

Micro Motion[®] Compact Density Meters

Peak performance precision density meter installation



Safety and approval information

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EU declaration of conformity for directives that apply to this product. The EU declaration of conformity, with all applicable European directives, and the complete ATEX Installation Drawings and Instructions are available on the internet at www.emerson.com or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive, can be found on the internet at www.emerson.com.

For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Full product specifications can be found in the product data sheet. Troubleshooting information can be found in the configuration manual. Product data sheets and manuals are available from the Micro Motion web site at www.emerson.com.

Return policy

Follow Micro Motion procedures when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Micro Motion will not accept your returned equipment if you fail to follow Micro Motion procedures.

Return procedures and forms are available on our web support site at www.emerson.com, or by phoning the Micro Motion Customer Service department.

Emerson Flow customer service

Email:

- Worldwide: flow.support@emerson.com
- Asia-Pacific: APflow.support@emerson.com

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Mexico	+41 (0) 41 7686 111	France	0800 917 901	India	800 440 1468
Argentina	+54 11 4837 7000	Germany	0800 182 5347	Pakistan	888 550 2682
Brazil	+55 15 3413 8000	Italy	8008 77334	China	+86 21 2892 9000
		Central & Eastern	+41 (0) 41 7686 111	Japan	+81 3 5769 6803
		Russia/CIS	+7 495 981 9811	South Korea	+82 2 3438 4600
		Egypt	0800 000 0015	Singapore	+65 6 777 8211
		Oman	800 70101	Thailand	001 800 441 6426
		Qatar	431 0044	Malaysia	800 814 008
		Kuwait	663 299 01		
		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

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1 Planning

Topics covered in this chapter:

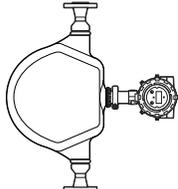
- *Installation checklist*
- *Best practices*
- *Pressure drop in the meter*
- *Power requirements*
- *Perform a pre-installation meter check*

1.1 Installation checklist

- Make sure that the hazardous area specified on the approval tag is suitable for the environment in which the meter will be installed.
- Verify that the local ambient and process temperatures are within the limits of the meter.
- If your meter will be wired to a remote-mount 2700 FOUNDATION™ fieldbus transmitter:
 - Refer to the instructions in this manual for preparing the 4-wire cable and wiring to the processor connections.
 - Refer to the instructions in the transmitter installation manual for mounting and wiring the 2700 FOUNDATION fieldbus transmitter.
 - Consider the maximum cable length between the meter and transmitter. The maximum recommended distance between the two devices is 1000 ft (300 m). Micro Motion recommends using Micro Motion cable.
- For optimal performance, install the meter in the preferred orientation.

The meter will work in any orientation as long as the vibrating tubes remain full of the process fluid. However, you should validate the meter performance prior to operation if you have installed it in a non-preferred orientation.

Table 1-1: Preferred meter orientation

Liquids and slurries	
----------------------	--

- Install the meter so that the flow direction arrow on the meter case matches the actual forward flow of the process. (Flow direction is also software-selectable.)
- For optimal performance, thermally insulate the meter and the inlet and bypass-loop pipeline to maintain stable temperatures.

Micro Motion offers a soft, weather-proof insulating jacket that is easily fitted to all CDM versions.

1.2 Best practices

The following information can help you get the most from your meter.

- Handle the meter with care. Follow local practices for lifting or moving the meter.
- Perform a Known Density Verification (KDV) check of the meter prior to installing the meter in your system.
- Install the meter in the preferred orientation in a vertical pipeline with liquids and slurries flowing upward.

Important

If you do not install the meter in the preferred orientation, you may need to apply a field offset to ensure optimal performance. Refer to your organizational standards for sampling and reference measurement to determine what the offset may be.

- Do not apply a compression force greater than 200 lbs (90.7 kg) when installing the meter.
- Thermally insulate the meter and the inlet and bypass-loop pipeline to maintain stable temperatures.
- There are no pipe run requirements for Micro Motion meters. Straight runs of pipe upstream or downstream are unnecessary.
- Keep the meter tubes full of process fluid.
- For halting flow through the meter with a single valve, install the valve downstream from the meter.
- Minimize bending and torsional stress on the meter. Do not use the meter to align misaligned piping.
- The meter does not require external supports. The flanges will support the meter in any orientation.
- Installing the meter in a bypass configuration allows you to remove the meter for servicing or calibration without affecting the main pipeline ([Section 1.2.1](#)).
- For bypass configurations using a pump, install the pump downstream of the meter to avoid pump heat transfer.
- For bypass configurations, maintain a target flow through the meter to ensure sample integrity and consistent temperature with the main line.

1.2.1 Recommended installations for bypass configurations

The following figures illustrate typical bypass configurations for installing the meter.

Figure 1-1: Bypass installation: S-Bend

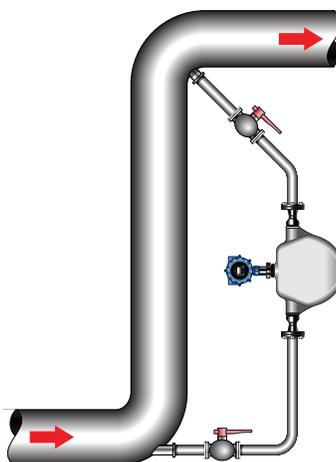


Figure 1-2: Bypass installation: Pressure bend

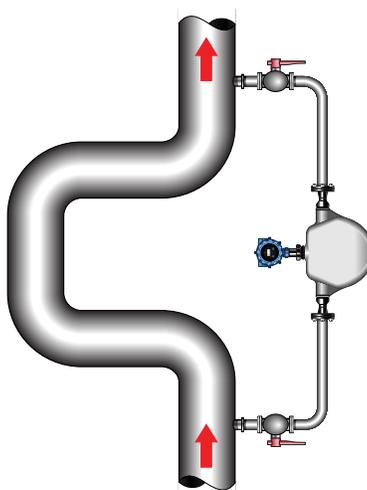


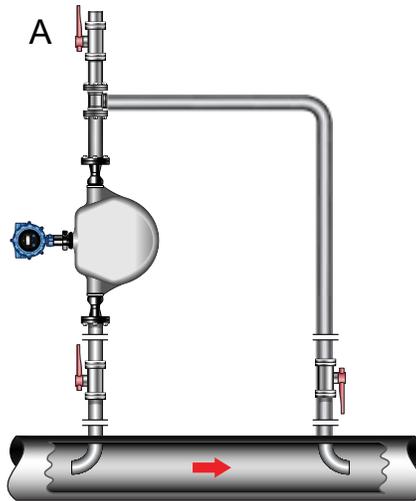
Figure 1-3: Bypass installation: Laminar flow



Important

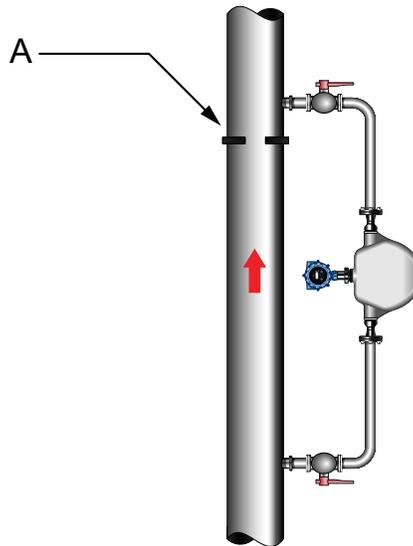
The laminar flow installation is only recommended for processes using refined, clean fluids with low viscosity.

Figure 1-4: Bypass installation: Pitot tube

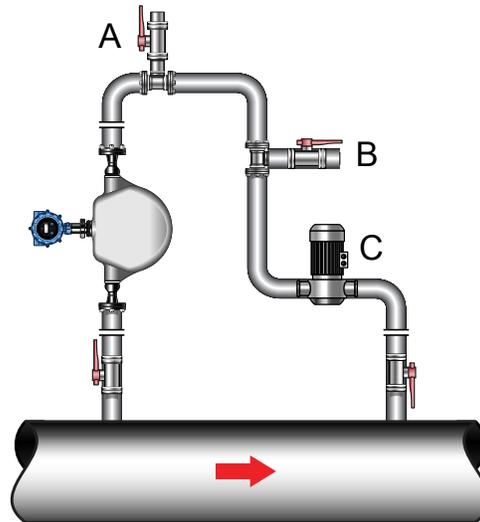


A. Vent

Figure 1-5: Bypass installation: Orifice plate



A. Orifice plate

Figure 1-6: Bypass installation: Pump

- A. Vent
 - B. Sample point
 - C. Pump
-

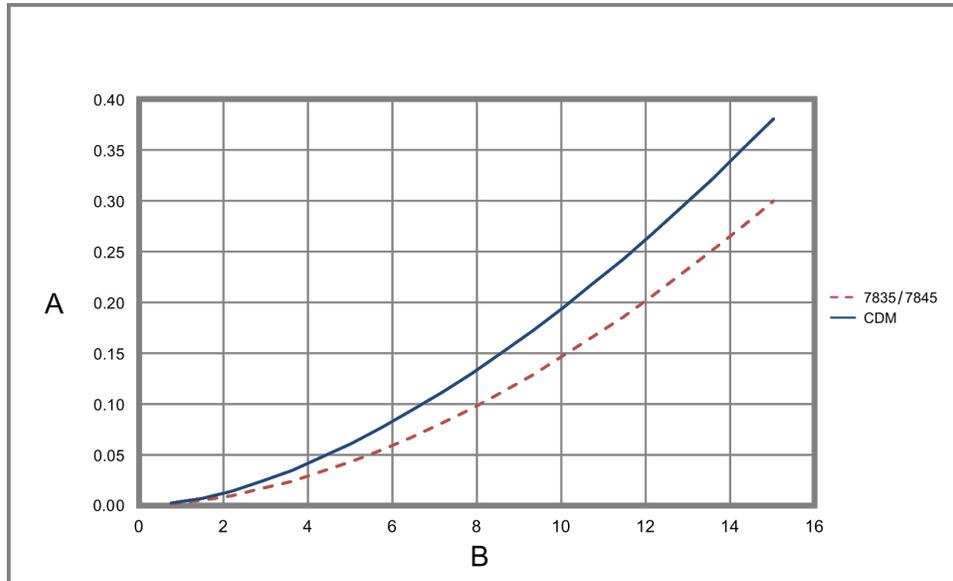
1.3 Pressure drop in the meter

The pressure drop in the meter depends on the process conditions. The following figures illustrate the pressure drop for the meter at varying fluid density and viscosity. In addition, these charts show how the meter compares to the Micro Motion 7835/7845 liquid density meters.

