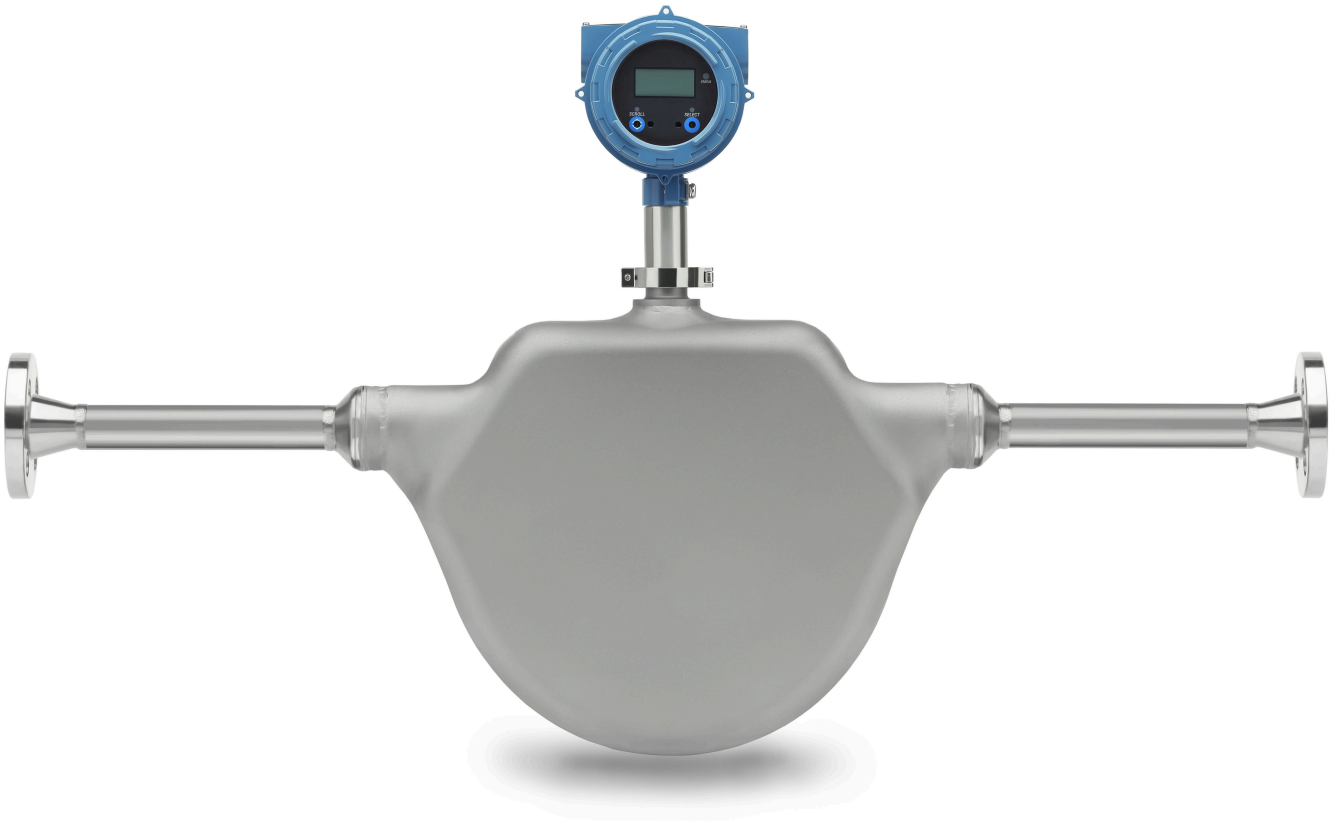
Installation Manual
MMI-20020999, Rev AC
May 2018

Micro Motion® Compact Density Meter (CDM)

7835/7845 Liquid Density Meter Retrofit Installation



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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*

Telephone:

North and South America		**Europe and Middle East**		**Asia Pacific**	
United States	800-522-6277	U.K.	0870 240 1978	Australia	800 158 727
Canada	+1 303-527-5200	The Netherlands	+31 (0) 704 136 666	New Zealand	099 128 804
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		

Contents

1 Planning

Topics covered in this chapter:

1.1 Retrofit installation overview

Following is an overview of the tasks required to install the Compact Density Meter (CDM) as a replacement to the Micro Motion 7835/7845 liquid density meter. We recommend that you review this information before beginning the retrofit installation.

Process	Reference
Confirm you have all parts necessary and meet the basic installation requirements.	See *Section 1.2*
Consider the installation best practices for the removal and installation of your meter(s).	See *Section 1.3*
Confirm any additional wiring, external power supplies, and/or resistance needed to wire to the CDM.	See *Chapter 4*
Remove the existing 7835/7845 liquid density meter.	See *Chapter 2*
Mount the CDM retrofit meter.	See *Chapter 3*
Wire the meter according to the recommended practices for your process environment and required approvals.	See *Chapter 4*
Ground the meter.	See *Grounding*

1.2 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.
- ☐ Verify the spacing requirements for the retrofit meter installation (see *Section 1.6*).

☐ Verify the retrofit wiring requirements, which may vary depending on your existing transmitter configuration:

- Confirm the CDM input/output wiring requirements (see *Chapter 4*).

Tip
Depending on your current configuration, you may need additional wiring or can reuse wiring that had been connected to devices no longer needed.

- For intrinsically safe hazardous area installations, you must purchase new barriers or isolators. You cannot reuse existing safety barriers or galvanic isolators for connecting to the CDM.

Tip
Micro Motion provides safety barrier and galvanic isolator installation kits for wiring the CDM in a hazardous environment. These kits provide the appropriate barriers or isolators depending on the outputs available and approvals required. Contact *flow.support@emerson.com* for more information on ordering these kits.

☐ 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. See *Section 4.6*.
- 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.

☐ 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.

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

1.3 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.

- If you are installing the meter into an application configuration requiring differential pressure, confirm the current configuration is suitable for the CDM.
- 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.
- 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.

