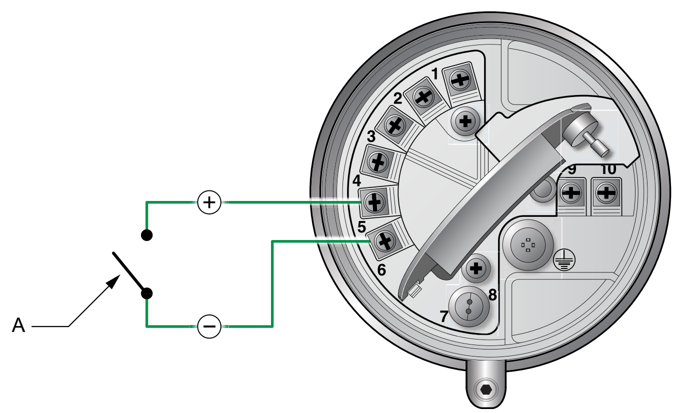
Figure 9-19: Recommended pull-up resistor versus supply voltage



9.5 Discrete input wiring

9.5.1 Internally powered discrete input wiring

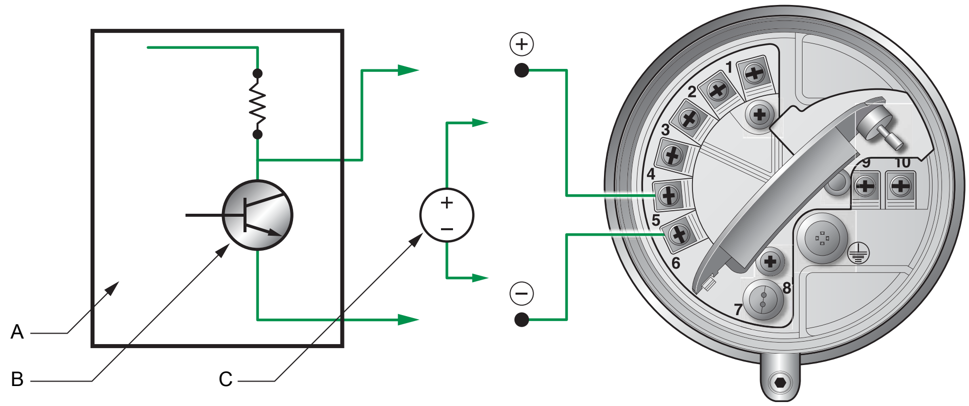
Figure 9-20: Internally powered discrete input wiring



A. Switch

9.5.2 Externally powered discrete input wiring

Figure 9-21: Externally powered discrete input wiring



A. PLC or other device
B. External DC Power Supply (VDC)
C. Direct DC input

Power is supplied by either a PLC/other device or by direct DC input.

Table 9-2: Input voltage ranges for external power

VDC	Range
3–30	High level
0–0.8	Low level
0.8–3	Undefined

10 I/O wiring for Model 2700 transmitters with Foundation fieldbus or PROFIBUS-PA

Topics covered in this chapter:

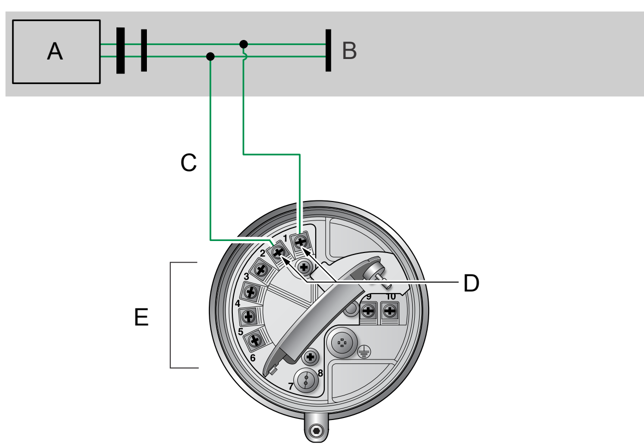
- *Foundation fieldbus wiring*
- *PROFIBUS-PA wiring*

10.1 Foundation fieldbus wiring

See the following wiring diagram, and refer to the Foundation fieldbus wiring specification.

