Installation Manual
MMI-20031632, Rev AA
August 2016

Micro Motion® 2-Wire Time Period Signal (TPS) Compact Density Meter (CDM)

2-Wire TPS CDM Installation Supplement

MICRO MOTION™

EMERSON™
Process Management

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 EC declaration of conformity for directives that apply to this product. The EC declaration of conformity, with all applicable European directives, and the complete ATEX Installation Drawings and Instructions are available on the internet at *www.micromotion.com* or through your local Micro Motion support center.

For information about the Pressure Equipment Directive, go to *www.micromotion.com/documentation*.

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 transmitter configuration manual. Product data sheets and manuals are available from the Micro Motion web site at *www.micromotion.com/documentation*.

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.micromotion.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
Venezuela	+58 26 1731 3446	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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Appendices and reference

1 Planning

Topics covered in this chapter:

1.1 2-wire installations

The 2-wire Time Period Signal (TPS) is a configuration option available on the Compact Density Meter (CDM).

This option provides:

- A TPS output superimposed on the same pair of wires used to power the meter
- An optional 4-wire connection to the internal RTD

Restriction

The 2-wire TPS device does not support:

- Internal calculations of density
- Internal calculations of process variables, such as velocity indication, case temperature measurement, or integral health diagnostics
- The display option available on the CDM

For more information on the availability of these features and functionality, refer to the full CDM installation and configuration manuals.

1.2 Installation checklist

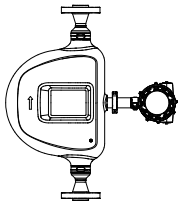
☐ Make sure that the hazardous area specified on the approval tag is suitable for the environment in which the meter will be installed.

☐ Verify that the local ambient and process temperatures are within meter limits.

☐ 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 — vertical, flowing up

Liquids and slurries	

☐ Confirm the CDM output wiring requirements.

Tip

Micro Motion provides safety barriers for wiring the CDM in a hazardous environment. For the 2-wire TPS CDM electronics, the spare part model codes BARRIER7787+ and BARRIER7764+ provide the barriers needed for an intrinsically-safe installation. For ordering information, contact *flow.support@emerson.com*.

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.
- 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.

Important

Do not use the meter to align misaligned piping as this can invalidate the meter calibration.

- The meter does not require external supports. The flanges will support the meter in any orientation.

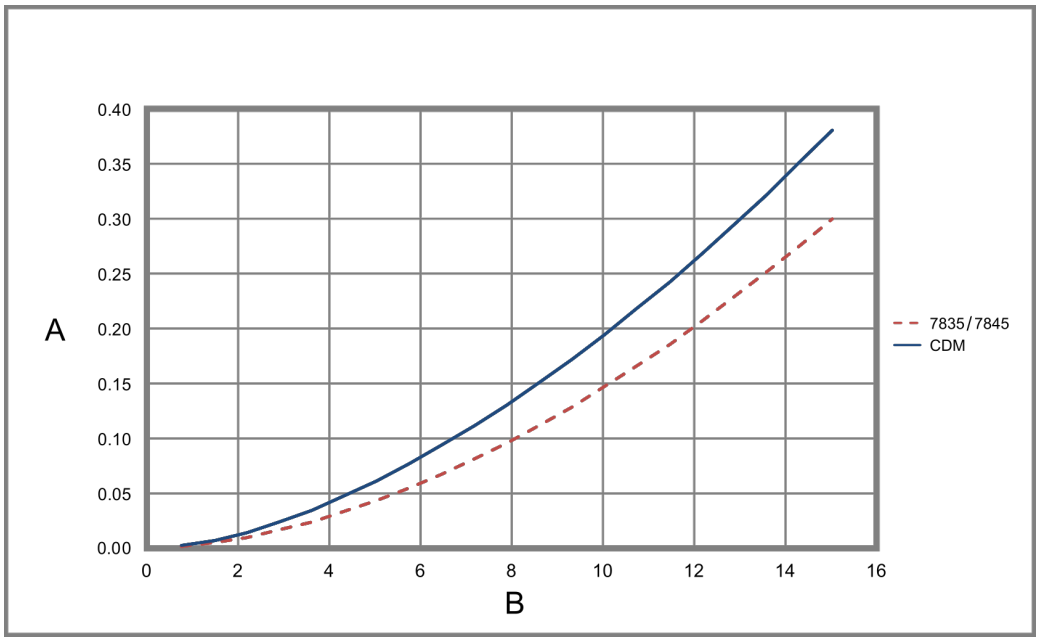
1.4 Pressure drop in the meter

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.micromotion.com*.

