

# Rosemount™ 8732EM Transmitter with FOUNDATION™ Fieldbus Protocol





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# 1 Safety messages

## **WARNING**

General hazards. Failure to follow these instructions could result in death or serious injury.

- Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.
- Installation and servicing instructions are for use by qualified personnel only. Do not perform any servicing other than that contained in the operating instructions, unless qualified.
- Verify the installation is completed safely and is consistent with the operating environment.
- Do not substitute factory components with non-factory components. Substitution of components may impair Intrinsic Safety.
- Do not perform any services other than those contained in this manual.
- Process leaks may result in death or serious injury.
- Mishandling products exposed to a hazardous substance may result in death or serious injury.
- The electrode compartment may contain line pressure; it must be depressurized before the cover is removed.
- If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.
- The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings. For information on Emerson nuclear-qualified products, contact your local sales representative.

 **WARNING**

Explosion hazards. Failure to follow these instructions could cause an explosion, resulting in death or serious injury.

- If installed in explosive atmospheres (hazardous areas, classified areas, or an “Ex” environment), it must be assured that the device certification and installation techniques are suitable for that particular environment.
- Do not remove transmitter covers in explosive atmospheres when the circuit is live. Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Do not disconnect equipment when a flammable or combustible atmosphere is present.
- Do not connect a Rosemount transmitter to a non-Rosemount sensor that is located in an explosive atmosphere. The transmitter has not been evaluated for use with other manufacturers' magnetic flowmeter sensors in hazardous (Ex or Classified) areas. Special care should be taken by the end-user and installer to ensure the transmitter meets the safety and performance requirements of the other manufacturer's equipment.
- Follow national, local, and plant standards to properly earth ground the transmitter and sensor. The earth ground must be separate from the process reference ground.
- Flowmeters ordered with non-standard paint options or non-metallic labels may be subject to electrostatic discharge. To avoid electrostatic charge build-up, do not rub the flowmeter with a dry cloth or clean with solvents.

 **WARNING**

Electrical hazards. Failure to follow these instructions could cause damaging and unsafe discharge of electricity, resulting in death or serious injury.

- Follow national, local, and plant standards to properly earth ground the transmitter and sensor. The earth ground must be separate from the process reference ground.
- Disconnect power before servicing circuits.
- Allow ten minutes for charge to dissipate prior to removing electronics compartment cover. The electronics may store energy in this period immediately after power is removed.
- Avoid contact with leads and terminals. High voltage that may be present on leads could cause electrical shock.
- Flowmeters ordered with non-standard paint options or non-metallic labels may be subject to electrostatic discharge. To avoid electrostatic charge build-up, do not rub the flowmeter with a dry cloth or clean with solvents.

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**NOTICE**

Damage hazards

Failure to follow these instructions could result in damage or destruction of equipment.

- The sensor liner is vulnerable to handling damage. Never place anything through the sensor for the purpose of lifting or gaining leverage. Liner damage may render the sensor inoperable.
  - Metallic or spiral-wound gaskets should not be used as they will damage the liner face of the sensor. If spiral wound or metallic gaskets are required for the application, lining protectors must be used. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the sensor ends are often used for protection.
  - Correct flange bolt tightening is crucial for proper sensor operation and life. All bolts must be tightened in the proper sequence to the stated torque specifications. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.
  - In cases where high voltage/high current are present near the meter installation, ensure proper protection methods are followed to prevent stray electricity from passing through the meter. Failure to adequately protect the meter could result in damage to the transmitter and lead to meter failure.
  - Completely remove all electrical connections from both sensor and transmitter prior to welding on the pipe. For maximum protection of the sensor, consider removing it from the pipeline.
  - Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.
-



## 2 Introduction

### 2.1 System description

The flowmeter consists of a sensor and a transmitter. The sensor is installed in-line with the process piping; the transmitter can be integrally mounted to the sensor or remotely mounted away from the sensor.

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**Figure 2-1: Integral field mount transmitter**



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**Figure 2-2: Remote field mount transmitter**



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There are three Rosemount™ flow sensors available.<sup>(1)</sup>

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**Figure 2-3: 8705 Flanged sensor**



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<sup>(1)</sup> Also available for use with 8707 High Signal sensor with dual calibration (option code D2).

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**Figure 2-4: 8711 Wafer sensor**



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**Figure 2-5: 8721 Hygienic sensor**

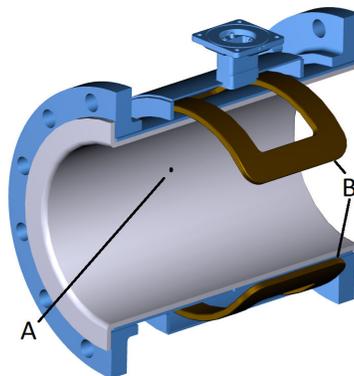


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The flow sensor contains two magnetic coils located on opposite sides of the sensor. Two electrodes, located perpendicular to the coils and opposite each other, make contact with the liquid. The transmitter energizes the coils and creates a magnetic field. A conductive liquid moving through the magnetic field generates an induced voltage at the electrodes. This voltage is proportional to the flow velocity. The transmitter converts the voltage detected by the electrodes into a flow reading. A cross-sectional view is shown in [Figure 2-6](#).

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**Figure 2-6: (8705) Sensor cross section**



- A. Electrode
  - B. Coils
- 

## 2.2 Product recycling/disposal

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

# 3 Sensor Installation

## Related information

[Remote Transmitter Installation](#)

## 3.1 Handling and Lifting Safety



### CAUTION

To reduce the risk of personal injury or damage to equipment, follow all lifting and handling instructions.

- Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping container.
- PTFE-lined sensors are shipped with end covers that protect it from both mechanical damage and normal unrestrained distortion. Remove the end covers just before installation.
- Keep the shipping plugs in the conduit ports until you are ready to connect and seal them. Appropriate care should be taken to prevent water ingress.
- The sensor should be supported by the pipeline. Pipe supports are recommended on both the inlet and outlet sides of the sensor pipeline. There should be no additional support attached to the sensor.
- Use proper PPE (Personal Protection Equipment) including safety glasses and steel toed shoes.
- Do not lift the meter by holding the electronics housing or junction box.
- The sensor liner is vulnerable to handling damage. Never place anything through the sensor for the purpose of lifting or gaining leverage. Liner damage can render the sensor useless.
- Do not drop the device from any height.

## 3.2 Location and Position

### 3.2.1 Environmental considerations

To ensure maximum transmitter life, avoid extreme temperatures and excessive vibration. Typical problem areas include the following:

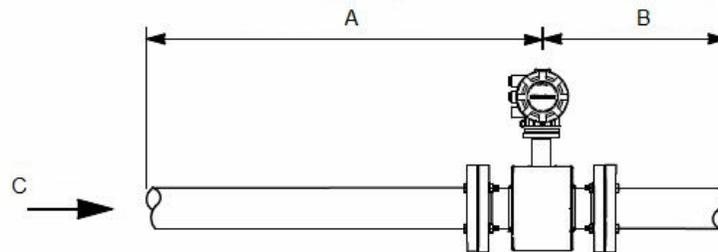
- High-vibration lines with integrally mounted transmitters
- Tropical/desert installations in direct sunlight
- Outdoor installations in arctic climates

Remote mounted transmitters may be installed in the control room to protect the electronics from the harsh environment and to provide easy access for configuration or service.

### 3.2.2 Upstream and downstream piping

To ensure specified accuracy over widely varying process conditions, install the sensor with a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane.

**Figure 3-1: Upstream and downstream straight pipe diameters**



- A. Five pipe diameters (upstream)
- B. Two pipe diameters (downstream)
- C. Flow direction

Installations with reduced upstream and downstream straight runs are possible. In reduced straight run installations, the meter may not meet accuracy specifications. Reported flow rates will still be highly repeatable.

### 3.2.3 Flow direction

The sensor should be mounted so that the arrow points in the direction of flow.

**Figure 3-2: Flow direction arrow**

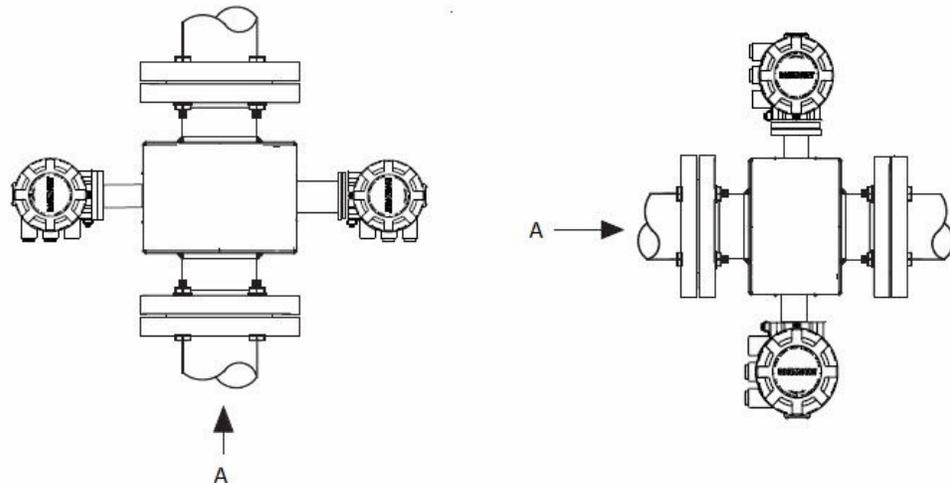


### 3.2.4 Sensor piping location and orientation

The sensor should be installed in a location that ensures it remains full during operation. Depending on where it is installed, orientation must also be considered.

- Vertical installation with upward process fluid flow keeps the cross-sectional area full, regardless of flow rate.
- Horizontal installation should be restricted to low piping sections that are normally full.

**Figure 3-3: Sensor orientation**

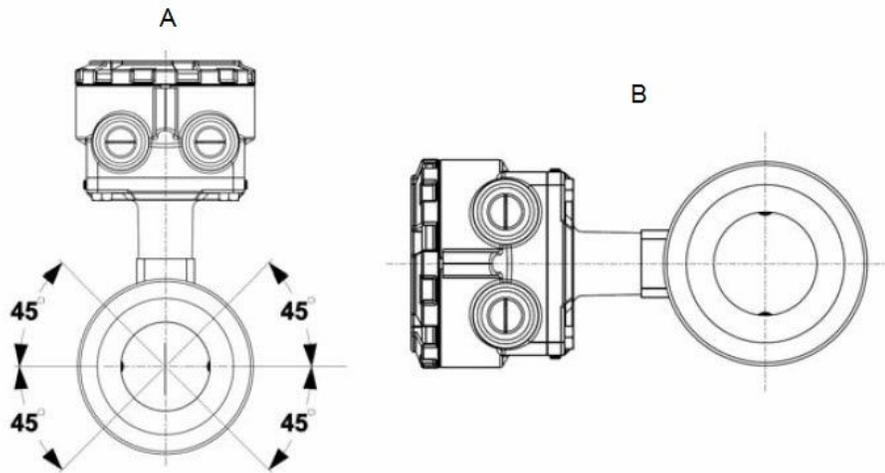


*A. Flow direction*

### 3.2.5 Electrode orientation

The electrodes in the sensor are properly oriented when the two measurement electrodes are in the 3 and 9 o'clock positions or within 45 degrees from the horizontal, as shown on the left side of [Figure 3-4](#). Avoid any mounting orientation that positions the top of the sensor at 90 degrees from the vertical position as shown on the right of [Figure 3-4](#).

Figure 3-4: Electrode orientation



- A. Correct orientation
- B. Incorrect orientation

The sensor may require a specific orientation to comply with Hazardous Area T-code rating. Refer to the appropriate reference manual for any potential restrictions.

## 3.3 Sensor Installation

### 3.3.1 Flanged sensors

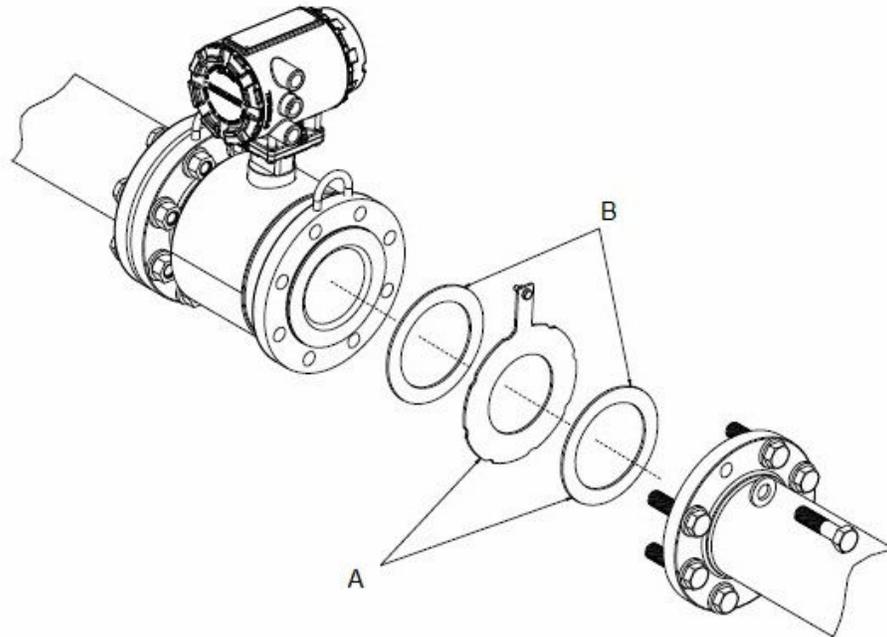
#### Gaskets

The sensor requires a gasket at each process connection. The gasket material must be compatible with the process fluid and operating conditions. Gaskets are required on each side of a grounding ring (see Figure 3-5). All other applications (including sensors with lining protectors or a grounding electrode) require only one gasket on each process connection.

#### Note

Metallic or spiral-wound gaskets should not be used as they will damage the liner face of the sensor. If spiral wound or metallic gaskets are required for the application, lining protectors must be used.

**Figure 3-5: Gasket placement for flanged sensors**



- A. Grounding ring and gasket (optional)
- B. Customer-supplied gasket

### **Bolts**

#### **Note**

Do not bolt one side at a time. Tighten both sides simultaneously. Example:

1. Snug upstream
2. Snug downstream
3. Tighten upstream
4. Tighten downstream

Do not snug and tighten the upstream side and then snug and tighten the downstream side. Failure to alternate between the upstream and downstream flanges when tightening bolts may result in liner damage.

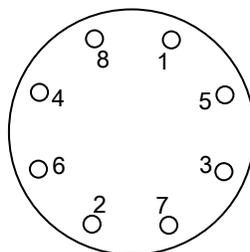
Suggested torque values by sensor line size and liner type are listed in [Table 3-2](#) for ASME B16.5 flanges and [Table 3-3](#) or [Table 3-4](#) for EN flanges. Consult the factory if the flange rating of the sensor is not listed. Tighten flange bolts on the upstream side of the sensor in the incremental sequence shown in [Figure 3-6](#) to 20% of the suggested torque values. Repeat the process on the downstream side of the sensor. For sensors with greater or fewer flange bolts, tighten the bolts in a similar crosswise sequence. Repeat this entire tightening sequence at 40%, 60%, 80%, and 100% of the suggested torque values.

If leakage occurs at the suggested torque values, the bolts can be tightened in additional 10% increments until the joint stops leaking, or until the measured torque value reaches the maximum torque value of the bolts. Practical consideration for the integrity of the

liner often leads to distinct torque values to stop leakage due to the unique combinations of flanges, bolts, gaskets, and sensor liner material.

Check for leaks at the flanges after tightening the bolts. Failure to use the correct tightening methods can result in severe damage. While under pressure, sensor materials may deform over time and require a second tightening 24 hours after the initial installation.

**Figure 3-6: Flange bolt torquing sequence**



Prior to installation, identify the lining material of the flow sensor to ensure the suggested torque values are applied.

**Table 3-1: Lining material**

| Fluoropolymer liners | Other liners                 |
|----------------------|------------------------------|
| T - PTFE             | P - Polyurethane             |
| F - ETFE             | N - Neoprene                 |
| A - PFA              | L - Linatex (Natural Rubber) |
| K - PFA+             | D - Adiprene                 |

**Table 3-2: Suggested flange bolt torque values for Rosemount 8705 (ASME)**

| Size code | Line size        | Fluoropolymer liners |                   | Other liners      |                        |
|-----------|------------------|----------------------|-------------------|-------------------|------------------------|
|           |                  | Class 150 (lb-ft)    | Class 300 (lb-ft) | Class 150 (lb-ft) | Class 300 (pound feet) |
| 005       | 0.5 inch (15 mm) | 8                    | 8                 | N/A               | N/A                    |
| 010       | 1 inch (25 mm)   | 8                    | 12                | 6                 | 10                     |
| 015       | 1.5 inch (40 mm) | 13                   | 25                | 7                 | 18                     |
| 020       | 2 inch (50 mm)   | 19                   | 17                | 14                | 11                     |
| 025       | 2.5 inch (65 mm) | 22                   | 24                | 17                | 16                     |
| 030       | 3 inch (80 mm)   | 34                   | 35                | 23                | 23                     |
| 040       | 4 inch (100 mm)  | 26                   | 50                | 17                | 32                     |
| 050       | 5 inch (125 mm)  | 36                   | 60                | 25                | 35                     |
| 060       | 6 inch (150 mm)  | 45                   | 50                | 30                | 37                     |
| 080       | 8 inch (200 mm)  | 60                   | 82                | 42                | 55                     |
| 100       | 10 inch (250 mm) | 55                   | 80                | 40                | 70                     |

**Table 3-2: Suggested flange bolt torque values for Rosemount 8705 (ASME) (continued)**

| Size code | Line size        | Fluoropolymer liners |                   | Other liners      |                        |
|-----------|------------------|----------------------|-------------------|-------------------|------------------------|
|           |                  | Class 150 (lb-ft)    | Class 300 (lb-ft) | Class 150 (lb-ft) | Class 300 (pound feet) |
| 120       | 12 inch (300 mm) | 65                   | 125               | 55                | 105                    |
| 140       | 14 inch (350 mm) | 85                   | 110               | 70                | 95                     |
| 160       | 16 inch (400 mm) | 85                   | 160               | 65                | 140                    |
| 180       | 18 inch (450 mm) | 120                  | 170               | 95                | 150                    |
| 200       | 20 inch (500 mm) | 110                  | 175               | 90                | 150                    |
| 240       | 24 inch (600 mm) | 165                  | 280               | 140               | 250                    |
| 300       | 30 inch (750 mm) | 195                  | 415               | 165               | 375                    |
| 360       | 36 inch (900 mm) | 280                  | 575               | 245               | 525                    |

**Table 3-3: Suggested flange bolt torque values for Rosemount 8705 sensors with fluoropolymer liners (EN 1092-1)**

| Size code | Line size         | Fluoropolymer liners (in Newton-meters) |       |       |       |
|-----------|-------------------|---|-------|-------|-------|
|           |                   | PN 10                                   | PN 16 | PN 25 | PN 40 |
| 005       | 0.5 inch (15 mm)  | N/A                                     | N/A   | N/A   | 10    |
| 010       | 1 inch (25 mm)    | N/A                                     | N/A   | N/A   | 20    |
| 015       | 1.5 inch (40 mm)  | N/A                                     | N/A   | N/A   | 50    |
| 020       | 2 inch (50 mm)    | N/A                                     | N/A   | N/A   | 60    |
| 025       | 2.5 inch (65 mm)  | N/A                                     | N/A   | N/A   | 50    |
| 030       | 3 inch (80 mm)    | N/A                                     | N/A   | N/A   | 50    |
| 040       | 4 inch (100 mm)   | N/A                                     | 50    | N/A   | 70    |
| 050       | 5.0 inch (125 mm) | N/A                                     | 70    | N/A   | 100   |
| 060       | 6 inch (150mm)    | N/A                                     | 90    | N/A   | 130   |
| 080       | 8 inch (200 mm)   | 130                                     | 90    | 130   | 170   |
| 100       | 10 inch (250 mm)  | 100                                     | 130   | 190   | 250   |
| 120       | 12 inch (300 mm)  | 120                                     | 170   | 190   | 270   |
| 140       | 14 inch (350 mm)  | 160                                     | 220   | 320   | 410   |
| 160       | 16 inch (400 mm)  | 220                                     | 280   | 410   | 610   |
| 180       | 18 inch (450 mm)  | 190                                     | 340   | 330   | 420   |
| 200       | 20 inch (500 mm)  | 230                                     | 380   | 440   | 520   |
| 240       | 24 inch (600 mm)  | 290                                     | 570   | 590   | 850   |

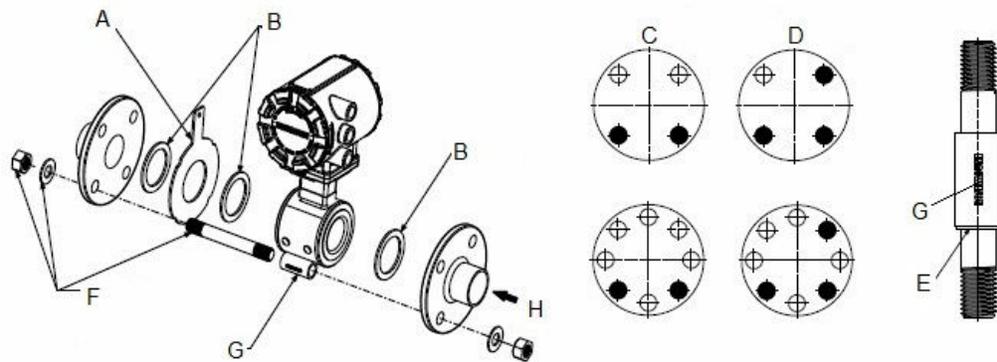
**Table 3-4: Suggested flange bolt torque values for Rosemount 8705 sensors with non-fluoropolymer liners (EN 1092-1)**

| Size code | Line size         | Non-fluoropolymer liners (in Newton-meters) |       |       |       |
|-----------|-------------------|---|-------|-------|-------|
|           |                   | PN 10                                       | PN 16 | PN 25 | PN 40 |
| 005       | 0.5 inch (15 mm)  | N/A   | N/A   | N/A   | 20    |
| 010       | 1 inch (25 mm)    | N/A   | N/A   | N/A   | 30    |
| 015       | 1.5 inch (40 mm)  | N/A   | N/A   | N/A   | 40    |
| 020       | 2 inch (50 mm)    | N/A   | N/A   | N/A   | 30    |
| 025       | 2.5 inch (65 mm)  | N/A   | N/A   | N/A   | 35    |
| 030       | 3 inch (80 mm)    | N/A   | N/A   | N/A   | 30    |
| 040       | 4 inch (100 mm)   | N/A   | 40    | N/A   | 50    |
| 050       | 5.0 inch (125 mm) | N/A   | 50    | N/A   | 70    |
| 060       | 6 inch (150mm)    | N/A   | 60    | N/A   | 90    |
| 080       | 8 inch (200 mm)   | 90  | 60    | 90    | 110   |
| 100       | 10 inch (250 mm)  | 70  | 80    | 130   | 170   |
| 120       | 12 inch (300 mm)  | 80  | 110   | 130   | 180   |
| 140       | 14 inch (350 mm)  | 110   | 150   | 210   | 288   |
| 160       | 16 inch (400 mm)  | 150   | 190   | 280   | 410   |
| 180       | 18 inch (450 mm)  | 130   | 230   | 220   | 280   |
| 200       | 20 inch (500 mm)  | 150   | 260   | 300   | 350   |
| 240       | 24 inch (600 mm)  | 200   | 380   | 390   | 560   |

### 3.3.2 Wafer sensors

When installing wafer sensors, there are several components that must be included and requirements that must be met.

**Figure 3-7: Wafer sensors installation components and assembly requirements**



- A. Ground ring (optional)
- B. Customer supplied gaskets
- C. Spacer installation (horizontal meters)
- D. Spacer installation (vertical meters)
- E. O-ring
- F. Installation studs, nuts, and washers (optional)
- G. Wafer alignment spacer
- H. Flow

### Gaskets

The sensor requires a gasket at each process connection. The gasket material selected must be compatible with the process fluid and operating conditions. Gaskets are required on each side of a grounding ring. See [Figure 3-7](#).

### Note

Metallic or spiral-wound gaskets should not be used as they will damage the liner face of the sensor.

### Alignment spacers

On 1.5 inch through 8 inch (40 through 200 mm) line sizes, alignment spacers are **required** to ensure proper centering of the wafer sensor between the process flanges. To order an Alignment Spacer Kit (quantity 3 spacers) use p/n 08711-3211-xxxx where xxxx equals the dash number shown in [Table 3-5](#).

**Table 3-5: Alignment spacers**

| Dash-no. (-xxxx) | Line size |      | Flange rating |
|------------------|-----------|------|---------------|
|                  | (in)      | (mm) |               |
| 0A15             | 1.5       | 40   | JIS 10K-20K   |
| 0A20             | 2         | 50   | JIS 10K-20K   |
| 0A30             | 3         | 80   | JIS 10K       |
| 0B15             | 1.5       | 40   | JIS 40K       |

**Table 3-5: Alignment spacers (continued)**

| Dash-no. (-xxxx) | Line size |      | Flange rating             |
|------------------|-----------|------|---------------------------|
|                  | (in)      | (mm) |                           |
| AA15             | 1.5       | 40   | ASME - 150#               |
| AA20             | 2         | 50   | ASME - 150#               |
| AA30             | 3         | 80   | ASME - 150#               |
| AA40             | 4         | 100  | ASME - 150#               |
| AA60             | 6         | 150  | ASME - 150#               |
| AA80             | 8         | 200  | ASME - 150#               |
| AB15             | 1.5       | 40   | ASME - 300#               |
| AB20             | 2         | 50   | ASME - 300#               |
| AB30             | 3         | 80   | ASME - 300#               |
| AB40             | 4         | 100  | ASME - 300#               |
| AB60             | 6         | 150  | ASME - 300#               |
| AB80             | 8         | 200  | ASME - 300#               |
| DB40             | 4         | 100  | EN 1092-1 - PN10/16       |
| DB60             | 6         | 150  | EN 1092-1 - PN10/16       |
| DB80             | 8         | 200  | EN 1092-1 - PN10/16       |
| DC80             | 8         | 200  | EN 1092-1 - PN25          |
| DD15             | 1.5       | 40   | EN 1092-1 - PN10/16/25/40 |
| DD20             | 2         | 50   | EN 1092-1 - PN10/16/25/40 |
| DD30             | 3         | 80   | EN 1092-1 - PN10/16/25/40 |
| DD40             | 4         | 100  | EN 1092-1 - PN25/40       |
| DD60             | 6         | 150  | EN 1092-1 - PN25/40       |
| DD80             | 8         | 200  | EN 1092-1 - PN40          |
| RA80             | 8         | 200  | AS40871-PN16              |
| RC20             | 2         | 50   | AS40871-PN21/35           |
| RC30             | 3         | 80   | AS40871-PN21/35           |
| RC40             | 4         | 100  | AS40871-PN21/35           |
| RC60             | 6         | 150  | AS40871-PN21/35           |
| RC80             | 8         | 200  | AS40871-PN21/35           |

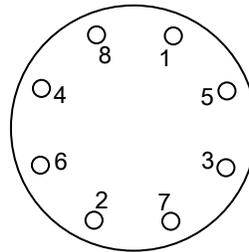
**Studs**

Wafer sensors require threaded studs. See [Figure 3-8](#) for torque sequence. Always check for leaks at the flanges after tightening the flange bolts. All sensors require a second tightening 24 hours after initial flange bolt tightening.

**Table 3-6: Stud specifications**

| Nominal sensor size  | Stud specifications  |
|----------------------|--|
| 0.15–1-in. (4–25 mm) | 316 SST ASTM A193, Grade B8M, Class 1 threaded mounted studs |
| 1½–8-in. (40–200 mm) | CS, ASTM A193, Grade B7, threaded mounting studs             |

**Figure 3-8: Flange bolt torquing sequence**



## Installation

1. Insert studs for the bottom side of the sensor between the pipe flanges and center the alignment spacer in the middle of the stud. See [Figure 3-7](#) for the bolt hole locations recommended for the spacers provided. Stud specifications are listed in [Table 3-6](#).
2. Place the sensor between the flanges. Make sure the alignment spacers are properly centered on the studs. For vertical flow installations slide the o-ring over the stud to keep the spacer in place. See [Figure 3-7](#). Ensure the spacers match the flange size and class rating for the process flanges. See [Table 3-5](#).
3. Insert the remaining studs, washers, and nuts.
4. Tighten to the torque specifications shown in [Table 3-7](#). Do not over-tighten the bolts or the liner may be damaged.

**Table 3-7: Rosemount 8711 torque specifications**

| Size code | Line size        | Pound-feet | Newton-meter |
|-----------|------------------|------------|--------------|
| 015       | 1.5 inch (40 mm) | 15         | 20           |
| 020       | 2 inch (50 mm)   | 25         | 34           |
| 030       | 3 inch (80 mm)   | 40         | 54           |
| 040       | 4 inch (100 mm)  | 30         | 41           |
| 060       | 6 inch (150 mm)  | 50         | 68           |
| 080       | 8 inch (200 mm)  | 70         | 95           |

### 3.3.3 Sanitary sensors

#### Gaskets

The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions.

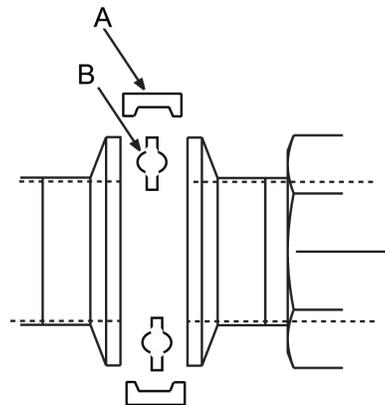
#### Note

Gaskets are supplied between the IDF fitting and the process connection fitting, such as a Tri-Clamp fitting, on all Rosemount 8721 Sanitary sensors except when the process connection fittings are not supplied and the only connection type is an IDF fitting.

#### Alignment and bolting

Standard plant practices should be followed when installing a magmeter with sanitary fittings. Unique torque values and bolting techniques are not required.