Important
The transmitter is either FISCO or FNICO approved. For FISCO-approved transmitters, a barrier is required.

Figure 10-1: Foundation fieldbus wiring diagram



A. Bus power supply
B. Foundation fieldbus network per Foundation fieldbus wiring specification
C. Spur to network per Foundation fieldbus wiring specification
D. Terminals 1 and 2
E. Terminals 3 – 6 (unused)

Note
The fieldbus communication terminals (1 and 2) are not polarity-sensitive.

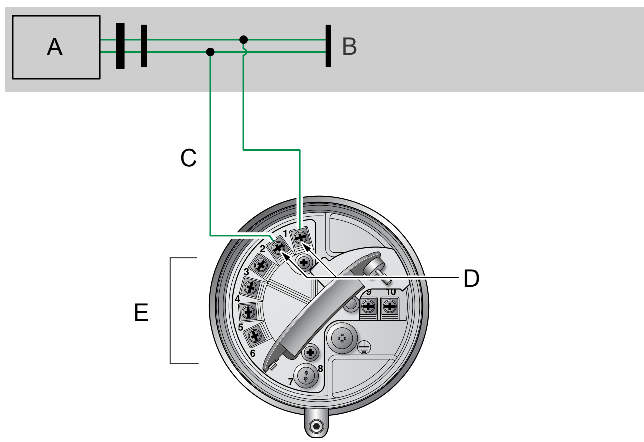
10.2 PROFIBUS-PA wiring

See the following wiring diagram, and refer to the *PROFIBUS-PA User and Installation Guideline* published by PNO.

Important

- The transmitter is FISCO approved.
- For intrinsically safe wiring, see the *PROFIBUS-PA User and Installation Guideline*.

Figure 10-2: PROFIBUS-PA wiring diagram



A. Bus power supply
B. PROFIBUS-PA segment per PROFIBUS-PA User and Installation Guideline
C. Spur to PROFIBUS-PA segment per PROFIBUS-PA User and Installation Guideline
D. Terminals 1 and 2
E. Terminals 3 – 6 (unused)

Note

The PROFIBUS communication terminals (1 and 2) are not polarity-sensitive.

11 Specifications

Topics covered in this chapter:

11.1 Electrical connections

Table 11-1: Electrical connections

Type	Description
Input/output connections	Three pairs of wiring terminals for transmitter outputs. Screw connectors accept one or two solid conductors, 14 to 12 AWG (2.5 to 4.0 mm^2); or one or two stranded conductors, 22 to 14 AWG (0.34 to 2.5 mm^2).
Power connections	One pair of wiring terminals accepts AC or DC power. One internal ground lug for power-supply ground wiring. Screw connectors accept one or two solid conductors, 14 to 12 AWG (2.5 to 4.0 mm^2); or one or two stranded conductors, 22 to 14 AWG (0.34 to 2.5 mm^2).
Digital communications maintenance connections	Two clips for temporary connection to the service port.
Core processor connection	The transmitter has two pairs of terminals for the 4-wire connection to the sensor-mounted core processor: • One pair is used for the RS-485 connection to the core processor • One pair is used to supply power to the core processor Plug terminals accept solid or stranded conductors, 24 to 12 AWG (0.40 to 3.5 mm^2).
Power	Self-switching AC/DC input, automatically recognizes supply voltage • 85 to 265 VAC, 50/60 Hz, 6 watts typical, 11 watts maximum • 18 to 100 VDC, 6 watts typical, 11 watts maximum • Complies with low voltage directive 2006/95/EC per EN 61010-1 (IEC 61010-1) with amendment 2, and Installation (Overvoltage) Category II, Pollution Degree 2