Important

For the most accurate pressure drop calculations using your process variables, use the Micro Motion product selector available at www.emerson.com.

Figure 1-7: Sample pressure drop calculations (fluid viscosity equals 2 cP)

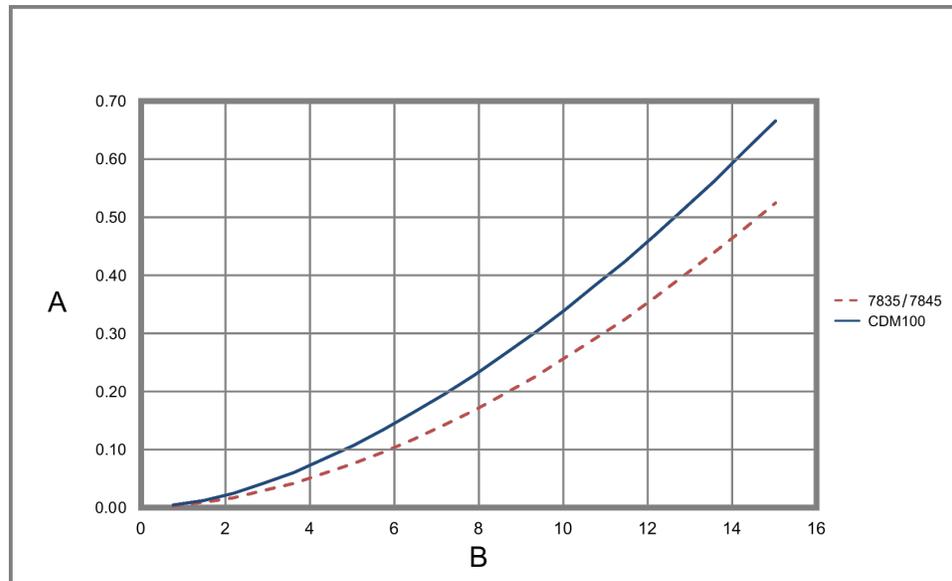


- A. Pressure drop (bar)
 B. Flow rate (m³/hr)

Note

- Density = 800 kg/m³
- Viscosity = 2 cP

Figure 1-8: Sample pressure drop calculations (fluid viscosity equals 10 cP)



- A. Pressure drop (bar)
 B. Flow rate (m³/hr)

Note

- Density = 800 kg/m³
- Viscosity = 10 cP

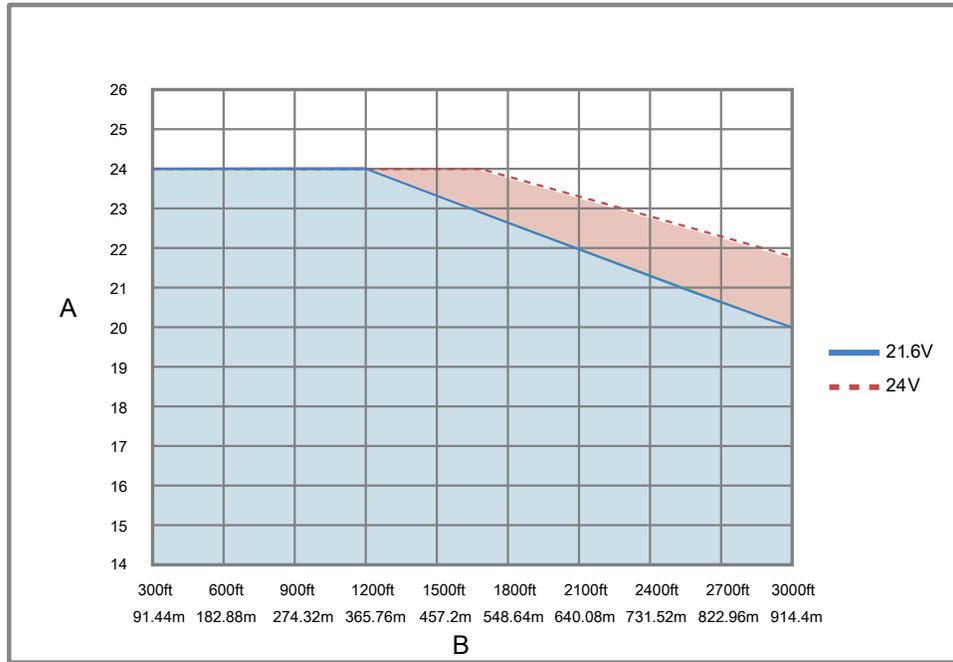
1.4 Power requirements

Following are the DC power requirements to operate the meter:

- Explosion-proof/flameproof meters:
 - 24 VDC, 0.65 W typical, 1.1 W maximum
 - Minimum recommended voltage: 21.6 VDC with 1000 ft of 24 AWG (300 m of 0.20 mm²) power-supply cable
 - At startup, power source must provide a minimum of 0.5 A of short-term current at a minimum of 19.6 V at the power-input terminals.
- Intrinsically safe meters:
 - 24 VDC, 0.7 W typical with 250 Ω barrier, 0.96 W maximum with 250 Ω barrier
 - Minimum recommended voltage: 22.8 VDC with 1000 ft of 22 AWG (300 m of 0.25 mm²) power-supply cable

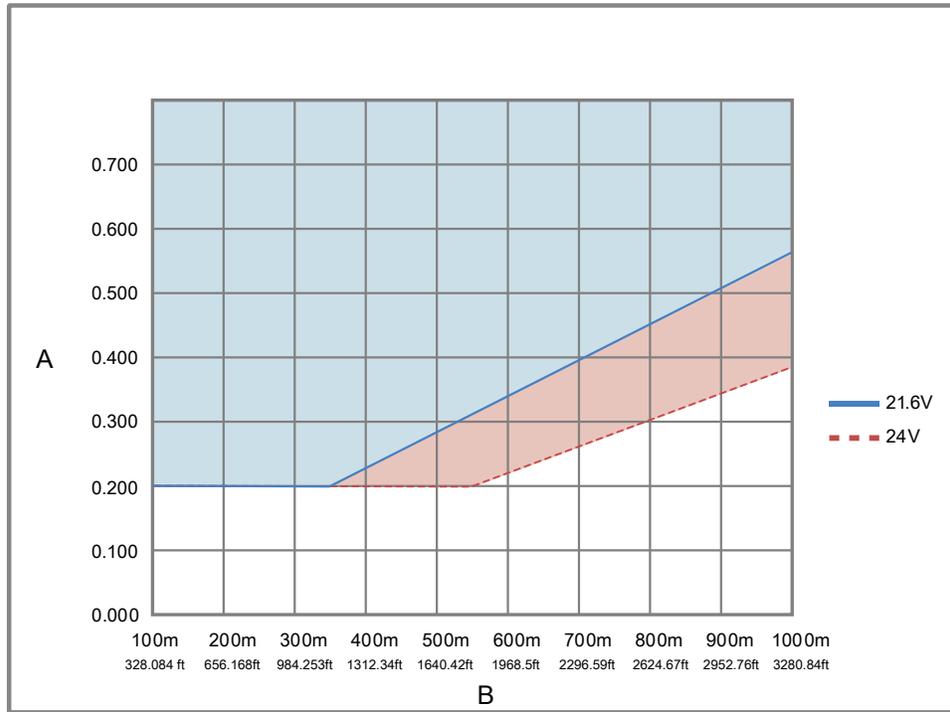
Power cable recommendations for explosion-proof/flameproof meters

Figure 1-9: Minimum wire gauge (AWG per feet)



- A. AWG maximum
- B. Distance of installation

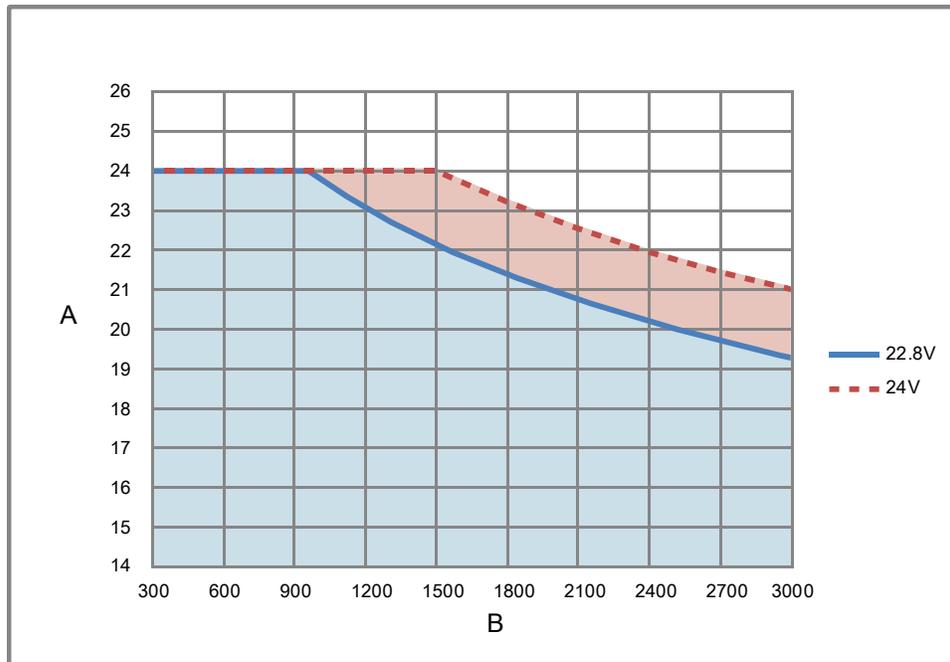
Figure 1-10: Minimum wire area (mm² per meter)