**Figure 3-9: Sanitary sensor gasket and clamp alignment**



- A. User supplied clamp
- B. User supplied gasket

### 3.4 Process reference connection

The figures shown in this section illustrate best practice installations for process reference connections only. For installations in conductive, unlined pipe it may be acceptable to use one ground ring or one lining protector to establish a process reference connection. Earth safety ground is also required as part of this installation, but is not shown in the figures. Follow national, local, and plant electrical codes for safety ground.

Use [Table 3-8](#) to determine which process reference option to follow for proper installation.

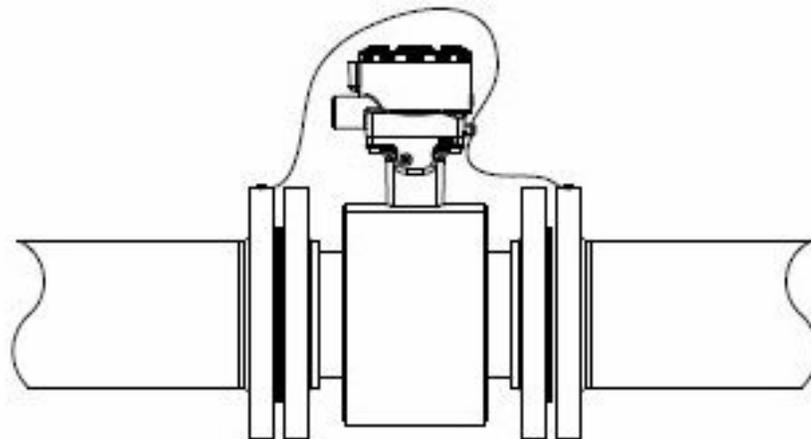
**Table 3-8: Process reference options**

| Type of pipe            | Grounding straps                | Grounding rings                 | Reference electrode             | Lining protectors               |
|-------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Conductive unlined pipe | See <a href="#">Figure 3-10</a> | See <a href="#">Figure 3-11</a> | See <a href="#">Figure 3-13</a> | See <a href="#">Figure 3-11</a> |
| Conductive lined pipe   | Insufficient grounding          | See <a href="#">Figure 3-11</a> | See <a href="#">Figure 3-10</a> | See <a href="#">Figure 3-11</a> |
| Non-conductive pipe     | Insufficient grounding          | See <a href="#">Figure 3-12</a> | Not recommended                 | See <a href="#">Figure 3-12</a> |

**Note**

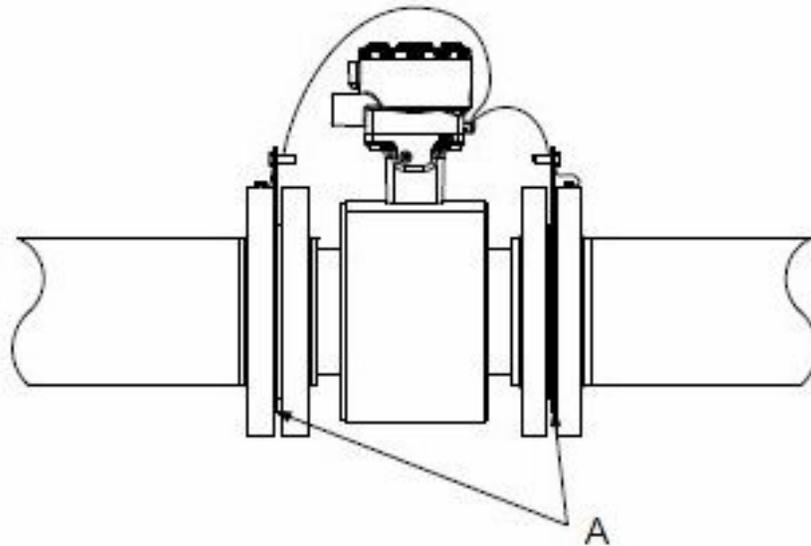
For line sizes 10-inch and larger the ground strap may come attached to the sensor body near the flange. See [Figure 3-14](#).

**Figure 3-10: Grounding straps in conductive unlined pipe or reference electrode in lined pipe**



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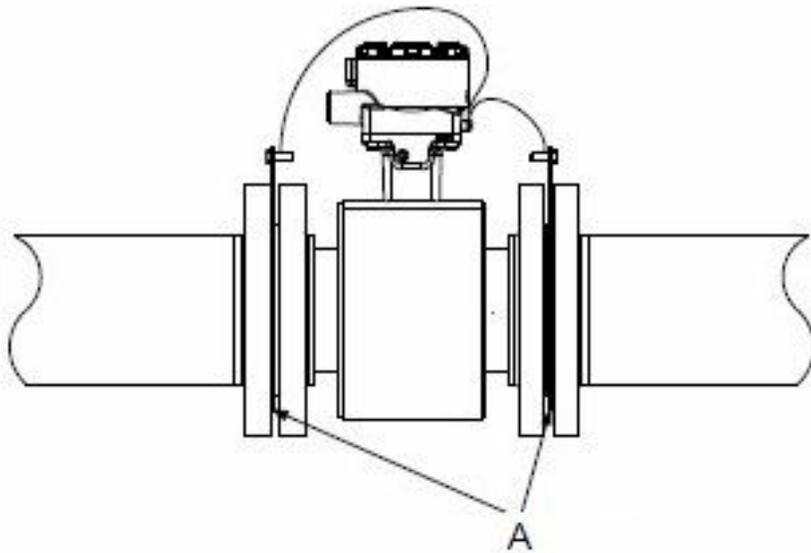
**Figure 3-11: Grounding with grounding rings or lining protectors in conductive pipe**



*A. Grounding rings or lining protectors*

---

**Figure 3-12: Grounding with grounding rings or lining protectors in non-conductive pipe**

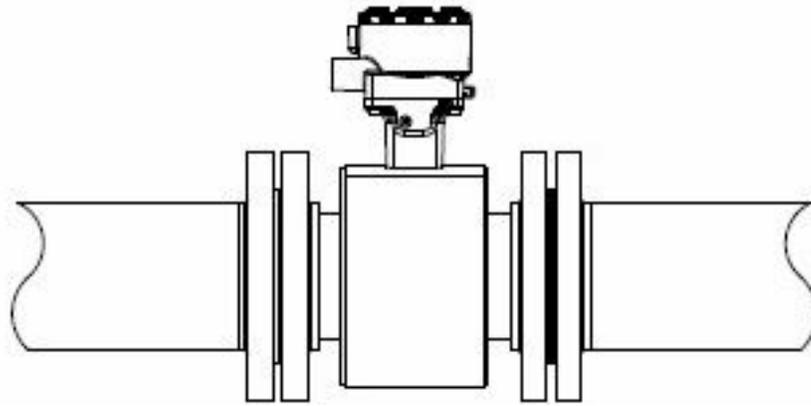


*A. Grounding rings or lining protectors*

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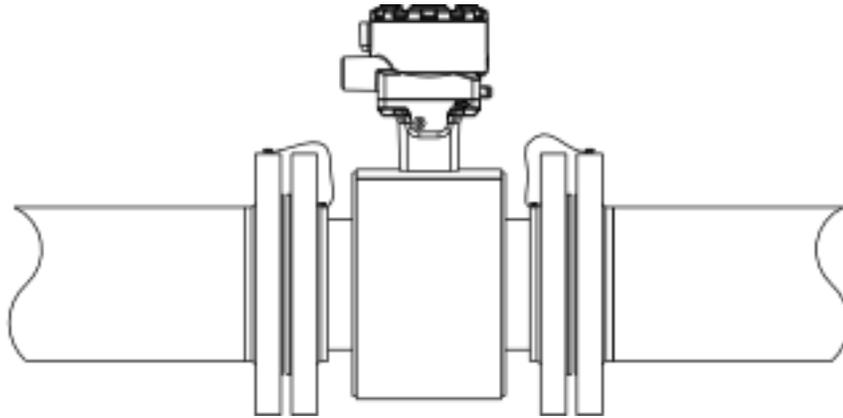
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**Figure 3-13: Grounding with reference electrode in conductive unlined pipe**



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**Figure 3-14: Grounding for line sizes 10-in. and larger**





## 4 Remote Transmitter Installation

This chapter provides instructions for installing and wiring a remotely mounted transmitter.

### Related information

[Sensor Installation](#)

### 4.1 Pre-Installation

Before installing the transmitter, there are several pre-installation steps that should be completed to make the installation process easier:

- Set the hardware switches if necessary
- Consider mechanical, electrical, and environmental requirements

---

#### Note

Refer to [Product Specifications](#) for more detailed requirements.

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#### Hardware switches

The electronics board is equipped with two user-selectable hardware switches. These switches set the Simulate Enable and Transmitter Security. The standard configuration for these switches when shipped from the factory are as follows:

**Table 4-1: Hardware switch default settings**

| Setting              | Factory configuration |
|----------------------|-----------------------|
| Simulate enable      | Off                   |
| Transmitter security | Off                   |

In most cases, it is not necessary to change the setting of the hardware switches. If the switch settings need to be changed, refer to [Hardware switches](#).

Be sure to identify any additional options and configurations that apply to the installation. Keep a list of these options for consideration during the installation and configuration procedures.

#### Mechanical considerations

The mounting site for the transmitter should provide enough room for secure mounting, easy access to conduit entries, full opening of the transmitter covers, and easy readability of the Display screen (if equipped).



**Table 4-2: Electrical data (continued)**

| Rosemount 8732E transmitter with FOUNDATION fieldbus |  |
|--|--|
| Fieldbus   | Fieldbus segment requires a separate 9VDC to 32VDC power supply with a power conditioner to decouple the power supply output from the fieldbus wiring segment. |

**Environmental considerations**

To ensure maximum transmitter life, avoid extreme temperatures and excessive vibration. Typical problem areas include the following:

- High-vibration lines with integrally mounted transmitters
- Tropical or desert installations in direct sunlight
- Outdoor installations in arctic climates

Remote mounted transmitters may be installed in the control room to protect the electronics from the harsh environment and to provide easy access for configuration or service.

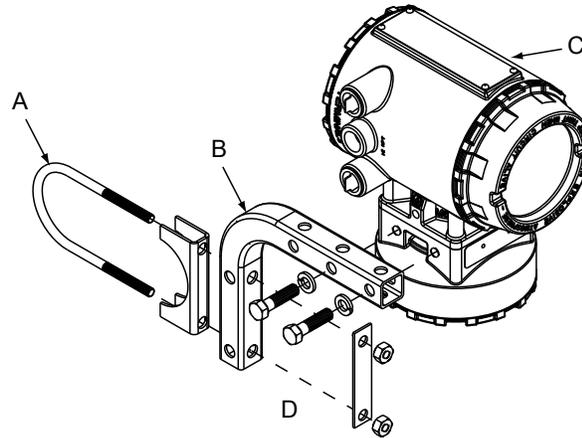
## 4.2 Transmitter symbols

|  |   |
|--|---|
| Caution symbol – check product documentation for details |  |
| Protective conductor (grounding) terminal                |  |

## 4.3 Mounting

Remote-mount transmitters are shipped with a mounting bracket for use on a 2-in. pipe or a flat surface.

**Figure 4-2: Rosemount 8732 transmitter mounting hardware**



- A. U-bolt
- B. Mounting bracket
- C. Transmitter
- D. Fasteners (example configuration)

1. Assemble the hardware as needed to accommodate the mounting configuration.
2. Secure the transmitter to the mounting hardware.

The LOI/Display can be rotated in 90 degree increments up to 180 degrees if desired. Do not rotate more than 180 degrees in any one direction.

## 4.4 Wiring

### 4.4.1 Conduit entries and connections

Transmitter conduit entry ports can be ordered with ½"-14NPT or M20 female threaded connections. Conduit connections should be made in accordance with national, local, and plant electrical codes. Unused conduit entries should be sealed with the appropriate certified plugs. The plastic shipping plugs do not provide ingress protection.

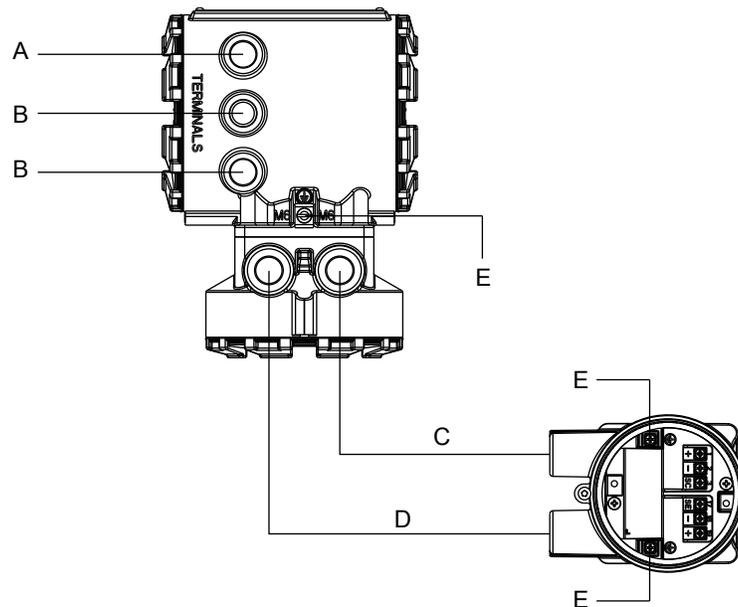
### 4.4.2 Conduit requirements

- For installations with an intrinsically safe electrode circuit, a separate conduit for the coil cable and the electrode cable may be required. Refer to [Product Certifications](#).
- For installations with non-intrinsically safe electrode circuit, or when using the combination cable, a single dedicated conduit run for the coil drive and electrode cable between the sensor and the remote transmitter may be acceptable. Removal of the

barriers for intrinsic safety isolation is permitted for non-intrinsically safe electrode installations.

- Bundled cables from other equipment in a single conduit are likely to create interference and noise in the system. See [Figure 4-3](#).
- Electrode cables should not be run together in the same cable tray with power cables.
- Output cables should not be run together with power cables.
- Select conduit size appropriate to feed cables through to the flowmeter.

**Figure 4-3: Best practice conduit preparation**



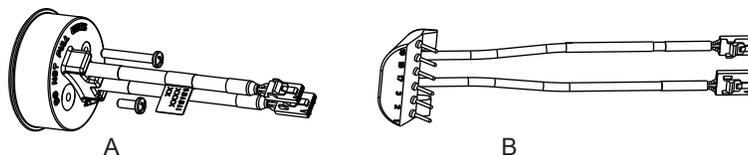
- A. Power
- B. Output
- C. Coil
- D. Electrode
- E. Safety ground

### 4.4.3 Sensor to transmitter wiring

#### Integral mount transmitters

Integral mount transmitters ordered with a sensor will be shipped assembled and wired at the factory using an interconnecting cable. Use only the factory supplied cable provided with the instrument. For replacement transmitters use the existing interconnecting cable from the original assembly. Replacement cables, if applicable, are available (see [Figure 4-4](#)).

**Figure 4-4: Replacement interconnecting cables**



- A. Socket module 08732-CSKT-0001
- B. IMS cable 08732-CSKT-0004

**Remote mount transmitters**

Cable kits are available as individual component cables or as a combination coil/electrode cable. Remote cables can be ordered directly using the kit numbers shown in [Table 4-3](#), [Table 4-4](#), and [Table 4-5](#). Equivalent Alpha cable part numbers are also provided as an alternative. To order cable, specify length as quantity desired. Equal length of component cables is required.

Examples:

- 25 feet = Qty (25) 08732-0065-0001
- 25 meters = Qty (25) 08732-0065-0002

**Table 4-3: Component cable kits - standard temperature (-20°C to 75°C)**

| Cable kit #                 | Description  | Individual cable                             | Alpha p/n              |
|-----------------------------|--|--|------------------------|
| 08732-0065-0001<br>(feet)   | Kit, component cables, Std temp (includes Coil and Electrode)      | Coil<br>Electrode                            | 2442C<br>2413C         |
| 08732-0065-0002<br>(meters) | Kit, component cables, Std temp (includes Coil and Electrode)      | Coil<br>Electrode                            | 2442C<br>2413C         |
| 08732-0065-0003<br>(feet)   | Kit, component cables, Std temp (includes Coil and I.S. Electrode) | Coil<br>Intrinsically Safe Blue<br>Electrode | 2442C<br>Not available |
| 08732-0065-0004<br>(meters) | Kit, component cables, Std temp (includes Coil and I.S. Electrode) | Coil<br>Intrinsically Safe Blue<br>Electrode | 2442C<br>Not available |

**Table 4-4: Component cable kits - extended temperature (-50°C to 125°C)**

| Cable kit #                 | Description  | Individual cable  | Alpha p/n                      |
|-----------------------------|--|-------------------|--------------------------------|
| 08732-0065-1001<br>(feet)   | Kit, Component Cables, Ext Temp. (includes Coil and Electrode) | Coil<br>Electrode | Not available<br>Not available |
| 08732-0065-1002<br>(meters) | Kit, Component Cables, Ext Temp. (includes Coil and Electrode) | Coil<br>Electrode | Not available<br>Not available |

**Table 4-4: Component cable kits - extended temperature (-50°C to 125°C) (continued)**

| Cable kit #                 | Description   | Individual cable                          | Alpha p/n                      |
|-----------------------------|---|---|--------------------------------|
| 08732-0065-1003<br>(feet)   | Kit, Component Cables, Ext Temp. (includes Coil and I.S. Electrode) | Coil<br>Intrinsically Safe Blue Electrode | Not available<br>Not available |
| 08732-0065-1004<br>(meters) | Kit, Component Cables, Ext Temp. (includes Coil and I.S. Electrode) | Coil<br>Intrinsically Safe Blue Electrode | Not available<br>Not available |

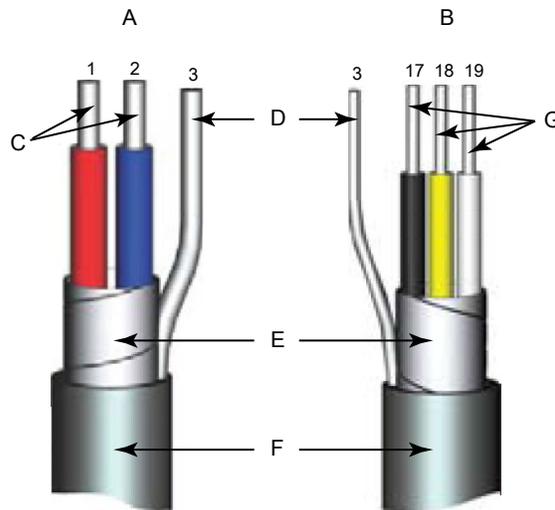
**Table 4-5: Combination cable kits - coil and electrode cable (-20°C to 80°C)**

| Cable kit #              | Description   |
|--------------------------|---|
| 08732-0065-2001 (feet)   | Kit, Combination Cable, Standard  |
| 08732-0065-2002 (meters) |   |
| 08732-0065-3001 (feet)   | Kit, Combination Cable, Submersible<br>(80°C dry/60°C Wet)<br>(33ft Continuous) |
| 08732-0065-3002 (meters) |   |

### Cable requirements

Shielded twisted pairs or triads must be used. For installations using the individual coil drive and electrode cable, see [Figure 4-5](#). Cable lengths should be limited to less than 500 feet (152 m). Consult factory for length between 500–1000 feet (152–304 m). Equal length cable is required for each. For installations using the combination coil drive/ electrode cable, see [Figure 4-6](#). Combination cable lengths should be limited to less than 330 feet (100 m).

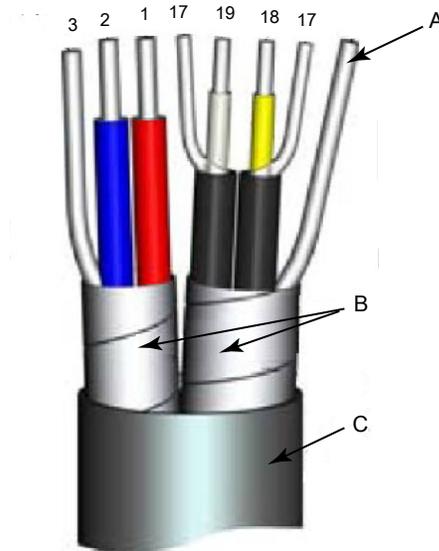
**Figure 4-5: Individual component cables**



- A. Coil drive
- B. Electrode
- C. Twisted, stranded, insulated 14 AWG conductors
- D. Drain
- E. Overlapping foil shield
- F. Outer jacket
- G. Twisted, stranded, insulated 20 AWG conductors

- 1 = Red
- 2 = Blue
- 3 = Drain
- 17 = Black
- 18 = Yellow
- 19 = White

**Figure 4-6: Combination coil and electrode cable**



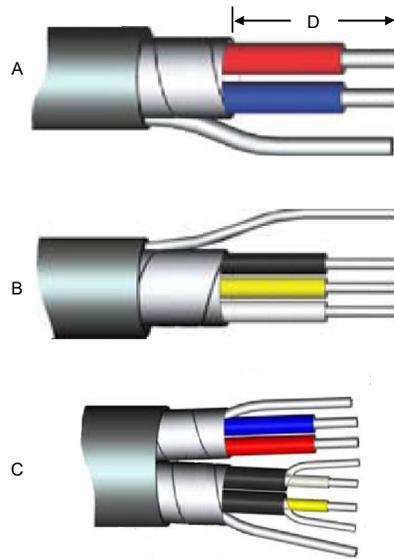
- A. *Electrode shield drain*
- B. *Overlapping foil shield*
- C. *Outer jacket*

- 1 = Red
- 2 = Blue
- 3 = Drain
- 17 = Reference
- 18 = Yellow
- 19 = White

### **Cable preparation**

Prepare the ends of the coil drive and electrode cables as shown in [Figure 4-7](#). Remove only enough insulation so that the exposed conductor fits completely under the terminal connection. Best practice is to limit the unshielded length (D) of each conductor to less than one inch. Excessive removal of insulation may result in an unwanted electrical short to the transmitter housing or other terminal connections. Excessive unshielded length, or failure to connect cable shields properly, may also expose the unit to electrical noise, resulting in an unstable meter reading.

Figure 4-7: Cable ends



- A. Coil
- B. Electrode
- C. Combination
- D. Unshielded length

**! WARNING**

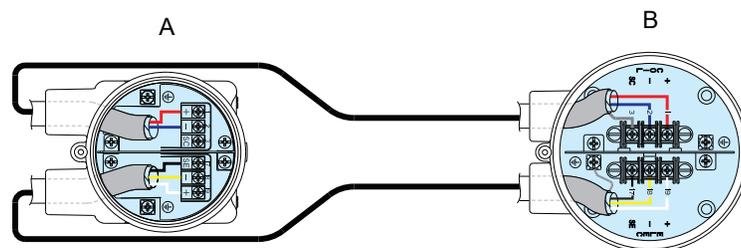
Shock hazard! Potential shock hazard across remote junction box terminals 1 and 2 (40V).

**! WARNING**

Explosion hazard! Electrodes exposed to process. Use only compatible transmitter and approved installation practices. For process temperatures greater than 284°F (140°C), use a wire rated for 257°F (125°C).

Remote junction box terminal blocks

Figure 4-8: Remote junction box views



- A. Sensor
- B. Transmitter

**Table 4-6: Sensor/transmitter wiring**

| Wire color      | Sensor terminal  | Transmitter terminal  |
|-----------------|--|---|
| Red             | 1  | 1   |
| Blue            | 2  | 2   |
| Coil drain      | 3 or float   | 3   |
| Black           | 17   | 17  |
| Yellow          | 18   | 18  |
| White           | 19   | 19  |
| Electrode drain |  or float |  |

**Note**

For hazardous locations, refer to [Product Certifications](#).





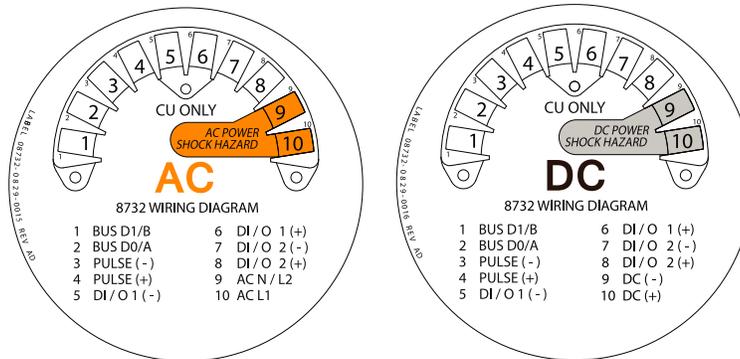
## 4.4.5 Power and fieldbus terminal blocks

Remove the back cover of the transmitter to access the terminal block.

### Note

To connect pulse output, see [Connect pulse output](#).

**Figure 4-11: Terminal blocks**



- A. AC version
- B. DC version

**Table 4-7: Power and I/O terminals**

| Terminal number | AC version      | DC version |
|-----------------|-----------------|------------|
| 1               | D1 / B          | D1 / B     |
| 2               | D0 / A          | D0 / A     |
| 3               | Pulse (-)       | Pulse (-)  |
| 4               | Pulse (+)       | Pulse (+)  |
| 5               | Not used        | Not used   |
| 6               | Not used        | Not used   |
| 7               | Not used        | Not used   |
| 8               | Not used        | Not used   |
| 9               | AC (Neutral)/L2 | DC (-)     |
| 10              | AC L1           | DC (+)     |

## 4.4.6 Powering the transmitter

Before connecting power to the transmitter, be sure to have the necessary electrical supplies and required power source:

- The AC powered transmitter requires 90–250V AC (50/60Hz).
- The DC powered transmitter requires 12–42V DC.

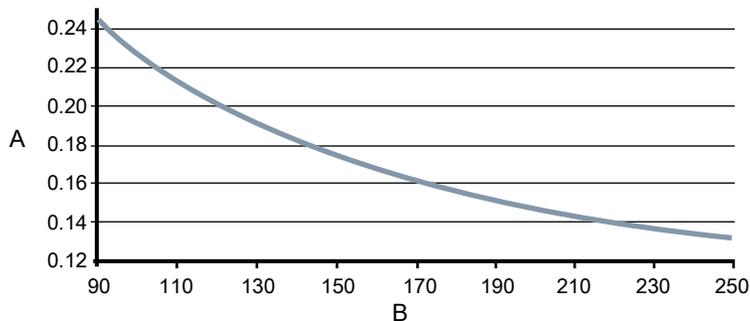
Wire the transmitter according to national, local, and plant electrical requirements.

If installing in a hazardous location, verify that the meter has the appropriate hazardous area approval. Each meter has a hazardous area approval tag attached to the top of the transmitter housing.

### AC power supply requirements

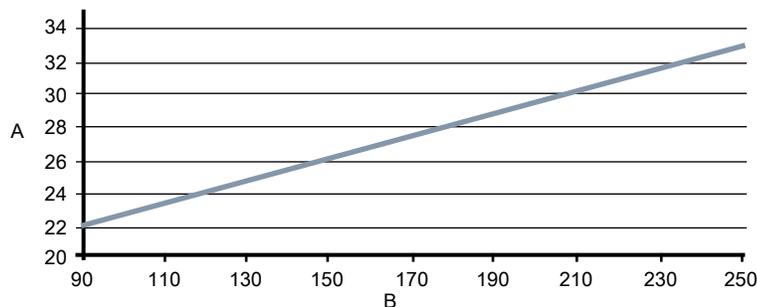
Units powered by 90 - 250VAC have the following power requirements. Peak inrush is 35.7A at 250VAC supply, lasting approximately 1ms. Inrush for other supply voltages can be estimated with:  $\text{Inrush (Amps)} = \text{Supply (Volts)} / 7.0$

**Figure 4-12: AC current requirements**



- A. Supply current (amps)  
B. Power supply (VAC)

**Figure 4-13: Apparent power**

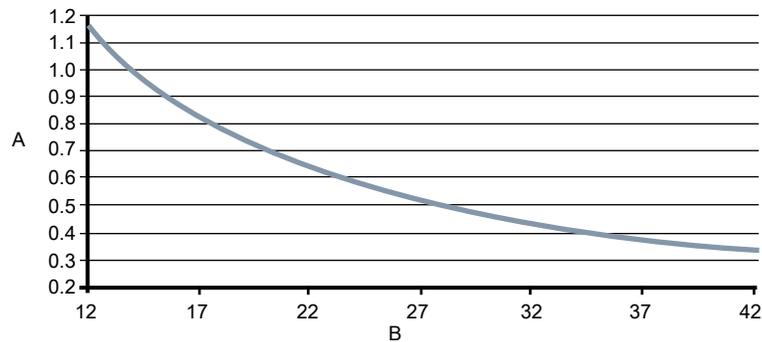


- A. Apparent power (VA)  
B. Power supply (VAC)

### DC power supply requirements

Standard DC units powered by 12VDC power supply may draw up to 1.2A of current steady state. Peak inrush is 42A at 42VDC supply, lasting approximately 1ms. Inrush for other supply voltages can be estimated with:  $\text{Inrush (Amps)} = \text{Supply (Volts)} / 1.0$

**Figure 4-14: DC current requirements**



- A. Supply current (amps)  
B. Power supply (VDC)

### Supply wire requirements

Use 10–18 AWG wire rated for the proper temperature of the application. For wire 10–14 AWG use lugs or other appropriate connectors. For connections in ambient temperatures above 122 °F (50 °C), use a wire rated for 194 °F (90 °C). For DC powered transmitters with extended cable lengths, verify that there is a minimum of 12VDC at the terminals of the transmitter with the device under load.

### Electrical disconnect requirements

Connect the device through an external disconnect or circuit breaker per national and local electrical code.

### Installation category

The installation category for the transmitter is OVERVOLTAGE CAT II.

### Overcurrent protection

The transmitter requires overcurrent protection of the supply lines. Fuse rating and compatible fuses are shown in [Table 4-8](#).

**Table 4-8: Fuse requirements**

| Power system | Power supply | Fuse rating        | Manufacturer               |
|--------------|--------------|--------------------|----------------------------|
| AC power     | 90–250VAC    | 2 Amp quick acting | Bussman AGC2 or equivalent |
| DC power     | 12–42VDC     | 3 Amp quick acting | Bussman AGC3 or equivalent |

### Power terminals

For AC powered transmitter (90–250VAC, 50/60 Hz):

- Connect AC Neutral to terminal 9 (AC N/L2) and AC Line to terminal 10 (AC/L1).