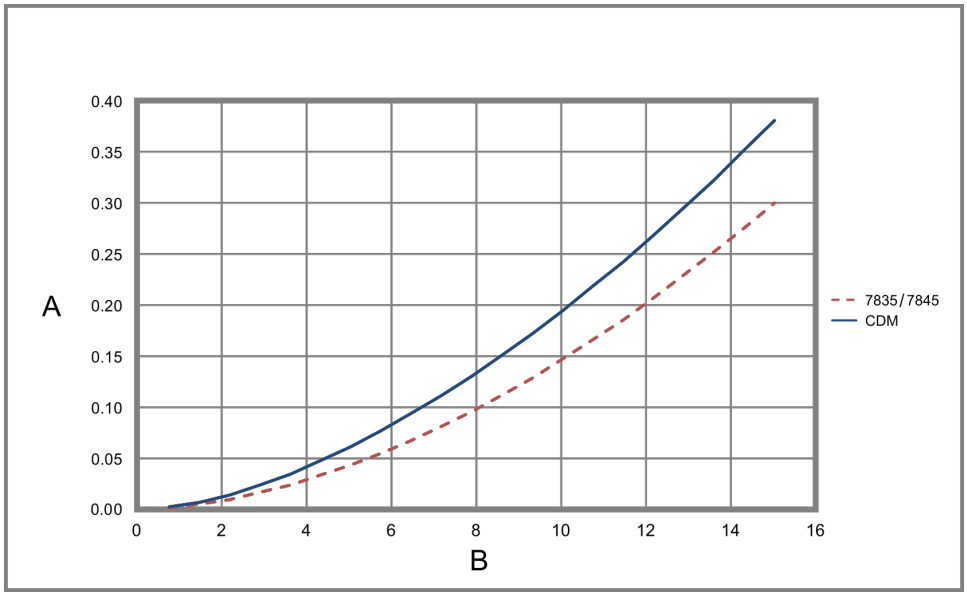
1.4 Pressure drop in the meter

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

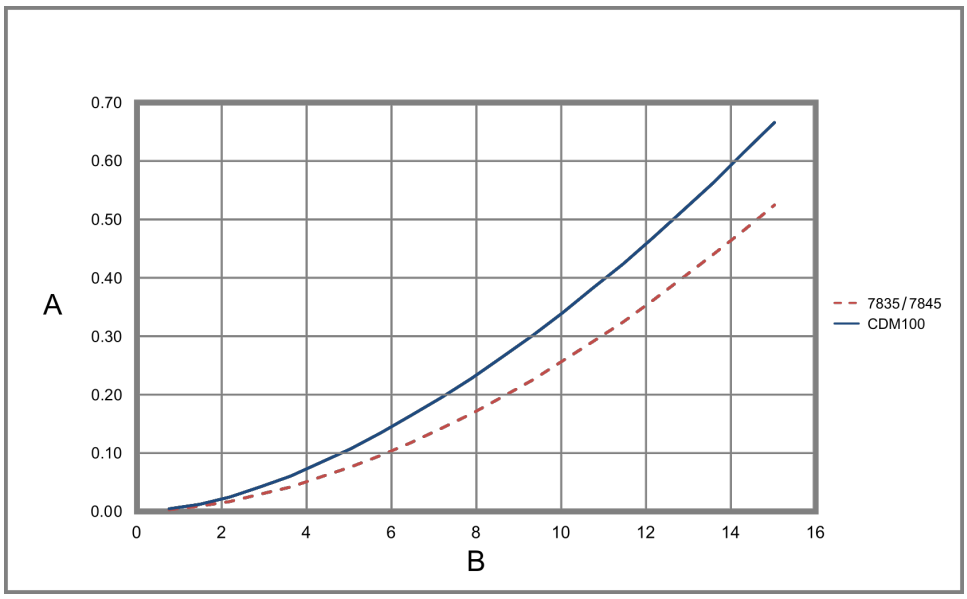


A. Pressure drop (bar)
B. Flow rate (m^3/hr)

Note

- Density = 800 kg/m^3
- Viscosity = 2 cP

Figure 1-2: Sample pressure drop calculations (fluid viscosity equals 10 cP)



A. Pressure drop (bar)
B. Flow rate (m^3/hr)

Note

- Density = 800 kg/m^3
- Viscosity = 10 cP

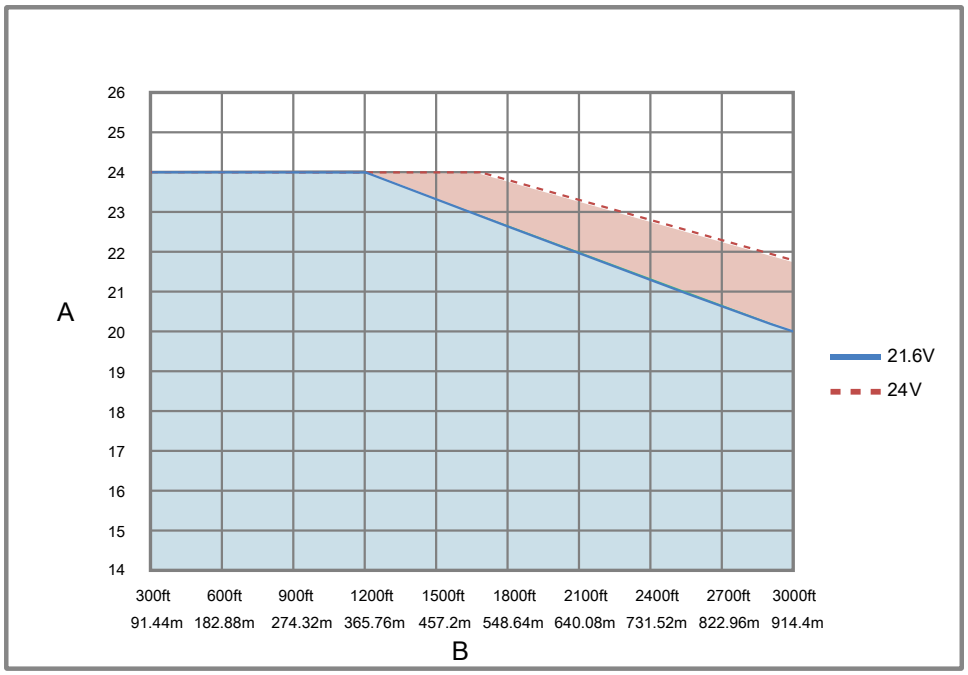
1.5 Power requirements

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 mm^2) 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 mm^2) power-supply cable

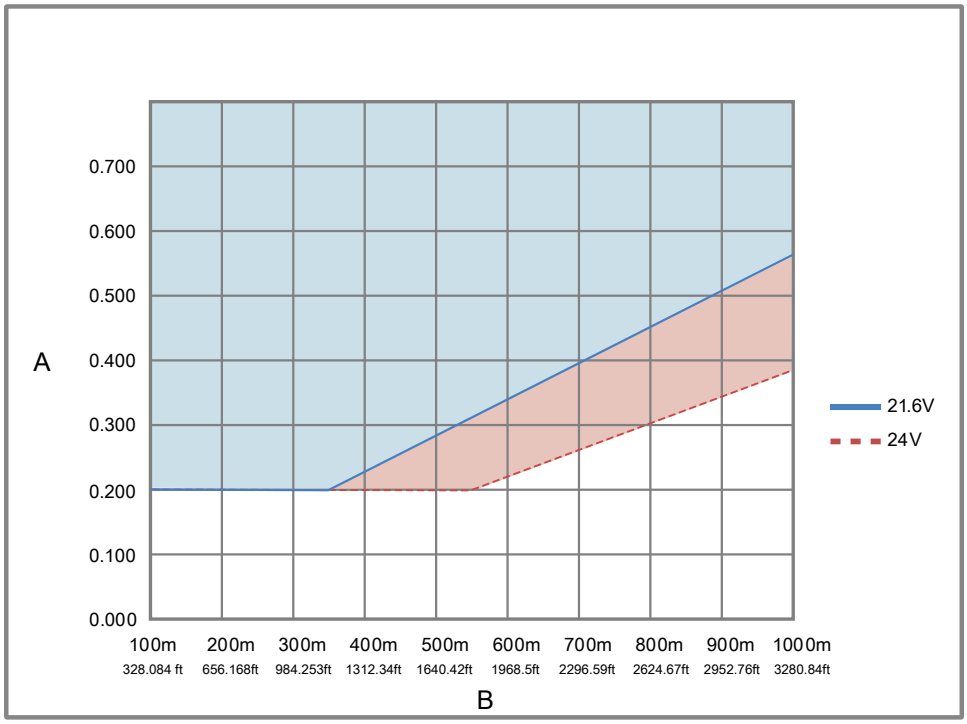
Power cable recommendations for explosion-proof/flameproof meters

Figure 1-3: Minimum wire gauge (AWG per feet)



A. AWG maximum
B. Distance of installation

Figure 1-4: Minimum wire area (mm^2 per meter)