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

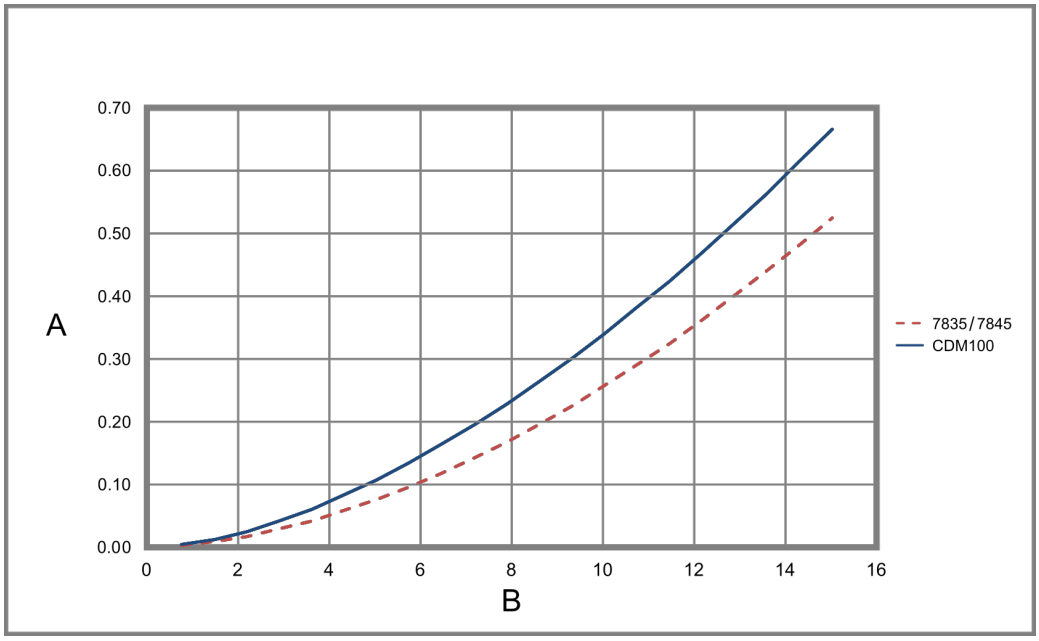


A. Pressure drop (bar)
B. Flow rate (m^3/hr)

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 Recommended flow rates

Typical flow recommendations	Flow rate	Velocity
Minimum	3 gpm (700 L/hr)	1.5 ft/sec (0.5 m/sec)
Normal	11 gpm (2,500 L/hr)	5 ft/sec (1.5 m/sec)
Maximum	75 gpm (17,000 L/hr)	30 ft/sec (9 m/sec)

Note

For fluids that contain abrasive particles, velocity should be below 10 ft/s (3 m/s).

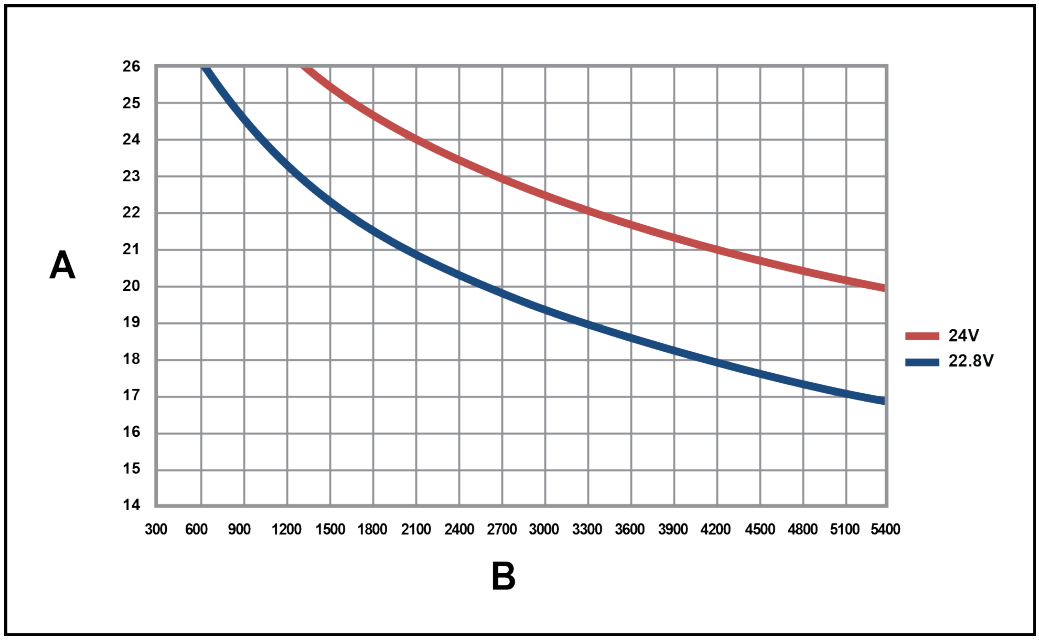
1.6 Power requirements

The following DC power requirements are needed to operate the meter:

- 24 VDC, 0.25 W typical with 300 Ω barrier, 0.3 W maximum with 300 Ω barrier
- Minimum recommended voltage: 22.8 VDC with 1000 ft of 22 AWG (300 m of 0.25 mm^2) power-supply cable with 300 Ω barrier