For DC powered transmitter:

- Connect negative to terminal 9 (DC -) and positive to terminal 10 (DC +).
- DC powered units may draw up to 1.2A.

#### Cover jam screw

For flow meters shipped with a cover jam screw, the screw should be installed after the instrument has been wired and powered up. Follow these steps to install the cover jam screw:

1. Verify the cover jam screw is completely threaded into the housing.
2. Install the housing cover and verify the cover is tight against the housing.
3. Using a 2.5 mm hex wrench, loosen the jam screw until it contacts the transmitter cover.
4. Turn the jam screw an additional ½ turn counterclockwise to secure the cover.

---

#### Note

Application of excessive torque may strip the threads.

---

5. Verify the cover cannot be removed.

## 4.4.7 Fieldbus wiring

### Transmitter communication input

The FOUNDATION fieldbus communication requires a minimum of 9VDC and a maximum of 32VDC at the transmitter communication terminals. Do not exceed 32VDC at the transmitter communication terminals. Do not apply AC line voltage to the transmitter communication terminals. Improper supply voltage can damage the transmitter.

### Field wiring

Power independent of the transmitter power supply must be supplied for FOUNDATION fieldbus communications. Use shielded, twisted pair for best results. In order to get maximum performance in new applications, twisted pair cable specifically designed for fieldbus communications should be used. The number of devices on a fieldbus segment is limited by the power supply voltage, the resistance of the cable, and the amount of current drawn by each device. See [Table 4-9](#) for cable specifications.

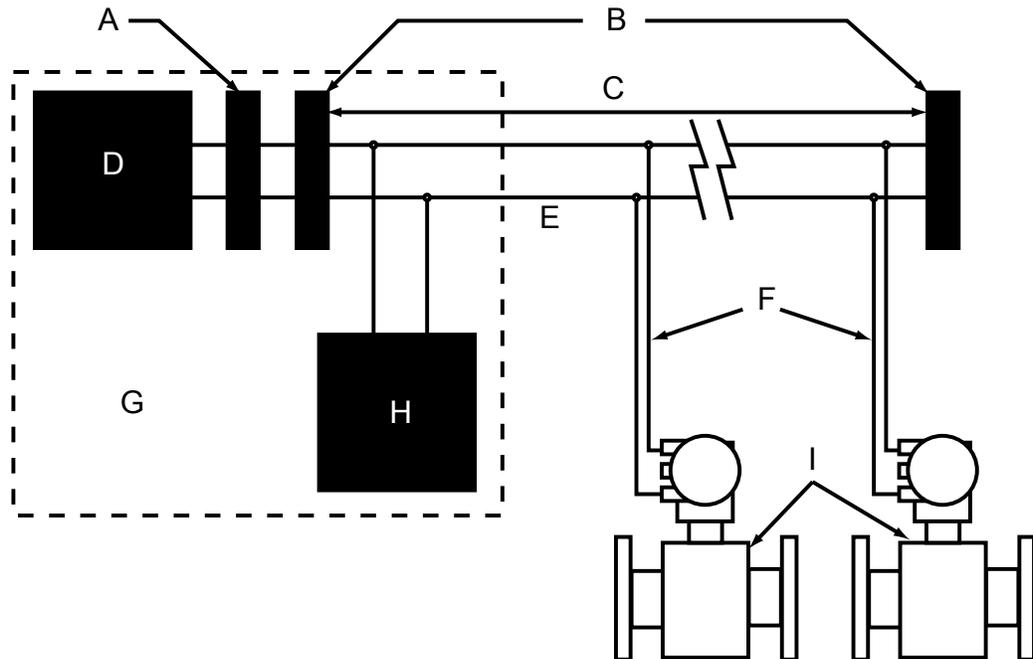
**Table 4-9: Ideal cable specifications for fieldbus wiring**

| Characteristic       | Ideal specification           |
|----------------------|-------------------------------|
| Impedance            | 100 Ohms ± 20% at 31.25 kHz   |
| Wire size            | 18 AWG (0.8 mm <sup>2</sup> ) |
| Shield coverage      | 90%                           |
| Attenuation          | 3 db/km                       |
| Capacitive unbalance | 2 nF/km                       |

### Power conditioning

Each fieldbus power supply requires a power conditioner to decouple the power supply output from the fieldbus wiring segment.

**Figure 4-15: Power connections**

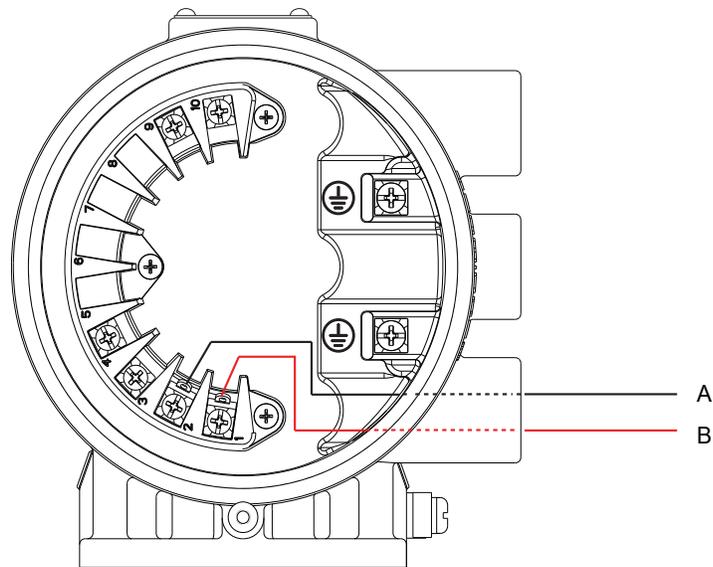


- A. Power conditioner
- B. Terminators
- C. Fieldbus segment
- D. Power supply
- E. Trunk
- F. Spurs
- G. Control room
- H. FOUNDATION fieldbus host
- I. Devices 1 through 11

### Transmitter wiring connection

- Use wire terminals 1 and 2.
- The transmitter fieldbus connection is polarity insensitive.

Figure 4-16: Fieldbus wiring



- A. Fieldbus terminal (2)
- B. Fieldbus terminal (1)

## 4.5 Cover jam screw

For flow meters shipped with a cover jam screw, the screw should be installed after the instrument has been wired and powered up. Follow these steps to install the cover jam screw:

1. Verify the cover jam screw is completely threaded into the housing.
2. Install the housing cover and verify the cover is tight against the housing.
3. Using a 2.5 mm hex wrench, loosen the jam screw until it contacts the transmitter cover.
4. Turn the jam screw an additional  $\frac{1}{2}$  turn counterclockwise to secure the cover.

### Note

Application of excessive torque may strip the threads.

5. Verify the cover cannot be removed.



## 5 Basic Configuration

Once the magnetic flowmeter is installed and power has been supplied, the transmitter basic setup parameters must be configured with a FOUNDATION fieldbus host (See [Communication methods](#)). Configuration settings are saved in nonvolatile memory within the transmitter.

The standard transmitter configuration, without Option Code C1, Custom Configuration, is shipped with the following parameters:

- Engineering Units: ft/s
- Sensor Size: 3-in.
- Sensor Calibration Number: 100000501000000

Descriptions of more advanced functions are included in [Advanced Configuration Functionality](#).

### 5.1 Communication methods

You will see references to the transmitter "LOI" (Local Operator Interface) in the fieldbus parameter names and on configuration screens and tools. However this type of display provides only one-way communication from the transmitter to the user for process variables, status, and diagnostics.

All configuration and other communication from the user to the transmitter requires one of two types of FOUNDATION fieldbus host:

- On an *enhanced FF host*, the transmitter parameters are displayed either in the form of a menu tree (for example, a Field Communicator) or in the form of tabbed display screens (for example, the AMS Intelligent Device Manager with DeltaV™ System). Both the menu tree and tabbed display screens are provided as part of the unique Device Description files specific to this transmitter.
- A *basic FF host* displays the transmitter parameters in the form of a list under the Resource block and transducer blocks.

This document contains information for both types of host.

---

#### Note

Fieldbus configuration tools and hosts from some vendors may interpret device information differently than others. As a result, you may notice slight differences in the paths, locations, or parameter names on your host or configuration tool.

---

### 5.2 FOUNDATION fieldbus configuration

#### Assigning physical device tag and node address

The transmitter is shipped with a blank physical device tag and a temporary address to allow a host to automatically assign an address and a physical device tag. If the physical device tag or address need to be changed, use the features of the configuration tool. The tools do the following:

- Change the physical device tag to a new value.
- Change the address to a new address.

When the transmitter is at a temporary address, only the physical device tag and address can be changed or written to. The resource, transducer, and function blocks are all disabled.

### Flow-specific AI block configuration

The factory configuration of the four Analog Input function blocks ("AI blocks") is the following:

- One of them is configured for flow:
  - CHANNEL parameter is set to 1
  - XD\_SCALE parameters are set to:
    - EU\_100: -39.37
    - EU\_0: -39.37
    - UNITS\_INDEX: ft/sec
    - DECIMAL: 2
  - L\_TYPE parameter is set to Direct
- The other three are configured as Totalizer A, Totalizer B, and Totalizer C

For more information:

- For totalizer configuration, see [Totalizer](#).
- For more information about AI block parameters, see [Analog Input \(AI\) Function Block](#).
- For additional AI block configuration and troubleshooting, refer to *FOUNDATION™ Fieldbus Function Blocks*, document 00809-0100-4783.

If you need to reconfigure the flow measurement AI block:

1. Set the CHANNEL parameter to 1 for flow.
2. Set the XD\_SCALE parameters (EU\_100, EU\_0, UNITS\_INDEX, and DECIMAL) to the desired measurement scale from the flow measurement transducer.
3. Set the L\_TYPE parameter to the desired linearization method, and then if necessary, set the OUT\_SCALE parameters:
  - For direct measurement (the AI block output is the same as the XD\_SCALE), set L\_TYPE to Direct. This completes the channel configuration.
  - For indirect measurement (the AI block output is scaled from the XD\_SCALE), set L\_TYPE to Indirect, and then set the OUT\_SCALE parameters (EU\_100, EU\_0, UNITS\_INDEX, and DECIMAL) to the scale required by the control/monitoring system.

### General, flow-specific block configuration

In general, only the transducer block and AI blocks have configurations for flow-specific parameters. All other function blocks are configured by linking the AI blocks to other blocks to be used for control and/or monitoring applications.

## 5.3 Basic Setup

### Descriptive tag

|                  |  |
|------------------|--|
| Enhanced FF host | Configure > Device Information > Description |
| Basic FF host    | TB > TAG_DESC (OD Index 2)                   |

The descriptive tag fieldbus parameter permits you to assign a 32 character identifier to a transmitter to distinguish it from others in your system. It is **not** the same as the physical device tag (see [Assigning physical device tag and node address](#)), which is used by the control scheme.

### Flow units

Flow units must be configured from the AI block configured for flow measurement. See [FOUNDATION fieldbus configuration](#).

### Line size

|                  |                              |
|------------------|------------------------------|
| Enhanced FF host | Configure > Basic Setup      |
| Basic FF host    | TB > TUBE_SIZE (OD Index 36) |

The line size (sensor size) must be set to match the actual sensor connected to the transmitter.

### Calibration number

|                  |                                      |
|------------------|--------------------------------------|
| Enhanced FF host | Configure > Basic Setup              |
| Basic FF host    | TB > FLOW_TUBE_CAL_NUM (OD Index 35) |

The sensor calibration number is a 16-digit number generated at the factory during flow calibration and is unique to each sensor and is located on the sensor tag.



## 6 Advanced installation details

### 6.1 Hardware switches

The electronics are equipped with two user-selectable hardware switches. These switches set the Transmitter Security and Simulate Enable.

#### 6.1.1 Transmitter security

The **SECURITY** switch allows the user to lock out any configuration changes attempted on the transmitter.

- When the security switch is in the **ON** position, the configuration can be viewed but no changes can be made.
- When the security switch is in the **OFF** position, the configuration can be viewed and changes can be made.

The switch is in the **OFF** position when the transmitter is shipped from the factory.

---

**Note**

The flow rate indication and totalizer functions remain active when the **SECURITY** switch is in either position.

---

#### 6.1.2 Simulate mode

The Simulate Mode switch is used in conjunction with the Analog Input (AI) function block. The switch is used to enable flow measurement and diagnostic alert simulation. To enable the simulate enable feature, the switch must transition from OFF to ON after power is applied to the transmitter, preventing the transmitter from being accidentally left in simulate mode. Simulate Mode is set in the OFF position when shipped from the factory.

#### 6.1.3 Changing hardware switch settings

---

**Note**

The hardware switches are located on the top side of the electronics board and changing their settings requires opening the electronics housing. If possible, carry out these procedures away from the plant environment in order to protect the electronics.

---

**Figure 6-1: Electronics Stack and Hardware Switches**



1. Place the control loop into manual control.
2. Disconnect power to the transmitter
3. Remove the electronics compartment cover.  
If the cover has a cover jam screw, this must be loosened prior to removal of the cover.
4. Remove the LOI/Display, if applicable.
5. Identify the location of each switch (see [Figure 6-1](#)).
6. Change the setting of the desired switches with a small, non-metallic tool.
7. Replace the LOI/Display, if applicable.
8. Replace the electronics compartment cover.  
If the cover has a cover jam screw, this must be tightened to comply with installation requirements. See [Cover jam screw](#) for details on the cover jam screw.
9. Return power to the transmitter and verify the flow measurement is correct.
10. Return the control loop to automatic control.

## 6.2 Connect pulse output

The pulse output function provides a galvanically isolated frequency signal that is proportional to the flow through the sensor. The signal is typically used in conjunction with an external totalizer or control system.

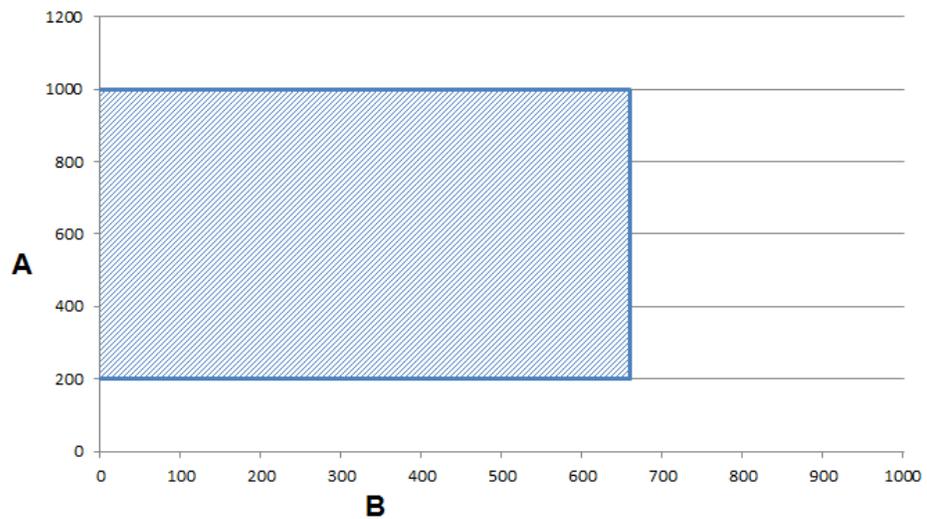
The transmitter supports a pulse output with an external power supply that meets the following requirements:

- Supply voltage: 5 to 24 VDC
- Maximum current: 100 mA
- Maximum power: 1.0 W
- Load resistance: 200 to 10k Ohms (typical value 1k Ohms). Refer to the figure indicated:

| Supply voltage | Resistance vs cable length     |
|----------------|--------------------------------|
| 5 VDC          | See <a href="#">Figure 6-2</a> |
| 12 VDC         | See <a href="#">Figure 6-3</a> |
| 24 VDC         | See <a href="#">Figure 6-4</a> |

- Pulse mode: Fixed pulse width or 50% duty cycle
- Pulse duration: 0.1 to 650 ms (adjustable)
- Maximum pulse frequency: 5,000 Hz
- FET switch closure: solid state switch

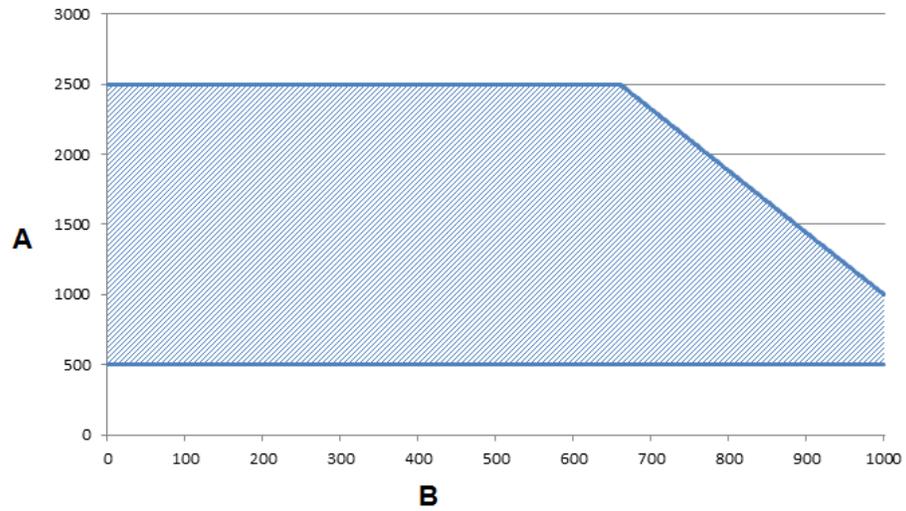
**Figure 6-2: 5 VDC Supply**



- A. Resistance ( $\Omega$ )
- B. Cable length (feet)

At 5000 Hz operation with a 5 VDC supply, pull-up resistances of 200 to 1000 Ohms allow cable lengths up to 660 ft (200 m).

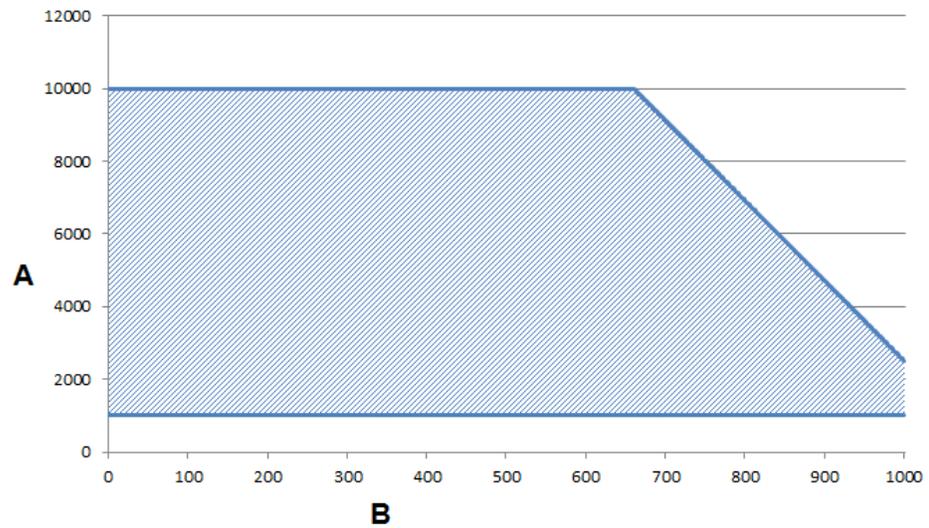
**Figure 6-3: 12 VDC Supply**



- A. Resistance ( $\Omega$ )
- B. Cable length (feet)

At 5000 Hz operation with a 12 VDC supply, pull-up resistances of 500 to 2500 Ohms allow cable lengths up to 660 ft (200 m). Resistances from 500 to 1000 Ohms allow a cable length of 1000 ft (330 m).

**Figure 6-4: 24 VDC Supply**



- A. Resistance ( $\Omega$ )
- B. Cable length (feet)

At 5000 Hz operation with a 24 VDC supply, pull-up resistances of 1000 to 10,000 Ohms allow cable lengths up to 660 ft (200 m). Resistances from 1000 to 2500 Ohms allow a cable length of 1000 ft (330 m).

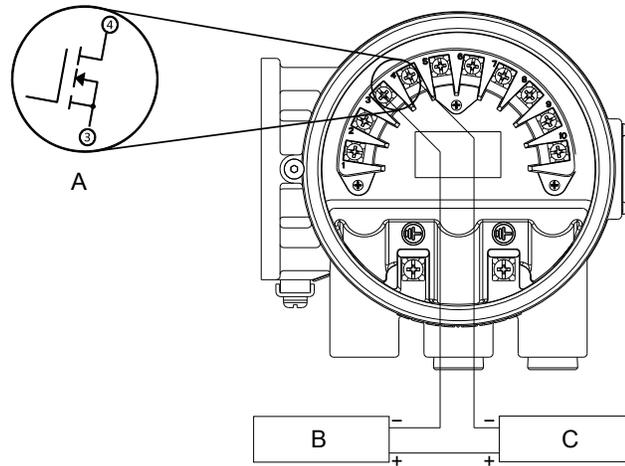
## 6.2.1

### Connecting an external power supply

**Note**

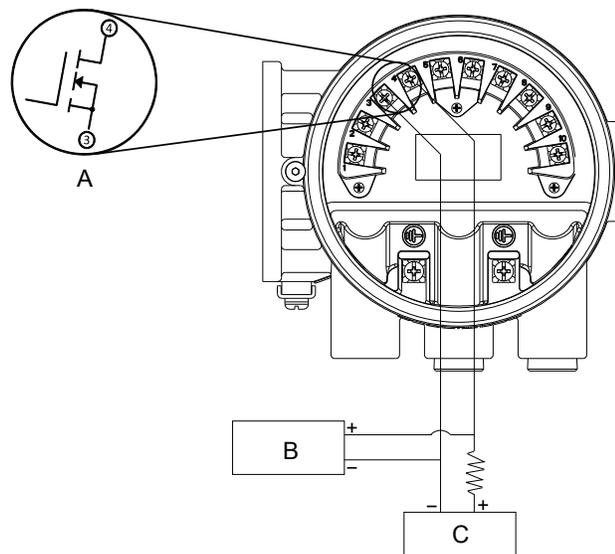
Total loop impedance must be sufficient to keep loop current below maximum rating. A resistor can be added in the loop to raise impedance.

**Figure 6-5: Connecting an electromechanical totalizer/counter with external power supply**



- A. Schematic showing FET between terminal 3 and 4
- B. 5–24 VDC power supply
- C. Electro-mechanical counter

**Figure 6-6: Connecting to an electronic totalizer/counter with external power supply**



- A. Schematic showing FET between terminal 3 and 4
- B. Electronic counter
- C. 5–24 VDC power supply

1. Ensure the power source and connecting cable meet the requirements outlined previously.

2. Turn off the transmitter and pulse output power sources.
3. Run the power cable to the transmitter.
4. Connect - DC to terminal 3.
5. Connect + DC to terminal 4.

## 6.3 Coil housing configuration

The coil housing provides physical protection of the coils and other internal components from contamination and physical damage that might occur in an industrial environment. The coil housing is an all-welded and gasket-free design.

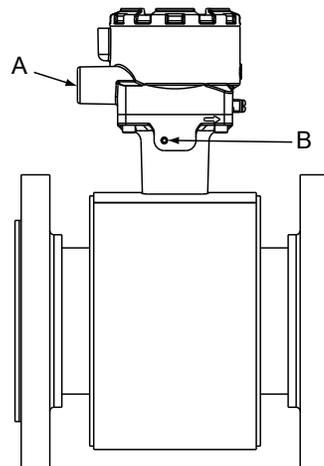
The 8705 model is available in four coil housing configurations. Configurations are identified by the M0, M1, M2, M3, or M4 options codes found in the model number. The 8711 and 8721 models are only available in one coil housing coil configuration; a separate option code is not available.

### 6.3.1 Standard coil housing configuration

The standard coil housing configuration is a factory sealed all-welded enclosure and is available for the following models (see [Figure 6-7](#)):

- 8705 with option code M0 - 8705xxxxxxxM0
- 8711 with option code M/L - 8711xxxxxxM/L
- 8721 with option code R/U - 8721xxxxxxR/U

**Figure 6-7: Standard Housing Configuration (8705 Shown)**



- A. Conduit connection
- B. No relief port (welded shut)

### 6.3.2 Process leak protection (option M1)

The 8705 is available with process leak detection through the use of a threaded connection and pressure relief valve (PRV). This coil housing configuration is a factory sealed all-welded enclosure. The M1 configuration is available for the 8705 only.

- 8705 with option code M1 - 8705xxxxxxxM1

A PRV can be installed in the threaded connection to prevent possible over-pressuring of the coil housing caused by a primary seal failure. The PRV is capable of venting fugitive emissions when pressure inside the coil housing exceeds five psi. Additional piping may be connected to the PRV to drain any process leakage to a safe location (see [Figure 6-8](#)).

In the event of a primary seal failure, this configuration will not protect the coils or other internal components of the sensor from exposure to the process fluid.

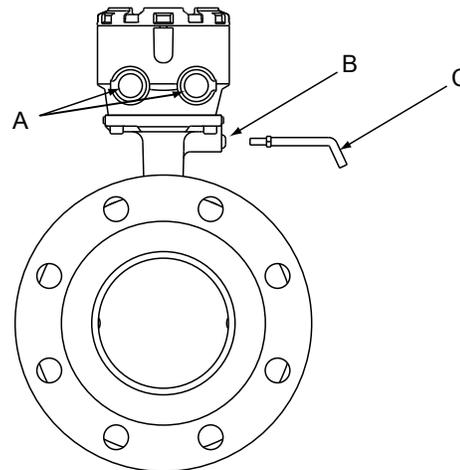
---

#### Note

The PRV is supplied with the meter to be installed by the customer. Installation of the PRV and any associated piping must be performed in accordance with environmental and hazardous area requirements.

---

**Figure 6-8: 8705 with M1 Coil Housing Configuration and PRV**



- A. Conduit connection
  - B. M6 threaded pressure relief port with removable cap screw
  - C. Optional: Use relief port to plumb to safe area (supplied by user).
- 

### 6.3.3 Process leak containment (Option M2 or M4)

The 8705 is available with process leak containment. The coil housing configuration is a factory sealed all-welded enclosure with the addition of sealed electrode compartments. The M2/M4 configuration is available for the 8705 only.

- 8705 with option code M2/M4 - 8705xxxxxxxM2/M4

This configuration divides the coil housing into separate compartments, one for each electrode and one for the coils. In the event of a primary seal failure, the fluid is contained

in the electrode compartment. The sealed electrode compartment prevents the process fluid from entering the coil compartment where it may damage the coils and other internal components. The electrode compartments are designed to contain the process fluid up to a maximum pressure of 740 psig.

- Code M2 - sealed, welded coil housing with separate sealed and welded electrode compartments (see [Figure 6-9](#)).
- Code M4 - sealed, welded coil housing with separate sealed and welded electrode compartments with a threaded port on the electrode tunnel cap, capable of venting fugitive emissions (see [Figure 6-10](#)).

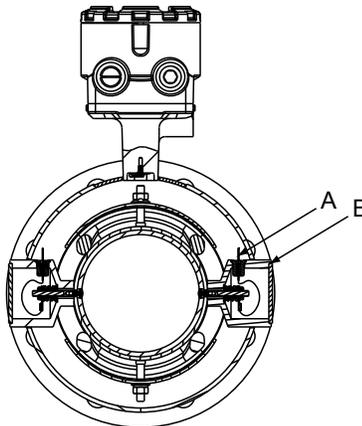
---

**Note**

To properly vent process fluid from the electrode compartment to a safe location, additional piping is required and must be installed by the user. Installation of any associated piping must be performed in accordance with environmental and hazardous area requirements. In the event of primary seal failure, the electrode compartment may be pressurized. Use caution when removing the cap screw.

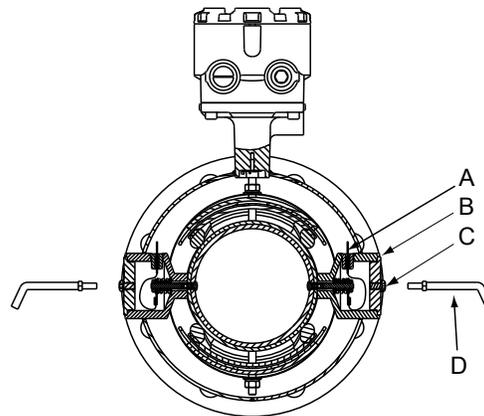
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**Figure 6-9: 8705 with M2 Coil Housing Configuration**



- A. 2x fused glass seal  
B. 2x sealed electrode compartment
-

**Figure 6-10: 8705 with M4 Coil Housing Configuration**



- A. 2x fused glass seal
- B. 2x sealed electrode compartment
- C. M6 threaded pressure relief port with removable cap screw
- D. Optional: Use relief port to plumb to safe area (supplied by user).

### 6.3.4 Process leak containment with electrode access (option M3)

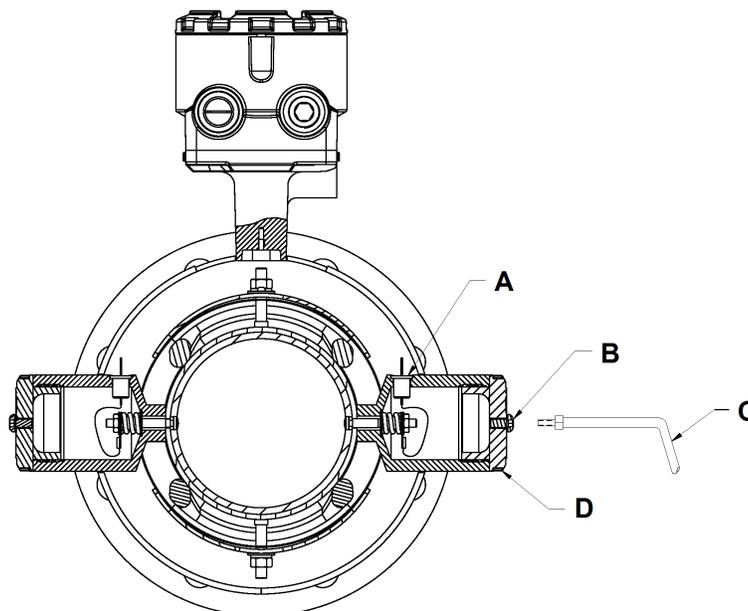
The 8705 is available with Process Leak Containment and Electrode Access. The coil housing configuration is a factory sealed, all-welded enclosure with the addition of sealed electrode compartments that include access covers. The M3 configuration is available on the 8705 only.