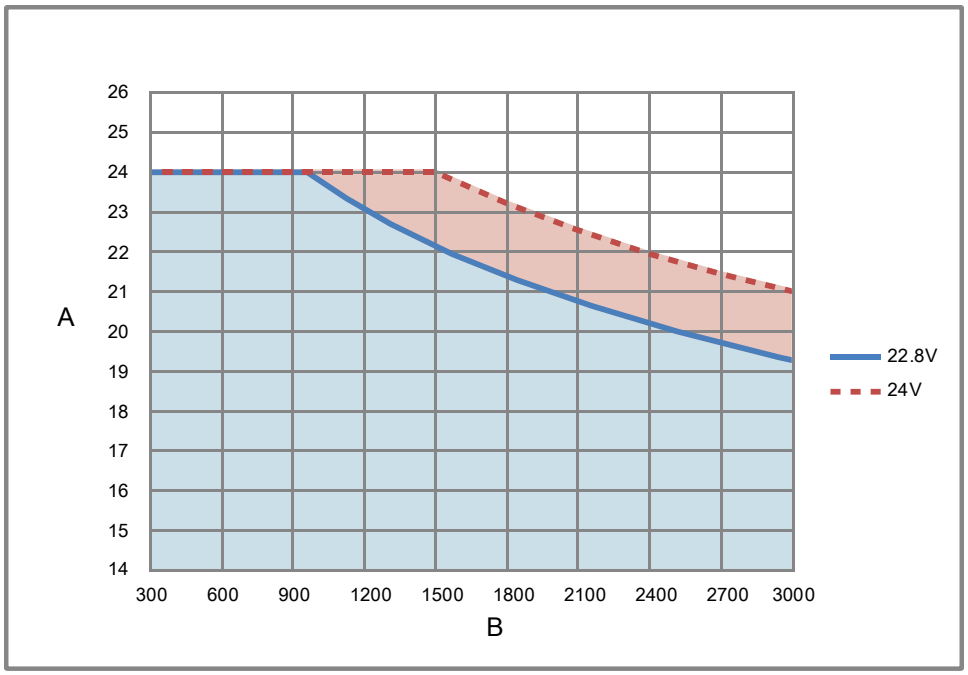


A. Minimum wire area (mm^2)

B. Distance of installation

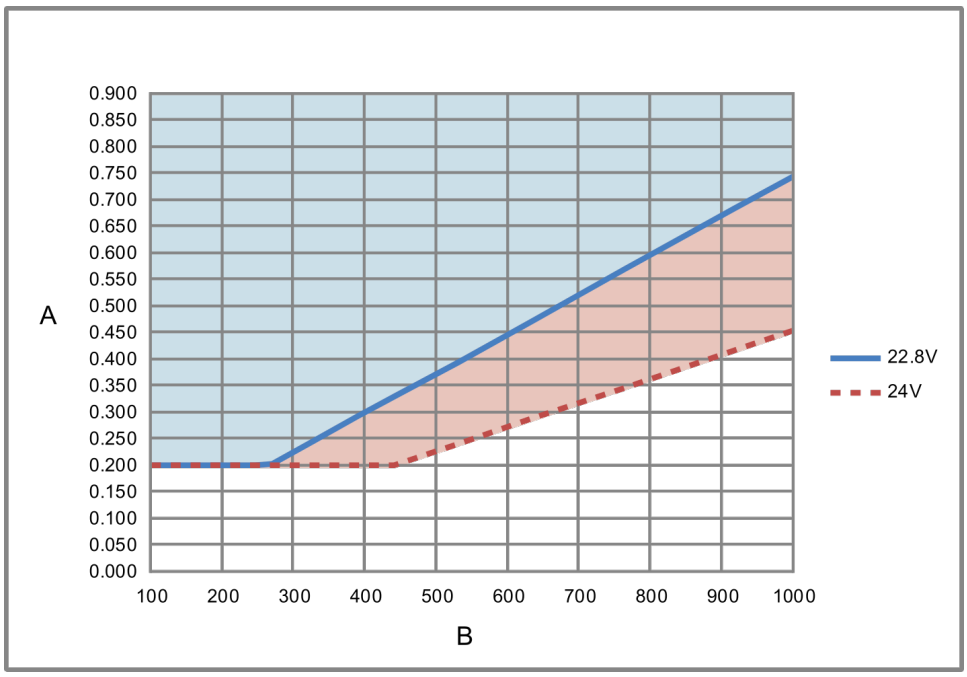
Power cable recommendations for intrinsically safe meters

Figure 1-5: Minimum wire gauge (AWG per feet)



A. AWG
B. Distance of installation

Figure 1-6: Minimum wire area (mm^2 per meter)



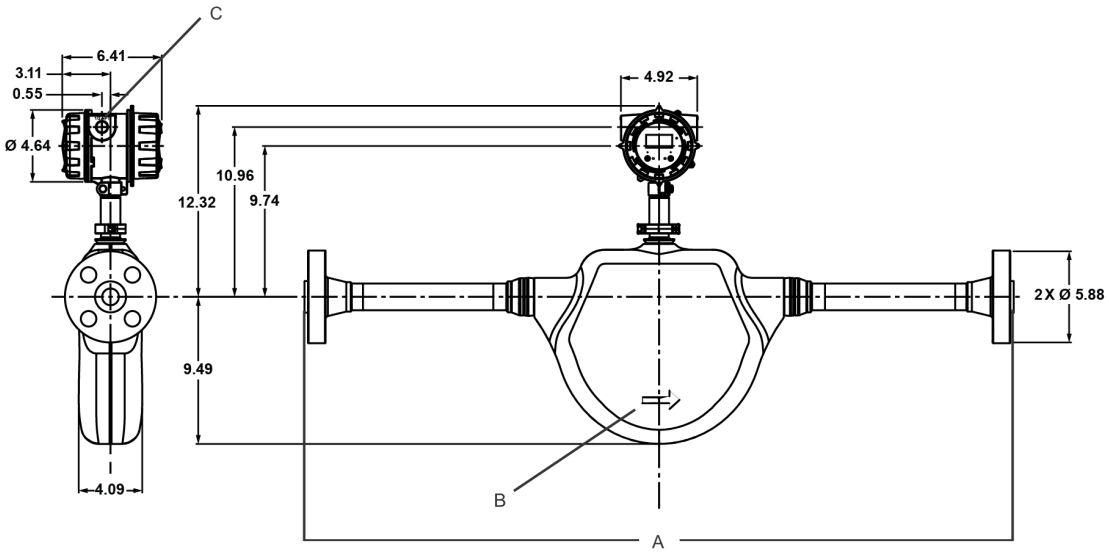
A. Minimum wire area (mm^2)

B. Distance of installation

1.6 Spacing requirements

When determining spacing requirements, be sure to consider the height requirements of the CDM in relation to the existing 7835/7845 meter (see *Figure 1-8*).

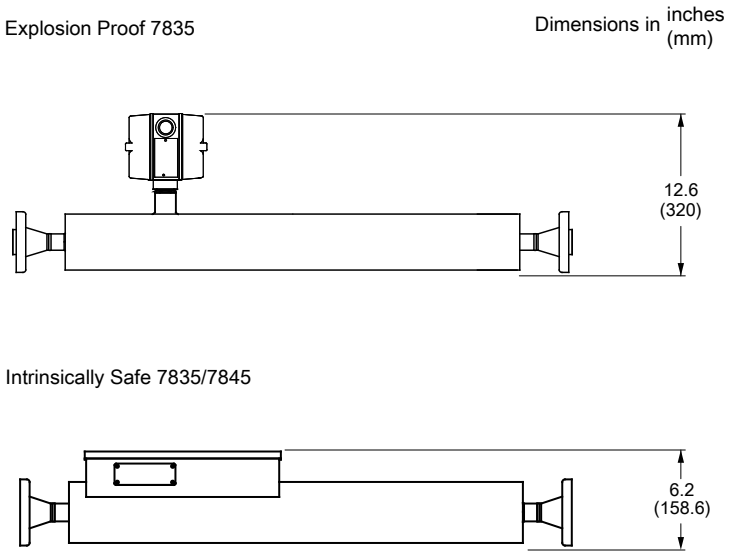
Figure 1-7: CDM retrofit meter dimensions



A. Dim. A — face to face is up to 40.4 inches (1026 mm) ± 0.125 in (3 mm)
B. Nominal flow direction — the meter can be configured for normal (forward), reversed, or bi-directional flow
C. 2x 1/2-14 NPT female electronic interface

Note
Drawing dimensions are in inches.

Figure 1-8: 7835/7845 meter dimensions (height only)



1.7 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.

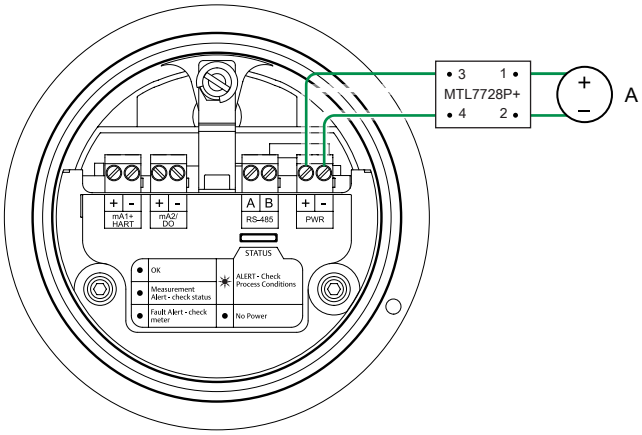
2. Visually inspect the meter for any physical damage.