Power cable recommendations for intrinsically-safe meters

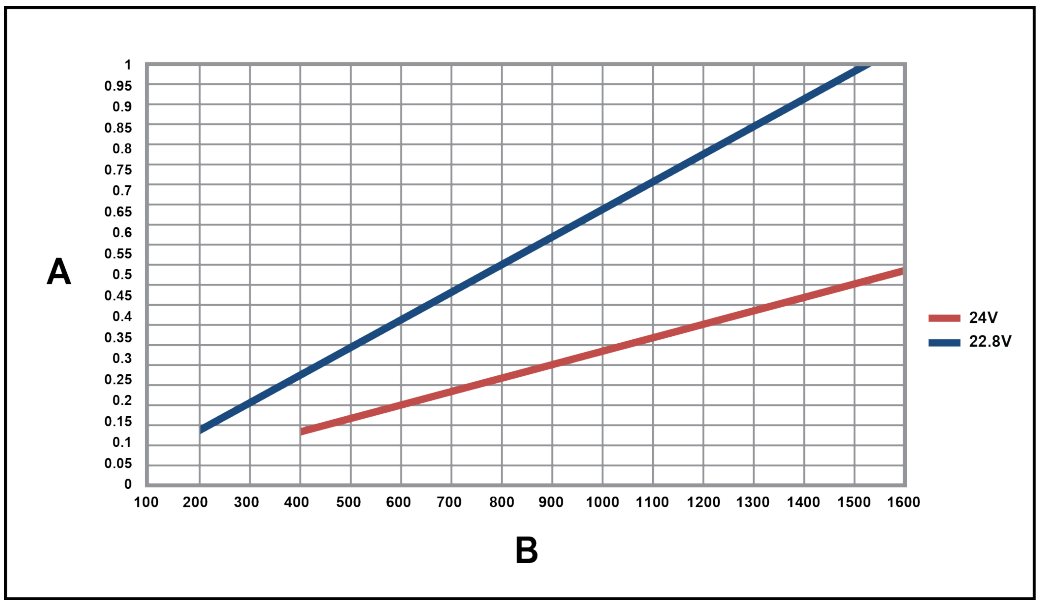
Figure 1-3: Minimum wire gauge with 300 Ω barrier



A. AWG

B. Distance of installation in feet

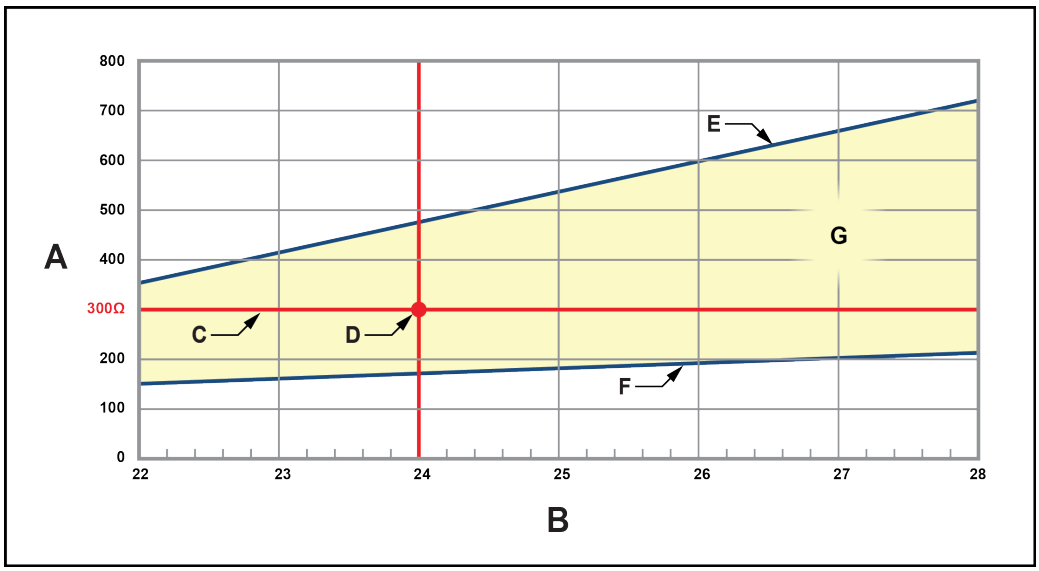
Figure 1-4: Minimum wire area with 300 Ω barrier



A. Minimum wire area (mm^2)

B. Distance of installation in meters

Figure 1-5: Limits of series resistance versus supply voltage



A. Series resistance (Ω)
B. Supply voltage (V)
C. 300 Ω barrier resistance
D. Normal operating point
E. Maximum resistance for correct operation
F. Minimum resistance for 5 volt TPS
G. The 2-wire CDM fully operates anywhere in the shaded area

1.7 Perform a pre-installation meter check

Micro Motion recommends that you check the meter prior to installation. This check confirms that the meter was not damaged during shipment.

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. Connect and power up the meter.

   To access the PWR terminals, remove the back transmitter housing cover.

4. Verify that the meter is empty, clean, and dry.

5. Allow the Time Period Signal (TPS) to stabilize to +/- 100ns before recording the value.
6. Once stabilized, measure the TPS output and temperature of the meter from the internal RTD.
7. Verify that the measured TPS value matches the *Verification Time Period (on Air) @ 20C (68F)* value shown on the calibration certificate to within the limits in the following table.

Meter type	Air check limit at 68 °F (20 °C)	Added temperature effect
CDM100M	+/- 2 µs	-570 (ns/°C) * (T-20 °C)
CDM100P	+/- 2 µs	-445 (ns/°C) * (T- 20 °C)

2 Mounting

Topics covered in this chapter:

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

2.1 Mount the meter

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

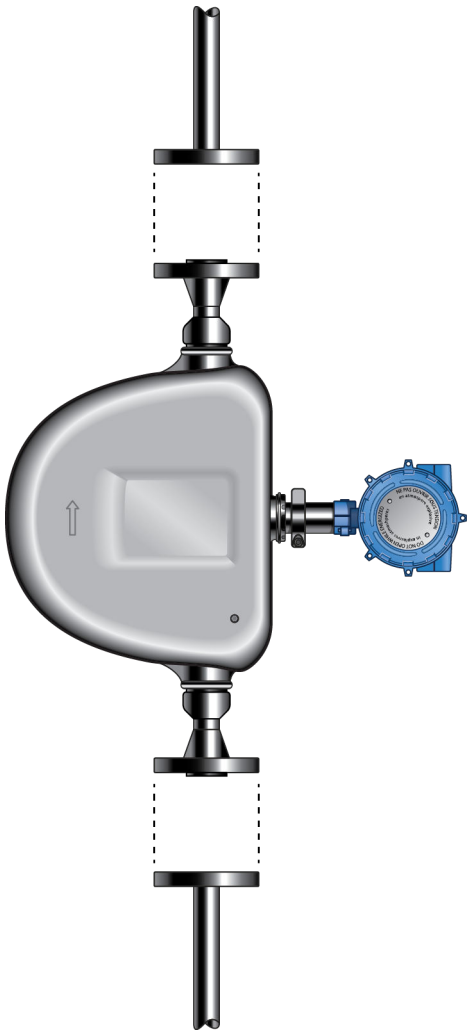
Tip

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

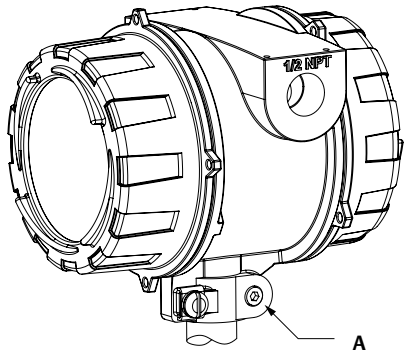
- *Do not use the meter to support the piping.*
- *The meter does not require external supports. The flanges will support the meter in any orientation.*
- *All pipework joints and couplings must be airtight to minimize the presence of gas bubbles in the fluid.*

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).

3 Wiring

Topics covered in this chapter:

3.1 Terminals and wiring requirements

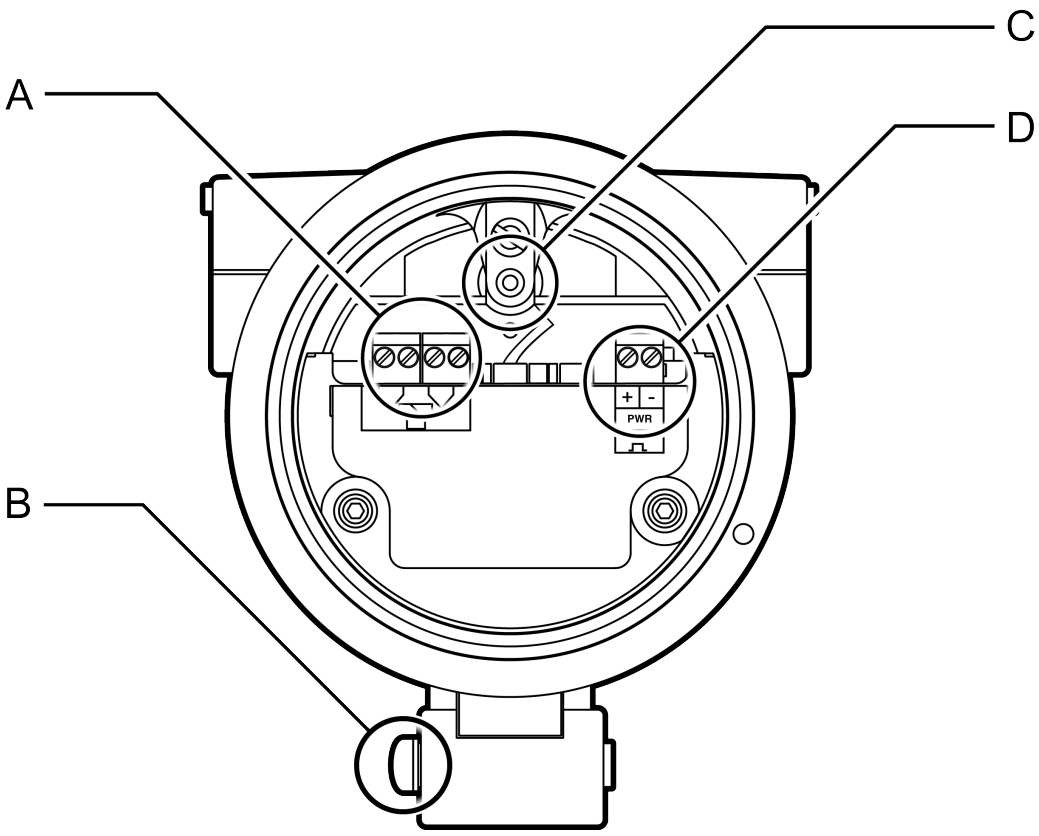
Three pairs of wiring terminals are available for transmitter outputs. One terminal is designated for the 24 VDC Power and Time Period Signal (TPS). The other two terminals are for the internal RTD connection.

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.

Figure 3-1: Output wiring terminals



A. RTD connector block
B. Chassis ground (external)
C. Chassis ground (internal)
D. Power/TPS connector block

3.2 Hazardous area output wiring

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

Information provided about wiring the safety barriers 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 Micro Motion Product Documentation DVD and accessible on the Micro Motion website at *www.micromotion.com*.**

3.2.1 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 3-1: Power in/signal output terminals 1, 2

Parameter		
Maximum input voltage	Ui	28 V
Maximum input current	Ii	93 mA
Maximum input power	Pi	0.65 W
Maximum internal capacitance	Ci	0 nF
Maximum internal inductance	Li	0 mH

Table 3-2: RTD terminals 5, 6, 7 and 8

Parameter		
Maximum input voltage	Ui	12 V
Maximum input current	Ii	36 mA
Maximum input power	Pi	0.432 W
Maximum internal capacitance	Ci	0 nF
Maximum internal inductance	Li	0 mH

The voltage, current, and power values are the total available to all four RTD connections.