- 8705 with option code M3 - 8705xxxxxxxxM3

This configuration divides the coil housing into separate compartments, one for each electrode and one for the coils. In the event of a primary seal failure, the fluid is contained in the electrode compartment. The sealed electrode compartment prevents the process fluid from entering the coil compartment where it may damage the coils and other internal components. The electrode compartments are designed to contain the process fluid up to a maximum pressure of 740 psig.

#### **! CAUTION**

To properly vent process fluid from the electrode compartment to a safe location, additional piping is required and must be installed by the user. Installation of any associated piping must be performed in accordance with environmental and hazardous area requirements. In the event of primary seal failure, the electrode compartment may be pressurized. Use caution when removing the cap screw.



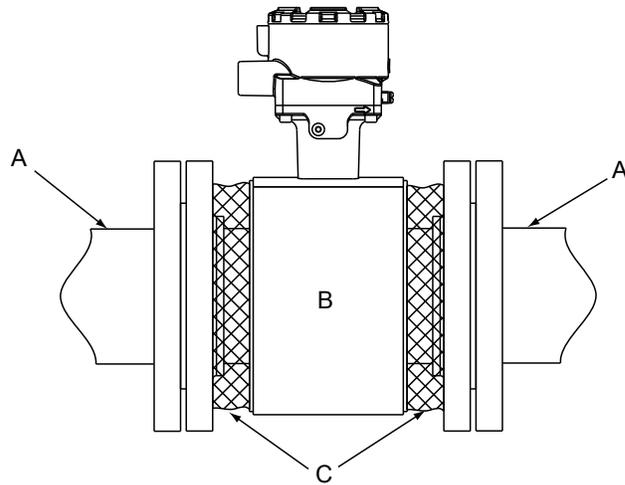
- A. 2X fused glass seal
- B. 2X M6 threaded pressure relief port
- C. Optional: use relief port to plumb to safe area (supplied by user)
- D. Threaded electrode access cover

### 6.3.5 Higher temperature applications and sensor insulation best practices

Insulation of the magnetic flowmeter sensor is not typically recommended. However, in applications with higher temperature process fluids (above 150°F / 65°C), plant safety, sensor reliability, and sensor longevity can be improved with careful attention to proper insulation.

1. In applications where process fluid permeation of the liner has been observed or may be expected, the rate of permeation can be reduced by decreasing the temperature gradient between the process fluid and the outside of the meter body. In these applications only the space between the process flanges and the coil housing should be insulated (see [Figure 6-11](#)).

**Figure 6-11: Insulating a Rosemount Magnetic Flowmeter for Permeation**



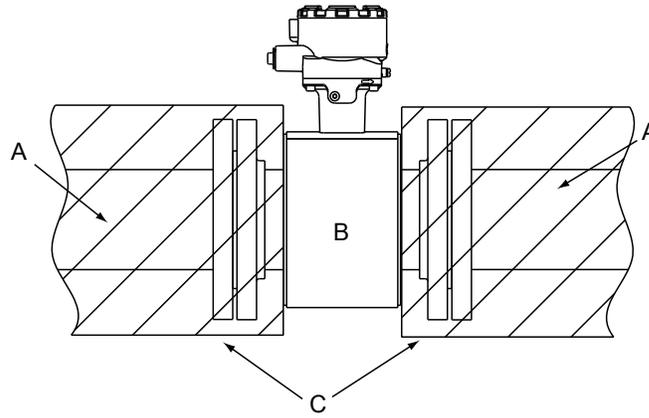
- A. Process piping
- B. Coil housing
- C. Insulation

2. When insulation of the magnetic flowmeter sensor is required due to plant safety standards designed to protect personnel from contact burns, extend the insulation up to the coil housing, covering both ends of the sensor and flanges (Figure 6-12).

The insulation should NOT cover the coil housing or the terminal junction box. Insulating the coil housing and the terminal junction box can result in overheating of the coil compartment and terminals, resulting in erratic/erroneous flow readings and potential damage or failure of the meter.

---

**Figure 6-12: Insulating a Rosemount Magnetic Flowmeter for Safety/Plant Standards**



- A. Process piping
  - B. Coil housing
  - C. Insulation
-



# 7 Advanced Configuration Functionality

## 7.1 Introduction

The transmitter features a full range of software functions, transmitter configurations, and diagnostic settings. These features can be accessed and configured using a basic or enhanced FF host.

## 7.2 Configure outputs

### 7.2.1 Pulse output

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Pulse Output</b>                     |
| Basic FF host    | TB > PULSE CONFIGURATION (OD Index #38) |

Under this function the pulse output of the transmitter can be configured.

#### Pulse scaling

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Pulse Output &gt; Factor</b>                   |
| Basic FF host    | TB > PULSE CONFIGURATION (OD Index #38)<br>FACTOR |

Transmitter may be commanded to supply a specified frequency between 1 pulse/ day at 39.37 ft/sec (12 m/s) to 5000 Hz at 1 ft/sec (0.3 m/s).

---

#### Note

The maximum pulse scaling frequency for transmitters with an intrinsically safe output is 5000 Hz.

---

#### Note

Line size, special units, and density must be selected prior to configuration of the pulse scaling factor.

The pulse output scaling equates one transistor switch closure pulse to a selectable number of volume units. The volume unit used for scaling pulse output is taken from the numerator of the configured flow units. For example, if gal/min had been chosen when selecting the flow unit, the volume unit displayed would be gallons.

---

#### Note

The pulse output scaling is designed to operate between 0 and 5000 Hz. The minimum conversion factor value is found by dividing the minimum span (in units of volume per second) by 5000 Hz.

---

When selecting pulse output scaling, the maximum pulse rate is 5000 Hz. With the 10 percent over range capability, the absolute limit is 5500 Hz. For example, if you want the transmitter to pulse every time 0.01 gallons pass through the sensor, and the flow rate is 5000 gal/min, you will exceed the 5000 Hz full-scale limit:

$$\frac{5000 \text{ gal}}{1 \text{ min}} \times \frac{1 \text{ min}}{(60 \text{ sec})} \times \frac{1 \text{ pulse}}{0.01 \text{ gal}} = 8,333.3 \text{ Hz}$$

The best choice for this parameter depends upon the required resolution, the number of digits in the totalizer, the extent of range required, and the maximum frequency limit of the external counter.

### Pulse factor units

|                  |   |
|------------------|---|
| Enhanced FF host | Pulse Output > Factor Units                             |
| Basic FF host    | TB > PULSE CONFIGURATION (OD Index #38)<br>FACTOR_UNITS |

The pulse factor unit assigns the unit of measure to the pulse scaling factor. The default read-only value is the unit of measure from the configured flow units. For example, if gal/min is selected when configuring the flow units, the pulse factor unit will be gallons.

**Table 7-1: Pulse factor volume units**

| Fieldbus unit code | Units                |
|--------------------|----------------------|
| 1048               | US Gallons           |
| 1038               | Liters               |
| 1049               | Imperial gallons     |
| 1034               | Cubic meters         |
| 1051               | Barrels (42 gallons) |
| 1042               | Cubic feet           |
| 1036               | Cubic centimeters    |
| 1052               | Barrels (31 gallons) |

**Table 7-2: Pulse factor mass units**

| Fieldbus unit code | Units       |
|--------------------|-------------|
| 1088               | Kilograms   |
| 1092               | Metric tons |
| 1094               | Pounds      |
| 1095               | Short tons  |

**Table 7-3: Pulse factor other units**

| Fieldbus unit code | Units          |
|--------------------|----------------|
| 1018               | Feet (default) |

**Table 7-3: Pulse factor other units (continued)**

| Fieldbus unit code | Units  |
|--------------------|--------|
| 1010               | Meters |

**Pulse width**

|                  |  |
|------------------|--|
| Enhanced FF host | Pulse Output > Pulse Width                             |
| Basic FF host    | TB > PULSE CONFIGURATION (OD Index #38)<br>PULSE_WIDTH |

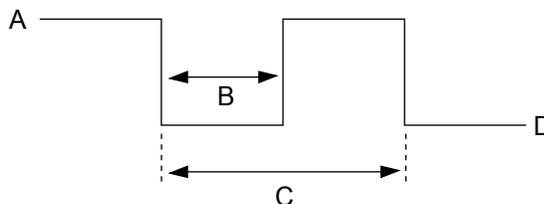
The factory default pulse width is 0.5 ms.

The width, or duration, of the pulse can be adjusted to match the requirements of different counters or controllers (see Figure 7-1). These are typically lower frequency applications (< 1000Hz). The transmitter will accept values from 0.1 ms to 650 ms.

For frequencies higher than 1000Hz, it is recommended to set the pulse mode to 50% duty cycle by setting the pulse mode to frequency output.

The pulse width will limit the maximum frequency output, If the pulse width is set too wide (more than 1/2 the period of the pulse) the transmitter will limit the pulse output. See example below.

**Figure 7-1: Pulse Output**



- A. Open
- B. Pulse width
- C. Period
- D. Closed

**Example**

If pulse width is set to 100 ms, the maximum output is 5Hz; for a pulse width of 0.5 ms, the maximum output would be 1000Hz (at the maximum frequency output there is a 50% duty cycle).

| Pulse width | Minimum period (50% duty cycle) | Maximum frequency  |
|-------------|---------------------------------|--|
| 100 ms      | 200 ms                          | $\frac{1 \text{ cycle}}{200 \text{ ms}} = 5 \text{ Hz}$    |
| 0.5 ms      | 1.0 ms                          | $\frac{1 \text{ cycle}}{1.0 \text{ ms}} = 1000 \text{ Hz}$ |

To achieve the greatest maximum frequency output, set the pulse width to the lowest value that is consistent with the requirements of the pulse output power source, pulse driven external totalizer, or other peripheral equipment.

The maximum flow rate is 10,000 gpm. Set the pulse output scaling such that the transmitter outputs 5000 Hz at 10,000 gpm.

$$\text{Pulse Scaling} = \frac{\text{Flow Rate (gpm)}}{(60 \frac{\text{sec}}{\text{min}}) \times (\text{frequency})}$$

$$\text{Pulse Scaling} = \frac{10,000 \text{ gpm}}{(60 \frac{\text{sec}}{\text{min}}) \times (5000 \text{ Hz})}$$

$$\text{Pulse Scaling} = 0.0333 \frac{\text{gal}}{\text{pulse}}$$

$$1 \text{ pulse} = 0.0333 \text{ gal}$$

---

### Note

Changes to pulse width are only required when there is a minimum pulse width required for external counters, relays, etc.

---

The external counter is ranged for 350 gpm and pulse is set for one gallon. Assuming the pulse width is 0.5 ms, the maximum frequency output is 5.833Hz.

$$\text{Frequency} = \frac{\text{Flow Rate (gpm)}}{(60 \frac{\text{sec}}{\text{min}}) \times (\text{pulse scaling} \frac{\text{gal}}{\text{pulse}})}$$

$$\text{Pulse Scaling} = \frac{350 \text{ gpm}}{(60 \frac{\text{sec}}{\text{min}}) \times 1 \frac{\text{gal}}{\text{pulse}}}$$

$$\text{Frequency} = 5.833 \text{ Hz}$$

The upper range value (20mA) is 3000 gpm. To obtain the highest resolution of the pulse output, 5000 Hz is scaled to the full scale analog reading.

$$\text{Frequency} = \frac{\text{Flow Rate (gpm)}}{(60 \frac{\text{sec}}{\text{min}}) \times (\text{pulse scaling} \frac{\text{gal}}{\text{pulse}})}$$

$$\text{Pulse Scaling} = \frac{3,000 \text{ gpm}}{(60 \frac{\text{sec}}{\text{min}}) \times 5000 \text{ Hz}}$$

$$\text{Pulse Scaling} = 0.01 \frac{\text{gal}}{\text{pulse}}$$

$$1 \text{ pulse} = 0.01 \text{ gal}$$

### Fixed frequency test mode

|                  |  |
|------------------|--|
| Enhanced FF host | Pulse Output > Fixed Frequency Mode                        |
| Basic FF host    | TB > PULSE CONFIGURATION (OD Index #38)<br>FIXED_FREQUENCY |

Fixed frequency test mode generates a constant, fixed-frequency pulse output. This can be useful for testing frequency input devices or control loop configurations.

**Table 7-4: Fixed frequency test mode**

| Fixed frequency parameter value | Mode  |
|---------------------------------|---|
| 0                               | Fixed frequency test mode disabled                                      |
| 1 to 5500 (Hz)                  | Fixed frequency test mode enabled, pulse output set to parameter value. |

To use pulse width settings, pulse mode must be set to pulse output.

## 7.2.2 Totalizer

The totalizer provides the total amount of fluid that has passed through the meter. There are three available totalizers: Total A, Total B, and Total C. They can be independently configured for one of the following options:

- Net - increments with forward flow and decrements with reverse flow (reverse flow must be enabled).
- Reverse total - will only increment with reverse flow if reverse flow is enabled
- Forward total - will only increment with forward flow

All totalizer values will be reset if **line size** is changed. This will happen even if the totalizer reset control is set to **non-resettable**.

The totalizers have the capability to increment the total to a maximum value of 50 feet per second of flow (or the volumetric equivalent) for a period of 20 years before roll-over occurs.

### View Totals

|                  |   |
|------------------|---|
| Enhanced FF host | Overview > View Totalizers  |
| Basic FF host    | TB > TOTAL_A_VALUE (OD Index #29)<br>TB > TOTAL_B_VALUE (OD Index #30)<br>TB > TOTAL_C_VALUE (OD Index #31) |

Displays the current value for each totalizer and shows the totalizer incrementing/decrementing based on totalizer configuration and flow direction.

### Configure totalizers

|                  |  |
|------------------|--|
| Enhanced FF host | Totalizers Control   |
| Basic FF host    | TB > TOTAL_A_CONFIG (OD Index #43)<br>TB > TOTAL_B_CONFIG (OD Index #44)<br>TB > TOTAL_C_CONFIG (OD Index #45) |

### Start, stop, reset all totalizers

|                  |   |
|------------------|---|
| Enhanced FF host | Totalizers Control > Start/Stop Totalizers<br>Totalizers Control > Reset All Totals |
| Basic FF host    | See below.  |

| Totalizer funtion    | Fieldbus parameter (Index #)                 | Parameter value |
|----------------------|--|-----------------|
| Start all totalizers | TOTALIZER CONTROL:<br>ENABLE_ALL (Index #42) | 2               |
| Stop all totalizers  | TOTALIZER CONTROL:<br>ENABLE_ALL(Index #42)  | 1               |
| Reset all totalizers | TOTALIZER CONTROL:<br>RESET_ALL (Index #42)  | 1               |

#### Note

If an individual totalizer is configured as non-resettable, reset all totalizers will **not** affect that totalizer.

### Totalizer direction

|                  |  |
|------------------|--|
| Enhanced FF host | Totalizers Control > Totalizer (A, B, C) > Flow Direction  |
| Basic FF host    | TB > TOTAL_A_CONFIG (OD Index #43)<br>TB > TOTAL_B_CONFIG (OD Index #44)<br>TB > TOTAL_C_CONFIG (OD Index #45)<br>FLOW_DIRECTION |

Configure the direction for the totalizers as either Net, Forward, or Reverse.

| FLOW_DIRECTION parameter value | Totalizer direction |
|--------------------------------|---------------------|
| 1                              | Net                 |
| 2                              | Forward only        |
| 3                              | Reverse only        |

### Totalizer units

|                  |   |
|------------------|---|
| Enhanced FF host | Totalizers Control > Totalizer (A, B, C) > Units  |
| Basic FF host    | TB > TOTAL_A_CONFIG (OD Index #43)<br>TB > TOTAL_B_CONFIG (OD Index #44)<br>TB > TOTAL_C_CONFIG (OD Index #45)<br>UNITS |

Configure the units for totalizers.

**Table 7-5: Volume units**

| Fieldbus unit code | Units                |
|--------------------|----------------------|
| 1048               | US Gallons           |
| 1038               | Liters               |
| 1049               | Imperial gallons     |
| 1034               | Cubic meters         |
| 1051               | Barrels (42 gallons) |
| 1042               | Cubic feet           |
| 1036               | Cubic centimeters    |
| 1052               | Barrels (31 gallons) |

**Table 7-6: Mass units**

| Fieldbus unit code | Units       |
|--------------------|-------------|
| 1088               | Kilograms   |
| 1092               | Metric tons |
| 1094               | Pounds      |
| 1095               | Short tons  |

**Table 7-7: Other units**

| Fieldbus unit code | Units          |
|--------------------|----------------|
| 1018               | Feet (default) |
| 1010               | Meters         |

**Reset configuration**

|                  |   |
|------------------|---|
| Enhanced FF host | Totalizers Control > Totalizer (A, B, C) > Reset Options  |
| Basic FF host    | TB > TOTAL_A_CONFIG (OD Index #43)<br>TB > TOTAL_B_CONFIG (OD Index #44)<br>TB > TOTAL_C_CONFIG (OD Index #45)<br>ALLOW_RESET |

Configure if the totalizer is non-resettable, or if it can be reset.

| ALLOW_RESET parameter value | Reset options     |
|-----------------------------|-------------------|
| 1                           | Reset not allowed |
| 2                           | Reset allowed     |

**Reset individual totalizer**

|                  |  |
|------------------|--|
| Enhanced FF host | Totalizers Control > Reset Totalizer (A, B, C) |
|------------------|--|

|               |   |
|---------------|---|
| Basic FF host | TB > TOTAL_A_CONFIG (OD Index #43)<br>TB > TOTAL_B_CONFIG (OD Index #44)<br>TB > TOTAL_C_CONFIG (OD Index #45)<br>RESET |
|---------------|---|

Independently reset the totalizers. This requires the reset option to be configured as resettable.

| RESET parameter value | Reset options   |
|-----------------------|-----------------|
| 1                     | Reset totalizer |

## 7.3 Configure LOI/Display

### 7.3.1 Flow and totalizer display

|                  |  |
|------------------|--|
| Enhanced FF host | LOI Flow Display Timing > Flow Rate Time<br>LOI Flow Display Timing > Totalizer (A, B, C) Time   |
| Basic FF host    | TB > LOI_CONFIGURATION (OD Index #53)<br>PV_LOI_TIME (Process variable)<br>TA_LOI_TIME (Totalizer A)<br>TB_LOI_TIME (Totalizer B)<br>TC_LOI_TIME (Totalizer C) |

The Process Variable and each of the three totalizer values can be shown in a scrolling cycle for zero to 10 seconds based on the settings selected in the LOI Configuration parameter. For basic FF hosts, the integer value of the parameter indicates the number of seconds the PV or totalizer value will be shown. To prevent the PV or a totalizer from appearing, set its value to zero.

- The default setting for the PV is 3 seconds
- The default setting for all totalizers is 0 seconds

#### Note

If all timing values are set to zero, the LOI/Display will default to showing only the PV.

### 7.3.2 Language

|                  |   |
|------------------|---|
| Enhanced FF host | Display Setup > Local Display Language            |
| Basic FF host    | TB > LOI_CONFIGURATION (OD Index #53)<br>LANGUAGE |

Use language to configure the display language shown on the LOI/Display.

**Table 7-8: Basic FF host languages**

| Parameter value | Language   |
|-----------------|------------|
| 1               | English    |
| 2               | Spanish    |
| 3               | German     |
| 4               | French     |
| 5               | Portuguese |

### 7.3.3 Backlight control

|                  |  |
|------------------|--|
| Enhanced FF host | Display Setup > Backlight                          |
| Basic FF host    | TB > LOI_CONFIGURATION (OD Index #53)<br>BACKLIGHT |

The LOI/Display backlight parameter determines whether or not the backlight is always on or always off.

**Table 7-9: BACKLIGHT parameter**

| Parameter value | Backlight control |
|-----------------|-------------------|
| 0               | OFF               |
| 5               | ON                |

## 7.4 Signal processing

The transmitter contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality.

If the 37 Hz coil drive mode has been set, and the output is still unstable, the damping and signal processing function should be used. It is important to set the coil drive mode to 37 Hz first, so the loop response time is not increased.

The transmitter provides for a very easy and straightforward start-up, and also incorporates the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the microprocessor can actually scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

See [Digital Signal Processing](#) for the detailed description of how the signal processing works.

### 7.4.1 PV (flow) damping

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Process Data > PV Damping |
| Basic FF host    | TB > DAMPING_CONSTANT (OD Index #32)          |

Primary variable damping allows selection of a response time, in seconds, to a step change in flow rate. It is most often used to smooth fluctuations in output.

## 7.4.2 Process density

|                  |  |
|------------------|--|
| Enhanced FF host | Signal Processing > Process Data > Density   |
| Basic FF host    | TB > DENSITY_CONSTANT (OD Index #34)<br>TB > DENSITY_CONSTANT_UNITS (OD Index #33) |

Use the process density value to convert from a volumetric flow rate to a mass flow rate using the following equation:

$$Q_m = Q_v \times \rho$$

Where:

$Q_m$  is the mass flow rate

$Q_v$  is the volumetric flow rate, and

$\rho$  is the fluid density

**Table 7-10: DENSITY\_CONSTANT\_UNITS parameter**

| Parameter value | Description                                    |
|-----------------|--|
| 1107            | Pounds per cubic foot (lb/ft <sup>3</sup> )    |
| 1097            | Kilograms per cubic meter (kg/m <sup>3</sup> ) |

## 7.4.3 Low flow cutoff

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Operation > Low Flow Cutoff |
| Basic FF host    | TB > LOW_FLOW_CUTOFF (OD Index #49)             |

Low flow cutoff allows the user to set a low flow limit to be specified. The flow reading is driven to zero for flow rates below the set point. The low flow cutoff units are the same as the PV units and cannot be changed. The low flow cutoff value applies to both forward and reverse flows.

## 7.4.4 Reverse flow

|                  |  |
|------------------|--|
| Enhanced FF host | Signal Processing > Operation > Reverse Flow |
| Basic FF host    | TB > REVERSE_FLOW (OD Index #75)             |

Use reverse flow to enable or disable the transmitter's ability to read flow in the opposite direction of the flow direction arrow (see [Flow direction](#)). This may occur when the process has bi-directional flow, or when either the electrode wires or the coil wires are reversed (see Troubleshooting [Remote wiring](#)). This also enables the totalizer to count in the reverse direction.

**Table 7-11: REVERSE\_FLOW parameter**

| Parameter value | Operating mode                  |
|-----------------|---------------------------------|
| 1               | Reverse flow disabled (default) |
| 2               | Reverse flow enabled            |

## 7.4.5 Coil drive frequency

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Coil drive > Coil Drive Frequency |
| Basic FF host    | TB > COIL_DRIVE_FREQ > (OD Index #37)                 |

Use coil drive frequency to change the pulse rate of the coils.

- 5 Hz - The standard coil drive frequency is 5 Hz, which is sufficient for nearly all applications.
- 37 Hz - If the process fluid causes a noisy or unstable output, increase the coil drive frequency to 37.5 Hz. If the 37 Hz mode is selected, perform the auto zero function for optimum performance.

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**Note**

37 Hz coil drive frequency should not be used for sensor sizes larger than 20-inch.

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See [Auto zero](#).



# 8 Advanced Diagnostics Configuration

## 8.1 Introduction

Rosemount magnetic flowmeters provide device diagnostics that detect and warn of abnormal situations throughout the life of the meter—from installation to maintenance and meter verification. With Rosemount magnetic flowmeter diagnostics enabled, plant availability and throughput can be improved, and costs through simplified installation, maintenance and troubleshooting can be reduced.

**Table 8-1: Basic diagnostics availability**

| Diagnostic name         | Diagnostic category | Product capability |
|-------------------------|---------------------|--------------------|
| Tunable Empty Pipe      | Process             | Standard           |
| Electronics Temperature | Maintenance         | Standard           |
| Coil Fault              | Maintenance         | Standard           |
| Transmitter Fault       | Maintenance         | Standard           |
| Reverse Flow            | Process             | Standard           |
| Electrode Saturation    | Process             | Standard           |
| Coil Current            | Maintenance         | Standard           |
| Coil Power              | Maintenance         | Standard           |

**Table 8-2: Advanced diagnostics availability**

| Diagnostic name               | Diagnostic category | Product capability |
|-------------------------------|---------------------|--------------------|
| High Process Noise            | Process             | Suite 1 (DA1)      |
| Grounding and Wiring Fault    | Installation        | Suite 1 (DA1)      |
| Coated Electrode Detection    | Process             | Suite 1 (DA1)      |
| Commanded Meter Verification  | Meter Health        | Suite 2 (DA2)      |
| Continuous Meter Verification | Meter Health        | Suite 2 (DA2)      |

### Options for accessing Rosemount Magmeter Diagnostics

Rosemount Magmeter Diagnostics can be viewed on the LOI/Display, and they can be viewed and accessed using a basic or enhanced FOUNDATION fieldbus host, such as AMS® Device Manager.

### Access diagnostics through AMS Device Manager

The value of the diagnostics increases significantly when AMS is used. The user will see simplified screen flow and procedures on how to respond to the diagnostics messages.

## 8.2 Licensing and enabling

All advanced diagnostics are licensed by ordering option code DA1, DA2, or both. In the event that a diagnostic option is not ordered, advanced diagnostics can be licensed in the field through the use of a license key. Each transmitter has a unique license key specific to the diagnostic option code. A trial license is also available to enable the advanced diagnostics. This temporary functionality will be automatically disabled after 30-days or when power to the transmitter is cycled, whichever occurs first. This trial code can be used a maximum of three times per transmitter. See the detailed procedures below for entering the license key and enabling the advanced diagnostics. To obtain a permanent or trial license key, contact your local Rosemount representative.

### 8.2.1 Licensing the diagnostics

1. Power up the transmitter.
2. Verify the software version is 4.4 software or later.

|                  |  |
|------------------|--|
| Enhanced FF host | License > License Upgrade > Software     |
| Basic FF host    | TB > DSP_SOFTWARE_REV_NUM (OD Index #59) |

3. Determine the Device ID.

|                  |  |
|------------------|--|
| Enhanced FF host | License > License Upgrade > Output Board Serial Number |
| Basic FF host    | TB > SERIAL_NUMBER (OD Index #115)                     |

4. Obtain a license key from a local Rosemount representative.
5. Enter license key.

|                  |   |
|------------------|---|
| Enhanced FF host | License > License Upgrade > License Key |
| Basic FF host    | TB > LICENSE_KEY (OD Index #82)         |

### 8.2.2 Enabling the diagnostics

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Enabled Diagnostics                   |
| Basic FF host    | TB > DIAGNOSTIC_HANDLING (OD Index #73). See below. |

After diagnostics are licensed, they can be enabled or disabled individually.

For Basic FOUNDATION fieldbus hosts, [Table 8-3](#) identifies which bits are associated with each diagnostic function. When the bit is set, the diagnostic is enabled.

**Table 8-3: DIAGNOSTIC\_HANDLING parameter**

| Bit | Diagnostic function  |
|-----|----------------------|
| 3   | Empty pipe detection |

**Table 8-3: DIAGNOSTIC\_HANDLING parameter (continued)**

| Bit | Diagnostic function                  |
|-----|--------------------------------------|
| 13  | High process noise                   |
| 15  | Grounding/wiring fault               |
| 10  | Electronics temperature out of range |
| 18  | Electrode coating                    |

## 8.3 Tunable empty pipe detection

The tunable empty pipe detection provides a means of minimizing issues and false readings when the pipe is empty. This is most important in batching applications where the pipe may run empty with some regularity. If the pipe is empty, this diagnostic will activate, set the flow rate to 0, and deliver an alert.

### Turning empty pipe on/off

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Enabled Diagnostics &gt; Empty Pipe Detection</b> |
| Basic FF host    | See <a href="#">Enabling the diagnostics</a> .                        |

The tunable empty pipe detection diagnostic can be turned on or off as required by the application. The empty pipe diagnostic is shipped turned “On” by default.

### 8.3.1 Tunable empty pipe parameters

The tunable empty pipe diagnostic has one read-only parameter, and two parameters that can be custom configured to optimize the diagnostic performance.

#### Empty pipe (EP) value

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Empty Pipe &gt; Value</b> |
| Basic FF host    | TB > EP_VALUE (OD Index #56)                  |

This parameter shows the current empty pipe value. This is a read-only value. This number is a unit-less number and is calculated based on multiple installation and process variables such as sensor type, line size, process fluid properties, and wiring. If the empty pipe value exceeds the empty pipe trigger level for a specified number of updates, then the empty pipe diagnostic alert will activate.

#### Empty pipe (EP) trigger level

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Empty Pipe &gt; Trigger Level</b> |
| Basic FF host    | TB > EP_TRIG_LEVEL (OD Index #55)                     |

Limits: 3 to 2000

Empty pipe trigger level is the threshold limit that the empty pipe value must exceed before the empty pipe diagnostic alert activates. The default setting from the factory is 100.

### Empty pipe (EP) counts

|                  |                                    |
|------------------|------------------------------------|
| Enhanced FF host | Diagnostics > Empty Pipe > Counts  |
| Basic FF host    | TB > EP_TRIG_COUNTS (OD Index #54) |

Limits: 2 to 50

Empty pipe counts is the number of consecutive updates that the transmitter must receive where the empty pipe value exceeds the empty pipe trigger level before the empty pipe diagnostic alert activates. The default setting from the factory is 5.

## 8.3.2 Optimizing tunable empty pipe

The tunable empty pipe diagnostic is set at the factory to properly diagnose most applications. If this diagnostic activates, the following procedure can be followed to optimize the empty pipe diagnostic for the application.

1. Record the empty pipe value with a full pipe condition.  
Full reading = 0.2
2. Record the empty pipe value with an empty pipe condition.  
Empty reading = 80.0
3. Set the empty pipe trigger level to a value between the full and empty readings.  
For increased sensitivity to empty pipe conditions, set the trigger level to a value closer to the full pipe value.  
Set the trigger level to 25.0
4. Set the empty pipe counts to a value corresponding to the desired sensitivity level for the diagnostic.  
For applications with entrained air or potential air slugs, less sensitivity may be desired.  
Set the counts to 10

## 8.4 Electronics temperature

The transmitter continuously monitors the temperature of the internal electronics. If the measured electronics temperature exceeds the operating limits of  $-40$  to  $140$  °F ( $-40$  to  $60$  °C) the transmitter will go into alarm and generate an alert.