   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 1-9: 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 Removing a 7835/7845 meter

Topics covered in this chapter:

2.1 Disconnect the 7835/7845 meter wiring

Prerequisites

- Be prepared to manually record the existing wiring connections to the 7835/7845 meter. You will use this information in re-wiring to the CDM.
- If you are using the 7835/7845 with Advanced electronics, be sure to record the parameters and ranges for the analog (mA) outputs — for example, Analog 1 is line density; 4-20 mA is 700-1000 kg/m^3.

⚠ CAUTION!

Confirm the applicable codes of practice for disconnecting and removing a meter. Meter installation and/or removal should be performed by suitably trained personnel only.

Procedure

1. Power down the 7835/7845 meter.
2. If the meter is in a hazardous area, wait five minutes before proceeding to the next step.
3. Remove the thermal insulation from the meter and the surrounding pipework (if applicable).
4. Remove the electronics housing cover to reveal the 7835/7845 wiring connections.
5. Manually record the existing wiring connections to the 7835/7845 meter.

   If you reuse the existing wiring, you should be sure to identify which wires connected to specific outputs and/or input devices in your existing configuration. You will use this information to match the wire connections to the appropriate input/output on the CDM.

   The following figures identify the terminal locations for the Standard electronics board (see *Figure 2-1*) and Advanced electronics board (see *Figure 2-2*).

Figure 2-1: Standard electronics terminal locations

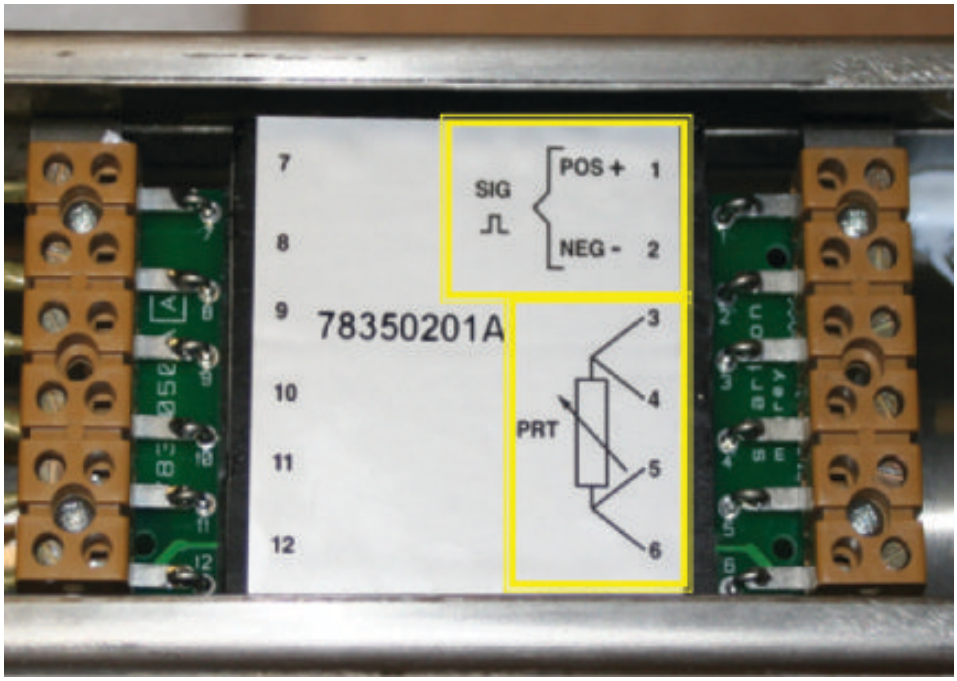
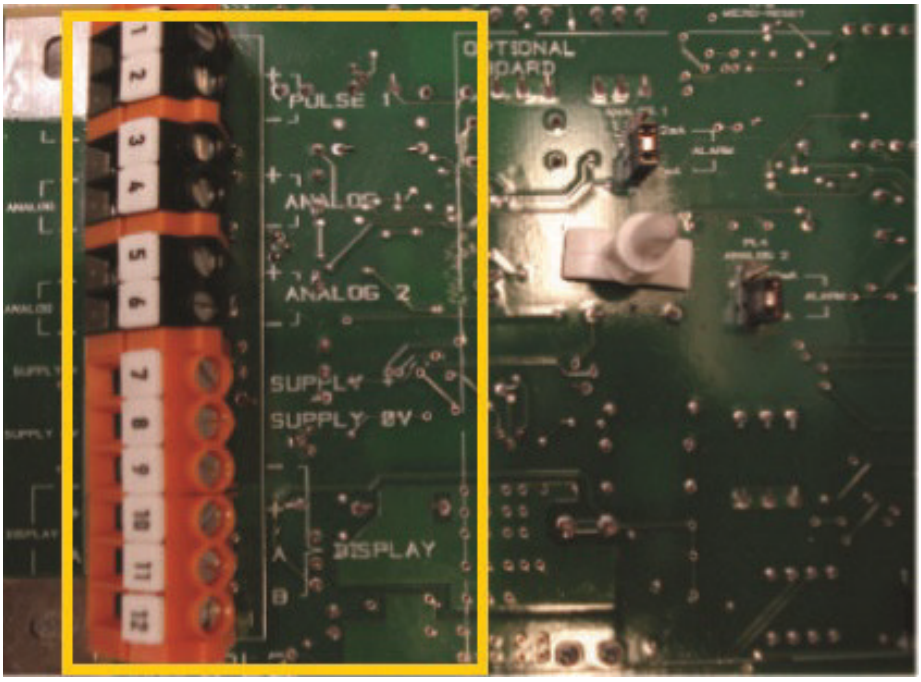


Figure 2-2: Advanced electronics terminal locations



6. Disconnect wiring from the meter.

2.2 Remove the meter from the pipeline

Prerequisites

Before you loosen or remove any connection, depressurize and drain the meter in accordance with the applicable codes of practice.

⚠ CAUTION!

You must take suitable precautions to ensure your safety if the equipment has come into contact with aggressive substances. Meter removal should be performed by suitably trained personnel only in accordance with applicable codes of practice.

Procedure

1. Disconnect the meter (break the seal).
2. Remove the meter.

   ⚠ CAUTION!

   Handle the meter with care when lifting and removing it from the pipeline. Micro Motion recommends that you use lifting straps fitted to the flanged ends to account for the meter weight and its sensitivity to impact.

3. Dispose of the meter in accordance with your local practices (if applicable).

3 Mounting

Topics covered in this chapter:

3.1 Mount the meter

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

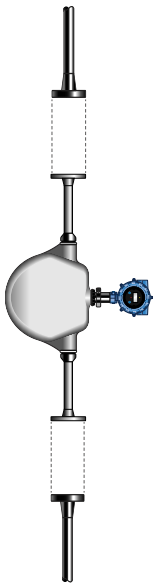
Tip

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 3-1: Mounting the sensor



Notes

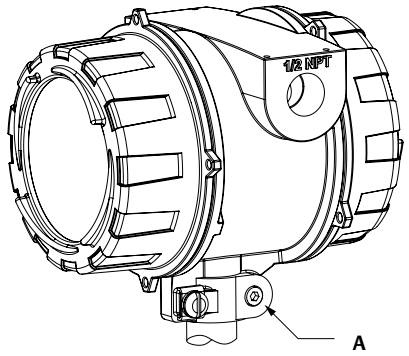
- *Do not use the meter to support the piping.*
- *The meter does not require external supports. The flanges will support the meter in any orientation.*
- *All pipework joints and couplings must be airtight to minimize the presence of gas bubbles in the fluid.*

3.2 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 3-2: Component to secure transmitter in place