11.2 Input/output signals

Table 11-2: I/O and digital communication for Model 1700 transmitters

Description	Model 1700 with output code	
	A	D
One active 4–20 mA output, not intrinsically safe: • Isolated to ±50 VDC from all other outputs and Earth ground • Maximum load limit: 820 ohms • Can report mass flow or volume flow • Output is linear with process from 3.8 to 20.5 mA, per NAMUR NE43 Version 03.02.2003	✓	
One active frequency/pulse output, not intrinsically safe: • Can report mass flow or volume flow, which can be used to indicate flow rate or total • Reports the same flow variable as the mA output • Scalable to 10,000 Hz • Voltage is +24 VDC ±3% with 2.2 kohm internal pull-up resistor • Linear with flow rate to 12,500 Hz • Configurable polarity: active high or active low • Can be configured as a discrete output to report flow direction and flow switch	✓	
One intrinsically safe passive 4–20mA output: • Maximum input voltage: 30 VDC, 1 watt maximum • Maximum load limit: $R_{max} = (V_{supply} - 12)/0.023$(1) • Can report mass flow or volume flow • Entity parameters: U_i = 30 VDC, I_i = 300 mA, P_i = 1W, Ci = 0.0005 μF, L_i = Less than 0.05mH • Output is linear with process from 3.8 to 20.5 mA, per NAMUR NE43 Version 03.02.2003		✓

One intrinsically safe frequency/pulse output or configurable frequency/pulse/discrete output:
• Maximum input voltage: 30 VDC, 0.75 watt maximum
• Maximum load limit:
  - Rmax = $(V_{supply} - 4)/0.003$
  - Rmin = $(V_{supply} - 25)/0.006$(2)
• Rreports the same flow variable as the mA output
• Frequency output is independent of the mA output
• Scalable to 10,000 Hz
• Entity parameters: U_i = 30 VDC, I_i = 100 mA, P_i = 0.75W, C_i = 0.0005 μF, L_i = Less than 0.05mH
• Output is linear with flow rate to 12,500 Hz
		✓

Service port: • Can be used for temporary connection only • Uses RS-485 Modbus signal, 38.4 kilobaud, one stop bit, no parity	✓	✓

Table 11-2: I/O and digital communication for Model 1700 transmitters *(continued)*

Description	Model 1700 with output code A	D
HART/RS-485, Modbus/RS-485: • One RS-485 output can be used for direct connection to a HART or Modbus host system; accepts data rates between 1200 baud and 38.4 kilobaud • HART revision 5 as default, selectable to HART revision 7	✓(3)	
HART/Bell 202: • HART Bell 202 signal is superimposed on the primary milliamp output, and is available for host system interface. Frequency 1.2 and 2.2 kHz, Amplitude: to 1.0 mA, 1200 baud, Requires 250 to 600 ohms load resistance • HART revision 5 as default, selectable to HART revision 7	✓	✓

(1) If communicating with HART a minimum of 250 ohms and 17.75 V supply is needed .

(2) Absolute minimum = 100 ohms for V_{supply} < 25.6 volts.

(3) Except when ordered with display code 8

Table 11-3: I/O and digital communication for Model 2700 transmitters

Description	Model 2700 with output code A 2	B C 3	D 4	E G	N
• One active 4–20 mA output, not intrinsically safe: - Isolated to ±50 VDC from all other outputs and Earth ground - Maximum load limit: 820 ohms - Can report mass flow, volume flow, density, temperature, or drive gain - Output is linear with process from 3.8 to 20.5 mA, per NAMUR NE43 Version 03.02.2003 • One active frequency/pulse output, not intrinsically safe: - Can report mass flow or volume flow, which can be used to indicate flow rate or total - Independent of mA output - Scalable to 10,000 Hz - Voltage is +24 VDC ±3% with 2.2 kohm internal pull-up resistor - Linear with flow rate to 12,500 Hz - Configurable polarity: active high or active low - Can be configured as a discrete output to report five discrete events, flow direction, flow switch, calibration in progress, or fault.	✓				

Table 11-3: I/O and digital communication for Model 2700 transmitters *(continued)*