## 8.4.1 Turning electronics temperature on/off

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Enabled Diagnostics &gt; Electronics Temperature Out of Range</b> |
| Basic FF host    | See <a href="#">Enabling the diagnostics</a> .  |

The electronics temperature diagnostic can be turned on or off as required by the application. The electronics temperature diagnostic will be turned on by default.

## 8.4.2 Electronics temperature parameters

The electronics temperature diagnostic has one read-only parameter. It does not have any configurable parameters.

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Electronics Temperature</b> |
| Basic FF host    | <b>TB &gt; ELECT_TEMP (OD Index #57)</b>        |

This parameter shows the current temperature of the electronics. This is a read-only value.

## 8.5 Ground/wiring fault detection

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the ground/wiring fault detection diagnostic, the transmitter specifically looks at the signal amplitude at frequencies of 50 Hz and 60 Hz which are the common AC cycle frequencies found throughout the world. If the amplitude of the signal at either of these frequencies exceeds 5 mV, that is an indication that there is a ground or wiring issue and that stray electrical signals are getting into the transmitter. The diagnostic alert will activate indicating that the ground and wiring of the installation should be carefully reviewed.

The ground/wiring fault detection diagnostic provides a means of verifying installations are done correctly. If the installation is not wired or grounded properly, this diagnostic will activate and deliver an alert. This diagnostic can also detect if the grounding is lost over-time due to corrosion or another root cause.

### 8.5.1 Turning ground/wiring fault on/off

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Enabled Diagnostics &gt; Grounding/Wiring Fault Detection</b> |
| Basic FF host    | See <a href="#">Enabling the diagnostics</a> .                                    |

The ground/wiring fault detection diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 Option) was ordered, then the ground/wiring fault detection diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

## 8.5.2 Ground/wiring fault parameters

The ground/wiring fault detection diagnostic has one read-only parameter. It does not have any configurable parameters.

### Line noise

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Ground/Wiring Fault Detection &gt; Line Noise</b> |
| Basic FF host    | <b>TB &gt; LINE_NOISE (OD Index #72)</b>                              |

The line noise parameter shows the amplitude of the line noise. This is a read-only value. This number is a measure of the signal strength at 50/60 Hz. If the line noise value exceeds 5 mV, then the ground/wiring fault diagnostic alert will activate.

## 8.6 High process noise detection

The high process noise diagnostic detects if there is a process condition causing an unstable or noisy reading that is not an actual flow variation. A common cause of high process noise is slurry flow, like pulp stock or mining slurries. Other conditions that cause this diagnostic to activate are high levels of chemical reaction or entrained gas in the liquid. If unusual noise or flow variation is seen, this diagnostic will activate and deliver an alert. If this situation exists and is left without remedy, it will add additional uncertainty and noise to the flow reading.

### 8.6.1 Turning high process noise on/off

|                  |   |
|------------------|---|
| Enhanced FF host | <b>Diagnostics &gt; Enabled Diagnostics &gt; High Process Noise Detection</b> |
| Basic FF host    | See <a href="#">Enabling the diagnostics</a> .                                |

The high process noise diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 Option) was ordered, then the high process noise diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

### 8.6.2 High process noise parameters

The high process noise diagnostic has two read-only parameters. It does not have any configurable parameters. This diagnostic requires that flow be present in the pipe and the velocity be greater than 1 ft/s (0.3 m/s).

#### 5 Hz signal to noise ratio (SNR)

|                  |  |
|------------------|--|
| Enhanced FF host | <b>Diagnostics &gt; High Process Noise Detection &gt; 5 Hz Signal-to-Noise Ratio</b> |
| Basic FF host    | <b>DIAG_SNR_5HZ (OD Index #69)</b>   |

This parameter shows the value of the signal to noise ratio at the coil drive frequency of 5 Hz. This is a read-only value. This number is a measure of the signal strength at 5 Hz relative to the amount of process noise. If the transmitter is operating in 5 Hz mode, and the signal to noise ratio remains below 25 for one minute, then the high process noise diagnostic alert will activate.

### 37 Hz signal to noise ratio (SNR)

|                  |  |
|------------------|--|
| Enhanced FF host | Diagnostics > High Process Noise Detection > 37 Hz Signal-to-Noise Ratio |
| Basic FF host    | DIAG_SNR_37HZ (OD Index #70)   |

This parameter shows the current value of the signal to noise ratio at the coil drive frequency of 37 Hz. This is a read-only value. This number is a measure of the signal strength at 37 Hz relative to the amount of process noise. If the transmitter is operating in 37 Hz mode, and the signal to noise ratio remains below 25 for one minute, then the high process noise diagnostic alert will activate.

## 8.7 Coated electrode detection

The coated electrode detection diagnostic provides a means of monitoring insulating coating buildup on the measurement electrodes. If coating is not detected, buildup over time can lead to a compromised flow measurement. This diagnostic can detect if the electrode is coated and if the amount of coating is affecting the flow measurement. There are two levels of electrode coating.

- Limit 1 indicates when coating is starting to occur, but has not compromised the flow measurement.
- Limit 2 indicates when coating is affecting the flow measurement and the meter should be serviced immediately.

### 8.7.1 Turning coated electrode detection on/off

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Enabled Diagnostics > Electrode Coating Detection |
| Basic FF host    | See <a href="#">Enabling the diagnostics</a> .                  |

The coated electrode detection diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 option) was ordered, then the coated electrode detection diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

### 8.7.2 Coated electrode parameters

The coated electrode detection diagnostic has four parameters. Two are read-only and two are configurable parameters. The electrode coating parameters need to be initially monitored to accurately set the electrode coating limit levels for each application.

### Electrode coating (EC) value

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Electrode Coating > Electrode Coating Value |
| Basic FF host    | TB > ELECTRODE_COATING > CURRENT_VALUE (OD Index #47)     |

The electrode coating value reads the value of the coated electrode detection diagnostic.

### Electrode coating (EC) level 1 limit

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Electrode Coating > Level 1 Limit     |
| Basic FF host    | TB > ELECTRODE_COATING_CFG > LEVEL_1 (OD Index #46) |

Set the criteria for the electrode coating limit 1 which indicates when coating is starting to occur, but has not compromised the flow measurement. The default value for this parameter is 1000 k Ohm.

### Electrode coating (EC) level 2 limit

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Electrode Coating > Level 2 Limit     |
| Basic FF host    | TB > ELECTRODE_COATING_CFG > LEVEL_2 (OD Index #46) |

Set the criteria for the electrode coating limit 2 which indicates when coating is affecting the flow measurement and the meter should be serviced immediately. The default value for this parameter is 2000 k Ohm.

### Maximum electrode coating (EC)

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Electrode Coating > Electrode Coating Max Value |
| Basic FF host    | TB > ELECTRODE_COATING_CFG > MAX_VALUE (OD Index #47)         |

The maximum electrode coating value reads the maximum value of the coated electrode detection diagnostic since the last maximum value reset.

### Clear maximum electrode value

|                  |   |
|------------------|---|
| Enhanced FF host | Diagnostics > Electrode Coating > Clear Max Electrode Coating |
| Basic FF host    | TB > ELECTRODE_COATING_CFG > CLEAR_MAX (OD Index #46)         |

Use this method to reset the maximum electrode coating value.

## 8.8 SMART™ Meter Verification

The SMART Meter Verification diagnostic provides a means of verifying the flowmeter is within calibration without removing the sensor from the process. This diagnostic test provides a review of the transmitter and sensor's critical parameters as a means to document verification of calibration. The results of this diagnostic provide the deviation amount from expected values and a pass/fail summary against user-defined criteria for the application and conditions. The SMART Meter Verification diagnostic can be configured to

run continuously in the background during normal operation, or it can be manually initiated as required by the application.

## 8.8.1 Sensor baseline (signature) parameters

The SMART Meter Verification diagnostic functions by taking a baseline sensor signature and then comparing measurements taken during the verification test to these baseline results.

The sensor signature describes the magnetic behavior of the sensor. Based on Faraday's law, the induced voltage measured on the electrodes is proportional to the magnetic field strength. Thus, any changes in the magnetic field will result in a calibration shift of the sensor. Having the transmitter take an initial sensor signature when first installed will provide the baseline for the verification tests that are done in the future. There are three specific measurements that are stored in the transmitter's non-volatile memory that are used when performing the calibration verification.

### Coil circuit resistance

|                  |  |
|------------------|--|
| Enhanced FF host | Meter Verification > Sensor Baseline > Coil Resistance |
| Basic FF host    | TB > COIL_RESIST_VALUE (OD Index #99)                  |

The coil resistance is a measurement of the coil circuit health. This value is used as a baseline to determine if the coil circuit is still operating correctly.

### Coil inductance (signature)

|                  |  |
|------------------|--|
| Enhanced FF host | Meter Verification > Sensor Baseline > Coil Inductance |
| Basic FF host    | TB > COIL_INDUCT_VALUE (OD Index #96)                  |

The coil inductance is a measurement of the magnetic field strength. This value is used as a baseline to determine if a sensor calibration shift has occurred.

### Electrode circuit resistance

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Sensor Baseline > Electrode Resistance |
| Basic FF host    | TB > ELECT_RESIST_VALUE (OD Index #101)                     |

The electrode circuit resistance is a measurement of the electrode circuit health. This value is used as a baseline to determine if the electrode circuit is still operating correctly.

## 8.8.2 Establishing the sensor baseline (signature)

The first step in running the SMART Meter Verification test is establishing the reference baseline that the test will use as the baseline for comparison. This is accomplished by having the transmitter take a baseline of the sensor.

### Reset baseline (re-signature meter)

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Sensor Baseline > Re-Baseline Sensor |
|------------------|---|

|               |   |
|---------------|---|
| Basic FF host | TB > PERFORM_REFINGERPRINT_FLOWTUBE (OD Index #110) |
|---------------|---|

Having the transmitter take an initial sensor baseline when first installed will provide the comparison point for the verification tests that are done in the future. The sensor baseline should be taken during the start-up process when the transmitter is first connected to the sensor, with a full line, and ideally with no flow in the line. Running the sensor baseline procedure when there is flow in the line is permissible, but this may introduce some noise into the electrode circuit resistance measurement. If an empty pipe condition exists, then the sensor baseline should only be run for the coils.

Once the sensor baseline process is complete, the measurements taken during this procedure are stored in non-volatile memory to prevent loss in the event of a power interruption to the meter. This initial sensor signature is required for both manual and continuous SMART Meter Verification.

#### Recall values (recall last saved)

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Sensor Baseline > Recall Last Baseline |
| Basic FF host    | TB > RECALL_FINGERPRINT_VALUES (OD Index #109)              |

In the event that the sensor baseline was reset accidentally or incorrectly, this function will restore the previously saved sensor baseline values.

## 8.8.3 SMART Meter Verification test criteria

The Smart Meter Verification diagnostic provides the ability to customize the test criteria to which the verification must be tested. The test criteria can be set for each of the flow conditions discussed above.

#### No flow limit

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Manual Meter Verification Limits > No Flow |
| Basic FF host    | TB > METER_VERIF_NO_FLOW_LIM (OD Index #108)                    |

Set the test criteria for the no flow condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated test only.

#### Flowing full limit

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Manual Meter Verification Limits > Flowing |
| Basic FF host    | TB > METER_VERIF_FLOWING_LIM (OD Index #107)                    |

Set the test criteria for the flowing, full condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated tests only.

### Empty pipe limit

|                  |  |
|------------------|--|
| Enhanced FF host | Meter Verification > Manual Meter Verification Limits > Empty Pipe |
| Basic FF host    | TB > METER_VERIF_EP_LIM (OD Index #106)                            |

Set the test criteria for the empty pipe condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated test only.

### Continuous limit

|                  |  |
|------------------|--|
| Enhanced FF host | Meter Verification > Continuous Meter Verification > Continuous Verification Limit |
| Basic FF host    | TB > CONT_METER_VERIFY_LIMIT (OD Index #84)  |

Set the test criteria for the continuous SMART Meter Verification diagnostic. The factory default for this value is set to five percent with limits configurable between two and ten percent. If the tolerance band is set too tightly, under empty pipe conditions or noisy flowing conditions, a false failure of the transmitter test may occur.

## 8.9 Run manual SMART Meter Verification

|                  |   |
|------------------|---|
| Enhanced FF host | Overview > Run Meter Verification         |
| Basic FF host    | TB > PERFORM_METER_VERIFY (OD Index #111) |

The SMART Meter Verification diagnostic will be available if the advanced diagnostic suite (DA2) was ordered. If DA2 was not ordered or licensed, this diagnostic will not be available. This method will initiate the manual meter verification test.

### 8.9.1 Test conditions

|                  |  |
|------------------|--|
| Enhanced FF host | Meter Verification > Meter Verification Parameters > Test Conditions |
| Basic FF host    | TB > METER_VERIF_TEST_COND_IN (OD Index #87)                         |

SMART Meter Verification can be initiated under three possible test conditions. This parameter is set at the time that the sensor baseline or SMART Meter Verification test is manually initiated.

- No flow** Run the SMART Meter Verification test with a full pipe and no flow in the line. Running the SMART Meter Verification test under this condition provides the most accurate results and the best indication of magnetic flowmeter health.
- Flowing full** Run the SMART Meter Verification test with a full pipe and flow in the line. Running the SMART Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health without shutting down

the process flow in applications when a shutdown is not possible. Running the diagnostic under flowing conditions can cause a false test failure if there is significant process noise present.

**Empty pipe**

Run the SMART Meter Verification test with an empty pipe. Running the SMART Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health with an empty pipe. Running the verification diagnostic under empty pipe conditions will not check the electrode circuit health.

## 8.9.2 Test scope

|                  |   |
|------------------|---|
| Enhanced FF host | Meter Verification > Meter Verification Parameters > Coils, Electrodes, Transmitter |
| Basic FF host    | TB > METER_VERIF_TEST_SCOPE (OD Index #86)  |

The manually initiated SMART Meter Verification test can be used to verify the entire flowmeter installation or individual parts such as the transmitter or sensor. This parameter is set at the time that the SMART Meter Verification test is manually initiated. There are three test scopes from which to choose.

Use the parameter values below to set the test scope. The parameter value must be set before initiating SMART Meter Verification.

| Register value | Test scope                   |
|----------------|------------------------------|
| 0              | Uninitialized                |
| 1              | All (sensor and transmitter) |
| 2              | Sensor                       |
| 3              | Transmitter                  |

**All**

Run the SMART Meter Verification test and verify the entire flowmeter installation. This parameter results in the diagnostic performing the transmitter calibration verification, sensor calibration verification, coil health check, and electrode health check. Transmitter calibration and sensor calibration are verified to the percentage associated with the test condition selected when the test was initiated. This setting applies to manually initiated tests only.

**Transmitter**

Run the SMART Meter Verification test on the transmitter only. This results in the verification test only checking the transmitter calibration to the limits of the test criteria selected when the verification test was initiated. This setting applies to manually initiated tests only.

**Sensor (coils and electrodes)**

Run the SMART Meter Verification test on the sensor only. This results in the verification test checking the sensor calibration to the limits of the test criteria selected when the SMART Meter Verification test was initiated, verifying the coil circuit health, and the electrode circuit health. This setting applies to manually initiated tests only.

## 8.10 Continuous SMART Meter Verification

Continuous SMART Meter Verification can be used to monitor and verify the health of the flowmeter system. The continuous SMART Meter Verification will not report results until 30 minutes after powering up to ensure the system is stable and to avoid false failures.

### 8.10.1 Test scope

Continuous SMART Meter Verification can be configured to monitor the sensor coils, electrodes, and transmitter calibration, All of these parameters can be individually enabled or disabled. These parameters apply to continuous SMART Meter Verification only.

#### Coils

|                  |  |
|------------------|--|
| Enhanced FF host | View Meter Verification Report                       |
| Basic FF host    | TB > CONT_METER_VERIFY_ENABLE > bit 0 (OD Index #85) |

Continuously monitor the sensor coil circuit by enabling this continuous SMART Meter Verification parameter.

#### Electrodes

|                  |  |
|------------------|--|
| Enhanced FF host | View Meter Verification Report                       |
| Basic FF host    | TB > CONT_METER_VERIFY_ENABLE > bit 1 (OD Index #85) |

Continuously monitor the electrode resistance by enabling this continuous SMART Meter Verification parameter.

#### Transmitter

|                  |  |
|------------------|--|
| Enhanced FF host | View Meter Verification Report                       |
| Basic FF host    | TB > CONT_METER_VERIFY_ENABLE > bit 2 (OD Index #85) |

Continuously monitor the transmitter calibration by enabling this continuous SMART Meter Verification parameter.

## 8.11 SMART Meter Verification test results

If the SMART Meter Verification test is manually initiated, the transmitter will make several measurements to verify the transmitter calibration, sensor calibration, coil circuit health, and electrode circuits health. The results of these tests can be reviewed and recorded on the calibration verification report (see [Optimizing continuous SMART Meter Verification](#)). This report can be used to validate that the meter is within the required calibration limits to comply with governmental regulatory agencies.

Depending on the method used to view the results, they will be displayed in either a menu structure, as a method, or in the report format.

The results are displayed in the order found in the following table. Each parameter displays a value used in the SMART Meter Verification diagnostic evaluation of the meter health.

**Table 8-4: Manual Smart Meter Verification Test Parameters**

| Transducer block parameter name | Index number(s) |
|---------------------------------|-----------------|
| METER_VERIF_TEST_SCOPE          | 86              |
| METER_VERIF_TEST_COND_IN        | 87              |
| METER_VERIF_TEST_COND_OUT       | 88              |
| METER_VERIF_CRITERIA            | 89              |
| METER_VERIF_RESULT              | 90              |
| COIL_RESIST_RESULT              | 91              |
| COIL_INDUCT_RESULT              | 92              |
| ELECT_RESIST_RESULT             | 93              |
| INT_SIM_RESULT                  | 94              |
| INT_SIM_DEVIATION               | 103             |

**Table 8-5: Continuous SMART Meter Verification Test Parameters**

| Parameter                                     | Index number(s) |
|---|-----------------|
| CONT_METER_VERIFY_LIMIT                       | 84              |
| CONT_METER_VERIFY_ENABLE                      | 85              |
| CONTINUOUS_MV_RESULTS: INTERNAL_SIM_VALUE     | 52              |
| CONTINUOUS_MV_RESULTS: INTERNAL_SIM_DEVIATION | 52              |
| CONTINUOUS_MV_RESULTS: COIL_INDUCT_VALUE      | 52              |
| CONTINUOUS_MV_RESULTS: COIL_INDUCT_DEVIATION  | 52              |
| CONTINUOUS_MV_RESULTS: COIL_RESIST_VALUE      | 52              |
| CONTINUOUS_MV_RESULTS: ELECTRODE_RESIST_VALUE | 52              |

## 8.12 SMART Meter Verification measurements

The SMART Meter Verification test will make measurements of the coil resistance, coil inductance, and electrode resistance and compare these values to the values taken during the sensor baseline process to determine the sensor calibration deviation, the coil circuit health, and the electrode circuit health. In addition, the measurements taken by this test can provide additional information when troubleshooting the meter.

### Coil circuit resistance

|                  |   |
|------------------|---|
| Enhanced FF host | <a href="#">View Meter Verification Report</a>  |
| Basic FF host    | Manual: TB > COIL_RESIST_RESULT (OD Index #91)<br>Continuous: TB > CONTINUOUS_MV_RESULTS > COIL_RESIST_VALUE (OD Index #52) |

The coil circuit resistance is a measurement of the coil circuit health. This value is compared to the coil circuit resistance signature measurement taken during the sensor baseline process to determine coil circuit health. This value can be continuously monitored using continuous SMART Meter Verification.

### Coil inductance (signature)

|                  |   |
|------------------|---|
| Enhanced FF host | <a href="#">View Meter Verification Report</a>  |
| Basic FF host    | Manual: TB > COIL_INDUCT_RESULT (OD Index #92)<br>Continuous: TB > CONTINUOUS_MV_RESULTS > COIL_INDUCT_VALUE (OD Index #52) |

The coil inductance is a measurement of the magnetic field strength. This value is compared to the coil inductance signature measurement taken during the sensor baseline process to determine sensor calibration deviation. This value can be continuously monitored using continuous SMART Meter Verification.

### Electrode circuit resistance

|                  |   |
|------------------|---|
| Enhanced FF host | <a href="#">View Meter Verification Report</a>  |
| Basic FF host    | Manual: TB > ELECT_RESIST_RESULT (OD Index #93)<br>Continuous: TB > CONTINUOUS_MV_RESULTS > ELECTRODE_RESIST_VALUE (OD Index #52) |

The electrode circuit resistance is a measurement of the electrode circuit health. This value is compared to the electrode circuit resistance signature measurement taken during the sensor baseline process to determine electrode circuit health. This value can be continuously monitored using continuous SMART Meter Verification.

### Actual velocity

|                  |   |
|------------------|---|
| Enhanced FF host | <a href="#">View Meter Verification Report</a>  |
| Basic FF host    | Manual: TB > INT_SIM_RESULT (OD Index #94)<br>Continuous: TB > CONTINUOUS_MV_RESULTS > INTERNAL_SIM_VELOCITY (OD Index #52) |

The actual velocity is a measurement of the simulated velocity signal. This value is compared to the simulated velocity to determine transmitter calibration deviation. This value can be continuously monitored using continuous SMART Meter Verification.

### Flow simulation deviation

|                  |  |
|------------------|--|
| Enhanced FF host | <a href="#">View Meter Verification Report</a>   |
| Basic FF host    | Manual: TB > INT_SIM_DEVIATION (OD Index #103)<br>Continuous: TB > CONTINUOUS_MV_RESULTS > INTERNAL_SIM_DEVIATION (OD Index #52) |

The flow simulation deviation is a measurement of the percent difference between the simulated velocity and the actual measured velocity from the transmitter calibration

verification test. This value can be continuously monitored using continuous SMART Meter Verification.

## 8.13 Optimizing the SMART Meter Verification

The SMART Meter Verification diagnostic can be optimized by setting the test criteria to the desired levels necessary to meet the compliance requirements of the application. The following examples below will provide some guidance on how to set these levels.

**Example 1** An effluent meter must be certified annually to comply with environmental regulations. This example regulation requires that the meter be certified to five percent. Since this is an effluent meter, shutting down the process may not be viable. In this instance the SMART Meter Verification test will be performed under flowing conditions. Set the test criteria for flowing, full to five percent to meet the requirements of the governmental agencies.

**Example 2** A pharmaceutical company requires bi-annual verification of meter calibration on a critical feed line for one of their products. This is an internal standard, and the plant requires a calibration record be kept on-hand. Meter calibration on this process must meet two percent. The process is a batch process so it is possible to perform the calibration verification with the line full and with no flow. Since the SMART Meter Verification test can be run under no flow conditions, set the test criteria for no flow to two percent to comply with the necessary plant standards.

**Example 3** A food and beverage company requires an annual calibration of a meter on a product line. The plant standard calls for the accuracy to be three percent or better. They manufacture this product in batches, and the measurement cannot be interrupted when a batch is in process. When the batch is complete, the line goes empty. Since there is no means of performing the SMART Meter Verification test while there is product in the line, the test must be performed under empty pipe conditions. The test criteria for empty pipe should be set to three percent, and it should be noted that the electrode circuit health cannot be verified.

### 8.13.1 Optimizing continuous SMART Meter Verification

For continuous SMART Meter Verification, there is only one test criteria value to configure, and it will be used for all flow conditions. The factory default is set to five percent to minimize the potential for false failures under empty pipe conditions. For best results, set the criteria to match the maximum value of the three test criteria set during manual meter verification (no flow, flowing full, and empty pipe).

For example, a plant might set the following manual meter verification test criteria: two percent for no flow, three percent for flowing full, and four percent for empty pipe. In this case, the maximum test criterion is four percent, so the test criteria for continuous SMART Meter Verification should be set to four percent. If the tolerance band is set too tightly, under empty pipe conditions or noisy flowing conditions, a false failure of the transmitter test may occur.

**Manual Calibration Verification Results**

|   |  |
|---|--|
| Report parameters   |  |
| User Name:<br>_____   | Calibration Conditions: <input type="checkbox"/> Internal <input type="checkbox"/> External  |
| Tag #:<br>_____   | Test Conditions: <input type="checkbox"/> Flowing <input type="checkbox"/> No Flow, Full Pipe<br><input type="checkbox"/> Empty Pipe |
| Flowmeter information and configuration   |  |
| Software Tag:   |  |
| Calibration Number:   |  |
| Line Size:  | PV Damping: _____  |
| Transmitter calibration verification results  | Sensor calibration verification results  |
| Simulated Velocity:   | Sensor Deviation %: _____  |
| Actual Velocity:  | Sensor Test:<br><input type="checkbox"/> PASS / <input type="checkbox"/> FAIL / <input type="checkbox"/> NOT TESTED                  |
| Deviation %:  | Coil Circuit Test:<br><input type="checkbox"/> PASS / <input type="checkbox"/> FAIL / <input type="checkbox"/> NOT TESTED            |
| Transmitter:<br><input type="checkbox"/> PASS / <input type="checkbox"/> FAIL / <input type="checkbox"/> NOT TESTED                       | Electrode Circuit Test:<br><input type="checkbox"/> PASS / <input type="checkbox"/> FAIL / <input type="checkbox"/> NOT TESTED       |
| Summary of Calibration Verification results   |  |
| Verification Results: The result of the flowmeter verification test is: <input type="checkbox"/> PASSED / <input type="checkbox"/> FAILED |  |
| Verification Criteria: This meter was verified to be functioning within _____ % of deviation from the original test parameters.           |  |
| Signature: _____  | Date: _____  |



# 9 Digital Signal Processing

## 9.1 Introduction

Magneters are used in applications that can create noisy flow readings. The transmitter has the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the microprocessor has digital signal processing that is capable of rejecting the noise specific to the application. This section explains the different types of process noise, provides instructions for optimizing the flow reading in noisy applications, and provides a detailed description of the digital signal processing functionality.

## 9.2 Process noise profiles

### 1/f noise

This type of noise has higher amplitudes at lower frequencies, but generally degrades over increasing frequencies. Potential sources of 1/f noise include chemical mixing and slurry flow particles rubbing against the electrodes.

### Spike noise

This type of noise generally results in a high amplitude signal at specific frequencies which can vary depending on the source of the noise. Common sources of spike noise include chemical injections directly upstream of the flowmeter, hydraulic pumps, and slurry flows with low concentrations of particles in the stream. The particles bounce off of the electrode generating a “spike” in the electrode signal. An example of this type of flow stream would be a recycle flow in a paper mill.

### White noise

This type of noise results in a high amplitude signal that is relatively constant over the frequency range. Common sources of white noise include chemical reactions or mixing that occurs as the fluid passes through the flowmeter and high concentration slurry flows where the particulates are constantly passing over the electrode head. An example of this type of flow stream would be a basis weight stream in a paper mill.

## 9.3 High process noise diagnostic

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the high process noise diagnostic, the transmitter specifically looks at the signal amplitude at frequencies of 2.5 Hz, 7.5 Hz, 32.5 Hz, and 42.5 Hz. The transmitter uses the values from 2.5 and 7.5 Hz and calculates an average noise level. This average is compared to the amplitude of the signal at 5 Hz. If the signal amplitude is not 25 times greater than the noise level, and the coil drive frequency is set at 5 Hz, the high process noise diagnostic will trip indicating that the flow signal may be compromised. The transmitter performs the same analysis around the 37.5 Hz coil drive frequency using the 32.5 Hz and 42.5 Hz values to establish a noise level.

## 9.4 Optimizing flow reading in noisy applications

If the flow reading is unstable, first check the wiring, grounding, and process reference associated with the magnetic flowmeter system. Ensure that the following conditions are met:

- Ground straps are attached to the adjacent flange or ground ring
- Grounding rings, lining protectors, or a process reference electrode are being used in lined or non-conductive piping

The causes of unstable transmitter output can usually be traced to extraneous voltages on the measuring electrodes. This “process noise” can arise from several causes including electrochemical reactions between the fluid and the electrode, chemical reactions in the process itself, free ion activity in the fluid, or some other disturbance of the fluid/electrode capacitive layer. In such noisy applications, an analysis of the frequency spectrum reveals process noise that typically becomes significant below 15 Hz.

In some cases, the effects of process noise may be sharply reduced by elevating the coil drive frequency above the 15 Hz region. Coil drive mode is selectable between the standard 5 Hz and the noise-reducing 37 Hz.

### 9.4.1 Coil drive frequency

|                  |                                     |
|------------------|-------------------------------------|
| Enhanced FF host | Signal Processing > Coil Drive      |
| Basic FF host    | TB > COIL_DRIVE_FREQ (OD Index #37) |

This parameter changes the pulse rate of the magnetic coils.

#### 5 Hz

The standard coil drive frequency is 5 Hz, which is sufficient for nearly all applications.

#### 37 Hz

If the process fluid causes a noisy or unstable flow reading, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function for optimum performance.

#### Note

37 Hz coil drive frequency mode should not be used for sensors larger than 20-inch.

### 9.4.2 Auto zero

|                  |                                       |
|------------------|---------------------------------------|
| Enhanced FF host | Signal Processing > Auto Zero         |
| Basic FF host    | TB > PERFORM_AUTO_ZERO (OD Index #60) |

To ensure optimum accuracy when using 37 Hz coil drive mode, there is an auto zero function that should be initiated. When using 37 Hz coil drive mode it is important to zero the system for the specific application and installation.

The auto zero procedure should be performed only under the following conditions:

- With the transmitter and sensor installed in their final positions. This procedure is not applicable on the bench.
- With the transmitter in 37 Hz coil drive mode. Never attempt this procedure with the transmitter in 5 Hz coil drive mode.
- With the sensor full of process fluid at zero flow.

These conditions should cause an output equivalent to zero flow.

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A clock symbol will appear in the lower right-hand corner of the display to indicate that the procedure is running.

**Note**

Failure to complete an auto zero may result in a flow velocity error of 5 to 10% at 1 ft/s (0.3 m/s). While the output level will be offset by the error, the repeatability will not be affected.