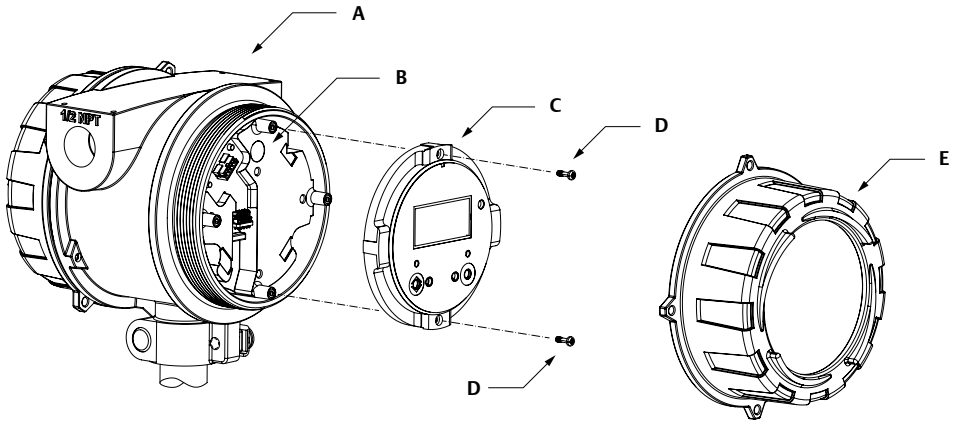
A. M5 socket-head cap screw

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).

3.3 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 3-3: 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.

4 Wiring

Topics covered in this chapter:

4.1 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.

4.2 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 mm^2).

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 4-1: 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
Processor for remote-mount Model 2700 FOUNDATION fieldbus	Disabled	Disabled	Modbus/RS-485

4.3 Retrofit wiring: terminal-to-output conversions

Depending on your current wiring configuration: additional wiring, power supplies, and/or resistance may be required to connect to the CDM. The following information explains the available outputs and wiring requirements of the CDM, and the pin-to-output connector relationships from the 7835/7845 to CDM.

4.3.1 Rewire from 7835/7845 Standard electronics meter

To wire from an existing 7835/7845 meter with Standard electronics, you must have purchased the CDM with the Time Period Signal (TPS) output. The rewiring from a Standards electronics installation requires reconnecting wiring from the 7835/7845 meter and a signal converter/flow computer device.

Procedure

See the following for information on the terminal-to-output relationships from the 7835/7845 and signal converter/flow computer to the CDM.

Important

Depending on whether you are wiring in an explosion proof/flameproof or intrinsically safe area, see the additional information documented for these types of installations.

Function	Take the wire from terminal pin:	...and, connect it to the CDM output terminal:
Time period	Pin 1 (on 7835/7845 meter)	TPS +
	Pin 2 (on 7835/7845 meter)	TPS –

Function	Take the wire from terminal pin:	...and, connect it to the CDM output terminal:
Temperature	Signal converter/flow computer terminals for temperature (See the signal converter/flow computer manual for more information on the device terminals.)	Two wires from the signal converter/flow computer connect to: • mA 1 + • mA 1 – **Important** You must configure the mA output 1 to **Temperature** to provide this measurement.
Power supply	Signal converter/flow computer terminals for power (See the signal converter/flow computer manual for more information on the device terminals.)	Two wires from the signal converter/flow computer connect to: • PWR + • PWR –

4.3.2 Rewire from 7835/7845 Advanced electronics meter

To wire from an existing 7835/7845 meter with Advanced electronics, you must have purchased one of the following CDM transmitter versions:

- Analog
- Time Period Signal (TPS)
- Any option with Modbus/RS-485
- Processor for remote-mount 2700 FOUNDATION™ fieldbus

Procedure

See the following for information on the terminal-to-output relationships from the 7835/7845 to the CDM.

Important

Depending on whether you are wiring in an explosion proof/flameproof or intrinsically safe area, see the additional information documented for these types of installations.

Function	Take the wire from terminal pin:	...and, connect it to the CDM output terminal:
Time period or status output(1)	Pin 1	TPS +
	Pin 2	TPS –
Analog 1	Pin 3	mA 1 +
	Pin 4	mA 1 –

Function	Take the wire from terminal pin:	...and, connect it to the CDM output terminal:
Analog 2	Pin 5	mA 2 +
	Pin 6	mA 2 –
Power supply	Pin 7	PWR +
	Pin 8	PWR –
Remote display	Pin 9	If you purchased a CDM with an integral transmitter and display, the Remote Display wiring is no longer needed.
	Pin 10	
RS-485	Pin 11	RS-485 A
	Pin 12	RS-485 B
If using the optional HART/mA output board:		
HART	HART/mA output board connections	If used for HART, this is now available on mA output 1 (wire accordingly)
Analog 3		If using a third mA output, no third mA output option is available on the CDM. You must wire to an external HART device.

(1) For further information regarding the status output, refer to the 7835/7845 Installation & Configuration manual.

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

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

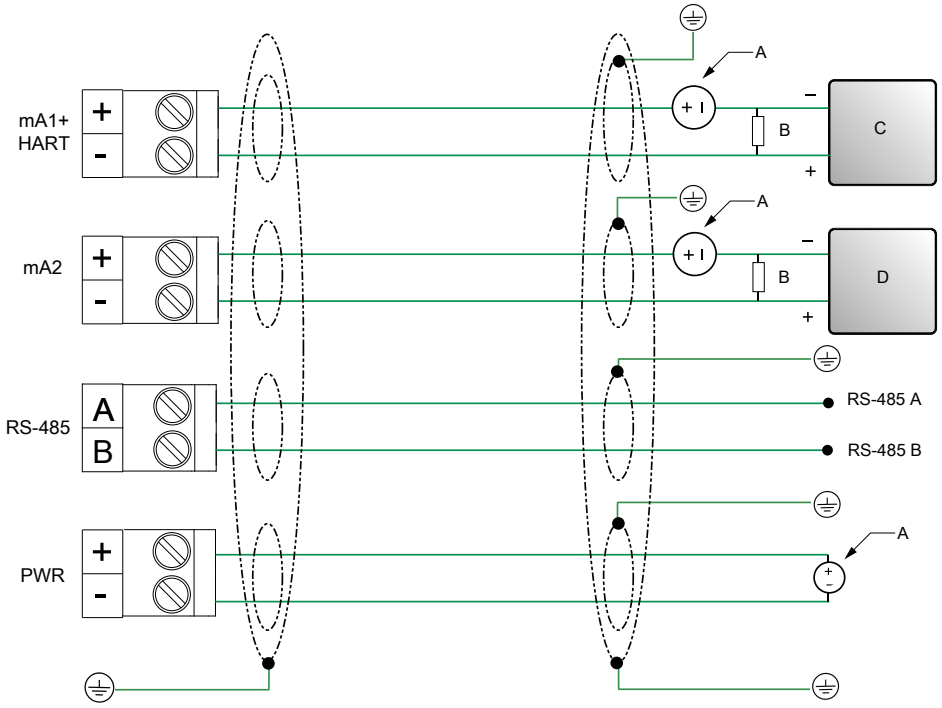
⚠ CAUTION!

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 4-1*).

Figure 4-1: 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.***

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

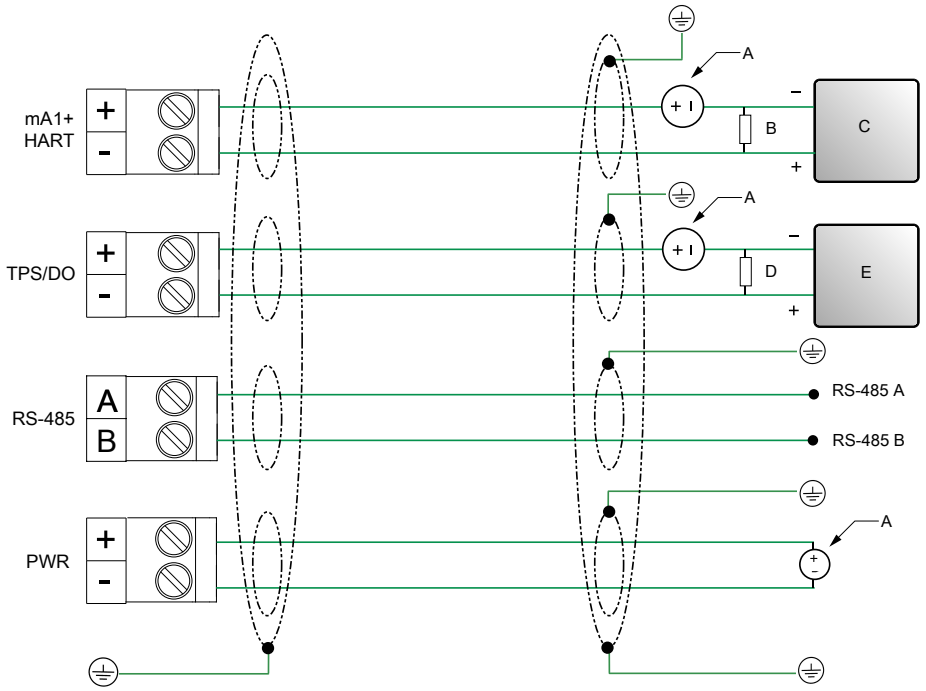
⚠ CAUTION!