- A. Minimum wire area (mm²)
- B. Distance of installation

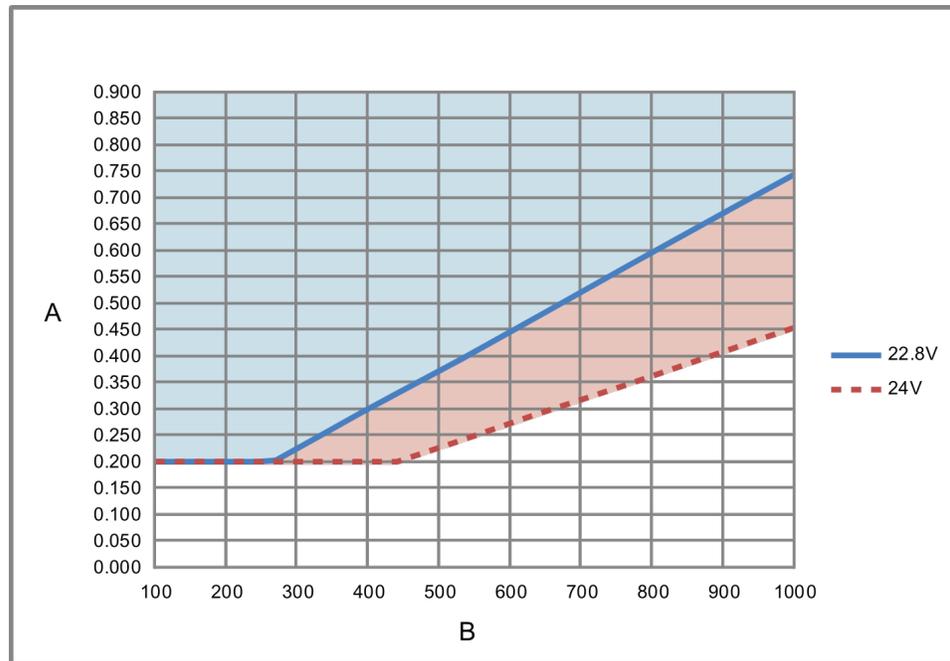
Power cable recommendations for intrinsically safe meters

Figure 1-11: Minimum wire gauge (AWG per foot)



- A. AWG
- B. Distance of installation

Figure 1-12: Minimum wire area (mm² per meter)



- A. Minimum wire area (mm²)
 B. Distance of installation

1.5 Perform a pre-installation meter check

Check the meter prior to installation to confirm that no damage occurred to the meter during shipment.

Procedure

1. Remove the meter from the box.

⚠ CAUTION!

Handle the meter with care. Follow all corporate, local, and national safety regulations for lifting and moving the meter.

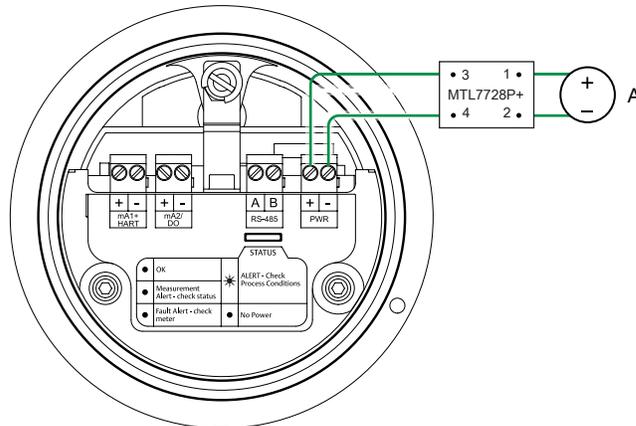
2. Visually inspect the meter for any physical damage.

If you notice any physical damage to the meter, immediately contact Micro Motion Customer Support at flow.support@emerson.com.

3. Position and secure the meter in a vertical position with the flow arrow pointing upward.
4. Connect the power wiring, and power up the meter.

Remove the back transmitter housing cover to access the **PWR** terminals.

Figure 1-13: Power supply wiring terminals



A. Barrier wiring is applicable to intrinsically safe installations only

5. Perform a Known Density Verification (KDV) check.

Use the Known Density Verification procedure to match the current meter calibration with the factory calibration. If the meter passes the test, then it has not drifted or changed during shipment.

For more information on performing a KDV check, see the configuration and use manual that shipped with the product.

2 Mounting

Topics covered in this chapter:

- *Mount the meter*
- *Rotate the electronics on the meter (optional)*
- *Rotate the display on the transmitter (optional)*

2.1 Mount the meter

Use your common practices to minimize torque and bending load on process connections.

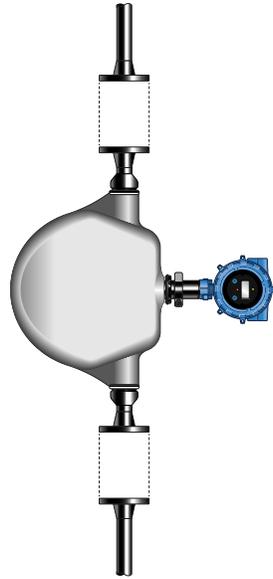
Tip

To reduce the risk of condensation or excessive moisture, the transmitter conduit opening should not point upward (if possible). The conduit opening of the transmitter can be rotated freely to facilitate wiring.

CAUTION!

Do not lift the meter by the electronics. Lifting the meter by the electronics can damage the device.

Figure 2-1: Mounting the sensor



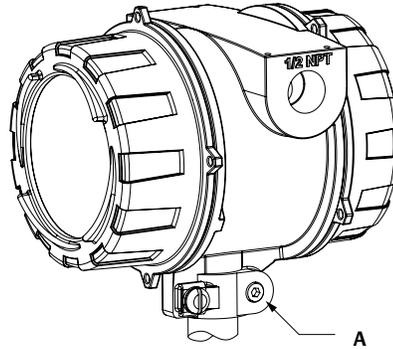
Notes

- Do not use the meter to support the piping.
 - The meter does not require external supports. The flanges will support the meter in any orientation.
 - All pipework joints and couplings must be airtight to minimize the presence of gas bubbles in the fluid.
-

2.2 Rotate the electronics on the meter (optional)

You can rotate the transmitter on the meter up to 90°.

1. Using a 4 mm hex key, loosen the cap screw that holds the transmitter in place.

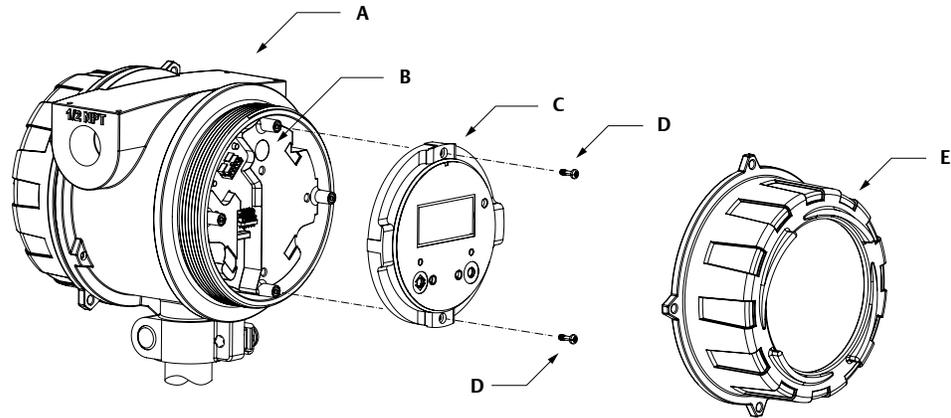
Figure 2-2: Component to secure transmitter in place

A. M5 socket-head cap screw

-
2. Rotate the transmitter clockwise to the desired orientation up to 90°.
 3. Secure the cap screw in place and tighten to 60 lb·in (6.8 N·m).

2.3 Rotate the display on the transmitter (optional)

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

Figure 2-3: Display components

- A. *Transmitter housing*
- B. *Sub-bezel*
- C. *Display module*
- D. *Display screws*
- E. *Display cover*

Procedure

1. If the meter is powered up, power it down.
2. Turn the display cover counterclockwise to remove it from the main enclosure.
3. Carefully loosen (and remove if necessary) the semi-captive display screws while holding the display module in place.
4. 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.

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

3 Wiring

Topics covered in this chapter:

- *Terminals and wiring requirements*
- *Explosion-proof/flameproof or non-hazardous output wiring*
- *Intrinsically safe output wiring*
- *Processor wiring for remote-mount 2700 FOUNDATION™ fieldbus option*
- *Wiring to external devices (HART multidrop)*
- *Wiring to signal converters and/or flow computers*

3.1 Terminals and wiring requirements

Three pairs of wiring terminals are available for transmitter outputs. These outputs vary depending on your transmitter output option ordered. The Analog (mA), Time Period Signal (TPS), and Discrete (DO) outputs require external power, and must be connected to an independent 24 VDC power supply.

For meters connecting to a remote-mount Model 2700 FOUNDATION™ fieldbus transmitter, you must wire the meter to the remote-mount Model 2700 transmitter using a 4-wire cable connection. See the processor wiring content in this manual for information on how to wire the meter.