### 9.4.3 Other signal processing tools

The transmitter contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality. If the 37 Hz coil drive frequency has been set, and the output is still unstable, the damping and signal processing function should be used. It is important to set the coil drive frequency to 37 Hz to increase the flow sampling rate. The transmitter provides an easy and straightforward start-up, and also incorporates the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the microprocessor can scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

**Operating mode**

|                  |  |
|------------------|--|
| Enhanced FF host | Signal Processing > Operation > Operating Mode |
| Basic FF host    | TB > SP_NOISE_MODE (OD Index #78)              |

The operating mode should be used only when the signal is noisy and gives an unstable output. Filter mode automatically uses 37 Hz coil drive mode and activates signal processing at the factory set default values. When using filter mode, perform an auto zero with no flow and a full sensor. Either of the parameters, coil drive mode or signal processing, may still be changed individually. Turning signal processing off or changing the coil drive frequency to 5 Hz will automatically change the operating mode from filter mode to normal mode. This software technique, known as signal processing, “qualifies” individual flow signals based on historic flow information and three user-definable parameters, plus an on/off control. These parameters are described below.

**Table 9-1: SP\_NOISE\_MODE parameter**

| Parameter value | Operation mode        |
|-----------------|-----------------------|
| 1               | Normal mode (default) |
| 2               | Filter mode           |

### Status

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Digital Signal Processing > Control |
| Basic FF host    | TB > SP_CONTROL (OD Index #77)                          |

Enable or disable the DSP capabilities. When ON is selected, the output is derived using a running average of the individual flow inputs. Signal processing is a software algorithm that examines the quality of the electrode signal against user-specified tolerances. The three parameters that make up signal processing (number of samples, maximum percent limit, and time limit) are described below.

**Table 9-2: SP\_CONTROL parameter**

| Parameter value | Operation mode    |
|-----------------|-------------------|
| 1               | DSP is turned OFF |
| 2               | DSP is turned ON  |

### Number of samples

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Digital Signal Processing > Samples |
| Basic FF host    | TB > SP_NUM_SAMPS (OD Index #79)                        |

The number of samples sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths with the number of samples equaling the number of increments used to calculate the average. This parameter can be configured for an integer value between 1 and 125. The default value is 90 samples.

For example:

- A value of 1 averages the inputs over the past  $1/10$  second
- A value of 10 averages the inputs over the past 1 second
- A value of 100 averages the inputs over the past 10 seconds
- A value of 125 averages the inputs over the past 12.5 seconds

### Percent limit

|                  |   |
|------------------|---|
| Enhanced FF host | Signal Processing > Digital Signal Processing > % Limit |
| Basic FF host    | TB > SP_PERCENT_LIMIT (OD Index #80)                    |

This parameter will set the tolerance band on either side of the running average, referring to percent deviation from the average. Values within the limit are accepted while value outside the limit are scrutinized to determine if they are a noise spike or an actual flow change. This parameter can be configured for an integer value between 0 and 100 percent. The default value is 2 percent.

### Time limit

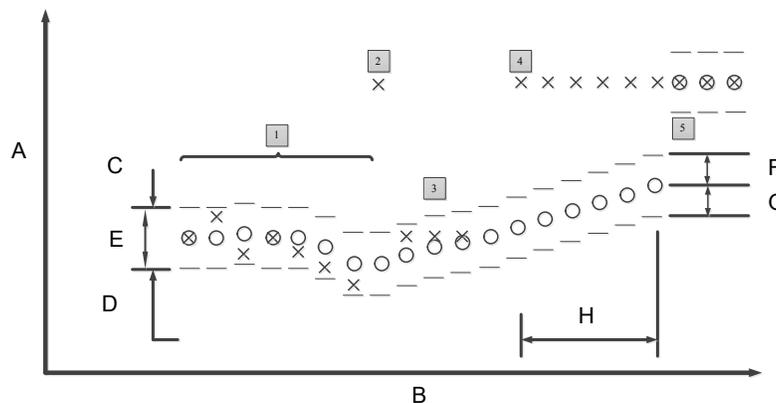
|                  |  |
|------------------|--|
| Enhanced FF host | Signal Processing > Digital Signal Processing > Time Limit |
| Basic FF host    | TB > SP_TIME_LIMIT (OD Index #81)                          |

The time limit parameter forces the output and running average values to the new value of an actual flow rate change that is outside the percent limit boundaries. It thereby limits response time to flow changes to the time limit value rather than the length of the running average. If the number of samples selected is 100, then the response time of the system is 10 seconds. In some cases this may be unacceptable. Setting the time limit forces the transmitter to clear the value of the running average and re-establish the output and average at the new flow rate once the time limit has elapsed. This parameter limits the response time added to the loop. A suggested time limit value of two seconds is a good starting point for most applicable process fluids. This parameter can be configured for a value between 0.6 and 256 seconds. The default value is 2 seconds.

## 9.5 Explanation of signal processing algorithm

An example plotting flow rate versus time is given below to help visualize the signal processing algorithm.

**Figure 9-1: Signal Processing Functionality**



- A. Flow rate
- B. Time (10 samples = 1 second)
- C. Upper value
- D. Lower value
- E. Tolerance band
- F. Maximum percent limit
- G. Minimum percent limit
- H. Time limit

- X = Input flow signal from sensor
- O = Average flow signals and transmitter output, determined by the number of samples parameter
- Tolerance band, determined by the percent limit parameter
- Upper value = average flow + [(percent limit/100) average flow]
- Lower value = average flow - [(percent limit/100) average flow]

1. This scenario is that of a typical non-noisy flow. The input flow signal is within the percent limit tolerance band, therefore qualifying itself as a good input. In this case the new input is added directly into the running average and is passed on as a part of the average value to the output.
2. This signal is outside the tolerance band and therefore is held in memory until the next input can be evaluated. The running average is provided as the output.
3. The previous signal currently held in memory is simply rejected as a noise spike since the next flow input signal is back within the tolerance band. This results in complete rejection of noise spikes rather than allowing them to be “averaged” with the good signals as occurs in the typical circuits.
4. As in number 2 above, the input is outside the tolerance band. This first signal is held in memory and compared to the next signal. The next signal is also outside the tolerance band (in the same direction), so the stored value is added to the running average as the next input and the running average begins to slowly approach the new input level.
5. To avoid waiting for the slowly incrementing average value to catch up to the new level input, an algorithm is provided. This is the “time limit” parameter. The user can set this parameter to eliminate the slow ramping of the output toward the new input level.

# 10 Maintenance

## 10.1 Introduction

This section covers basic transmitter maintenance. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

## 10.2 Safety information

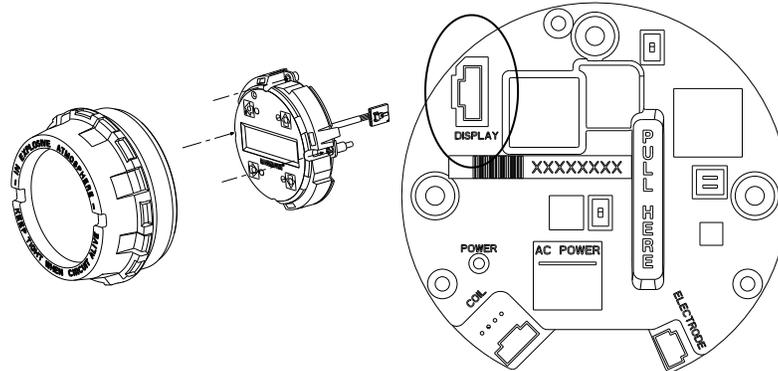
### **WARNING**

Failure to follow these maintenance guidelines could result in death or serious injury.

- Installation and servicing instructions should be performed by qualified personnel only.
- Do not perform any servicing other than that contained in the operating instructions.
- Verify the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.
- Do not connect the transmitter to a non-Rosemount sensor that is located in an explosive atmosphere.
- Mishandling products exposed to a hazardous substance may result in death or serious injury.
- If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

## 10.3 Installing a LOI/Display

Figure 10-1: Installing a LOI/Display



1. If the transmitter is installed in a control loop, secure the loop.
2. Remove power from the transmitter.
3. Remove the cover on the electronics compartment of the transmitter housing. If the cover has a cover jam screw, loosen it before removing the cover.  
See [Cover jam screw](#) for details on the cover jam screw.
4. On the electronics stack, locate the serial connection labeled “DISPLAY”.  
See [Figure 10-1](#).
5. Plug the serial connector from the back of the LOI/Display into the receptacle on the electronics stack.  
The LOI/Display can be rotated in 90 degree increments to provide the best viewing position. Rotate the LOI/Display to the desired orientation, taking care to not exceed 360 degrees of rotation. Exceeding 360 degrees of rotation could damage the LOI/Display cable and/or connector.
6. Once the serial connector is installed on the electronics stack, and the LOI/Display is oriented in the desired position, tighten the three mounting screws.
7. Install the extended cover with the glass viewing pane and tighten to metal-to-metal contact.  
If the cover has a cover jam screw, this must be tightened to comply with installation requirements. Return power to the transmitter and verify that it is functioning correctly and reporting the expected flow rate.
8. If installed in a control loop, return the loop to automatic control.

## 10.4 Replacing electronics stack

Make sure that the existing electronics stack is the same as the replacement (Revision 4) electronics stack. There are two ways to make sure:

- Look at the complete transmitter model number. Current (Revision 4) electronics are only compatible with Models 8732EM. If your transmitter model number as shown on the model number tag is not 8732EM, you cannot use a Revision 4 board stack.
- Visually inspect the existing and new electronics stacks to ensure that they are physically alike. The current (Revision 4) version of the stack has its electrical connections in different locations from the older versions. Both are shown in [Figure 10-2](#).

---

**Note**

You must open the housing and expose the electronics stack to inspect it (steps [Step 1](#) through [Step 5](#) below). Follow all applicable safety procedures and see [Powering the transmitter](#) for details on the covers.

---

**Figure 10-2: Electronics Stack Identification**



- A. Current (Revision 4) electronics stack.  
B. Old electronics stack.
- 

1. If the transmitter is installed in a control loop, secure the loop.
2. Remove power from the transmitter.
3. Remove the LOI/Display-side cover of the transmitter.

---

**Note**

See [Powering the transmitter](#) for details on the covers.

---

4. Remove the three screws that hold the LOI/Display to the electronics stack.
5. Carefully unplug the LOI/Display connector and remove and set aside the LOI/Display.
6. Carefully unplug the coil and electrode connectors.
7. Remove the three screws that secure the electronics stack into the housing.
8. Carefully pull out the electronics stack by the handle marked **PULL HERE**.
9. Remove the screws from the old electronics stack and insert them into the new electronics stack.

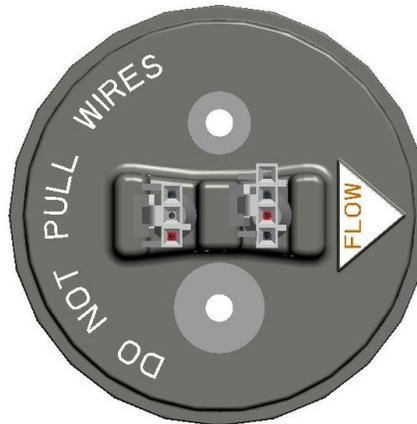
10. Hold the new electronics stack by the handle and carefully insert it into the housing, making certain that the screw holes and electrical connectors are in proper alignment to seat the stack.
11. Securely tighten the three electronics stack screws into the housing.
12. Plug in the coil and electrode connectors.
13. Replace the LOI/Display and refasten the three screws to secure it to the electronics stack.
14. Reinstall the LOI/Display-side cover of the transmitter and tighten it to ensure the housing is properly sealed to meet ingress protection requirements.
15. Return power to the transmitter and verify that it is functioning correctly and reporting the expected flow rate.
16. If installed in a control loop, return the loop to automatic control.

## 10.5 Replacing a socket module/terminal block

The socket module connects the sensor adapter to the transmitter. The socket module is a replaceable component.

To remove the socket module, loosen the two mounting screws and pull up on the socket module from the base. When removing the socket module, do not pull on the wires. See [Figure 10-3](#).

**Figure 10-3: Socket Module Warning**



### 10.5.1 Replacing an integral mount socket module

The integral mount socket module is shown in [Figure 10-4](#). To gain access to the socket module, the transmitter must be removed from the sensor adapter.

**Figure 10-4: Socket Module—Integral Mount**



## Removing an integral mount socket module

1. Disconnect power.
2. Remove electronics cover to gain access to the coil and electrode cables.
3. If the transmitter has a LOI/Display, it will need to be removed to gain access to the coil and electrode cables.
4. Disconnect the coil and electrode cables.
5. Remove the four transmitter mounting bolts.
6. Lift the transmitter off of the sensor adapter.
7. To remove the socket module, loosen the two mounting screws and pull up on the socket module from the base.
8. When removing the socket module, do not pull on the wires.

See [Figure 10-3](#).

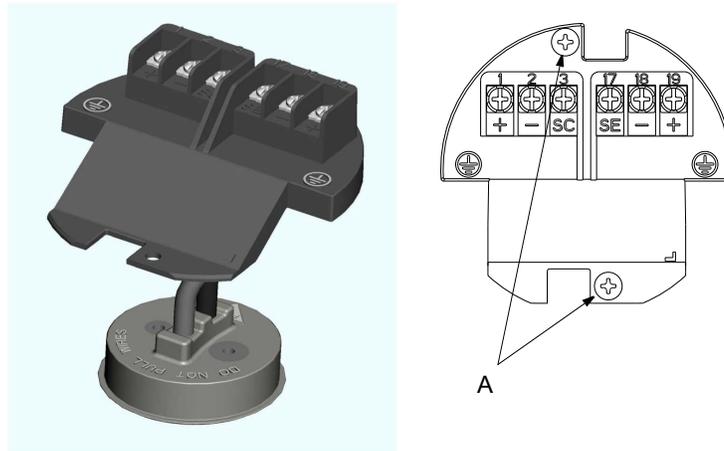
## Installing an integral mount socket module

1. To insert a new integral mount socket module, press the base into its keyed position and tighten the two mounting screws.
2. The coil and electrode cables are fed through the bottom opening of the transmitter and plugged into the face of the electronics.
3. The coil and electrode cables are keyed so they will only fit into their dedicated location.
4. If the transmitter has a LOI/Display, it will need to be removed to access the coil and electrode ports.
5. Once the connections are made, the transmitter can be secured to the sensor adapter using the four mounting bolts.

## 10.5.2 Replacing a terminal block socket module

The terminal block socket module is shown in [Figure 10-5](#). To gain access to the socket module, remove the junction box from the sensor adapter.

**Figure 10-5: Socket Module—Terminal Block**



A. Mounting screws:

- 2X—standard
- 4X—with I.S. divider

## Removing a terminal block socket module

1. Disconnect power to the transmitter and the remote cabling connected to the terminal block.
2. Remove the junction box cover to gain access to the remote cabling.
3. To disconnect the terminal block from the junction box housing, remove the two mounting screws and the two divider mounting screws (if applicable).
4. Pull up on the terminal block to expose the socket module base.
5. To remove the socket module, loosen the two mounting screws and pull up on the socket module from the base.
6. When removing the socket module, do not pull on the wires.

## Installing a terminal block socket module

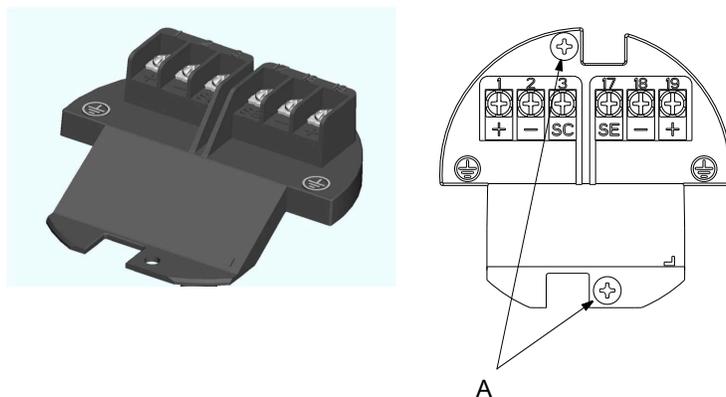
1. Insert the new terminal block socket module, press the base into its keyed position, and tighten the two mounting screws.
2. Connect the terminal block to the junction box housing by tightening the two mounting screws.

Install the divider with the two mounting screws if applicable.

3. Reconnect remote cabling and power and replace junction box cover.

## 10.5.3 Replacing a terminal block with amp clips

Figure 10-6: Terminal block with amp clips



A. *Mounting screws:*

- 2X—standard
- 4X—with I.S. divider

### Removing a terminal block

1. Disconnect power to the transmitter.
2. Remove the junction box cover on the sensor to gain access to the remote cabling and disconnect the remote cabling connected to the terminal block.
3. To disconnect the terminal block from the junction box housing, remove the two mounting screws and the two divider mounting screws (if applicable).
4. Pull up on the terminal block to expose the connecting wires.
5. To remove the terminal block, unclip both wire connectors.

### Installing a terminal block

1. Clip the connecting wires to the back of the terminal block, the clips are different sizes and must be connected to their matching receptacle.
2. Connect the terminal block to the junction box housing by tightening the two mounting screws. Install the divider with the two mounting screws if applicable.
3. Reconnect remote cabling, replace the junction box cover on the sensor, and connect power.

## 10.6 Trims

Trims are used to calibrate the transmitter, re-zero the transmitter, and calibrate the transmitter with another manufacturer's sensor. Proceed with caution whenever performing a trim function.

### 10.6.1 Digital trim

|                  |  |
|------------------|--|
| Enhanced FF host | Service Tools > Digital Trim                 |
| Basic FF host    | TB > PERFORM_ELECTRONICS_TRIM (OD Index #61) |

Digital trim is the function by which the factory calibrates the transmitter. This procedure is rarely needed by users. It is only necessary if the transmitter is suspected to be no longer accurate. A Rosemount 8714D Calibration Standard is required to complete a digital trim. Attempting a digital trim without a Rosemount 8714D Calibration Standard may result in an inaccurate transmitter or an error message. The digital trim must be performed with the coil drive mode set to 5Hz and with a nominal sensor calibration number stored in the memory.

#### Note

Attempting a digital trim without a Rosemount 8714D Calibration Standard may result in an inaccurate transmitter, or a "DIGITAL TRIM FAILURE" message may appear. If this message occurs, no values were changed in the transmitter. Simply cycle power on the transmitter to clear the message.

To simulate a nominal sensor with the Rosemount 8714D Calibration Standard, change/verify the following parameters in the transmitter:

- Calibration Number-1000015010000000
- Units-ft/s
- Coil Drive Frequency-5Hz

Before changing any of the configuration parameters, be sure to record the original values so that the transmitter can be returned to the original configuration prior to being placed back into operation. Failure to return the settings to the original configuration will result in incorrect flow and totalizer readings.

The instructions for changing the calibration number, and units are located in [Basic Setup](#). Instructions for changing the coil drive frequency can be found on [Coil drive frequency](#).

Set the loop to manual (if necessary) and then complete the following steps:

1. Power down the transmitter.
2. Connect the transmitter to a Rosemount 8714D Calibration Standard.
3. Power up the transmitter with the Rosemount 8714D connected and read the flow rate.

The electronics need about a 5-minute warm-up time to stabilize.

4. Set the 8714D Calibration Standard to the 30 ft/s (9.1 m/s) setting.

5. The flow rate reading after warm-up should be between 29.97 (9.1 m/s) and 30.03 ft/s (9.2 m/s).
6. If the reading is within the range, return the transmitter to the original configuration parameters.
7. If the reading is not within this range, initiate a digital trim.

The digital trim takes about 90 seconds to complete. No transmitter adjustments are required.

## 10.6.2 Universal trim

|                  |   |
|------------------|---|
| Enhanced FF host | Service Tools > Digital Trim  |
| Basic FF host    | TB > U_FLOW_RATE (OD Index #74)<br>TB > PERFORM_UNIVERSAL_TRIM (OD Index #76) |

The universal auto trim function enables the transmitter to calibrate sensors that were not calibrated at the factory. The function is activated as one step in a procedure known as in-process calibration. If a sensor has a 16-digit calibration number, in-process calibration is not required. If it does not, or if the sensor is made by another manufacturer, complete the following steps for in-process calibration. Refer to [Implementing a Universal Transmitter](#).

1. Determine the flow rate of the process fluid in the sensor.

### Note

The flow rate in the line can be determined by using another sensor in the line, by counting the revolutions of a centrifugal pump, or by performing a bucket test to determine how fast a given volume is filled by the process fluid.

2. Enter the flow rate into the Universal Flow Rate parameter.
3. Start the universal auto trim.

When the routine is completed, the sensor is ready for use.

## 10.7 Review

|                  |              |
|------------------|--------------|
| Enhanced FF host | Classic View |
|------------------|--------------|

The transmitter includes a capability to review the configuration variable settings.

The flowmeter configuration parameters set at the factory should be reviewed to ensure accuracy and compatibility with the particular application of the flowmeter.



# 11 Troubleshooting

## 11.1 Introduction

This section covers basic transmitter and sensor troubleshooting. Problems in the magnetic flowmeter system are usually indicated by incorrect output readings from the system, error messages, or failed tests. Consider all sources when identifying a problem in the system. If the problem persists, consult the local Rosemount representative to determine if the material should be returned to the factory. Emerson offers several diagnostics that aid in the troubleshooting process. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

The transmitter performs self-diagnostics on the entire magnetic flowmeter system: the transmitter, the sensor, and the interconnecting wiring. By sequentially troubleshooting each individual piece of the magmeter system, it becomes easier to identify the problem and make the appropriate adjustments.

If there are problems with a new magmeter installation, see [Installation check and guide](#) below for a quick guide to solve the most common installation problems. For existing magmeter installations, lists the most common magmeter problems and corrective actions.

## 11.2 Safety information



### **WARNING**

Failure to follow these troubleshooting guidelines could result in death or serious injury.

- Installation and servicing instructions should be performed by qualified personnel only.
- Do not perform any servicing other than that contained in the operating instructions.
- Verify that the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.
- Do not connect the transmitter to a non-Rosemount sensor that is located in an explosive atmosphere.
- Mishandling products exposed to a hazardous substance may result in death or serious injury.
- If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

## 11.3 Installation check and guide

Use this guide to check new installations of Rosemount magnetic flowmeter systems that appear to malfunction.

### 11.3.1 Transmitter

#### Checking the transmitter before applying power

Before applying power to the magnetic flowmeter system, make the following transmitter checks:

1. Record the transmitter model number and serial number.
2. Visually inspect the transmitter for any damage including the terminal block.
3. Verify the proper wiring connections have been made for the power and outputs.

#### Checking the transmitter after applying power

Apply power to the magnetic flowmeter system before making the following transmitter checks:

1. Check for an active error message or status alert. Refer to [Diagnostic messages](#).
2. Verify the correct sensor calibration number is entered in the transmitter.  
The calibration number is listed on the sensor nameplate.
3. Verify the correct sensor line size is entered in the transmitter.  
The line size value is listed on the sensor nameplate.
4. If desired, use a Rosemount 8714D to verify the transmitter calibration.

### 11.3.2 Sensor

Be sure that power to magnetic flowmeter system is removed before beginning the following sensor checks:

1. Record the sensor model number and serial number.
2. Visually inspect the sensor for any damage including inside the remote junction box, if applicable.
3. For horizontal flow installations, ensure that the electrodes remain covered by process fluid.  
For vertical or inclined installations, ensure that the process fluid is flowing up into the sensor to keep the electrodes covered by process fluid.
4. Verify the flow arrow is pointing in the same direction as forward flow.
5. Ensure the grounding straps on the sensor are connected to grounding rings, lining protectors, or the adjacent pipe flanges. Improper grounding will cause erratic operation of the system.

Sensors with a ground electrode will not require the grounding straps to be connected.

### 11.3.3 Remote wiring

1. The electrode signal and coil drive wires must be separate cables, unless Rosemount specified combo cable is used.  
See [Sensor to transmitter wiring](#).
2. The electrode signal wire and coil drive wire must be twisted shielded cable. Rosemount recommends 20 AWG twisted shielded cable for the electrode signal and 14 AWG twisted shielded cable for the coil drive.  
See [Sensor to transmitter wiring](#).
3. See [Product Certifications](#) regarding wiring installation requirements.
4. See [Wiring Diagrams](#) for component and/or combination cable wiring.
5. Verify there is minimal exposed wiring and shielding.  
Less than 1 inch (25 mm) is recommended.
6. Verify that the single conduit that houses both the electrode signal and coil drive cables do not contain any other wires, including wires from other magmeters.

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**Note**

For installations requiring intrinsically safe electrodes, the signal and coil drive cables must be run in individual conduits.

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### 11.3.4 Process fluid

1. The process fluid should have a minimum conductivity of 5 microSiemens/cm (5 micro mhos/cm).
2. The process fluid must be free of air and gas.
3. The sensor must be full of process fluid.
4. The process fluid must be compatible with the wetted materials - liner, electrodes, ground rings, and lining protectors.  
Refer to the *Rosemount® Magnetic Flowmeter Material Selection Guide (00816-0100-3033)* Technical Note for details.
5. If the process is electrolytic or has cathodic protection, refer to the *Installation and Grounding of Magmeters in Typical and Special Applications (00840-2400-4727)* Technical Note for special installation requirements.

## 11.4 Diagnostic messages

Problems in the magnetic flowmeter system are usually indicated by incorrect output readings from the system, error messages, or failed tests. Consider all sources in identifying a problem in the system.

**Table 11-1: Fieldbus communication diagnostic messages**

| Error message              | Potential cause                  | Corrective action                   |
|----------------------------|----------------------------------|-------------------------------------|
| Fieldbus Not Communicating | Fieldbus segment is disconnected | Connect the fieldbus segment        |
|                            | Fieldbus segment power missing   | Verify the segment fieldbus voltage |
|                            | Electronics failure              | Replace electronics                 |

**Table 11-2: Basic Diagnostic Messages**

| Error message                      | Potential cause   | Corrective action   |
|------------------------------------|---|---|
| Sensor Processor Not Communicating | Transmitter input power (AC/DC) is not connected  | Connect the input power. If the LCD displays a message, the input power is applied.                         |
|                                    | Electronics failure   | Replace electronics   |
| Empty Pipe                         | Empty pipe  | None - message will clear when pipe is full   |
|                                    | Wiring error  | Check that wiring matches appropriate wiring diagrams   |
|                                    | Electrode error   | Perform sensor tests - see <a href="#">Installed sensor tests</a>   |
|                                    | Conductivity less than 5 microSiemens per cm  | Increase conductivity to greater than or equal to 5 microSiemens per cm                                     |
|                                    | Intermittent diagnostic   | Adjust tuning of empty pipe parameters - see <a href="#">Troubleshooting empty pipe</a>                     |
| Coil Open Circuit                  | Improper wiring   | Check coil drive wiring and sensor coils. Perform sensor tests - see <a href="#">Installed sensor tests</a> |
|                                    | Other manufacturer's sensor   | Change coil current to 75 mA - set calibration numbers to 10000550100000030                                 |
|                                    |   | Perform a universal auto-trim to select the proper coil current   |
|                                    | Electronics board failure   | Replace electronics stack   |
| Coil circuit open fuse             | Replace the sensor  |   |
| Auto Zero Failure                  | Flow is not set to zero   | Force flow to zero, perform auto zero trim  |
|                                    | Unshielded cable in use   | Change wire to shielded cable   |
|                                    | Moisture problems   | See <a href="#">Installed sensor tests</a>  |
| Auto-Trim Failure                  | No flow in pipe while performing Universal Auto Trim  | Establish a known flow rate, and perform universal auto-trim calibration                                    |
|                                    | Wiring error  | Check that wiring matches appropriate wiring diagrams   |
|                                    | Flow rate is changing in pipe while performing Universal Auto-Trim routine                                | Establish a constant flow rate, and perform universal auto-trim calibration                                 |
|                                    | Flow rate through sensor is significantly different than value entered during Universal Auto-Trim routine | Verify flow in sensor and perform universal auto-trim calibration   |

**Table 11-2: Basic Diagnostic Messages (continued)**

| Error message  | Potential cause   | Corrective action  |
|--|---|--|
|  | Incorrect calibration number entered into transmitter for Universal Auto-Trim routine | Replace sensor calibration number with 1000005010000000  |
|  | Wrong sensor size selected  | Correct sensor size setting - see  |
|  | Sensor failure  | Perform sensor tests - see <a href="#">Installed sensor tests</a>  |
| Electronics Failure  | Electronics self check failure  | Cycle power to see if diagnostic message clears  |
|  |   | Replace Electronics stack  |
| Electronics Temp Fail  | Ambient temperature exceeded the electronics temperature limits                       | Move transmitter to a location with an ambient temperature range of -40 to 140 °F (-40 to 60 °C)           |
| Reverse Flow   | Electrode or coil wires reverse   | Verify wiring between sensor and transmitter   |
|  | Flow is reverse   | Turn ON Reverse Flow Enable to read flow   |
|  | Sensor installed backwards  | Install sensor correctly, or switch either the electrode wires (18 and 19) or the coil wires (1 and 2)     |
| Flow rate > 43 ft/sec  | Flow rate is greater than 43 ft/sec   | Lower flow velocity, increase pipe diameter  |
|  | Improper wiring   | Check coil drive wiring and sensor coils   |
|  |   | Perform sensor tests - see <a href="#">Installed sensor tests</a>  |
| Digital Trim Failure (Cycle power to clear messages, no changes were made) | The calibrator (8714B/C/D) is not connected properly                                  | Review calibrator connections  |
|  | Incorrect calibration number entered into transmitter                                 | Replace sensor calibration number with 1000015010000000  |
|  | Calibrator is not set to 30 FPS   | Change calibrator setting to 30 FPS  |
|  | Bad calibrator or calibrator cable  | Replace calibrator and/or calibrator cable   |
| Coil Over Current  | Improper wiring   | Check coil drive wiring and sensor coils Perform sensor tests - see <a href="#">Installed sensor tests</a> |
|  | Transmitter failure   | Replace the electronics stack  |
| Electrode Saturation   | Improper wiring   | See <a href="#">Wiring</a>   |
|  | Improper process reference  | See <a href="#">Process reference connection</a>   |
|  | Improper earth grounding  | Verify earth ground connections - see <a href="#">Wiring</a>   |
|  | Application requires special transmitter  | Replace transmitter with transmitter that includes special option F0100                                    |