The total inductance (La) and capacitance (Ca) allowable for the electronics plus the cable connecting it to the Zener barriers must be equal or less than the specified values for the hazardous are classification. Refer to the hazardous area approvals documentation shipped with the meter.

Hazardous area capacitance	The capacitance (Ci) of the meter is 0.0 µF. There is no extra capacitance when calculating the maximum capacitance allowable for the connecting cable. Therefore, the cable capacitance may be less or equal to the maximum permitted capacitance (Ca) specified by the safety barrier: `(Ccable ≤ Ca)`
Hazardous area inductance	The inductance (Li) of the meter is 0.0 µH. There is no extra inductance when calculating the maximum inductance allowable for the connecting cable. Therefore, the cable inductance may be less or equal to the maximum permitted inductance (La) specified by the safety barrier: `(Lcable ≤ La)`

3.2.2 Wire all intrinsically-safe installations using Zener safety barriers

Micro Motion provides safety barriers for wiring 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 the appropriate barriers.

⚠ CAUTION!

- **Install the meter installation and wiring only if you are suitably trained 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.micromotion.com*.**
- **Wire the i.s. barrier earth directly to its own earth bar as described in the safety instructions. If you do not have a good i.s. earth — for example, if you are installing the meter in a dry area, then use galvanic isolators instead of Zener safety barriers. Order galvanic isolators from an external supplier since Micro Motion does not sell them.**

The barriers are used for connecting all of the available meter outputs. Use the following barriers with the designated output.

Output(s)	Barrier	Model code for ordering
Power and TPS	MTL 7787+	BARRIER7787
RTD	MTL 7764+ (two)	BARRIER7764

Procedure

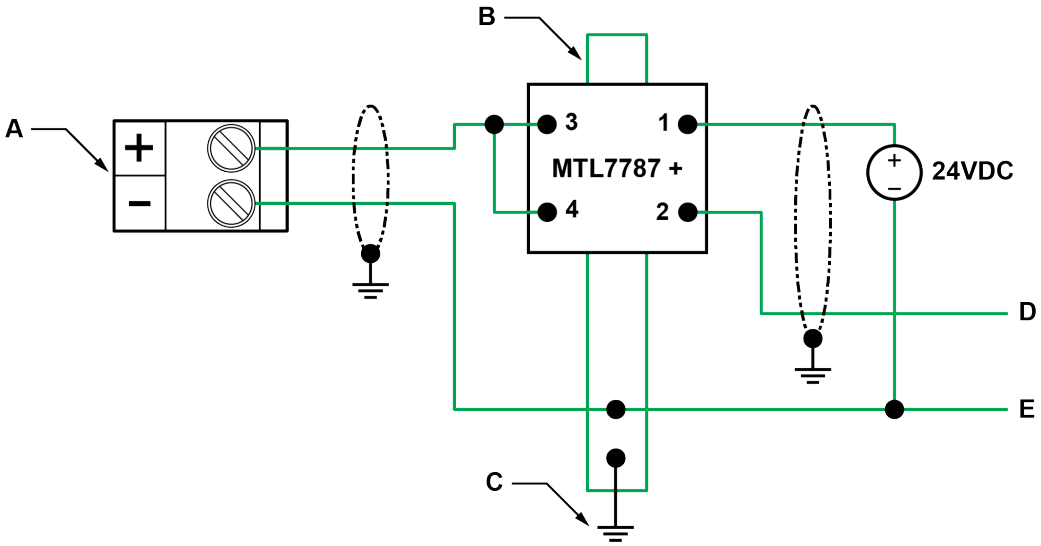
Using the 2-wire wiring diagrams, wire the barriers to the appropriate output terminal and pins.

2-wire wiring diagrams

⚠ 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.**

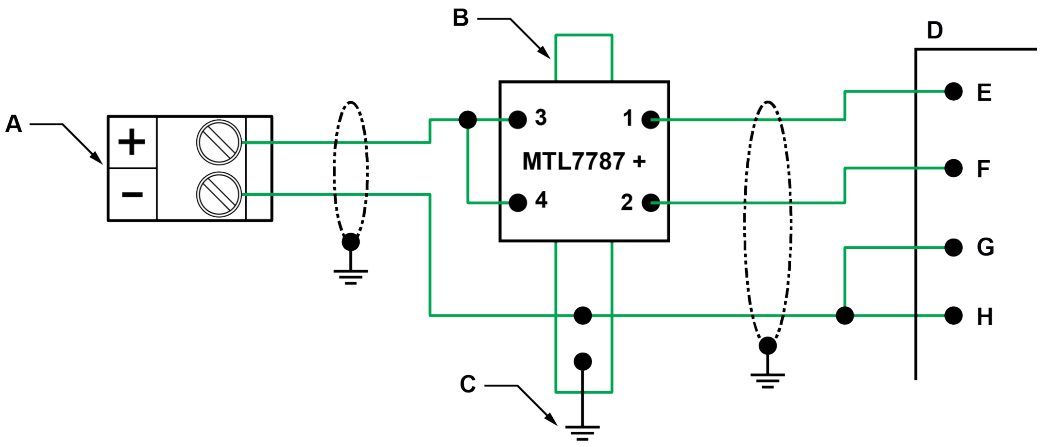
Figure 3-2: Minimum 2-wire barrier connection