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 4-2*).

Figure 4-2: Wiring the TPS or Discrete output version



A. 24 VDC
B. R_{load} (250 Ω resistance)
C. HART-compatible host or controller; and/or signal device
D. R_{load} (500 Ω resistance recommended)
E. Signal converter/flow computer or discrete input device

Note

- *For operating the milliamp output with a 24V supply, a maximum total loop resistance of 657 Ω is allowed.*
- *When operating the TPS or Discrete output with a 24 VDC power supply, a maximum total loop resistance of 1300 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.***

4.5 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*.**

4.5.1 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 4-2: 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 4-3: 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 µH
External inductance/resistance ratio (L_o/R_o)	31.1 µH/Ω
Cable parameters for Group IIB	
External capacitance (C_o)	660 nF
External inductance (L_o)	610 µH
External inductance/resistance ratio (L_o/R_o)	124.4 µH/Ω

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

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

Hazardous area capacitance The capacitance (Ci) of the meter is 0.0011 µF. This value added to the wire capacitance (Ccable) must be lower than the maximum allowable capacitance (Ca) specified by the safety barrier. Use the following equation to calculate the maximum length of the cable between the meter and the barrier: `Ci + Ccable ≤ Ca`

Hazardous area inductance The inductance (Li) of the meter is 0.0 µH. This value plus the field wiring inductance (Lcable), must be lower than the maximum allowable inductance (La) specified by the safety barrier. The following equation can then be used to calculate the maximum cable length between the meter and the barrier: `Li + Lcable ≤ La`

4.5.2 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*.**

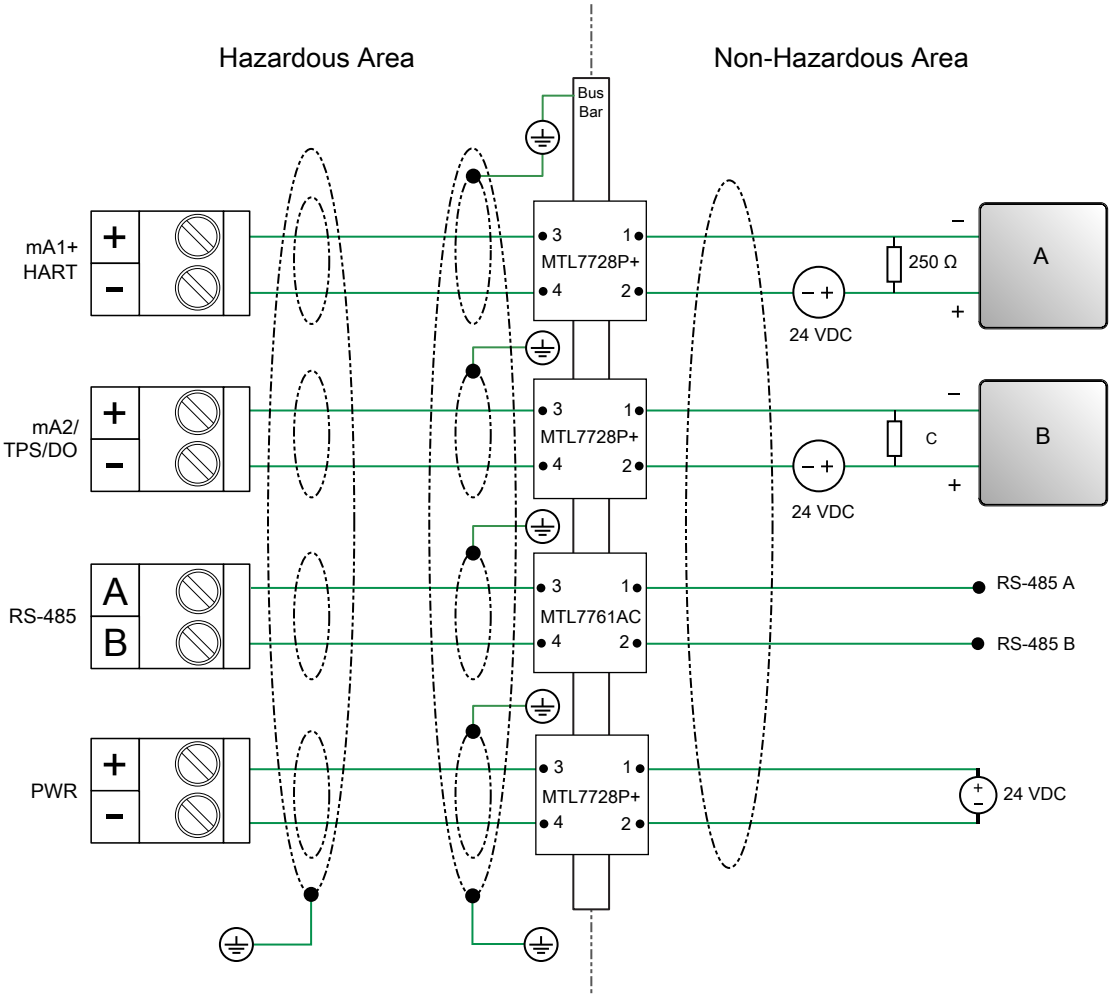
The safety barrier kit provides barriers for connecting all of the available meter outputs. Use the provided barriers with the designated output.

Output(s)	Barrier
4–20 mA	MTL7728P+
• 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 4-3*).