Description	Model 2700 with output code				
	A 2	B C 3	D 4	E G	N
Three input/output channels (A, B, and C) that can be configured from the following choices:[4] • One or two active 4–20 mA outputs, not intrinsically safe: - Isolated to ±50 VDC from all other outputs and earth ground - Maximum load limits of mA1: 820 ohms; of mA2: 420 ohms - Can report mass flow, volume flow, density, temperature, or drive gain - Output is linear with process from 3.8 to 20.5 mA, per NAMUR NE43 Version 03.02.2003 • One or two active or passive frequency/pulse outputs, not intrinsically safe - Can report mass flow or volume flow, which can be used to indicate flow rate or total - If configured as a dual pulse output, the channels are electrically isolated but not independent[5] - Scalable to 10,000 Hz - If active, output voltages is +15 VDC ±3% with a 2.2 kohm internal pull-up resistor - If passive, output voltage is 30 VDC maximum, 24 VDC typical, sinking up to 500 mA at 30 VDC - Output is linear with flow rate to 12,500 Hz • One or two active or passive discrete outputs, not intrinsically safe: - Can report five discrete events, flow switch, forward/reverse flow, calibration in progress, or fault - If active, output voltage is +15 VDC ±3% with a 2.2 kohm internal pull-up resistor - If passive, output voltage is 30 VDC maximum, 24 VDC typical, sinking up to 500 mA at 30 VDC		✓			
One Foundation fieldbus H1 or PROFIBUS-PA output: • FOUNDATION fieldbus and PROFIBUS-PA wiring is intrinsically safe with an intrinsically safe power supply • The transmitter fieldbus circuit is passive, and draws power from the fieldbus segment. Current draw from the fieldbus segment is 13 mA • Manchester-encoded digital signal conforms to IEC 61158-2				✓	
One FOUNDATION fieldbus H1 output: • FOUNDATION fieldbus wiring is non-incendive • The transmitter fieldbus circuit is passive, and draws power from the fieldbus segment. Current draw from the fieldbus segment is 13 mA • Manchester-encoded digital signal conforms to IEC 61158-2					✓

Table 11-3: I/O and digital communication for Model 2700 transmitters *(continued)*

Description	Model 2700 with output code				
	A 2	B C 3	D 4	E G	N

• Two intrinsically safe passive 4–20mA outputs:
- Maximum input voltage: 30 VDC, 1 watt maximum
- Maximum load limit: $R_{max} = (V_{supply} - 12)/0.023$(6)
- Can report mass flow, volume flow, density, temperature, or drive gain
- Entity parameters: U_i = 30 VDC, I_i = 300 mA, P_i = 1W, Ci = 0.0005 µF, L_i = Less than 0.05mH
- Output is linear with process from 3.8 to 20.5 mA, per NAMUR NE43 Version 03.02.2003
• One intrinsically safe frequency/pulse output or configurable frequency/pulse/discrete output:
- Maximum input voltage: 30 VDC, 0.75 watt maximum
- Maximum load limit:
  - Rmax = (V_{supply} - 4)/0.003
  - Rmin = (V_{supply} - 25)/0.006 (7)
- Can report mass flow or volume flow, which can be used to indicate flow rate or total
- Frequency output is independent of the mA output
- Scalable to 10,000 Hz
- Entity parameters: U_i = 30 VDC, I_i = 100 mA, P_i = 0.75W, C_i = 0.0005 µF, L_i = Less than 0.05mH
- Output is linear with flow rate to 12,500 Hz
			✓		

Service port: • Can be used for temporary connection only • Uses RS-485 Modbus signal, 38.4 kilobaud, one stop bit, no parity	✓	✓	✓	✓	✓
HART/RS-485, Modbus/RS-485: • One RS-485 output can be used for direct connection to a HART or Modbus host system; accepts data rates between 1200 baud and 38.4 kilobaud • HART revision 5 as default, selectable to HART revision 7	✓				
HART/Bell 202: • HART Bell 202 signal is superimposed on the primary milliamp output, and is available for host system interface. Frequency 1.2 and 2.2 kHz, Amplitude: to 1.0 mA, 1200 baud, Requires 250 to 600 ohms load resistance • HART revision 5 as default, selectable to HART revision 7	✓	✓	✓		

(4) When output option B is ordered, the channels are configured at the factory for two mA and one frequency output; When output option C is selected, the channels are custom configured at the factory.