The screw connectors for each output terminal accept a maximum wire size of 14 AWG (2.5 mm²).

Important

- Output wiring requirements depend on whether the meter will be installed in a safe area or a hazardous area. It is your responsibility to verify that this installation meets all corporate, local, and national safety requirements and electrical codes.
- If you will configure the meter to poll an external temperature or pressure device, you must wire the mA output to support HART communications. You may use either HART/mA single-loop wiring or HART multi-drop wiring.

Table 3-1: Transmitter outputs

Transmitter version	Output channels		
	A	B	C
Analog	4–20 mA + HART	4–20 mA	Modbus/RS-485
Time period signal (TPS)	4–20 mA + HART	Time Period Signal (TPS)	Modbus/RS-485
Discrete	4–20 mA + HART	Discrete output	Modbus/RS-485

Table 3-1: Transmitter outputs (continued)

Transmitter version	Output channels		
	A	B	C
Processor for remote-mount Model 2700 FOUNDATION fieldbus	Disabled	Disabled	Modbus/RS-485

3.2 Explosion-proof/flameproof or non-hazardous output wiring

3.2.1 Wire the Analog outputs version in an explosion-proof/flameproof or non-hazardous area

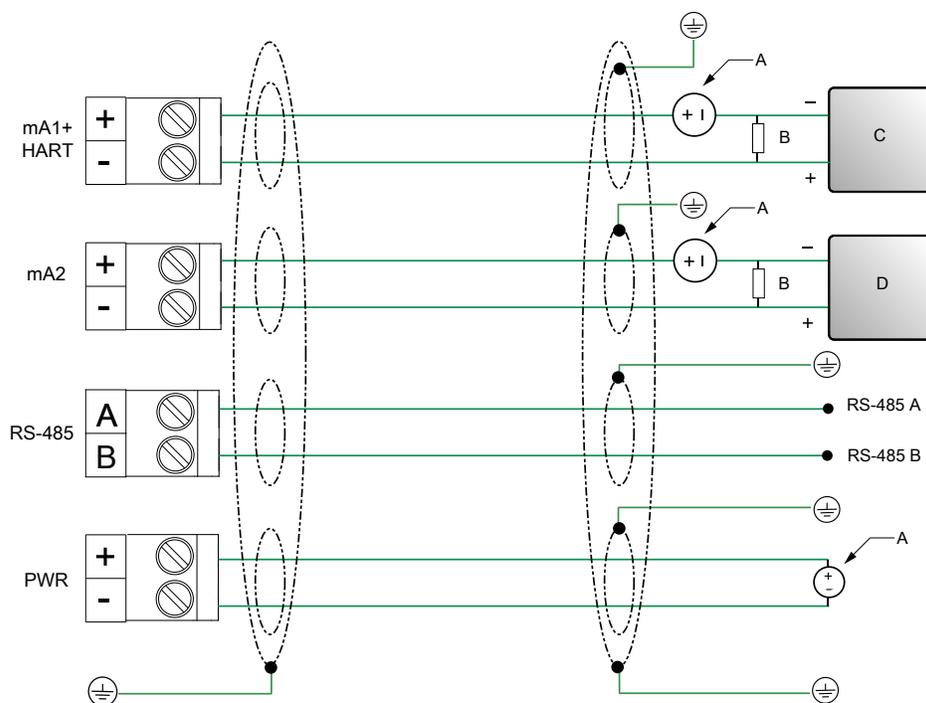
⚠ CAUTION!

Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.

Procedure

Wire to the appropriate output terminal and pins (see [Figure 3-1](#)).

Figure 3-1: Wiring the Analog outputs



- A. 24 VDC
- B. R_{load} (250 Ω resistance)
- C. HART-compatible host or controller; and/or signal device
- D. Signal device

Note

For operating the milliamp outputs with a 24V supply, a maximum total loop resistance of 657 Ω is allowed.

CAUTION!

- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.2.2 Wire the Time Period Signal (TPS) or Discrete output version in an explosion-proof/flameproof or non-hazardous area

 **CAUTION!**

Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.

Procedure

Wire to the appropriate output terminal and pins (see [Figure 3-2](#)).

3.3 Intrinsically safe output wiring

Micro Motion provides safety barrier and galvanic isolator installation kits for wiring the meter in a hazardous environment. These kits provide the appropriate barriers or isolators depending on the outputs available and approvals required.

Information provided about wiring the safety barriers and galvanic isolators is intended as an overview. You should wire the meter according to the standards that are applicable at your site.

⚠ CAUTION!

- **Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.**
- **Refer to the hazardous area approvals documentation shipped with your meter. Safety instructions are available on the Product Documentation DVD and accessible at www.emerson.com.**

3.3.1 Hazardous area entity parameters

⚠ DANGER!

- **Hazardous voltage can cause severe injury or death. To reduce the risk of hazardous voltage, shut off power before wiring the meter.**
- **Improper wiring in a hazardous environment can cause an explosion. Install the meter only in an area that complies with the hazardous classification tag on the meter.**

Input entity parameters

Table 3-2: Input entity parameters: all connections

Parameter	Power supply	4–20 mA /Discrete Output/Time Period Signal	RS-485
Voltage (U_i)	30 VDC	30 VDC	18 VDC
Current (I_i)	484 mA	484 mA	484 mA
Power (P_i)	2.05 W	2.05 W	2.05 W
Internal capacitance (C_i)	0.0 pF	0.0 pF	0.0011 pF
Internal inductance (L_i)	0.0 H	0.0 H	0.0 H

RS-485 output and cable parameters

All connections to the meter receive their power from the connected intrinsically safe barrier. All cable parameters are derived from the output parameters of these devices. The RS-485 connection also receives power from the connected barrier (MTL7761AC), although this connection has specific output and cable parameters.

Table 3-3: RS-485 output and cable entity parameters (MTL7761AC)

Input parameters	
Voltage (U_i)	18 VDC
Current (I_i)	100 mA
Internal capacitance (C_i)	1 nF
Internal inductance (L_i)	0.0 H
Output parameters	
Voltage (U_o)	9.51 VDC
Current (instantaneous) (I_o)	480 mA
Current (steady state) (I)	106 mA
Power (P_o)	786 mW
Internal resistance (R_i)	19.8 Ω
Cable parameters for Group IIC	
External capacitance (C_o)	85 nF
External inductance (L_o)	154 μ H
External inductance/resistance ratio (L_o/R_o)	31.1 μ H/ Ω
Cable parameters for Group IIB	
External capacitance (C_o)	660 nF
External inductance (L_o)	610 μ H
External inductance/resistance ratio (L_o/R_o)	124.4 μ H/ Ω

Hazardous area voltage The meter entity parameters require the selected barrier's open-circuit voltage to be limited to less than 30 VDC ($V_{max} = 30$ VDC).

Hazardous area current The meter entity parameters require the selected barrier's short-circuit currents to sum to less than 484 mA ($I_{max} = 484$ mA) for all outputs.

Hazardous area capacitance The capacitance (C_i) of the meter is 0.0011 μ F. This value added to the wire capacitance (C_{cable}) must be lower than the maximum allowable capacitance (C_a) specified by the safety barrier. Use the following equation to calculate the maximum length of the cable between the meter and the barrier: $C_i + C_{cable} \leq C_a$

Hazardous area inductance The inductance (L_i) of the meter is 0.0 μ H. This value plus the field wiring inductance (L_{cable}), must be lower than the maximum allowable inductance (L_a) specified by the safety barrier. The following equation can then be used to calculate the maximum cable length between the meter and the barrier: $L_i + L_{cable} \leq L_a$

3.3.2 Wire all intrinsically safe outputs using safety barriers

Micro Motion provides a safety barrier installation kit for wiring the meter in a hazardous area. Contact your local sales representative or customer support at flow.support@emerson.com for more information on ordering a barrier kit.

⚠ CAUTION!

- **Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.**
- **Refer to the hazardous area approvals documentation shipped with your meter. Safety instructions are available on the Product Documentation DVD and accessible at www.emerson.com.**