A. Power / TPS out
B. IS barrier earth bar
C. IS ground
D. TPS signal +
E. TPS signal –

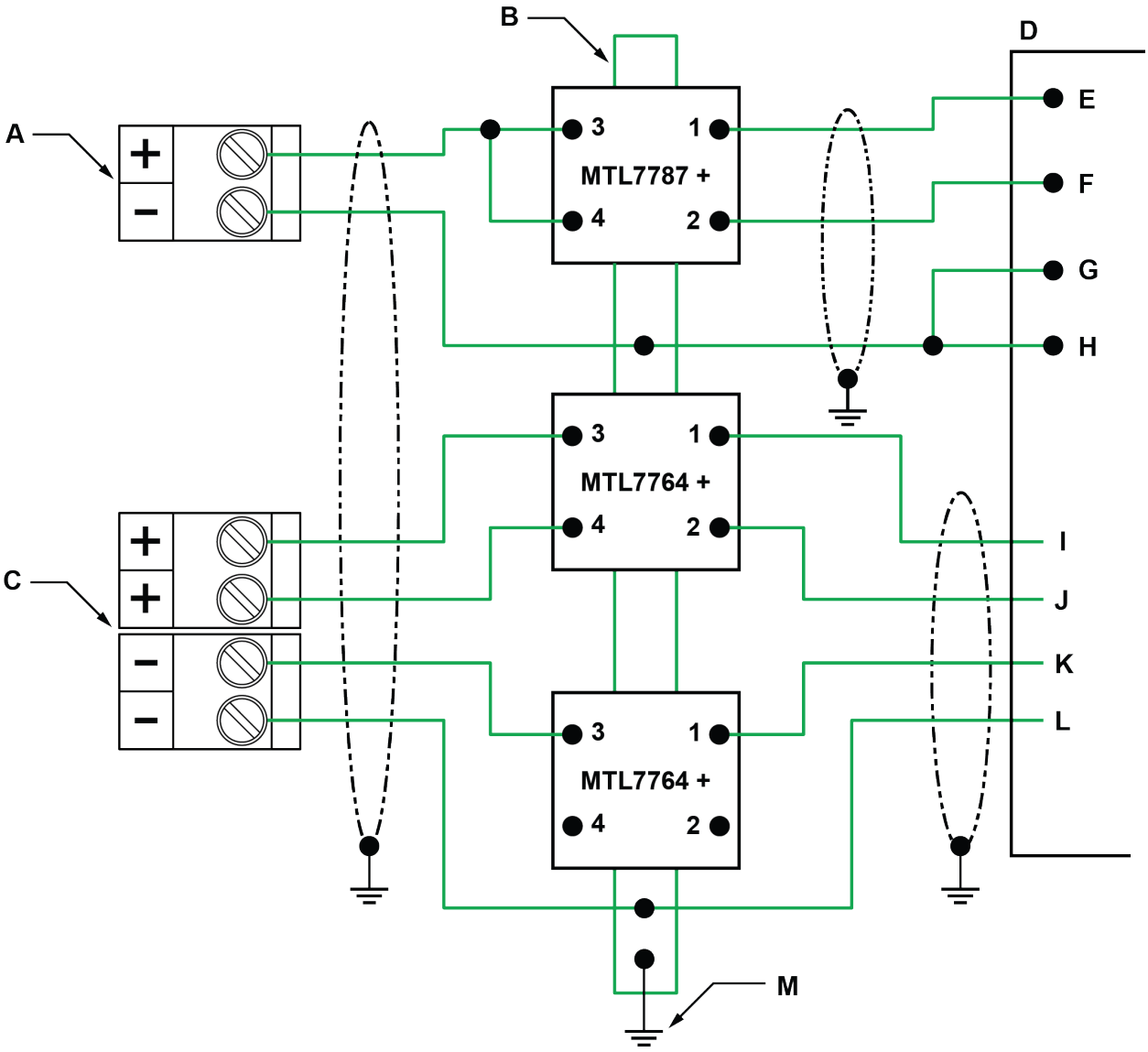
Figure 3-3: 2-wire barrier connection with flow computer / signal converter

The following figure describes a 2-wire barrier connection that is powered through a flow computer / signal converter.



A. Power / TPS out
B. IS barrier earth bar
C. IS ground
D. Flow computer / signal converter
E. Power +
F. TPS signal +
G. Power –
H. TPS signal –

Figure 3-4: 2-wire barrier connection plus RTD barrier connection



A. Power / TPS out
B. IS barrier earth bar
C. RTD
D. Flow computer / signal converter
E. Power +
F. TPS signal +
G. Power –
H. TPS signal –
I. RTD supply +
J. RTD signal +
K. RTD signal –
L. RTD supply –

M. IS ground

Note

If required, use two separate screened cables via two separate cable glands, one for the power and one for the RTD. However, Micro Motion recommends that you use a single cable to facilitate a good seal through a single cable entry gland.

3.3 Wire to galvanic isolators

In hazardous area installations where there is no proper I.S. ground available, such as dry locations, Micro Motion recommends that you use galvanic isolators instead of Zener barriers. Galvanic isolators convert the signal differently from Zenier barriers when passing the signal across an isolation gap.

Prerequisites

- Galvanic isolators (MTL5532 and MTL5575)

  Note

  Micro Motion does not sell galvanic isolators. Obtain the isolators from an external supplier.