(5) For custody transfer using double-pulse frequency output, the transmitter can be configured for two frequency outputs. The second output can be phase shifted –90, 0, 90, or 180 degrees from the first output, or the dual-pulse output can be set to quadrature mode

(6) If communicating with HART a minimum of 250 ohms and 17.75 V supply is needed.

(7) Absolute minimum = 100 ohms for V_{supply} < 25.6 volts.

11.3 Local display

The local display is an optional component. Transmitters can be ordered with or without a local display. A localized Chinese-language display is also available for purchase in China only.

Table 11-4: Local display (standard)

Type	Description
Local interface functions	Segmented 2-line display with LCD screen with optical controls and meter-status LED is standard. • Suitable for hazardous area installation. • Available in both backlit and non-backlit versions. • Available in non-glass or non-glare tempered glass lens versions • Can be rotated on transmitter, 360 degrees, in 90-degree increments. • Supports English, French, German, and Spanish languages. • View process variables; start, stop, and reset totalizers; view and acknowledge alarms. • Zero the meter, Smart Meter Verification, simulate outputs, change measurement units, configure outputs, and set RS-485 communications options. • Three-color LED status light on display panel indicates meter condition at a glance.

Table 11-5: Local display optimized for Chinese-language support (China only)

Type	Description
Local interface functions	Segmented 6-line graphical display with LCD screen with optical controls and meter-status LED is standard. • Suitable for hazardous area installation. • Available in both backlit and non-backlit versions. • Available in glass lens version. • Can be rotated on transmitter, 360 degrees, in 90-degree increments. • Supports English and Chinese languages. • View process variables; start, stop, and reset totalizers; view and acknowledge alarms. • Zero the meter, Smart Meter Verification, simulate outputs, change measurement units, configure outputs, and set RS-485 communications options. • Three-color LED status light on display panel indicates meter condition at a glance.

11.4 Environmental limits

Table 11-6: Environmental specifications

Type	Value
Ambient temperature limits	–40 to +140 °F (–40 to +60 °C)
Humidity limits	5 to 95% relative humidity, non-condensing at 140 °F (60 °C)
Vibration limits	Meets IEC 60068-2-6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g
EMI effects	Complies with EMC Directive 2004/108/EC per EN 61326 Industrial Complies with NAMUR NE-21 (22.08.2007)
Ambient temperature effect on analog outputs	On mA output: ±0.005% of span per °C

If possible, install the transmitter in a location that will prevent direct exposure to sunlight. The environmental limits for the transmitter may be further restricted by hazardous area approvals.

11.5 Physical specifications

Table 11-7: Physical specifications

Type	Description
Mounting options	Field-mount • Integrally mounted to a Micro Motion F-Series or R-Series sensor • Remotely mounted to any 4-wire or 9-wire Micro Motion Coriolis sensor
Housing	NEMA 4X (IP66) polyurethane-painted cast aluminum
Weight (4-wire remote-mount option)	8 lb (3.6 kg)
Weight (9-wire remote-mount option)	14 lb (6.3 kg)
Cable gland entrances	1/2″–14 NPT or M20 × 1.5 female conduit ports for outputs and power supply 3/4″–14 NPT female conduit port for sensor/core processor cable

Figure 11-1: 4-wire remote mount transmitter dimensions (painted aluminum housing)