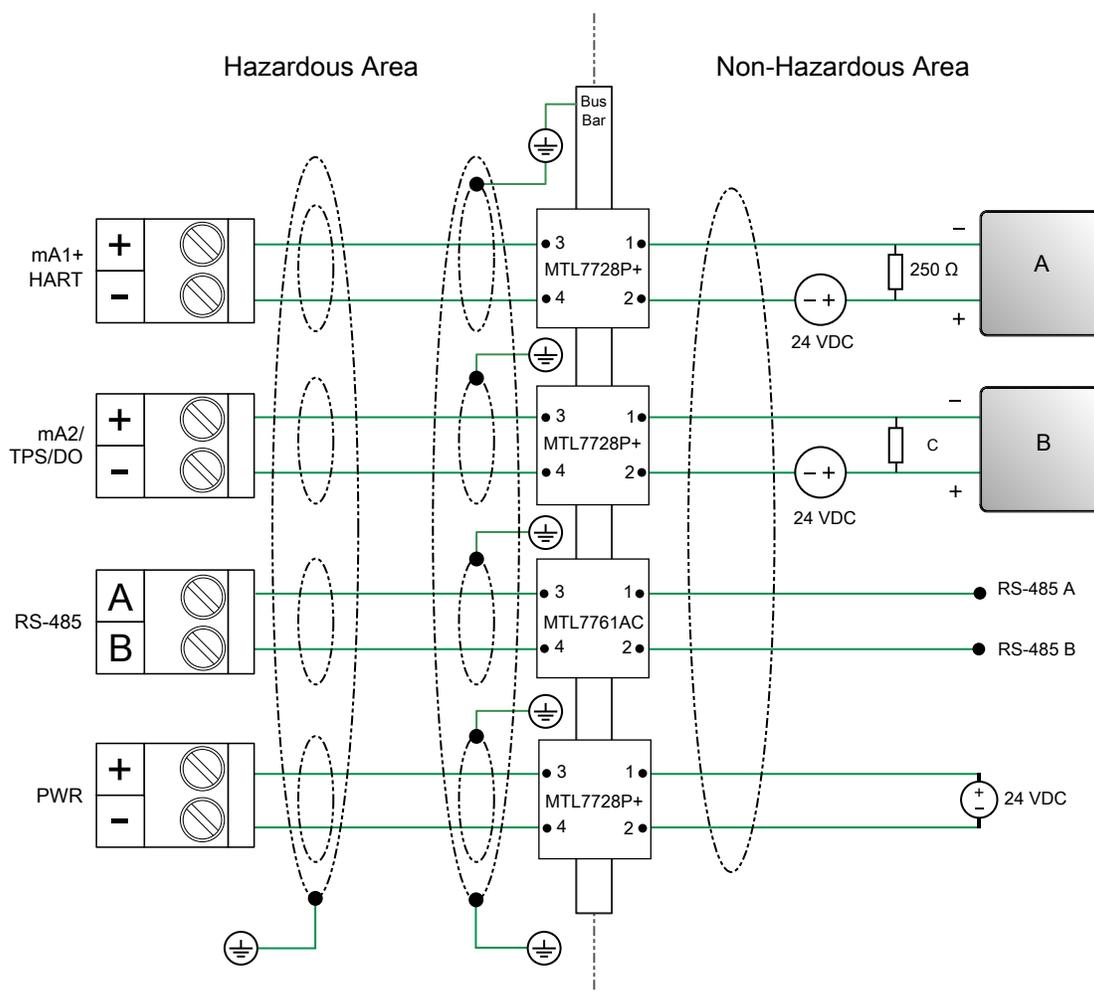
The safety barrier kit provides barriers for connecting all of the available meter outputs. Use the provided barriers with the designated output.

Output(s)	Barrier
4–20 mA	MTL7728P+
<ul style="list-style-type: none"> • 4–20 mA • Time Period Signal (TPS) • Discrete 	MTL7728P+
Modbus/RS-485	MTL7761AC
Power	MTL7728P+

Procedure

Wire the barriers to the appropriate output terminal and pins (see [Figure 3-3](#)).

Figure 3-3: Intrinsically safe mA/DO/TPS output wiring using safety barriers



A. HART/Field Communicator device

B. Signal device

C. The recommended resistance will vary depending on your Channel B output. For mA outputs, 250 Ω is the recommended resistance. For TPS or Discrete outputs, 500–1000 Ω is the recommended resistance.

⚠ CAUTION!

- In an electrically noisy environment, screen the cable in a safe area.
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- For safety, do not terminate the inner individual screens to earth in a hazardous area.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.3.3 Wire the intrinsically safe Analog outputs version using galvanic isolators

Micro Motion provides a galvanic isolator installation kit specific to wiring the Analog version of the meter in a hazardous area. Contact your local sales representative or Micro Motion Customer Support at flow.support@emerson.com for more information on ordering an isolator kit for your meter.

CAUTION!

- **Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.**
- **Refer to the hazardous area approvals documentation shipped with your meter. Safety instructions are available on the Micro Motion Product Documentation DVD and accessible on the Micro Motion website at www.emerson.com.**

The galvanic isolator kit (Analog version) provides isolators for connecting the following outputs. Use the provided isolators with the designated output.

Note

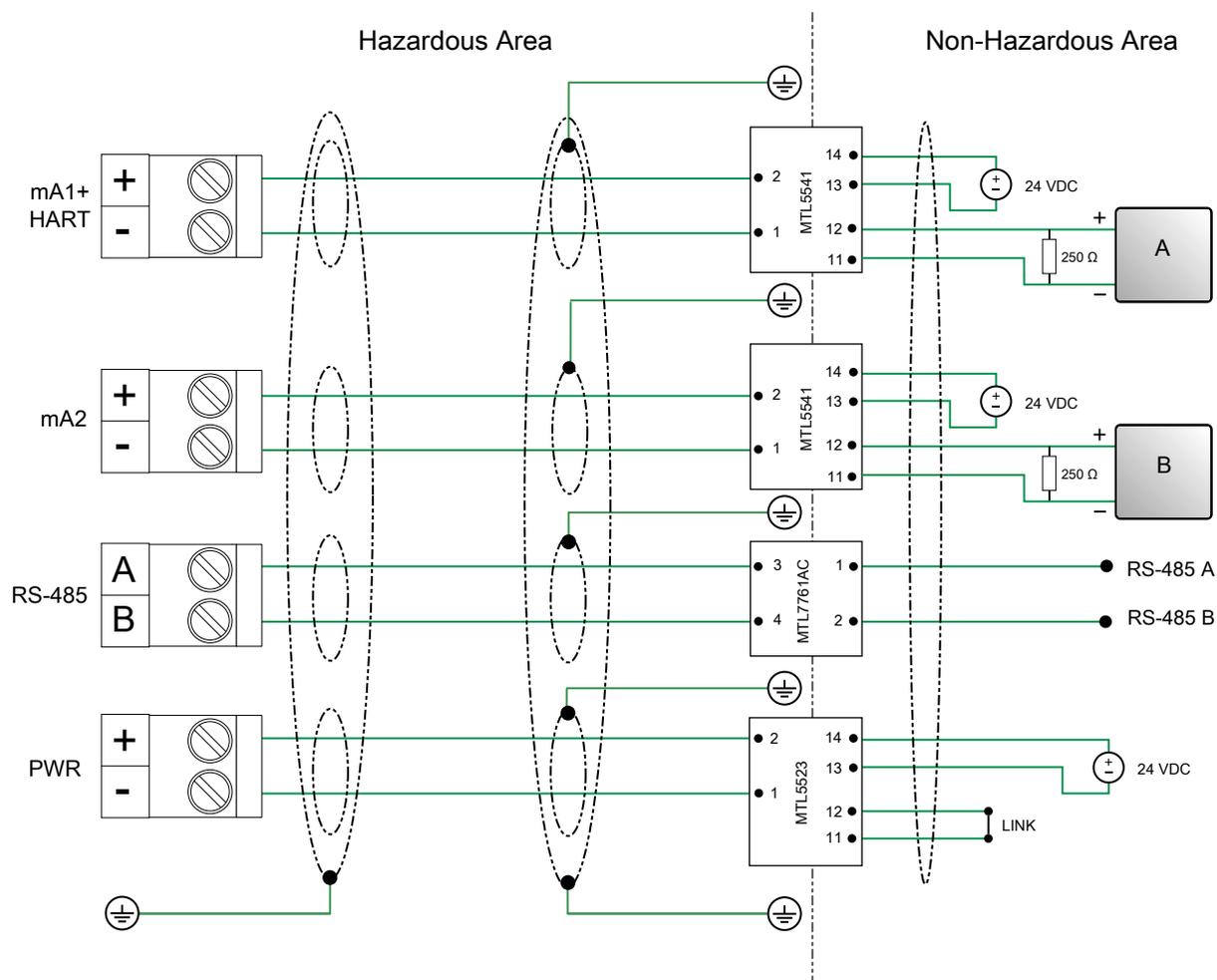
The RS-485 barrier is not isolated.

Output(s)	Isolator
4–20 mA + HART	MTL5541
4–20 mA	MTL5541
Modbus/RS-485	MTL7761AC
Power	MTL5523

Procedure

Wire the isolators to the appropriate output terminal and pins (see [Figure 3-4](#)).

Figure 3-4: Intrinsically safe output wiring using galvanic isolators (mA outputs option)



A. HART/Field Communicator device

B. Signal device

⚠ CAUTION!

- In an electrically noisy environment, screen the cable in a safe area.
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- For safety, do not terminate the inner individual screens to earth in a hazardous area.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.3.4 Wire the intrinsically safe Time Period Signal (TPS) or Discrete output version using galvanic isolators

Micro Motion provides a galvanic isolator installation kit specific to wiring the Time Period Signal (TPS) and Discrete versions of the meter in a hazardous area. Contact your local sales representative or Micro Motion Customer Support at flow.support@emerson.com for more information on ordering an isolator kit for your meter.

CAUTION!

- **Meter installation and wiring should be performed by suitably trained personnel only in accordance with the applicable code of practice.**
- **Refer to the hazardous area approvals documentation shipped with your meter. Safety instructions are available on the Micro Motion Product Documentation DVD and accessible on the Micro Motion website at www.emerson.com.**

The galvanic isolator kit (TPS/Discrete version) provides isolators for connecting the following outputs. Use the provided isolators with the designated output.