Figure 4-3: 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.***

4.5.3 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

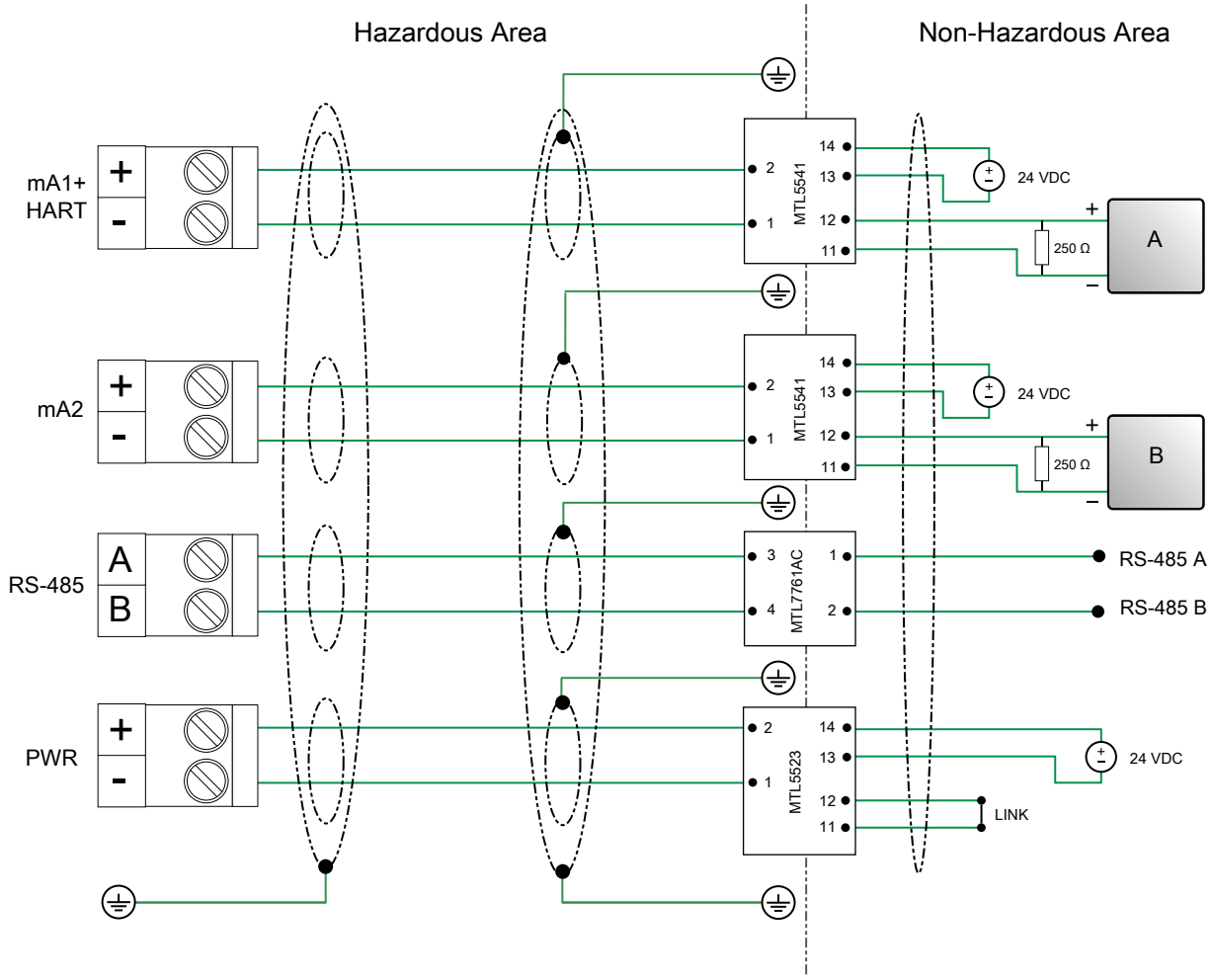
The RS-485 barrier is not isolated.

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 4-4*).

Figure 4-4: 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.***

4.5.4 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

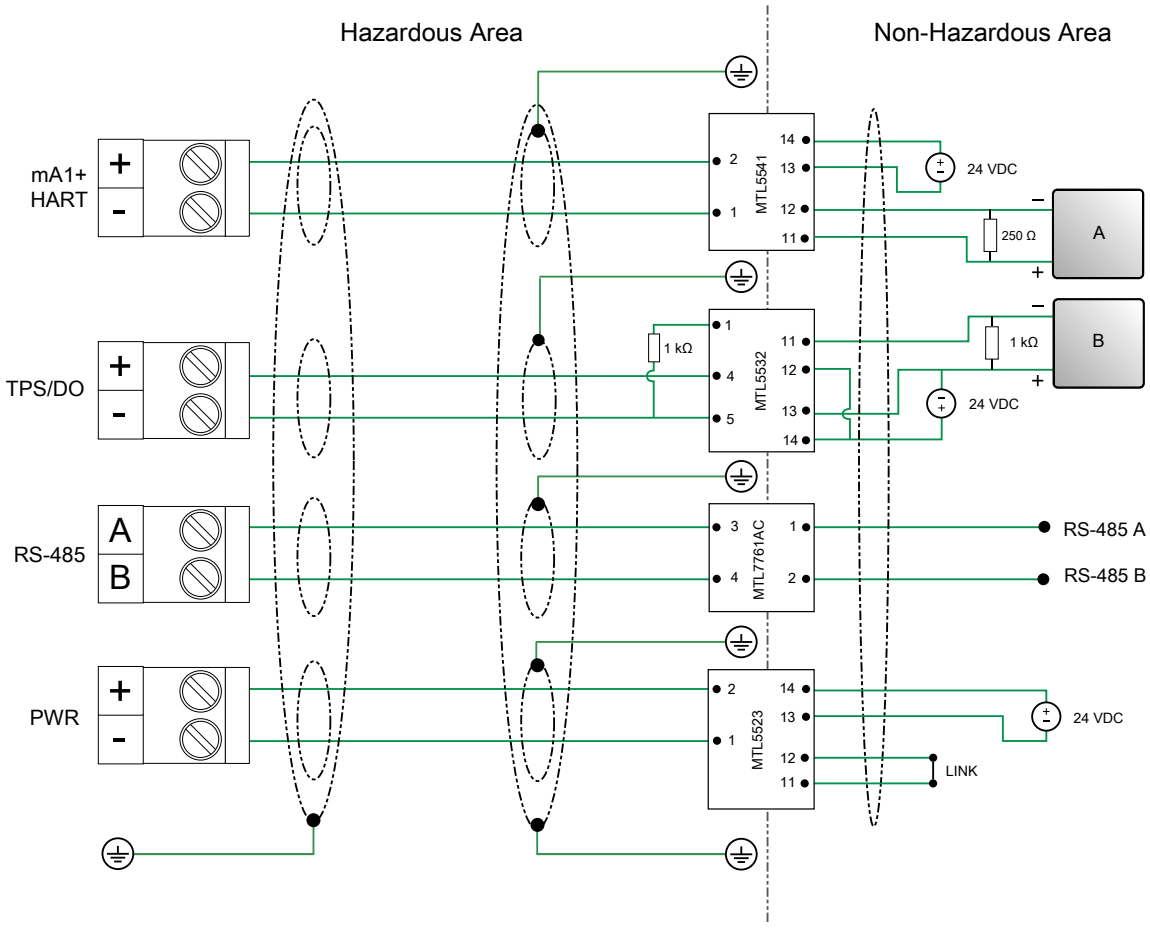
The RS-485 barrier is not isolated.

Output(s)	Isolator
4–20 mA + HART	MTL5541
• 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 4-5*).

Figure 4-5: 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 4-4*).

   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 4-6: MTL5532 switch location (plus ON/OFF switch position)

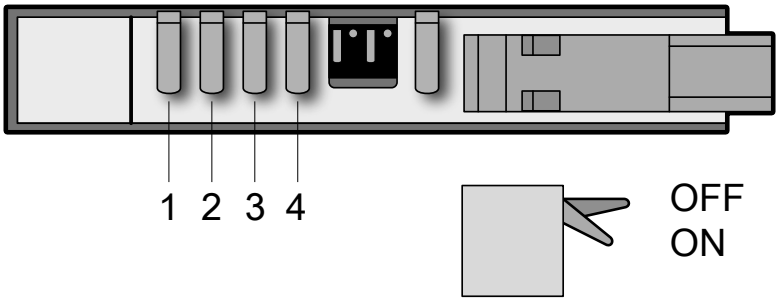


Table 4-4: MTL5532 switch settings

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

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

4.6.1 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 4-5: 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 µH
Maximum external inductance/resistance ratio (L_o/R_o)	31.1 µH/Ω
Cable parameters for Group IIB	
Maximum external capacitance (C_o)	660 nF
Maximum external inductance (L_o)	260 µH
Maximum external inductance/resistance ratio (L_o/R_o)	124.4 µH/Ω

4.6.2 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 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 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 360º 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

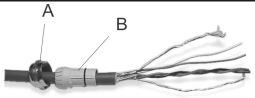
For user-supplied cable glands, the gland must be capable of terminating the drain wires.

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

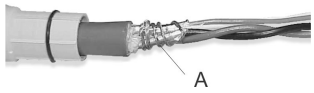
3. Strip the cable jacket.

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)

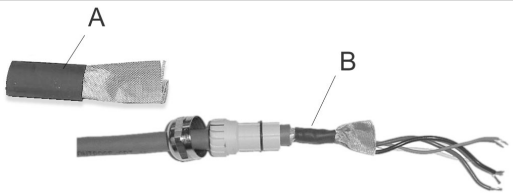
6. Wrap the drain wires twice around the shield and cut off the excess drain wires.