- A Zener diode

  The MTL5532 pulse isolator has a trigger level connected to the power + pin that is not connected to the power – pin. Therefore, a Zener diode ensures a reliable switching point.

- A pull-up resistor

  The resistor is required because the output is passive.

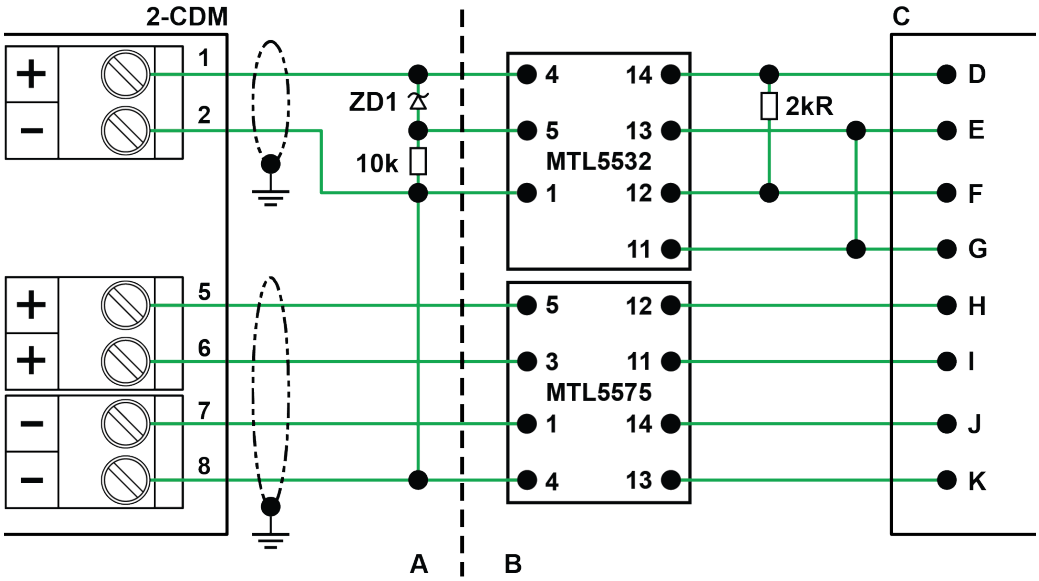
- A 20 V to 35 V supply on the safe area side.

The MTL5575 is used specifically for the 4-wire RTD, and converts the RTD voltage and current into a 4-20mA loop signal on the safe area side. The isolator requires 20 V to 35 V DC energization from the safe area side that also supplies the active output of the 4-20 mA loop.

Procedure

Using the 2-wire galvanic isolator wiring diagram, wire the isolators to the appropriate output terminal and pins.

Figure 3-5: 2-wire galvanic isolator connections



A. Hazardous area
B. Safe area
C. Flow computer / signal converter
D. Power +
E. Power –
F. TPS signal +
G. TPS signal –
H. Analog i/p +
I. Analog i/p –
J. Analog pwr +
K. Analog pwr –

Note

Connect the screens to the chassis if no better earth is available.

Isolator trip level switch setting	*Zener voltage*
12 V	*6.2 V*
6 V	*13 V*
3 V	*16 V*

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

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.

5 Verifying

Use the following procedure after installation to verify that your meter is working correctly.

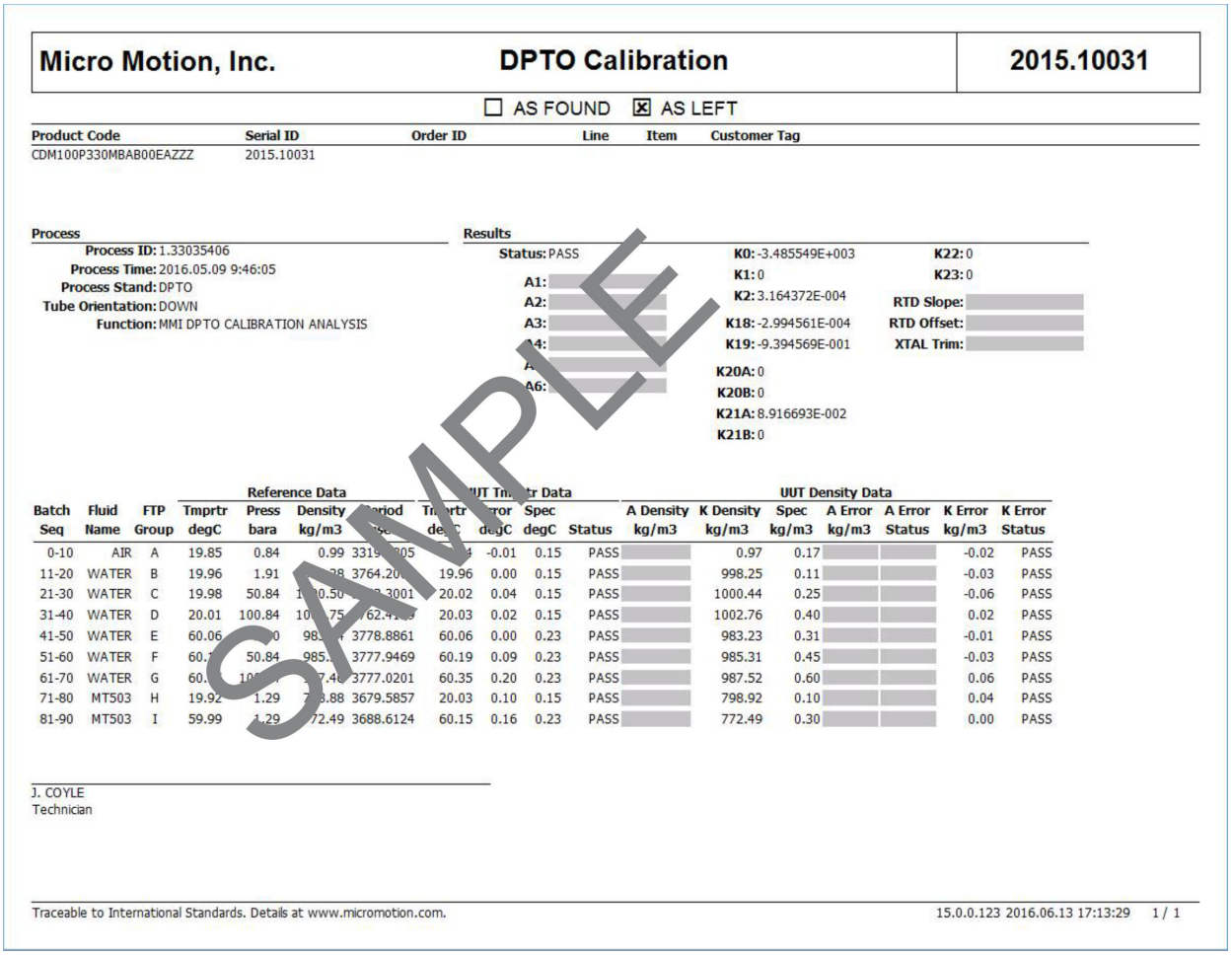
1. Check for a series resistance of approximately 300 Ω either as a load resistor or the Zener barrier.
2. Measure the current consumption and the supply voltage at the meter terminals.
3. Verify that the measured values match the values in the following table.