Note

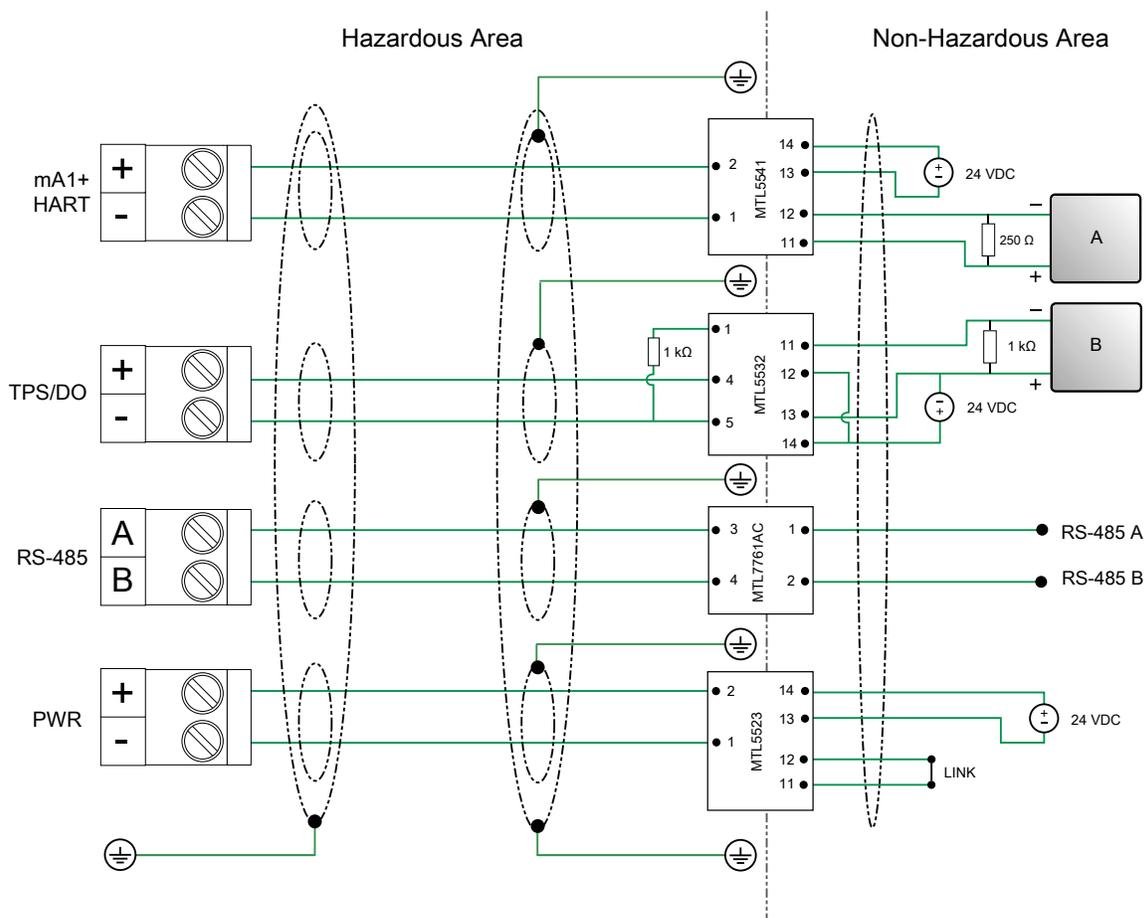
The RS-485 barrier is not isolated.

Output(s)	Isolator
4–20 mA + HART	MTL5541
<ul style="list-style-type: none"> • Time Period Signal (TPS) • Discrete 	MTL5532
Modbus/RS-485	MTL7761AC
Power	MTL5523

Procedure

1. Wire the isolators to the appropriate output terminal and pins (see [Figure 3-5](#)).

Figure 3-5: Hazardous area output wiring using galvanic isolators (TPS and Discrete output options)



- A. HART/Field Communicator
 B. Signal device

⚠ CAUTION!

- In an electrically noisy environment, screen the cable in a safe area.
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- For safety, do not terminate the inner individual screens to earth in a hazardous area.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

2. Set the isolator switch settings for the TPS/DO connection (MTL5532 isolator). You must set the isolator switches appropriately for Pins 1 through 5 (see [Table 3-4](#)).

The switches are located on the side of the isolator, and must be set to either **Off** (the up position) or **On** (the down position).

Figure 3-6: MTL5532 switch location (plus ON/OFF switch position)

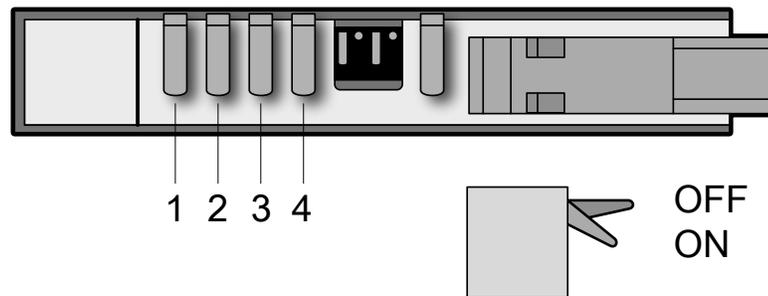


Table 3-4: MTL5532 switch settings

Switch	ON/OFF?
1	ON
2	OFF
3	OFF
4	OFF

3.4 Processor wiring for remote-mount 2700 FOUNDATION™ fieldbus option

3.4.1 RS-485 entity parameters for the remote-mount 2700 FOUNDATION™ fieldbus option

⚠ DANGER!

Hazardous voltage can cause severe injury or death. To reduce the risk of hazardous voltage, shut off power before wiring the meter.

⚠ DANGER!

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

Table 3-5: RS-485 output and cable entity parameters

Cable parameters for intrinsically safe circuit (linear)	
Voltage (U_i)	17.22 VDC
Current (I_i)	484 mA
Maximum capacitance (C_i)	1 nF
Maximum inductance (L_i)	Negligible
Cable parameters for Ex ib IIB, Ex ib IIC	
Voltage (U_o)	9.51 VDC
Current (instantaneous) (I_o)	480 mA
Current (steady state) (I)	106 mA
Power (P_o)	786 mW
Internal resistance (R_i)	19.8 Ω
Cable parameters for Group IIC	
Maximum external capacitance (C_o)	85 nF
Maximum external inductance (L_o)	25 μ H
Maximum external inductance/resistance ratio (L_o/R_o)	31.1 μ H/ Ω
Cable parameters for Group IIB	
Maximum external capacitance (C_o)	660 nF
Maximum external inductance (L_o)	260 μ H
Maximum external inductance/resistance ratio (L_o/R_o)	124.4 μ H/ Ω

3.4.2 Connect 4-wire cable

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 cable supplied by Micro Motion consists of one pair of red and black 18 AWG (0.75 mm²) wires for the VDC connection, and one pair of white and green 22 AWG (0.35 mm²) wires for the RS-485 connection.

User-supplied 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.
- Wire gauge of 22 AWG or larger, with a maximum cable length of 1000 feet.

Prepare a cable with a metal conduit

Prerequisites

Note

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

Procedure

1. Remove the integral processor cover using a flat-blade screw driver.
2. Run the conduit to the sensor.
3. Pull the cable through the conduit.
4. Cut the drain wires and let them float at both ends of the conduit.

Prepare a cable with user-supplied cable glands

Prerequisites

Important

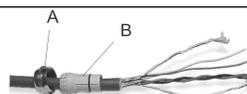
For user-supplied cable glands, the gland must be capable of terminating the drain wires.

Procedure

1. Remove the core processor cover using a flat-blade screw driver.
2. Pass the wires through the gland.
3. Terminate the shield and drain wires inside the gland.
4. Assemble the gland according to vendor instructions.

Prepare a cable with Micro Motion-supplied cable glands

1. Remove the core processor cover using a flat-blade screw driver.
2. Pass the wires through the gland nut and clamping insert.



- A. Gland nut
B. Clamping insert
-

3. Strip the cable jacket.

Option	Description
NPT gland type	Strip 4-1/2 inch (115 mm)
M20 gland type	Strip 4-1/4 inch (108 mm)

4. Remove the clear wrap and filler material.
5. Strip most of the shielding.

Option	Description
NPT gland type	Strip all but 3/4 inch (19 mm)
M20 gland type	Strip all but 1/2 inch (12 mm)

6. Wrap the drain wires twice around the shield and cut off the excess drain wires.



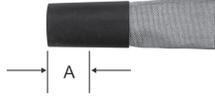
A. Drain wires wrapped around shield

7. For foil (shielded cable) only:

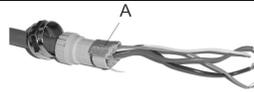
Note

For braided (armored cable) skip this step and continue to the next step.

Option	Description
NPT gland type	<p>a. Slide the shielded heat shrink over the drain wires. Ensure that the wires are completely covered.</p> <p>b. Apply heat (250 °F or 120 °C) to shrink the tubing. Do not burn the cable.</p> <p>c. Position the clamping insert so the interior end is flush with the braid of the heat shrink.</p>
<p>The diagram shows two stages of the process. Part A shows a cylindrical piece of shielded heat shrink tubing. Part B shows the same tubing after being heated and shrunk onto the drain wires of the cable. A label 'A' points to the unshrunk tubing, and a label 'B' points to the shrunk tubing. Below the images, the labels are defined: 'A. Shielded heat shrink' and 'B. After heat is applied'.</p>	
	<p>A. Shielded heat shrink B. After heat is applied</p>

Option	Description
M20 gland type	Trim 0.3 in (7 mm).  A. Trim

8. Assemble the gland by folding the shield or braid back over the clamping insert and 1/8 inch (3 mm) past the O-ring.



A. Shield folded back

9. Install the gland body into the conduit opening on the core processor housing.
10. Insert the wires through the gland body and tighten the gland nut onto the gland body.

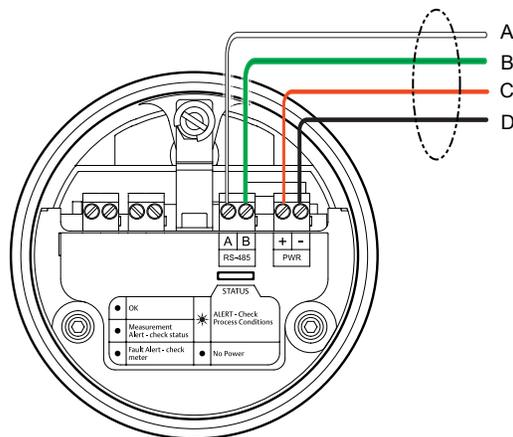


A. Shield folded back
B. Gland body

3.4.3 Processor wiring for the remote-mount 2700 FOUNDATION fieldbus™ option

The following figure illustrates how to connect the individual wires of a 4-wire cable to the processor terminals. For detailed information on mounting and wiring to the remote-mount 2700 FOUNDATION fieldbus transmitter, see the transmitter installation manual.