**Table 11-3: Advanced Process Diagnostic Messages**

| Error message          | Potential cause                     | Corrective action                                |
|------------------------|-------------------------------------|--|
| Grounding/Wiring Fault | Improper installation of wiring     | See <a href="#">Wiring</a>                       |
|                        | Coil/electrode shield not connected | See <a href="#">Wiring</a>                       |
|                        | Improper process grounding          | See <a href="#">Process reference connection</a> |

**Table 11-3: Advanced Process Diagnostic Messages (continued)**

| Error message                                      | Potential cause   | Corrective action  |
|--|---|--|
|  | Faulty ground connection  | Check wiring for corrosion, moisture in the terminal block -see <a href="#">Process reference connection</a> |
|  | Sensor not full   | Verify sensor is full<br>Enable empty pipe detection   |
| High Process Noise                                 | Slurry flows - mining/pulp stock  | Decrease the flow rate below 10 ft/s (3 m/s)   |
|  |   | Complete the possible solutions listed under <a href="#">Troubleshooting high process noise</a>              |
|  | Chemical additives upstream of the sensor   | Move injection point downstream of the sensor or move the sensor to a new location                           |
|  |   | Complete the possible solutions listed under <a href="#">Troubleshooting high process noise</a>              |
|  | Electrode not compatible with the process fluid   | Refer to the <i>Rosemount® Magnetic Flowmeter Material Selection Guide (00816-0100-3033)</i>                 |
|  | Gas/air in line   | Move the sensor to another location in the process line to ensure that it is full under all conditions       |
|  | Electrode coating   | Enable coated electrode detection diagnostic   |
|  |   | Use bullet-nose electrodes   |
|  |   | Downsize sensor to increase flowrate above 3 ft/s (1 m/s)  |
|  |   | Periodically clean sensor  |
| Styrofoam or other insulating particles            | Complete the possible solutions listed under <a href="#">Troubleshooting high process noise</a> |  |
|  | Consult factory   |  |
| Low conductivity fluids (below 10 microsiemens/cm) | Trim electrode and coil wires - see <a href="#">Sensor Installation</a>                         |  |
|  | Use integral mount transmitter  |  |
|  | Set coil drive frequency to 37Hz  |  |
| Electrode Coating Level 1                          | Coating is starting to buildup on electrode and interfering with measurement signal             | Schedule maintenance to clean electrode  |
|  |   | Use bullet nose electrodes   |
|  |   | Downsize sensor to increase flow rate above 3ft/s (1ms)  |
|  | Process fluid conductivity has changed  | Verify process fluid conductivity  |
| Electrode Coating Level 2                          | Coating has built-up on electrode and is interfering with measurement signal                    | Schedule maintenance to clean electrode  |
|  |   | Use bullet nose electrodes   |
|  |   | Downsize sensor to increase flow rate above 3ft/s (1ms)  |
|  | Process fluid conductivity has changed  | Verify process fluid conductivity  |

Table 11-4: Advanced Meter Verification Messages

| Error message                       | Potential cause  | Corrective action  |
|-------------------------------------|--|--|
| Meter Ver Failed                    | Transmitter calibration verification test failed                 | Verify pass/fail criteria  |
|                                     |  | Rerun SMART™ Meter Verification under no flow conditions                               |
|                                     |  | Verify calibration using 8714D Calibration Standard                                    |
|                                     |  | Perform digital trim   |
|                                     |  | Replace electronics board  |
|                                     | Sensor calibration test failed                                   | Verify pass/fail criteria  |
|                                     |  | Rerun SMART Meter Verification   |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
|                                     | Sensor coil circuit test failed                                  | Verify pass/fail criteria  |
|                                     |  | Rerun SMART Meter Verification   |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
|                                     | Sensor electrode circuit test failed                             | Verify electrode resistance has a baseline (signature) value from a full pipe baseline |
|                                     |  | Verify test condition was selected properly  |
|                                     |  | Verify pass/fail criteria  |
|                                     |  | Rerun SMART Meter Verification   |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
| Continuous Meter Verification Error | Transmitter calibration verification test failed                 | Verify pass/fail criteria  |
|                                     |  | Run manual SMART Meter Verification under no flow conditions                           |
|                                     |  | Verify calibration using 8714D Calibration Standard                                    |
|                                     |  | Perform digital trim   |
|                                     |  | Replace electronics stack  |
|                                     | Sensor calibration test failed                                   | Run manual SMART Meter Verification  |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
|                                     | Sensor coil circuit test failed                                  | Run manual SMART Meter Verification  |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
|                                     | Sensor electrode circuit test failed                             | Run manual SMART Meter Verification  |
|                                     |  | Perform sensor tests - see <a href="#">Installed sensor tests</a>                      |
|                                     |  | Verify electrode resistance has a signature value from a full pipe baseline            |
| Simulated Velocity Out of Spec      | Unstable flow rate during the verification test or noisy process | Run manual transmitter verification test with no flow and a full pipe                  |

**Table 11-4: Advanced Meter Verification Messages (continued)**

| Error message                    | Potential cause  | Corrective action  |
|----------------------------------|--|--|
|                                  | Transmitter drift or faulty electronics                      | Verify transmitter electronics with 8714D Calibration Standard. The dial on the 8714D should be set to 30 ft/s (9.14 m/s). The transmitter should be set up with the nominal calibration number (1000015010000000) and 5 Hz coil drive frequency.<br>Perform an electronics trim using the 8714D<br>If the electronics trim doesn't correct the issue, replace the electronics |
| Coil Resistance Out of Spec      | Moisture in the terminal block of the sensor or shorted coil | Perform sensor tests - see <a href="#">Installed sensor tests</a><br>If the problem persists, replace the sensor   |
| Coil Signature Out of Spec       | Moisture in the terminal block of the sensor or shorted coil | Perform sensor tests - see <a href="#">Installed sensor tests</a><br>If the problem persists, replace the sensor   |
|                                  | Calibration shift caused by heat cycling or vibration        | Perform sensor tests - see <a href="#">Installed sensor tests</a><br>If the problem persists, replace the sensor   |
| Electrode Resistance Out of Spec | Moisture in the terminal block of the sensor                 | Perform sensor tests - see <a href="#">Installed sensor tests</a><br>If the problem persists, replace the sensor   |
|                                  | Electrode coating  | Enable coated electrode detection diagnostic<br>Use bullet-nose electrodes<br>Downsize sensor to increases flowrate above 3 ft/s (1 m/s)<br>Periodically clean sensor  |
|                                  | Shorted electrodes   | Perform sensor tests - see <a href="#">Installed sensor tests</a><br>If the problem persists, replace the sensor   |

## 11.4.1 Troubleshooting empty pipe

The following actions can be taken if empty pipe detection is unexpected:

1. Verify the sensor is full.
2. Verify the sensor has not been installed with a measurement electrode at the top of the pipe.
3. Decrease the sensitivity by setting the empty pipe trigger level to a value of at least 20 counts above the empty pipe value read with a full pipe.
4. Decrease the sensitivity by increasing the empty pipe counts to compensate for process noise. The empty pipe counts is the number of consecutive empty pipe value readings above the empty pipe trigger level required to set the empty pipe diagnostic. The count range is 2-50, factory default set at 5.
5. Increase process fluid conductivity above 50 microsiemens/cm.

6. Properly connect the wiring between the sensor and the transmitter. Corresponding terminal block numbers in the sensor and transmitter must be connected.
7. Perform the sensor electrical resistance tests. For more detailed information, consult [Installed sensor tests](#).

## 11.4.2 Troubleshooting ground/wiring fault

If transmitter detects high levels (greater than 5mV) 50/60 Hz noise caused by improper wiring or poor process grounding:

1. Verify the transmitter is earth grounded.
2. Connect ground rings, grounding electrode, lining protector, or grounding straps. Grounding diagrams can be found in [Process reference connection](#).
3. Verify the sensor is full.
4. Verify wiring between sensor and transmitter is prepared properly. Shielding should be stripped back less than 1 inch (25 mm).
5. Use separate shielded twisted pairs for wiring between sensor and transmitter.
6. Properly connect the wiring between the sensor and the transmitter. Corresponding terminal block numbers in the sensor and transmitter must be connected.

## 11.4.3 Troubleshooting high process noise

### Note

In applications where very high levels of noise are a concern, it is recommended that a dual-calibrated Rosemount High-Signal 8707 sensor be used. These sensors can be calibrated to run at lower coil drive current supplied by the standard Rosemount transmitters, but can also be upgraded by changing to the 8712H High-Signal transmitter.

### 1/f noise

This type of noise has higher amplitudes at lower frequencies, but generally degrades over increasing frequencies. Potential sources of 1/f noise include chemical mixing and slurry flow particles rubbing against the electrodes. This type of noise can be mitigated by switching to the 37Hz coil drive frequency.

### Spike noise

This type of noise generally results in a high amplitude signal at specific frequencies which can vary depending on the source of the noise. Common sources of spike noise include chemical injections directly upstream of the flowmeter, hydraulic pumps, and slurry flows with low concentrations of particles in the stream. The particles bounce off of the electrode generating a “spike” in the electrode signal. An example of this type of flow stream would be a recycle flow in a paper mill. The type of noise can be mitigated by switching to the 37Hz coil drive frequency and enabling the digital signal processing.

### White noise

This type of noise results in a high amplitude signal that is relatively constant over the frequency range. Common sources of white noise include chemical reactions or mixing

that occurs as the fluid passes through the flowmeter and high concentration slurry flows where the particulates are constantly passing over the electrode head. An example of this type of flow stream would be a basis weight stream in a paper mill. This type of noise can be mitigated by switching to the 37Hz coil drive frequency and enabling the digital signal processing.

### Noise ratio less than 25 in 5 Hz mode

The transmitter detected high levels of process noise. If the signal to noise ratio is less than 25 while operating in 5 Hz mode, proceed with the following steps:

1. Increase transmitter coil drive frequency to 37 Hz (refer to [Coil drive frequency](#) and, if possible, perform auto zero function [Auto zero](#)).
2. Verify sensor is electrically connected to the process with process reference electrode, grounding rings with grounding straps, or lining protector with grounding straps.
3. If possible, redirect chemical additions downstream of the magmeter.
4. Verify process fluid conductivity is above 10 microSiemens/cm.

### Noise ratio less than 25 in 37 Hz mode

If the signal to noise ratio is less than 25 while operating in 37 Hz mode, proceed with the following steps:

1. Turn on the Digital Signal Processing (DSP) technology and follow the setup procedure (see [Digital Signal Processing](#)).

This will minimize the level of damping in the flow measurement and control loop while also stabilizing the reading to minimize valve actuation.

2. Increase damping to stabilize the signal (refer to [PV \(flow\) damping](#)).

This will add response time to the control loop.

3. Move to a Rosemount High-Signal flowmeter system.

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#### Note

The High-Signal flowmeter system described below is currently **not** available with a FOUNDATION fieldbus output.

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This flowmeter will deliver a stable signal by increasing the amplitude of the flow signal by ten times to increase the signal to noise ratio. For example if the signal to noise ratio (SNR) of a standard magnetic flowmeter is 5, the High-Signal would have a SNR of 50 in the same application. The Rosemount High-Signal system is comprised of the 8707 sensor which has modified coils and magnetics and the 8712H High-Signal transmitter.

## 11.4.4 Troubleshooting coated electrode detection

In the event that electrode coating is detected, use the following table to determine the appropriate course of action.

**Table 11-5: Troubleshooting the Electrode Coating Diagnostic**

| Error message             | Potential causes of error  | Steps to correct   |
|---------------------------|--|--|
| Electrode Coating Level 1 | <ul style="list-style-type: none"> <li>Insulating coating is starting to build up on the electrode and may interfere with the flow measurement signal</li> <li>Process fluid conductivity has decreased to a level close to operational limits of the meter</li> </ul> | <ul style="list-style-type: none"> <li>Verify process fluid conductivity</li> <li>Schedule maintenance to clean the electrodes</li> <li>Use bullet nose electrodes</li> <li>Replace the meter with a smaller diameter meter to increase the flow velocity to above 3 ft/s (1 m/s)</li> </ul> |
| Electrode Coating Level 2 | <ul style="list-style-type: none"> <li>Insulating coating has built up on the electrodes and is interfering with the flow measurement signal</li> <li>Process fluid conductivity has decreased to a level below the operational limits of the meter</li> </ul>         | <ul style="list-style-type: none"> <li>Verify process fluid conductivity</li> <li>Schedule maintenance to clean the electrodes</li> <li>Use bullet nose electrodes</li> <li>Replace the meter with a smaller diameter meter to increase the flow velocity to above 3 ft/s (1 m/s)</li> </ul> |

## 11.4.5 Troubleshooting the SMART Meter Verification test

If the SMART Meter Verification test fails, use the following table to determine the appropriate course of action. Begin by reviewing the SMART Meter Verification results to determine the specific test that failed.

**Table 11-6: Troubleshooting the SMART Meter Verification Diagnostic**

| Test                            | Potential cause  | Corrective action   |
|---------------------------------|--|---|
| Transmitter Verification Test   | <ul style="list-style-type: none"> <li>Unstable flow reading during the test</li> <li>Noise in the process</li> <li>Transmitter drift</li> <li>Faulty electronics</li> </ul> | <ul style="list-style-type: none"> <li>Rerun SMART Meter Verification (8714i) under No Flow conditions</li> <li>Check the transmitter calibration with the 8714D Calibration Standard</li> <li>Perform a digital trim</li> <li>Replace the electronics stack</li> </ul> |
| Sensor Calibration Verification | <ul style="list-style-type: none"> <li>Moisture in the sensor terminal block</li> <li>Calibration shift caused by heat cycling or vibration</li> </ul>                       | <ul style="list-style-type: none"> <li>Rerun SMART Meter Verification (8714i)</li> <li>Perform the sensor checks detailed in <a href="#">Sensor troubleshooting</a>.</li> </ul>   |
| Coil Circuit Health             | <ul style="list-style-type: none"> <li>Moisture in the sensor terminal block</li> <li>Shorted Coil</li> </ul>  | <ul style="list-style-type: none"> <li>Remove the sensor and send back for evaluation and / or recalibration</li> </ul>   |

**Table 11-6: Troubleshooting the SMART Meter Verification Diagnostic (continued)**

| Test                     | Potential cause  | Corrective action |
|--------------------------|--|-------------------|
| Electrode Circuit Health | <ul style="list-style-type: none"> <li>• Electrode resistance baseline was not taken after installation</li> <li>• Test condition was not selected properly</li> <li>• Moisture in the sensor terminal block</li> <li>• Coated electrodes</li> <li>• Shorted electrodes</li> </ul> |                   |

## 11.5 Basic troubleshooting

When troubleshooting a magmeter, it is important to identify the issue. below provides common symptoms displayed by a magmeter that is not functioning properly. This table provides potential causes and suggested corrective actions for each symptom.

**Table 11-7: Common magmeter issue**

| Symptom                       | Electronics failure   | Corrective action  |
|-------------------------------|---|--|
| Status Is bad                 | <ul style="list-style-type: none"> <li>• Electronics failure</li> </ul>                             | <ul style="list-style-type: none"> <li>• Cycle power</li> <li>• If status is still bad, verify transmitter operation with an 8714 D Calibration Standard</li> <li>• Replace the electronics stack</li> </ul>   |
|                               | <ul style="list-style-type: none"> <li>• Open coil circuit</li> </ul>                               | <ul style="list-style-type: none"> <li>• Check coil drive circuit connections at the sensor and at the transmitter</li> </ul>  |
|                               | <ul style="list-style-type: none"> <li>• Coil power or coil current is over limit</li> </ul>        | <ul style="list-style-type: none"> <li>• Check coil drive circuit connections at the sensor and at the transmitter</li> <li>• Cycle power</li> <li>• If status is still bad, verify transmitter operation with an 8714D Calibration Standard</li> <li>• Replace the electronics stack</li> </ul> |
| Status Is Bad                 | <ul style="list-style-type: none"> <li>• Connected to incompatible sensor</li> </ul>                | <ul style="list-style-type: none"> <li>• See <a href="#">Implementing a Universal Transmitter</a></li> </ul>   |
| Error Messages on LOI/Display | <ul style="list-style-type: none"> <li>• Many possible causes depending upon the message</li> </ul> | <ul style="list-style-type: none"> <li>• See <a href="#">Table 11-2</a>, <a href="#">Table 11-3</a>, and <a href="#">Table 11-4</a> for the LOI/Display messages</li> </ul>  |

**Table 11-7: Common magmeter issue (continued)**

| Symptom   | Electronics failure  | Corrective action  |
|---|--|--|
| Reading does not appear to be within rated accuracy                                   | <ul style="list-style-type: none"> <li>Transmitter, control system, or other receiving device not configured properly</li> </ul>           | <ul style="list-style-type: none"> <li>Check all configuration variables for the transmitter, sensor, communicator, and/or control system</li> <li>Check these other transmitter settings:                             <ul style="list-style-type: none"> <li>Sensor calibration number</li> <li>Units</li> <li>Line size</li> </ul> </li> </ul> |
|   | <ul style="list-style-type: none"> <li>Electrode Coating</li> </ul>  | <ul style="list-style-type: none"> <li>Enable Coated Electrode Detection diagnostic</li> <li>Use bullet-nose electrodes</li> <li>Downsize sensor to increase flow rate above 3 ft/s</li> <li>Periodically clean sensor</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Gas/air in line</li> </ul>  | <ul style="list-style-type: none"> <li>Move the sensor to another location in the process line to ensure that it is full under all conditions</li> </ul>   |
|   | <ul style="list-style-type: none"> <li>Moisture problem</li> </ul>   | <ul style="list-style-type: none"> <li>Perform the sensor tests - see <a href="#">Sensor troubleshooting</a></li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Insufficient upstream/downstream pipe diameter</li> </ul>   | <ul style="list-style-type: none"> <li>Move sensor to a new location with 5 pipe diameters upstream and 2 pipe diameters downstream if possible</li> </ul>   |
|   | <ul style="list-style-type: none"> <li>Cables for multiple magmeters run through same conduit</li> </ul>                                   | <ul style="list-style-type: none"> <li>Use dedicated conduit run for each sensor and transmitter</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Improper wiring</li> </ul>  | <ul style="list-style-type: none"> <li>If electrode shield and electrode signal wires are switched, flow indication will be about half of what is expected. Check wiring diagrams.</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Flow rate is below 1 ft/s (specification issue)</li> </ul>  | <ul style="list-style-type: none"> <li>See accuracy specification for specific transmitter and sensor</li> </ul>   |
|   | <ul style="list-style-type: none"> <li>Auto zero was not performed when the coil drive frequency was changed from 5 Hz to 37 Hz</li> </ul> | <ul style="list-style-type: none"> <li>Set the coil drive frequency to 37 Hz, verify the sensor is full, verify there is no flow, and perform the auto zero function</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Sensor failure—shorted electrode</li> </ul>   | <ul style="list-style-type: none"> <li>Perform the sensor tests - see <a href="#">Sensor troubleshooting</a></li> </ul>  |
| <ul style="list-style-type: none"> <li>Sensor failure—shorted or open coil</li> </ul> | <ul style="list-style-type: none"> <li>Perform the sensor tests - see <a href="#">Sensor troubleshooting</a></li> </ul>                    |  |

**Table 11-7: Common magmeter issue (continued)**

| Symptom                  | Electronics failure   | Corrective action   |
|--------------------------|---|---|
|                          | <ul style="list-style-type: none"> <li>Transmitter failure</li> </ul>   | <ul style="list-style-type: none"> <li>Verify transmitter operation with an 8714 Calibration Standard or replace the electronics board</li> </ul>   |
| Noisy Process            | <ul style="list-style-type: none"> <li>Chemical additives upstream of magnetic flowmeter</li> </ul>   | <ul style="list-style-type: none"> <li>See <a href="#">Troubleshooting high process noise</a></li> <li>Move injection point downstream of magnetic flowmeter, or move magnetic flowmeter</li> </ul>   |
|                          | <ul style="list-style-type: none"> <li>Sludge flows—mining/coal/sand/slurries (other slurries with hard particles)</li> </ul>                                   | <ul style="list-style-type: none"> <li>Decrease flow rate below 10 ft/s</li> </ul>  |
|                          | <ul style="list-style-type: none"> <li>Styrofoam or other insulating particles in process</li> </ul>  | <ul style="list-style-type: none"> <li>See <a href="#">Troubleshooting high process noise</a></li> <li>Consult factory</li> </ul>   |
|                          | <ul style="list-style-type: none"> <li>Electrode coating</li> </ul>   | <ul style="list-style-type: none"> <li>Enable Coated Electrode Detection diagnostic</li> <li>Use a smaller sensor to increase flow rate above 3 ft/s</li> <li>Periodically clean sensor</li> </ul>  |
|                          | <ul style="list-style-type: none"> <li>Gas/air in line</li> </ul>   | <ul style="list-style-type: none"> <li>Move the sensor to another location in the process line to ensure that it is full under all conditions</li> </ul>  |
|                          | <ul style="list-style-type: none"> <li>Low conductivity fluids (below 10 microsiemens/cm)</li> </ul>  | <ul style="list-style-type: none"> <li>Trim electrode and coil wires – see <a href="#">Conduit requirements</a></li> <li>Keep flow rate below 3 ft/s</li> <li>Integral mount transmitter</li> <li>Use component cable - see <a href="#">Sensor to transmitter wiring</a></li> </ul>   |
| Meter output is unstable | <ul style="list-style-type: none"> <li>Medium to low conductivity fluids (10–25 microsiemens/cm) combined with cable vibration or 60 Hz interference</li> </ul> | <ul style="list-style-type: none"> <li>Eliminate cable vibration</li> <li>Move cable to lower vibration run</li> <li>Tie down cable mechanically</li> <li>Use an integral mount</li> <li>Trim electrode and coil wires - see <a href="#">Sensor to transmitter wiring</a></li> <li>Route cable line away from other equipment powered by 60 Hz</li> <li>Use component cable - see <a href="#">Sensor to transmitter wiring</a></li> </ul> |

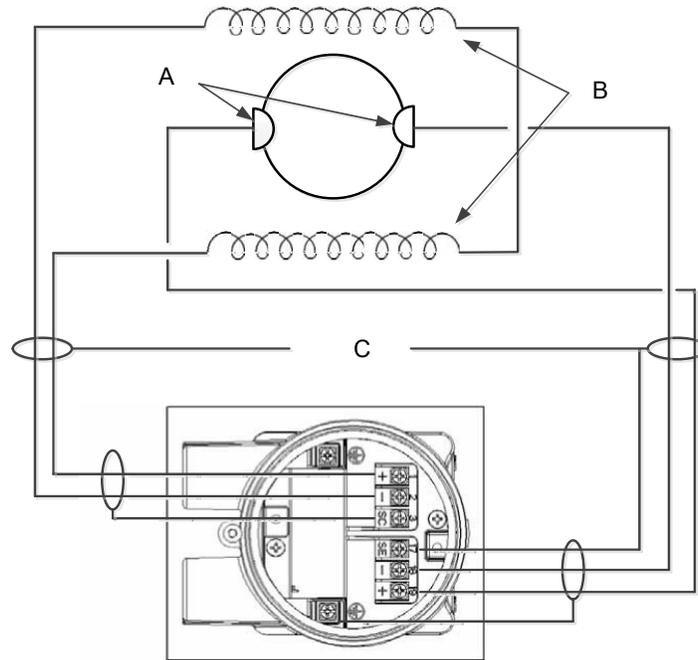
**Table 11-7: Common magmeter issue (continued)**

| Symptom | Electronics failure  | Corrective action  |
|---------|--|--|
|         | <ul style="list-style-type: none"> <li>Electrode incompatibility</li> </ul>                                    | <ul style="list-style-type: none"> <li>Check the <i>Technical Data Sheet, Magnetic Flowmeter Material Selection Guide</i> (document number 00816-0100-3033), for chemical compatibility with electrode material</li> </ul> |
|         | <ul style="list-style-type: none"> <li>Improper grounding</li> </ul>   | <ul style="list-style-type: none"> <li>Check ground wiring – see <a href="#">Process reference connection</a> for wiring and grounding procedures</li> </ul>   |
|         | <ul style="list-style-type: none"> <li>High local magnetic or electric fields</li> </ul>                       | <ul style="list-style-type: none"> <li>Move magnetic flowmeter (20–25 ft away is usually acceptable)</li> </ul>  |
|         | <ul style="list-style-type: none"> <li>Control loop improperly tuned</li> </ul>                                | <ul style="list-style-type: none"> <li>Check control loop tuning</li> </ul>  |
|         | <ul style="list-style-type: none"> <li>Sticky valve (look for periodic oscillation of meter output)</li> </ul> | <ul style="list-style-type: none"> <li>Service valve</li> </ul>  |
|         | <ul style="list-style-type: none"> <li>Sensor failure</li> </ul>   | <ul style="list-style-type: none"> <li>Perform the sensor tests (See <a href="#">Sensor troubleshooting</a>)</li> </ul>  |

## 11.6 Sensor troubleshooting

This section describes manual tests that can be performed on the sensor to verify the health of individual components. The tests will require the use of a digital multimeter capable of measuring conductance in nanoSiemens and an LCR meter. A sensor circuit diagram is shown in [Figure 11-1](#). The tests described below will check for continuity or isolation of the internal components of the sensor.

Figure 11-1: Sensor Circuit Diagram (Simplified)



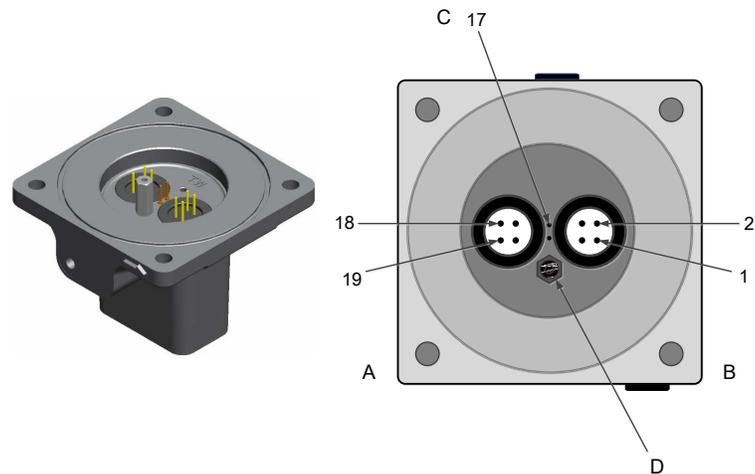
- A. Electrodes
- B. Coils
- C. Sensor housing

## 11.6.1 Sensor adapter feed through pins

The sensor adapter is the part of the sensor that provides the internal connection feed-through wiring from the internal sensor components to the socket module connections. The top of the adapter has 10 pins - four pins for the coils, four pins for the electrodes, and two pins for the process reference. Each connection point has two pins associated for redundant continuity. See [Figure 11-2](#).

The best location for testing the sensor components is taking measurements directly on the feed-through pins. Direct measurement on the pins eliminates the possibility of an erroneous measurement caused by a bad socket module or remote wiring. The figure below shows the feed-through pin connections as they relate to the terminal connections described in the tests.

**Figure 11-2: Sensor Adapter Feed-through Pins**

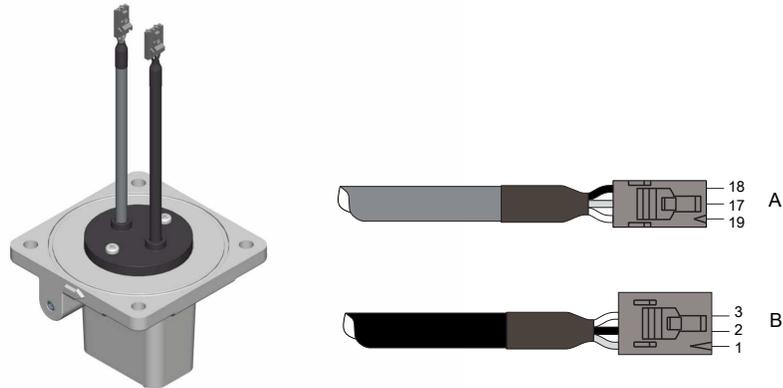


- A. Electrode side
- B. Coil side
- C. Process reference
- D. Orientation key

## 11.6.2 Sensor adapter direct lead pins

The sensor adapter direct leads are the part of the sensor that provides the direct connection from the internal sensor components to the terminal block connections. The top of the adapter has 6 pins - three pins for the coils, and three pins for the electrodes. See [Figure 11-3](#). The best location for testing the sensor components is taking measurements directly on the slot pins. Direct measurement on the pins eliminates the possibility of an erroneous measurement caused by a bad terminal block or remote wiring. [Figure 11-3](#) shows the slot pin connections as they relate to the terminal connections described in the tests.

**Figure 11-3: Sensor adapter direct lead pins**



- A. Electrode side
- B. Coil side

## 11.6.3 Socket module

**Figure 11-4: Remote Mount Socket Module**



## 11.7 Installed sensor tests

If a problem with an installed sensor is identified, refer to [Table 11-8](#) through [Table 11-12](#) to assist in troubleshooting the sensor. Disconnect or turn off power to the transmitter before performing any of the sensor tests. Always check the operation of test equipment before each test.

If possible, take all readings from feed-through pins in the sensor adapter. If the pins in the sensor adapter are inaccessible, take measurements at the sensor terminal block or

through remote cabling as close to the sensor as possible. Readings taken through remote cabling that is more than 100 feet (30 meters) in length may provide incorrect or inconclusive information and should be avoided.

The expected values in the test below assume the measurements have been taken directly at the pins.