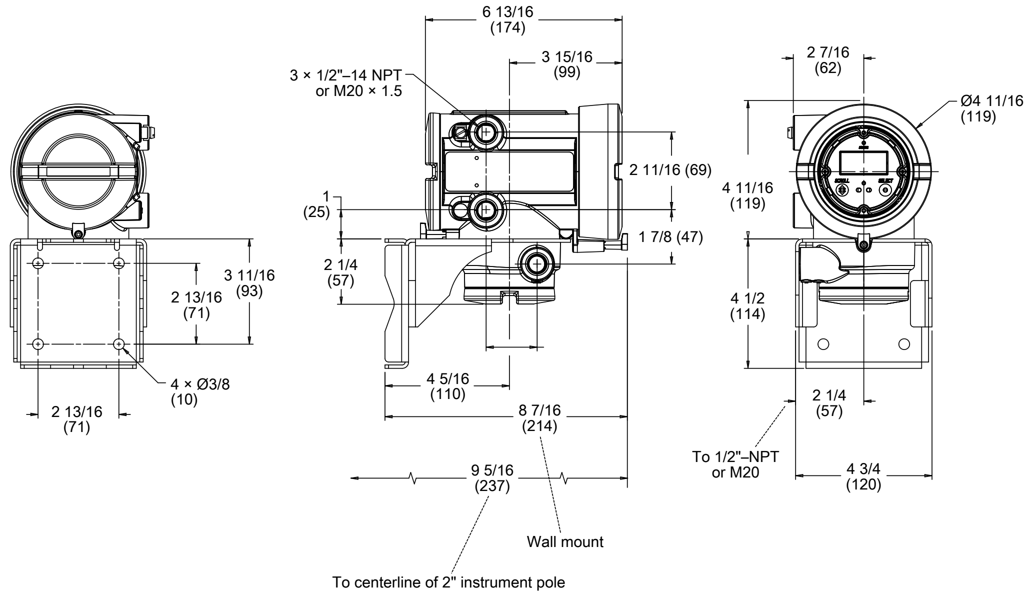


Figure 11-2: 9-wire remote mount transmitter dimensions (painted aluminum housing)

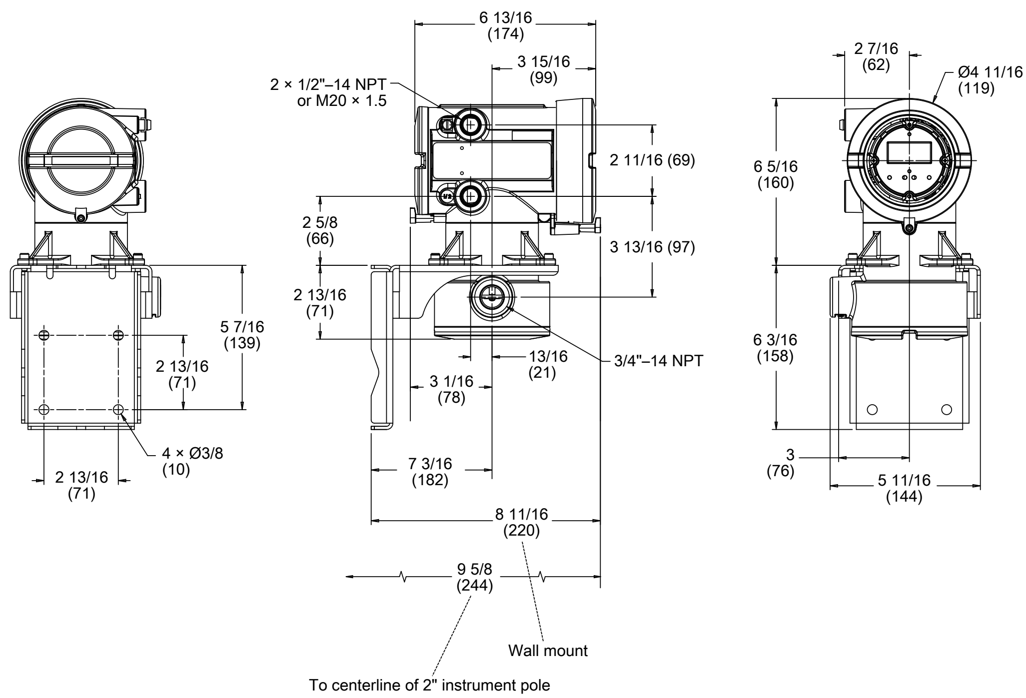


Figure 11-3: 4-wire and 9-wire remote mount transmitter dimensions (stainless steel housing)