Figure 3-7: Processor (Modbus/RS-485) connections to the remote-mount 2700 FF transmitter



- A. White wire to RS-485/A terminal
- B. Green wire to RS-485/B terminal
- C. Red wire to Power supply (+) terminal
- D. Black wire to Power supply (-) terminal

Important

- To meet the EC Directive for EMC (Electromagnetic Compatibility), it is recommended that the meter be connected using a suitable instrumentation cable. The instrumentation cable should have individual screen(s), foil or braid over each twisted pair and an overall screen to cover all cores. Where permissible, the overall screen should be connected to earth at both ends (360° bonded at both ends). The inner individual screen(s) should be connected at only one end, the controller end.
- Metal cable glands should be used where the cables enter the meter amplifier box. Unused cable ports should be fitted with metal blanking plugs.

3.5 Wiring to external devices (HART multidrop)

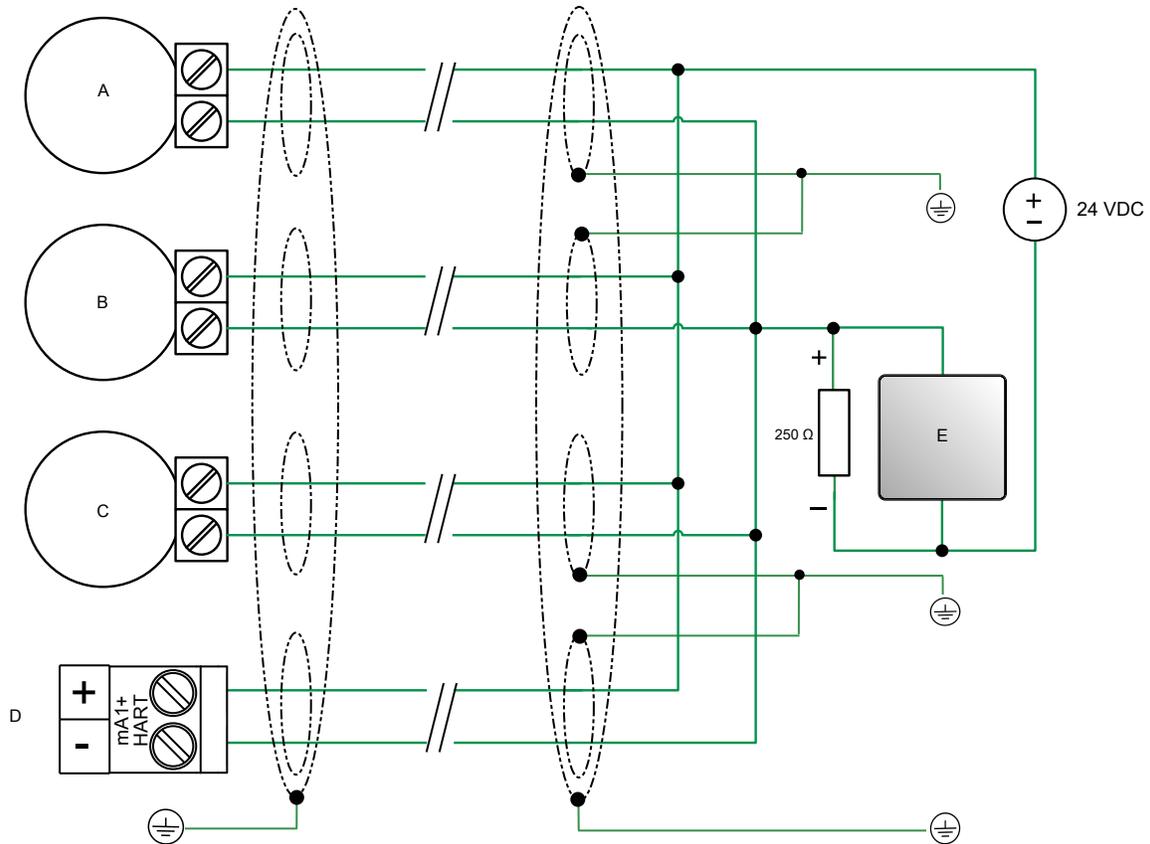
You can wire up to three external HART devices with the meter. The following information provides wiring diagrams for making those connections in safe and hazardous environments.

3.5.1 Wire mA1 in a HART multi-drop environment

Important

To wire power and outputs, see [Wire power and outputs in a HART single-loop environment](#).

Figure 3-8: Wire mA1 in a HART multi-drop environment



- A. HART Device 1
- B. HART Device 2
- C. HART Device 3
- D. Meter (mA+/HART output)
- E. HART/Field Communicator

⚠ CAUTION!

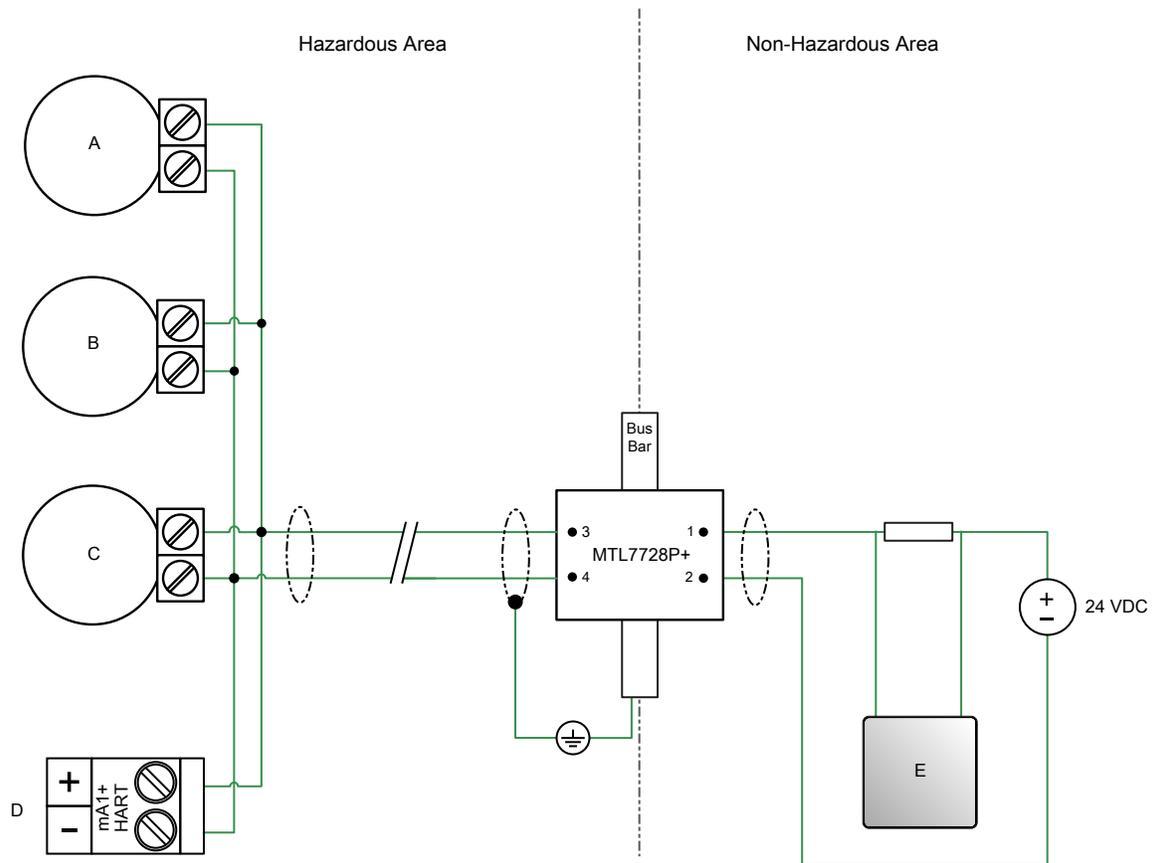
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.5.2 Wire external HART devices in an intrinsically safe area

You can wire up to three external HART devices in an intrinsically safe environment. Following are diagrams showing a HART multidrop connection using a single barrier connection (see [Figure 3-9](#)) and multiple barrier connections (see [Figure 3-10](#)).

When connecting to a single barrier, do the following to determine your cable parameters (for each device):