Power supply voltage (safe area)	CDM terminal voltage (hazardous area)	Supply current
22.8 VDC	18.4 ± 0.5 VDC	13.6 mA ± 0.7 mA
24.0 VDC	20.0 ± 0.5 VDC	12.4 mA ± 0.7 mA
28.0 VDC	24.9 ± 0.5 VDC	9.8 mA ± 0.7 mA

Appendix A
Sample calibration certificate

Your meter was shipped with a calibration certificate. The calibration certificate describes the calibrations and configurations that were performed or applied at the factory.

Figure A-1: Sample calibration certificate: 2-wire TPS CDM



Micro Motion, Inc. | **DPTO Calibration** | **2015.10031**

☐ AS FOUND ☒ AS LEFT

Product Code	Serial ID	Order ID	Line	Item	Customer Tag
CDM100P330MBAB00EAZZZ	2015.10031				

Process

Process ID: 1.33035406
Process Time: 2016.05.09 9:46:05
Process Stand: DPTO
Tube Orientation: DOWN
Function: MMI DPTO CALIBRATION ANALYSIS

Results

Status: PASS

A1:
A2:
A3:
A4:
A5:
A6:

K0: -3.485549E+003
K1: 0
K2: 3.164372E-004
K18: -2.994561E-004
K19: -9.394569E-001
K20A: 0
K20B: 0
K21A: 8.916693E-002
K21B: 0
K22: 0
K23: 0
RTD Slope:
RTD Offset:
XTAL Trim:

			Reference Data				UUT Tmprtr Data				UUT Density Data						
Batch Seq	Fluid Name	FTP Group	Tmprtr degC	Press bara	Density kg/m3	Period usec	Tmprtr degC	Error degC	Spec degC	Status	A Density kg/m3	K Density kg/m3	Spec kg/m3	A Error kg/m3	A Error Status	K Error kg/m3	K Error Status
0-10	AIR	A	19.85	0.84	0.99	3319.[illegible]	[illegible]	-0.01	0.15	PASS		0.97	0.17			-0.02	PASS
11-20	WATER	B	19.96	1.91	[illegible]	3764.20[illegible]	19.96	0.00	0.15	PASS		998.25	0.11			-0.03	PASS
21-30	WATER	C	19.98	50.84	1[illegible]0.50	[illegible].3001	20.02	0.04	0.15	PASS		1000.44	0.25			-0.06	PASS
31-40	WATER	D	20.01	100.84	10[illegible].75	[illegible]62.41[illegible]	20.03	0.02	0.15	PASS		1002.76	0.40			0.02	PASS
41-50	WATER	E	60.06	[illegible]0	98[illegible]	3778.8861	60.06	0.00	0.23	PASS		983.23	0.31			-0.01	PASS
51-60	WATER	F	60.[illegible]	50.84	985.[illegible]	3777.9469	60.19	0.09	0.23	PASS		985.31	0.45			-0.03	PASS
61-70	WATER	G	60.[illegible]	10[illegible]	[illegible]7.4[illegible]	3777.0201	60.35	0.20	0.23	PASS		987.52	0.60			0.06	PASS
71-80	MT503	H	19.92	1.29	[illegible]8.88	3679.5857	20.03	0.10	0.15	PASS		798.92	0.10			0.04	PASS
81-90	MT503	I	59.99	1.29	772.49	3688.6124	60.15	0.16	0.23	PASS		772.49	0.30			0.00	PASS

J. COYLE
Technician

Traceable to International Standards. Details at www.micromotion.com.

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