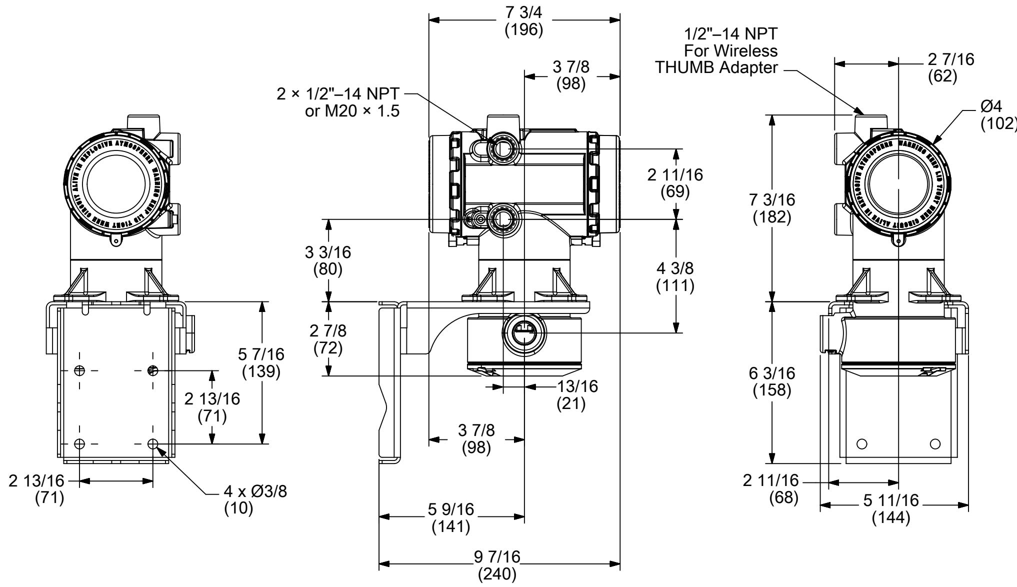


Figure 11-4: Remote core processor dimensions

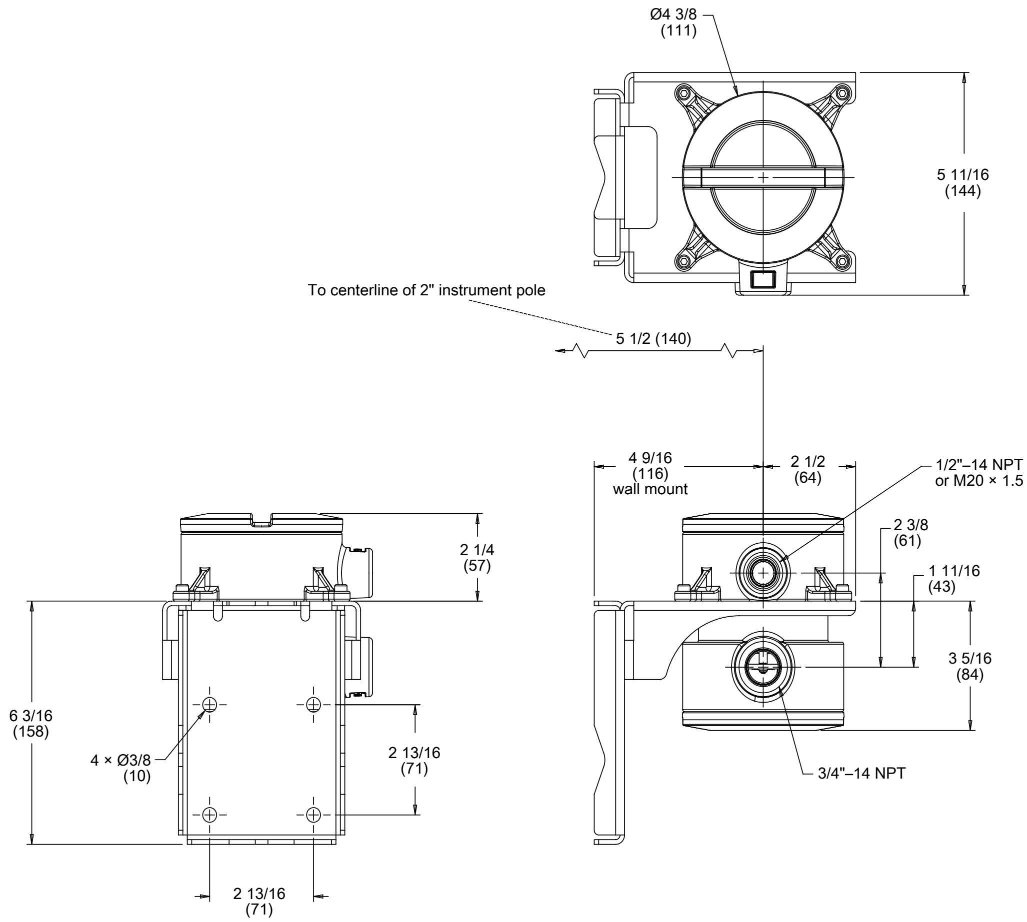
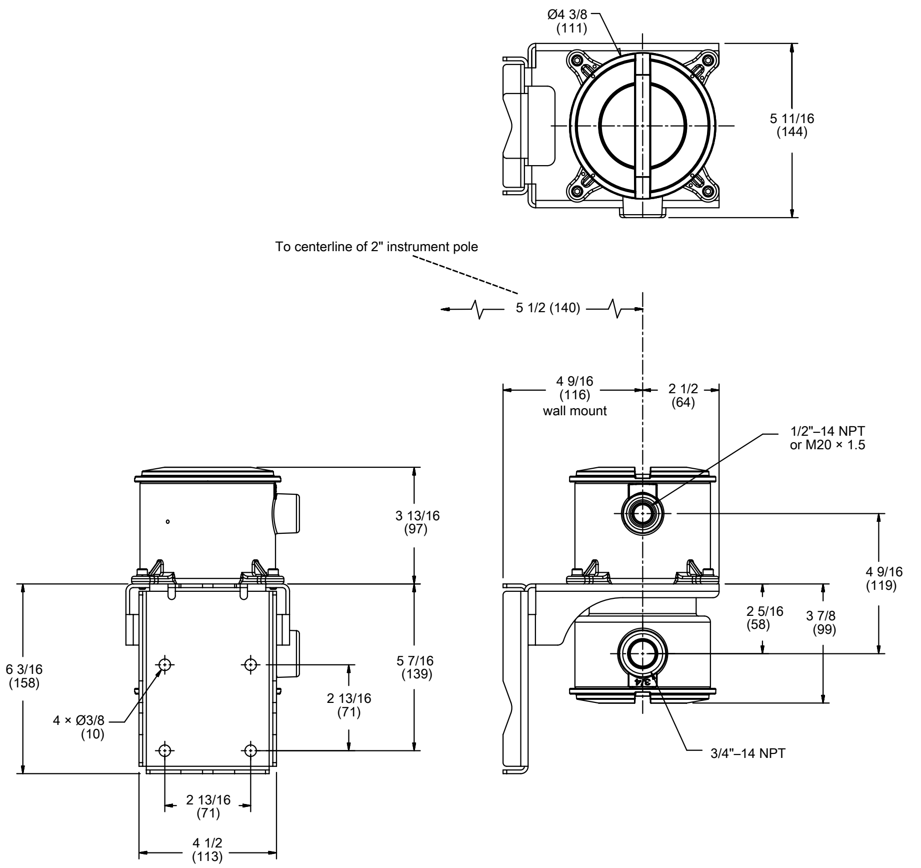


Figure 11-5: Remote enhanced core processor dimensions



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20001700
Rev CE
2015

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