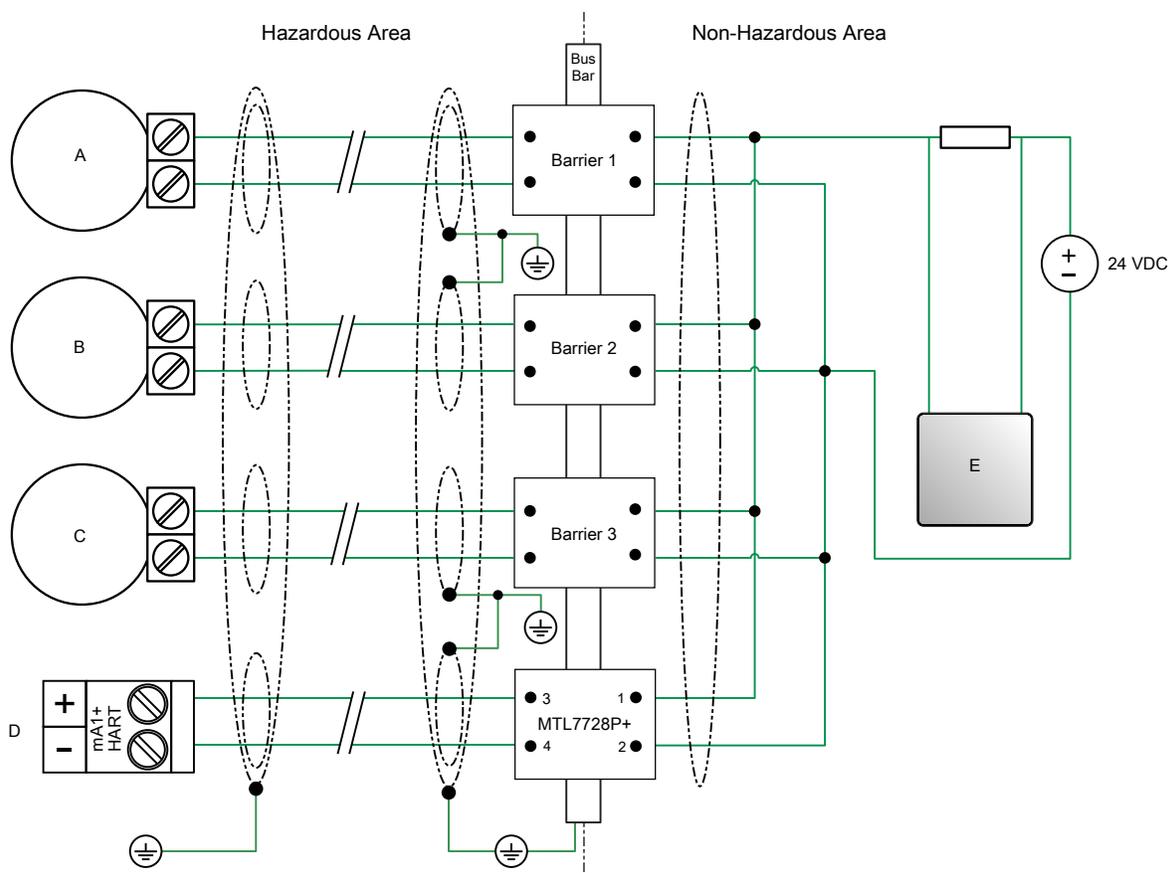
- Sum the C_i and L_i parameters for each device connected.
- Subtract the sum from the C_o and L_o for the barrier.
- Configure all devices to be operating at a fixed 4 mA output.

Figure 3-9: Wiring external devices in an intrinsically safe area (single barrier)


- A. HART Device 1
- B. HART Device 2
- C. HART Device 3
- D. Meter (mA+/HART output)
- E. HART/Field Communicator

⚠ CAUTION!

- **In an electrically noisy environment, screen the cable in a safe area.**
- **To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.**
- **For safety, do not terminate the inner individual screens to earth in a hazardous area.**
- **Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.**

Figure 3-10: Wiring external devices in an intrinsically safe area (multiple barriers)


- A. HART Device 1
- B. HART Device 2
- C. HART Device 3
- D. Meter (mA+/HART output)
- E. HART/Field Communicator

⚠ CAUTION!

- **In an electrically noisy environment, screen the cable in a safe area.**
- **To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.**
- **For safety, do not terminate the inner individual screens to earth in a hazardous area.**
- **Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.**

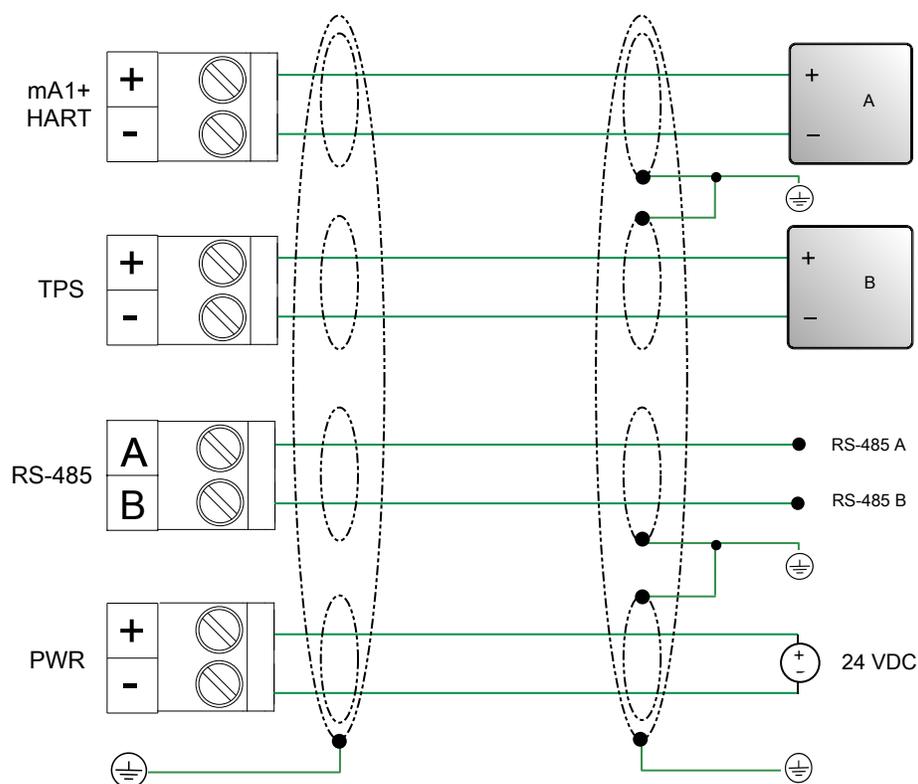
3.6 **Wiring to signal converters and/or flow computers**

For meters with a Time Period Signal (TPS) output, you can wire the meter to an signal converter or flow computer directly. The following information provides wiring diagrams for making those connections in safe and hazardous environments.

When wiring the meter to an active HART host or signal converter/flow computer, you are not required to provide external power to the output connections. These active devices provide the 24 VDC necessary for these connections.

3.6.1 Wire to a signal converter/flow computer in an explosion-proof/flameproof or non-hazardous area

Figure 3-11: Wiring to a signal converter/flow computer in an explosion-proof/flameproof or non-hazardous area



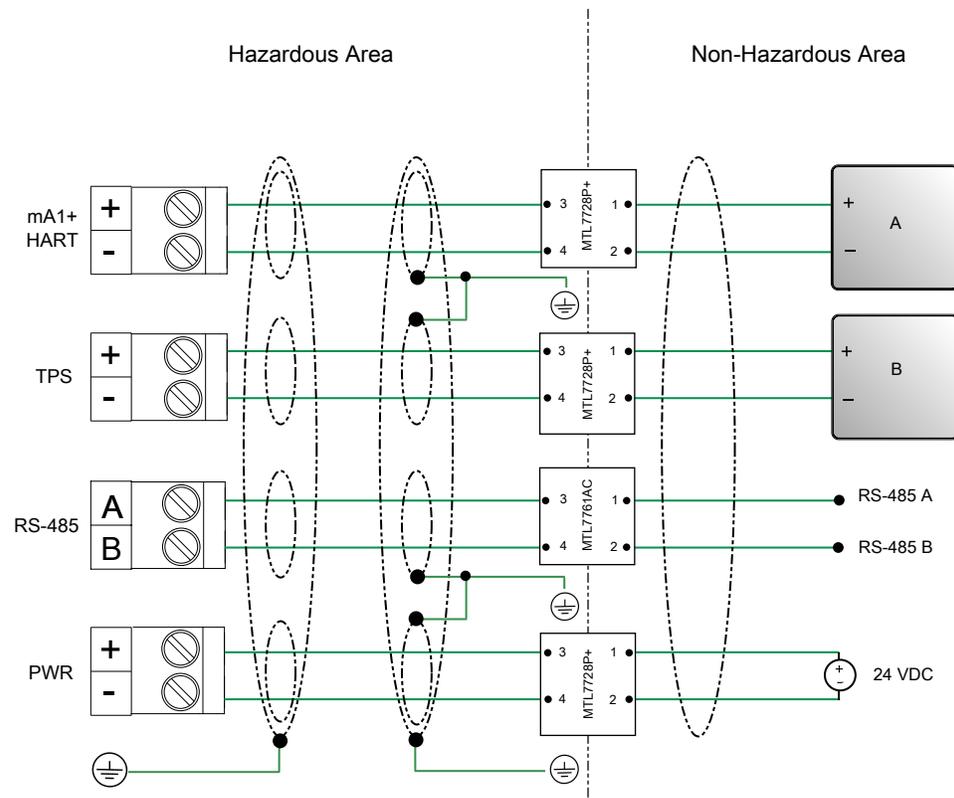
- A. Active HART host
 B. Active signal converter/flow computer

⚠ CAUTION!

- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.6.2 Wire to a signal converter/flow computer in an intrinsically safe area

Figure 3-12: Wiring to a signal converter/flow computer in an intrinsically safe area



- A. Active HART host
 B. Active signal converter/flow computer

⚠ CAUTION!

- In an electrically noisy environment, screen the cable in a safe area.
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- For safety, do not terminate the inner individual screens to earth in a hazardous area.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

4 Grounding

The meter must be grounded according to the standards that are applicable at the site. The customer is responsible for knowing and complying with all applicable standards.

Prerequisites

Use the following guides for grounding practices:

- In Europe, IEC 79-14 is applicable to most installations, in particular Sections 12.2.2.3 and 12.2.2.4.
- In the U.S.A. and Canada, ISA 12.06.01 Part 1 provides examples with associated applications and requirements.

If no external standards are applicable, follow these guidelines to ground the sensor:

- Use copper wire, 14 AWG (2,0 mm²) 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.

CAUTION!

Ground the flowmeter to earth, or follow ground network requirements for the facility. Improper grounding can cause measurement error.

Procedure

Check the joints in the pipeline.

- If the joints in the pipeline are ground-bonded, the sensor is automatically grounded and no further action is necessary (unless required by local code).
- If the joints in the pipeline are not grounded, connect a ground wire to the grounding screw located on the sensor electronics.

Tip

The sensor electronics may be a transmitter, core processor, or junction box. The grounding screw may be internal or external.



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