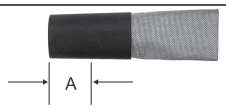


A. Drain wires wrapped around shield

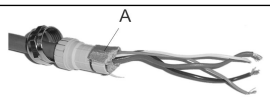
7. For foil (shielded cable) only:

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

Option	Description
NPT gland type	a. Slide the shielded heat shrink over the drain wires. Ensure that the wires are completely covered. b. Apply heat (250 °F or 120 °C) to shrink the tubing. Do not burn the cable. c. Position the clamping insert so the interior end is flush with the braid of the heat shrink.  *A. Shielded heat shrink* *B. After heat is applied*

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

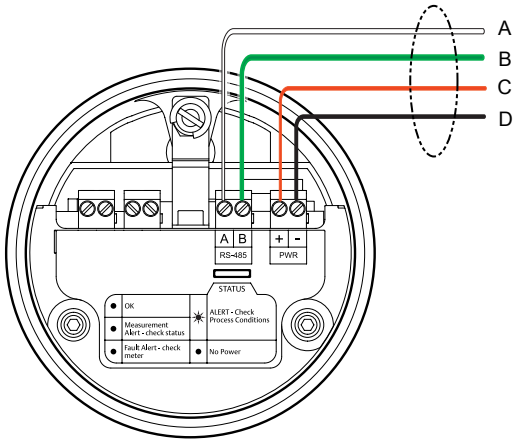
9. Install the gland body into the conduit opening on the core processor housing.
10. Insert the wires through the gland body and tighten the gland nut onto the gland body.

A. Shield folded back
B. Gland body

4.6.3 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 4-7: 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.*

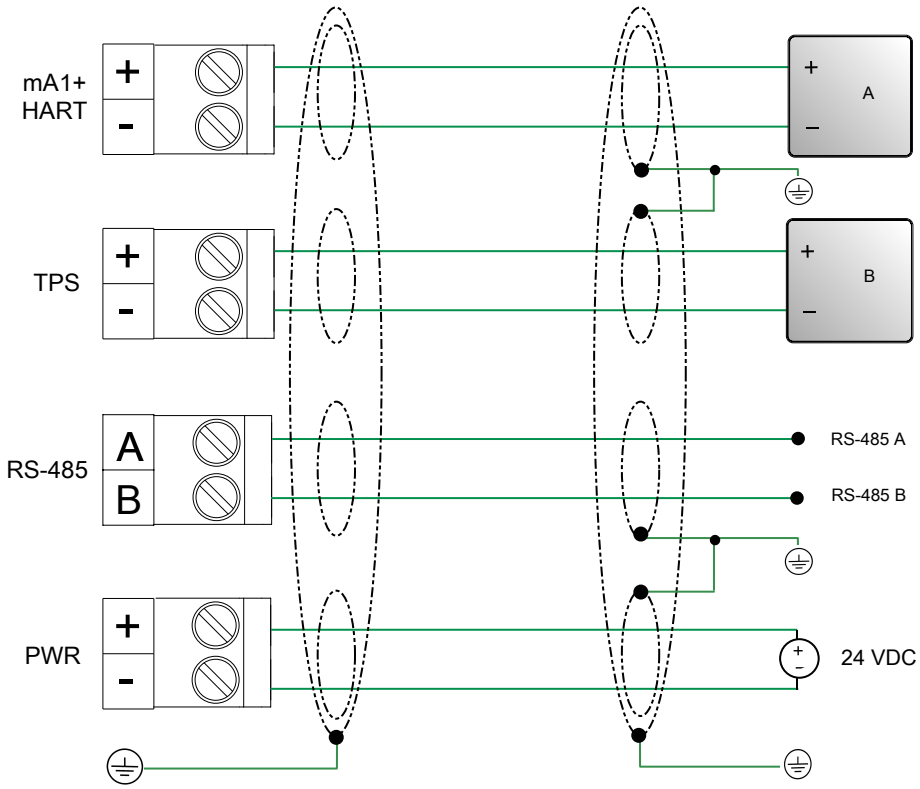
4.7 Wiring to signal converters and/or flow computers

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.

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

Figure 4-8: Wiring to a signal converter/flow computer in an explosion-proof/ flameproof or non-hazardous area



A. Active HART host

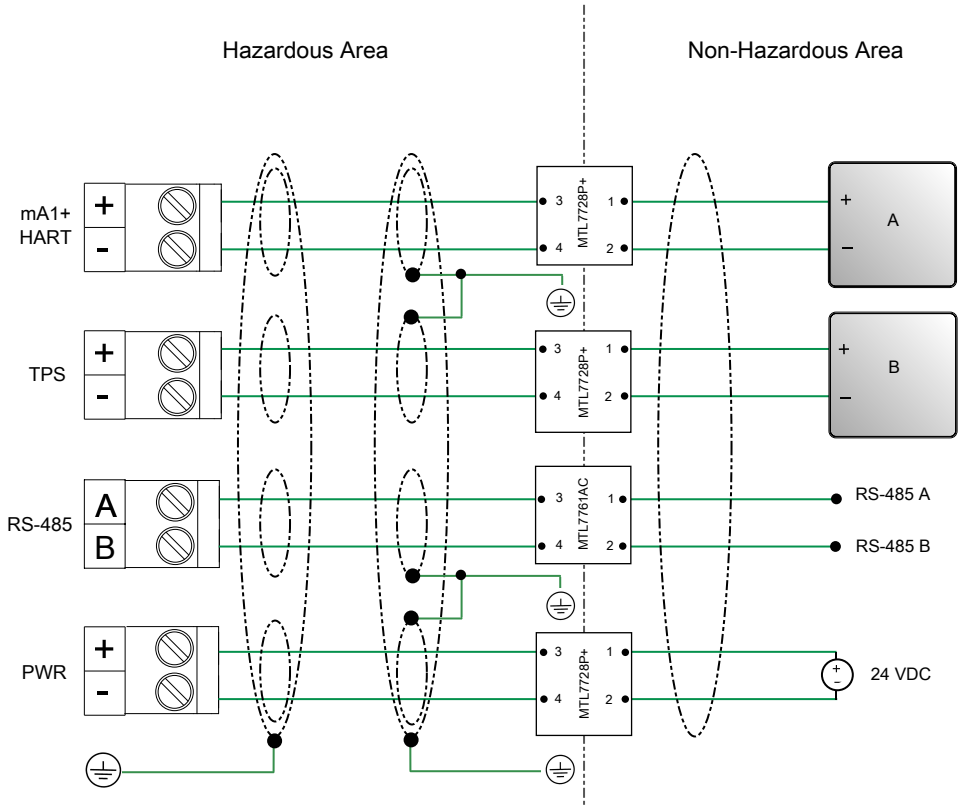
B. Active signal converter/flow computer

⚠ 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.***

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

Figure 4-9: 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.***

5 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

Micro Motion suggests the following guides for grounding practices:

- In Europe, EN 60079-14 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.
- For IECEx installations, IEC 60079-14 is applicable.

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

- Use copper wire, 18 AWG (0.75 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.

⚠ CAUTION!

Ground the meter 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.

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Micro Motion Inc. USA
Worldwide Headquarters
7070 Winchester Circle
Boulder, Colorado USA 80301
T +1 303-527-5200
T +1 800-522-6277
F +1 303-530-8459
www.emerson.com

Micro Motion Europe
Emerson Automation Solutions
Neonstraat 1
6718 WX Ede
The Netherlands
T +31 (0) 70 413 6666
F +31 (0) 318 495 556
www.micromotion.nl

Micro Motion Asia
Emerson Automation Solutions
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T +65 6777-8211
F +65 6770-8003

Micro Motion United Kingdom
Emerson Automation Solutions
Emerson Process Management Limited
Horsfield Way
Bredbury Industrial Estate
Stockport SK6 2SU U.K.
T +44 0870 240 1978
F +44 0800 966 181

Micro Motion Japan
Emerson Automation Solutions
1-2-5, Higashi Shinagawa
Shinagawa-ku
Tokyo 140-0002 Japan
T +81 3 5769-6803
F +81 3 5769-6844

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