**Table 11-8: Test A. Sensor coil**

| Test conditions   | Expected value                 | Potential cause  | Corrective action   |
|---|--------------------------------|--|---|
| <ul style="list-style-type: none"> <li>Location: installed or uninstalled</li> <li>Required equipment: multimeter</li> <li>Measuring at connections: 1 and 2 = R</li> </ul> | $2\Omega \leq R \leq 18\Omega$ | <ul style="list-style-type: none"> <li>Open or shorted coil</li> </ul> | <ul style="list-style-type: none"> <li>Remove and replace sensor</li> </ul> |

**Table 11-9: Test B: Shields to case**

| Test conditions  | Expected value | Potential cause   | Corrective action   |
|--|----------------|---|---|
| <ul style="list-style-type: none"> <li>Location: installed or uninstalled</li> <li>Required equipment: multimeter</li> <li>Measuring at connections: <ul style="list-style-type: none"> <li>— 17 and 3</li> <li>— 3 and case ground</li> <li>— 17 and case ground</li> </ul> </li> </ul> | $<0.3\Omega$   | <ul style="list-style-type: none"> <li>Moisture in terminal block</li> <li>Leaky electrode</li> <li>Process behind liner</li> </ul> | <ul style="list-style-type: none"> <li>Clean terminal block</li> <li>Remove sensor</li> </ul> |

**Table 11-10: Test C. Coil to coil shield**

| Test conditions   | Expected value         | Potential cause   | Corrective action  |
|---|------------------------|---|--|
| <ul style="list-style-type: none"> <li>Location: installed or uninstalled</li> <li>Required equipment: multimeter</li> <li>Measuring at connections: <ul style="list-style-type: none"> <li>— 1 and 3</li> <li>— 2 and 3</li> </ul> </li> </ul> | $\infty\Omega (< 1nS)$ | <ul style="list-style-type: none"> <li>Process behind liner</li> <li>Leaky electrode</li> <li>Moisture in terminal block</li> </ul> | <ul style="list-style-type: none"> <li>Remove sensor and dry</li> <li>Clean terminal block</li> <li>Confirm with sensor coil test</li> </ul> |

**Table 11-11: Test D. Electrode to electrode shield**

| Test conditions  | Expected value   | Potential cause   | Corrective action  |
|--|--|---|--|
| <ul style="list-style-type: none"> <li>Location: installed</li> <li>Required equipment: LCR (Set to Resistance and 120 Hz)</li> <li>Measuring at connections:                             <ul style="list-style-type: none"> <li>18 and 17 = R<sub>1</sub></li> <li>19 and 17 = R<sub>2</sub></li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>R<sub>1</sub> and R<sub>2</sub> should be stable</li> <li> R<sub>1</sub>-R<sub>2</sub>  ≤ 300Ω</li> </ul> | <ul style="list-style-type: none"> <li>Unstable R<sub>1</sub> or R<sub>2</sub> values confirm coated electrode</li> <li>Shorted electrode</li> <li>Electrode not in contact with process</li> <li>Empty pipe</li> <li>Low conductivity</li> <li>Leaky electrode</li> <li>Process reference ground not connected properly</li> </ul> | <ul style="list-style-type: none"> <li>Remove coating from sensor wall</li> <li>Use bullet-nose electrodes</li> <li>Repeat measurement</li> <li>Remove sensor and complete tests in <a href="#">Uninstalled sensor tests</a></li> <li>Connect process reference ground per <a href="#">Process reference connection</a></li> </ul> |

**Table 11-12: Test E. Electrode to Electrode**

| Test conditions  | Expected value  | Potential cause   | Corrective action  |
|--|---|---|--|
| <ul style="list-style-type: none"> <li>Location: installed</li> <li>Required equipment: LCR (Set to Resistance and 120 Hz)</li> <li>Measuring at connections: 18 and 19                             <ul style="list-style-type: none"> <li>18 and 17 = R<sub>1</sub></li> <li>19 and 17 = R<sub>2</sub></li> </ul> </li> </ul> | Should be stable and same relative magnitude of R <sub>1</sub> and R <sub>2</sub> from Test D | <ul style="list-style-type: none"> <li>Unstable R<sub>1</sub> or R<sub>2</sub> values confirm coated electrode</li> <li>Shorted electrode</li> <li>Electrode not in contact with process</li> <li>Empty pipe</li> <li>Low conductivity</li> <li>Leaky electrode</li> <li>Process reference ground not connected properly</li> </ul> | <ul style="list-style-type: none"> <li>Remove coating from sensor wall</li> <li>Use bullet-nose electrodes</li> <li>Repeat measurement</li> <li>Remove sensor and complete tests in <a href="#">Uninstalled sensor tests</a></li> <li>Connect process reference ground per <a href="#">Process reference connection</a></li> </ul> |

To test the sensor, a multimeter capable of measuring conductance in nanoSiemens is preferred. Conductance is the reciprocal of resistance.

Or:

$$1 \text{ nanosiemens} = \frac{1}{1 \text{ gigaohm}} \quad 1 \text{ nanosiemens} = \frac{1}{1 \times 10^9 \text{ ohm}}$$

## 11.8 Uninstalled sensor tests

Sensor troubleshooting can also be performed on an uninstalled sensor. If test results from installed sensor tests are inconclusive, the next step is remove the sensor and perform the tests outlined in this section. Take measurements from the feed-through pins and directly on the electrode head inside the sensor. The measurement electrodes, 18 and 19, are on opposite sides in the inside diameter of the sensor. If applicable, the third process reference electrode is between the two measurement electrodes.

The expected values in the test below assume the measurements have been taken directly at the pins.

**Table 11-13: Test A. Terminal to front electrode**

| Test conditions  | Expected value  | Potential cause   | Corrective action   |
|--|-----------------|---|---|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>18 and electrode 18<sup>(1)</sup></li> </ul> | $\leq 1 \Omega$ | <ul style="list-style-type: none"> <li>Shorted electrode</li> <li>Open electrode</li> <li>Coated electrode</li> </ul> | <ul style="list-style-type: none"> <li>Replace sensor</li> <li>Remove coating from sensor wall</li> </ul> |

(1) When the connection head is in the vertical upright position and the flow arrow (see [Flow direction](#)) on the connection head flange points to the right, the front of the meter will be facing towards you. Electrode 18 is on the front of the meter. If you cannot determine the front of the meter, measure both electrodes. One electrode should result in an open reading, while the other electrode should be less than 0.3 ohm.

**Table 11-14: Test B. Terminal to back electrode**

| Test conditions  | Expected value  | Potential cause   | Corrective action   |
|--|-----------------|---|---|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>19 and electrode 19<sup>(1)</sup></li> </ul> | $\leq 1 \Omega$ | <ul style="list-style-type: none"> <li>Shorted electrode</li> <li>Open electrode</li> <li>Coated electrode</li> </ul> | <ul style="list-style-type: none"> <li>Replace sensor</li> <li>Remove coating from sensor wall</li> </ul> |

(1) When the connection head is in the vertical upright position and the flow arrow (see [Flow direction](#)) on the connection head flange points to the right, the front of the meter will be facing towards you. Electrode 18 is on the front of the meter. If you cannot determine the front of the meter, measure both electrodes. One electrode should result in an open reading, while the other electrode should be less than 0.3 ohm.

**Table 11-15: Test C. Terminal to reference electrode**

| Test conditions   | Expected value    | Potential cause   | Corrective action   |
|---|-------------------|---|---|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>17 and process reference electrode<sup>(1)</sup></li> </ul> | $\leq 0.3 \Omega$ | <ul style="list-style-type: none"> <li>Shorted electrode</li> <li>Open electrode</li> <li>Coated electrode</li> </ul> | <ul style="list-style-type: none"> <li>Replace sensor</li> <li>Remove coating from sensor wall</li> </ul> |

(1) Only valid if the sensor has a process reference electrode.

**Table 11-16: Test D. Terminal to case ground**

| Test conditions   | Expected value    | Potential cause   | Corrective action  |
|---|-------------------|---|--|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>17 and safety ground</li> </ul> | $\leq 0.3 \Omega$ | <ul style="list-style-type: none"> <li>Moisture in terminal block</li> <li>Leaky electrode</li> <li>Process behind liner</li> </ul> | <ul style="list-style-type: none"> <li>Clean terminal block</li> <li>Replace terminal block</li> <li>Replace sensor</li> </ul> |

**Table 11-17: Test E. Electrode to electrode shield**

| Test conditions   | Expected value                  | Potential cause  | Corrective action  |
|---|---------------------------------|--|--|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>18 and 17</li> <li>19 and 17</li> </ul> | $\infty \Omega (<1 \text{ nS})$ | <ul style="list-style-type: none"> <li>Shorted electrode</li> <li>Leaky electrode</li> <li>Moisture in terminal block</li> </ul> | <ul style="list-style-type: none"> <li>Replace sensor</li> <li>Clean terminal block</li> <li>Replace terminal block</li> </ul> |

**Table 11-18: Test F. Electrode shield to coil**

| Test conditions   | Expected value                  | Potential cause   | Corrective action  |
|---|---------------------------------|---|--|
| <ul style="list-style-type: none"> <li>Location: uninstalled</li> <li>Required equipment: Multimeter</li> <li>17 and 1</li> </ul> | $\infty \Omega (<1 \text{ nS})$ | <ul style="list-style-type: none"> <li>Process in coil housing</li> <li>Moisture in terminal block</li> </ul> | <ul style="list-style-type: none"> <li>Replace sensor</li> <li>Clean terminal block</li> <li>Replace terminal block</li> </ul> |

## 11.9 Technical support

Email addresses:

Worldwide: [flow.support@emerson.com](mailto:flow.support@emerson.com)

Asia-Pacific: [APflow.support@emerson.com](mailto:APflow.support@emerson.com)

Middle East and Africa: [FlowTechnicalSupport@emerson.com](mailto:FlowTechnicalSupport@emerson.com)

| 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) 318 495 555 | 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 3238 3677    | Italy                  | 8008 77334          | China        | +86 21 2892 9000 |

| North and South America |                  | Europe and Middle East |                     | Asia Pacific |                  |
|-------------------------|------------------|------------------------|---------------------|--------------|------------------|
| 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       |              |                  |

## 11.10 Service

To expedite the return process outside the United States, contact the nearest Rosemount representative.

Within the United States and Canada:

- For returns, contact the Flow RMA Team at 800-522-6277.
- For other assistance or information, contact the North American Response Center at 800-654-RSMT (7768), which is available 24 hours a day.

Be prepared to provide product, model, and serial numbers, as well as information about the process material to which the product was last exposed.



### **WARNING**

Mishandling products exposed to a hazardous substance may result in death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

When a return is authorized, a Return Material Authorization (RMA) number will be issued.



# A Product Specifications

## A.1 Rosemount 8700M Flowmeter Platform specifications

The tables below outline some of the basic performance, physical, and functional specifications of the Rosemount 8700M Magnetic Flowmeter Platform.

- [Table A-1](#) provides an overview of the Rosemount 8732EM Transmitter.
- [Table A-2](#) provides an overview of the Rosemount 8700M Sensor products.

**Table A-1: Rosemount 8732EM Transmitter Specifications**

|  |                              |  |
|--|------------------------------|--|
|  | Model                        | 8732EM                                     |
|  | Base accuracy <sup>(1)</sup> | 0.25% Standard 0.15% High Accuracy Option  |
|  | Mounting                     | Integral or Remote                         |
|  | Power supply                 | Global AC or DC                            |
|  | User interface               | LCD display only<br>No display             |
|  | Communication protocol       | FOUNDATION™ fieldbus                       |
|  | Diagnostics                  | Basic, DA1, DA2                            |
|  | Sensor compatibility         | All Rosemount plus other manufacturers     |
|  | Detailed specifications      | <a href="#">Transmitter specifications</a> |
|  | Ordering information         | Product Data Sheet                         |

(1) For complete accuracy specifications, please refer to [Transmitter functional specifications](#).

**Table A-2: Rosemount Sensor Specifications**

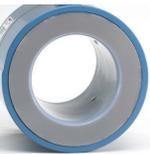
|   |                              |  |
|---|------------------------------|--|
|  | Model                        | 8705   |
|   | Style                        | Flanged  |
|   | Base accuracy <sup>(1)</sup> | 0.25% Standard 0.15% High Accuracy Option            |
|   | Line sizes                   | ½-in. to 36-in. (15 mm to 900 mm)                    |
|   | Design features              | Standard Process Design                              |
|   | Detailed specifications      | <a href="#">8705-M Flanged Sensor Specifications</a> |
|   | Ordering information         | Product Data Sheet                                   |

**Table A-2: Rosemount Sensor Specifications (continued)**

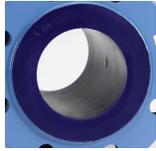
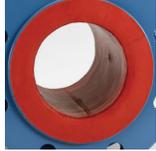
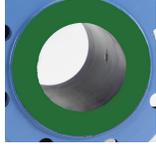
|   |                              |  |
|---|------------------------------|--|
|  | Model                        | 8711   |
|   | Style                        | Wafer  |
|   | Base accuracy <sup>(1)</sup> | 0.25% Standard 0.15% High Accuracy Option                      |
|   | Line sizes                   | 1½ -in. to 8-in. (40 mm to 200 mm)                             |
|   | Design features              | Compact, Light Weight  |
|   | Detailed specifications      | <a href="#">8711-M/L Wafer Sensor Specifications</a>           |
|   | Ordering information         | Product Data Sheet   |
|  | Model                        | 8721   |
|   | Style                        | Hygienic (sanitary)  |
|   | Base accuracy <sup>(1)</sup> | 0.5% Standard 0.25% High Accuracy Option                       |
|   | Line sizes                   | ½-in. to 4-in. (15 mm to 100 mm)                               |
|   | Design features              | 3-A CIP/SIP  |
|   | Detailed specifications      | <a href="#">8721 Hygienic (Sanitary) Sensor Specifications</a> |
|   | Ordering information         | Product Data Sheet   |

(1) For complete accuracy specifications, refer to the sensor detailed specifications.

**Table A-3: Lining Material Selection**

| Liner material  | General characteristics                            |
|---|--|
|  | Best chemical resistance                           |
|   | Better abrasion resistance than PTFE               |
|   | Best high temperature capabilities                 |
|   | Process temperature: -58 to 350 °F (-50 to 177 °C) |
|  | Highly chemical resistant                          |
|   | Excellent high temperature capabilities            |
|   | Process temperature: -58 to 350 °F (-50 to 177 °C) |
|  | Excellent chemical resistance                      |
|   | Better abrasion resistance than PTFE               |
|   | Process temperature: -58 to 300 °F (-50 to 149 °C) |
| Polyurethane  | Limited chemical resistance                        |

**Table A-3: Lining Material Selection (continued)**

| Liner material  | General characteristics   |
|---|---|
|                    | Excellent abrasion resistance for slurries with small and medium particles          |
|   | Process temperature: 0 to 140 °F (-18 to 60 °C)                                     |
|   | Typically applied in clean water  |
| Neoprene<br>       | Very good abrasion resistance for small and medium particles                        |
|   | Better chemical resistance than polyurethane  |
|   | Typically applied in water with chemicals, and sea water                            |
|   | Preferred liner for high pressure > ASME B16.5 Class 900                            |
|   | Process temperature: 0 to 176 °F (-18 to 80 °C)                                     |
| Linatex Rubber<br> | Limited chemical resistance especially in acids                                     |
|   | Very good abrasion resistance for large particles                                   |
|   | Softer material than polyurethane and neoprene                                      |
|   | Typically applied in mining slurries  |
|   | Process temperature: 0 to 158 °F (-18 to 70 °C)                                     |
| Adiprene<br>     | Ideal for applications with high salinity and/or hydrocarbon carryover              |
|   | Excellent abrasion resistance   |
|   | Typically used for Water Injection, Recovered Water, and Coal Gasification Slurries |
|   | Preferred liner for high pressure > ASME B16.5 Class 900                            |
|   | Process temperature: 0 to 200 °F (-18 to 93 °C)                                     |

**Table A-4: Electrode Material**

| Electrode material            | General characteristics  |
|-------------------------------|--|
| 316L Stainless Steel          | Good corrosion resistance  |
|                               | Good abrasion resistance   |
|                               | Not recommended for sulfuric or hydrochloric acids                           |
| Nickel Alloy 276 (UNS N10276) | Better corrosion resistance  |
|                               | High strength  |
|                               | Good in slurry applications  |
|                               | Effective in oxidizing fluids  |
| Tantalum                      | Excellent corrosion resistance   |
|                               | Not recommended for hydrofluoric acid, fluorosilic acid, or sodium hydroxide |
| 80% Platinum<br>20% Iridium   | Best chemical resistance   |
|                               | Expensive material   |

**Table A-4: Electrode Material (continued)**

| Electrode material      | General characteristics                                     |
|-------------------------|---|
|                         | Not recommended for aquaregia                               |
| Titanium                | Better chemical resistance                                  |
|                         | Better abrasion resistance                                  |
|                         | Good for sea water applications                             |
|                         | Not recommended for hydrofluoric or sulfuric acid           |
| Tungsten Carbide coated | Limited chemical resistance                                 |
|                         | Best abrasion resistance                                    |
|                         | High concentration slurries                                 |
|                         | Preferred electrode for oil and gas fracturing applications |

**Table A-5: Electrode Type**

| Electrode type   | General characteristics   |
|--|---|
| Standard Measurement   | Lowest cost   |
|  | Good for most applications  |
| Measurement + Reference Electrode<br>(Also see <a href="#">Table A-6</a> and <a href="#">Table A-7</a> for grounding options and installation) | Low cost grounding option especially for large line sizes           |
|  | Minimum conductivity of 100 microSiemens/cm                         |
|  | Not recommended for electrolytic or galvanic corrosion applications |
| Bulldog  | Extended head protrudes into the flow stream for self-cleaning      |
|  | Best option for coating processes                                   |
| Flat Head  | Low profile head  |
|  | Best option for abrasive slurries                                   |

**Table A-6: Process Reference Options**

| Grounding options                       | General characteristics   |
|---|---|
| No Grounding Options (grounding straps) | Acceptable for conductive unlined pipe  |
|   | Grounding straps provided at no cost  |
| Reference Electrode                     | Same material as measurement electrodes   |
|   | Sufficient grounding option when process fluid conductivity is greater than 100 microSiemens/cm |

**Table A-6: Process Reference Options (continued)**

| Grounding options | General characteristics  |
|-------------------|--|
|                   | Not recommended in electrolysis applications, galvanic corrosion applications, applications where the electrodes may coat, or non-conductive pipe. |
| Grounding Rings   | Low conductivity process fluids  |
|                   | Cathodic or electrolysis applications that may have stray currents in or around the process  |
|                   | Variety of materials for process fluid compatibility   |
| Lining Protectors | Protect upstream edge of sensor from abrasive fluids   |
|                   | Permanently installed on sensor  |
|                   | Protect liner material from over torquing of flange bolts  |
|                   | Provide ground path and eliminate need for grounding rings or reference electrode  |
|                   | Required for applications where Flexitallic gaskets are used   |

**Table A-7: Process Reference Installation**

| Type of pipe            | Grounding straps | Grounding rings | Reference electrode | Lining protectors |
|-------------------------|------------------|-----------------|---------------------|-------------------|
| Conductive unlined pipe | Acceptable       | Not required    | Not required        | Not required      |
| Conductive lined pipe   | Not acceptable   | Acceptable      | Acceptable          | Acceptable        |
| Non-conductive pipe     | Not acceptable   | Acceptable      | Not recommended     | Acceptable        |

## A.2 Transmitter specifications

### A.2.1 Transmitter functional specifications

#### Sensor compatibility

Compatible with Rosemount 8705, 8711, and 8721 sensors. Compatible with AC and DC powered sensors of other manufacturers.

#### Transmitter coil drive current

500mA

#### Flow rate range

Capable of processing signals from fluids with velocities between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/s).

**Conductivity limits**

Process liquid must have a conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater.

**Power supply**

- 90 - 250VAC @ 50/60Hz
- 12 - 42VDC

**Line power fuses**

- 90 - 250VAC systems:
  - 2 amp quick acting
  - Bussman AGC2 or equivalent
- 12 - 42VDC systems
  - 3 amp quick acting
  - Bussman AGC3 or equivalent

**Power consumption**

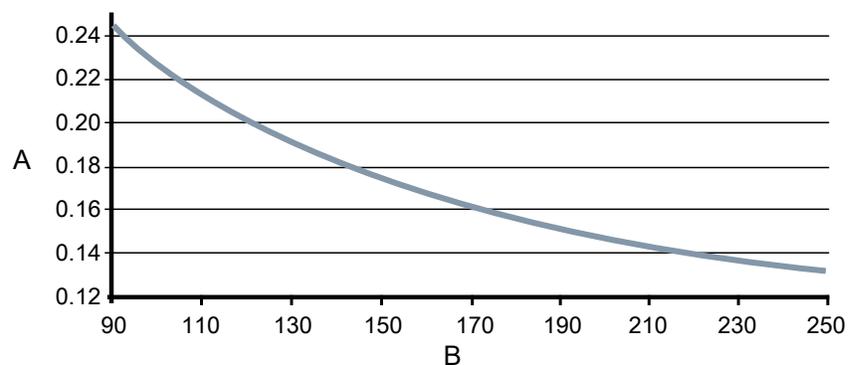
- 90 - 250VAC: 40VA maximum
- 12 - 42VDC: 15W maximum

**Switch-on current**

- At 250VAC: Maximum 35.7A (< 5ms)
- At 42VDC: Maximum 42A (< 5ms)

**AC power supply requirements**

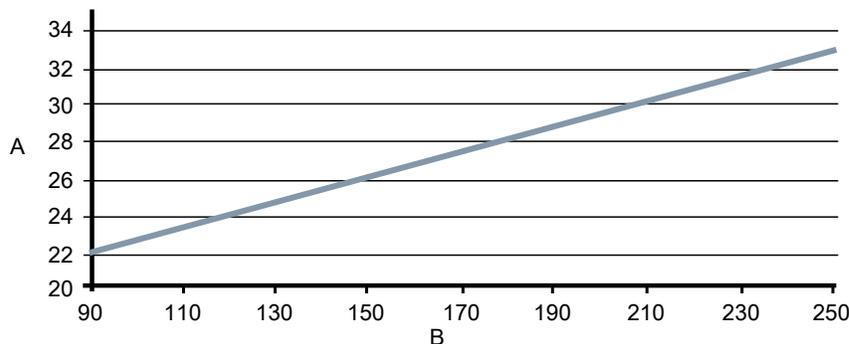
Units powered by 90 - 250VAC have the following power requirements. Peak inrush is 35.7A at 250VAC supply, lasting approximately 1ms. Inrush for other supply voltages can be estimated with:  $\text{Inrush (Amps)} = \text{Supply (Volts)} / 7.0$

**Figure A-1: AC current requirements**

A. Supply current (amps)

B. Power supply (VAC)

**Figure A-2: Apparent power**

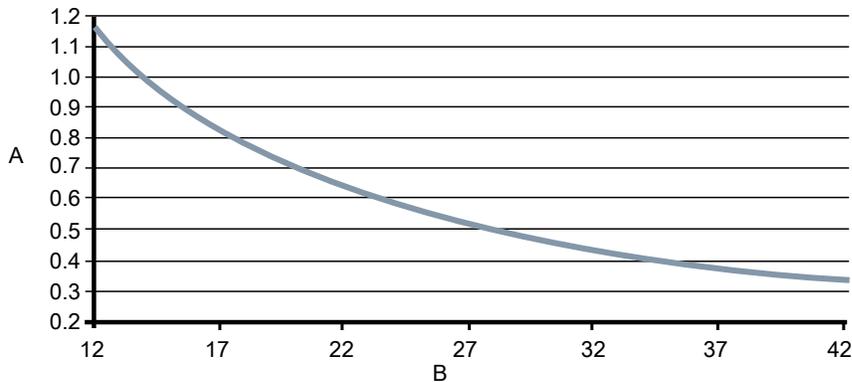


A. Apparent power (VA)  
B. Power supply (VAC)

**DC power supply requirements**

Units powered by 12VDC power supply may draw up to 1.2A of current steady state. Peak inrush is 42A at 42VDC supply, lasting approximately 1ms. Inrush for other supply voltages can be estimated with:  $\text{Inrush (Amps)} = \text{Supply (Volts)} / 1.0$

**Figure A-3: DC current requirements**



A. Supply current (amps)  
B. Power supply (VDC)

**Ambient temperature limits**

- Operating:
  - -58 to 140 °F (-50 to 60 °C) without LOI/Display
  - -4 to 140 °F (-20 to 60 °C) with LOI/Display
  - The LOI/Display will not be visible at temperatures below -20°C
- Storage:
  - -58 to 185 °F (-50 to 85 °C) without LOI/Display
  - -22 to 176 °F (-30 to 80 °C) with LOI/Display

#### Humidity limits

0–95% RH to 140 °F (60 °C)

#### Altitude

2000 meters maximum

#### Enclosure rating

Type 4X, IEC 60529, IP66 (transmitter)

#### Transient protection rating

Built in transient protection that conforms to:

- IEC 61000-4-4 for burst currents
- IEC 61000-4-5 for surge currents
- IEC 611185-2.2000, Class 3 up to 2kV and up to 2kA protection

#### Turn-on time

- 5 minutes to rated accuracy from power up
- 5 seconds from power interruption

#### Start-up time

50ms from zero flow

#### Low flow cut-off

Adjustable between 0.01 and 38.37 ft/s (0.003 and 11.7 m/s). Below selected value, output is driven to the zero flow rate signal level.

#### Overrange capability

Signal output will remain linear until 110% of upper range value or 44 ft/s (13 m/s). The signal output will remain constant above these values. Out of range message displayed on LOI/Display and the Field Communicator.

#### Damping

Adjustable between 0 and 256 seconds

## A.2.2 Advanced diagnostics capabilities

#### Basic

- Self test
- Transmitter faults
- Pulse output test
- Tunable empty pipe
- Reverse flow
- Coil circuit fault

- Electronics temperature

#### Process diagnostics (DA1)

- Ground/wiring fault
- High process noise
- Electrode coating diagnostic

#### Smart Meter Verification (DA2)

- Smart Meter Verification (continuous or on-demand)

## A.2.3 Output signals

### FOUNDATION™ Fieldbus output

|  |   |
|--|---|
| <b>Output signal</b>                               | Manchester-encoded digital signal that conforms to IEC 1158-2 and ISA 50.02 |
| <b>Scheduled Entries</b>                           | Seven (7)   |
| <b>Links</b>                                       | Twenty (20)   |
| <b>Virtual Communications Relationships (VCRs)</b> | One (1) predefined (F6, F7) Nineteen (19) configurable                      |

### FOUNDATION™ fieldbus function blocks

**Table A-8: Function block execution times**

| Block                                  | Execution time (milliseconds) |
|--|-------------------------------|
| Resource (RB)                          | —                             |
| Transducer (TB)                        | —                             |
| Analog Input (AI)                      | 15                            |
| Proportional/Integral/Derivative (PID) | 20                            |
| Integrator (INT)                       | 25                            |
| Arithmetic (AR)                        | 25                            |
| Discrete Output (DO)                   | 15                            |

|   |   |
|---|---|
| <b>Transducer Block</b>                   | The transducer block calculates flow from the measured induced voltage. The calculation includes information related to the calibration number, line size, and diagnostics.   |
| <b>Resource Block</b>                     | The resource block contains physical transmitter information, including available memory, manufacturer identification, device type, software tag, and unique identification.  |
| <b>Backup Link Active Scheduler (LAS)</b> | The transmitter is classified as a device link master. A device link master can function as a Link Active Scheduler (LAS) if the current link master device fails or is removed from the segment. The host or other configuration tool is used to download the schedule for the |

application to the link master device. In the absence of a primary link master, the transmitter will claim the LAS and provide permanent control for the H1 segment.

|   |   |                     |                                  |                         |   |                  |  |
|---|---|---------------------|----------------------------------|-------------------------|---|------------------|--|
| <b>Diagnostics</b>                      | The transmitter automatically performs continuous self-diagnostics. The user can perform on-line testing of the transmitter digital signal. Advanced simulation diagnostics are available. This enables remote verification of the electronics via a flow signal generator built into the electronics. The sensor strength value can be used to view the process flow signal and provide information regarding filter settings. |                     |                                  |                         |   |                  |  |
| <b>Analog Input</b>                     | The AI function block processes the measurement and makes it available to other function blocks. The AI function block also allows filtering, alarming, and engineering unit changes.   |                     |                                  |                         |   |                  |  |
| <b>Arithmetic Block</b>                 | Provides pre-defined application-based equations including flow with partial density compensation, electronic remote seals, hydrostatic tank gauging, ratio control and others.   |                     |                                  |                         |   |                  |  |
| <b>Proportional/Integral/Derivative</b> | The PID function block provides a sophisticated implementation of the universal PID algorithm. The PID function block features input for feed forward control, alarms on the process variable, and control deviation. The PID type (series or Instrument Society of America [ISA]) is user-selectable on the derivative filter.   |                     |                                  |                         |   |                  |  |
| <b>Integrator</b>                       | The standard integrator block is available for totalization of flow.  |                     |                                  |                         |   |                  |  |
|   | <table> <tr> <td><b>Reverse Flow</b></td> <td>Detects and reports reverse flow</td> </tr> <tr> <td><b>Software Lockout</b></td> <td>A write-lock switch and software lockout are provided in the resource function block.</td> </tr> <tr> <td><b>Totalizer</b></td> <td>Non-volatile totalizer for net, gross, forward and reverse totals.</td> </tr> </table>  | <b>Reverse Flow</b> | Detects and reports reverse flow | <b>Software Lockout</b> | A write-lock switch and software lockout are provided in the resource function block. | <b>Totalizer</b> | Non-volatile totalizer for net, gross, forward and reverse totals. |
| <b>Reverse Flow</b>                     | Detects and reports reverse flow  |                     |                                  |                         |   |                  |  |
| <b>Software Lockout</b>                 | A write-lock switch and software lockout are provided in the resource function block.   |                     |                                  |                         |   |                  |  |
| <b>Totalizer</b>                        | Non-volatile totalizer for net, gross, forward and reverse totals.  |                     |                                  |                         |   |                  |  |
| <b>Discrete Output</b>                  | The DO function block processes a discrete setpoint and saves it to a specified channel to produce an output signal. The block supports mode control, output tracking, and simulation.  |                     |                                  |                         |   |                  |  |

### Scalable pulse frequency adjustment

- 0-5000Hz, externally powered: Input 5 - 28VDC
- Pulse value can be set to equal desired volume in selected engineering units
- Pulse width adjustable from 0.1 to 650 ms

### Output testing

**Pulse output test** Transmitter may be commanded to supply a specified frequency between 1 and 5000Hz.

### Sensor compensation

Rosemount sensors are calibrated in a flow lab at the factory and are assigned a calibration number. The calibration number must be entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

Transmitters and other manufacturers' sensors can be calibrated at known process conditions or at the Rosemount NIST-Traceable Flow Facility. Transmitters calibrated on site require a two-step procedure to match a known flow rate. This procedure can be found in the operations manual.

## A.2.4 Performance specifications

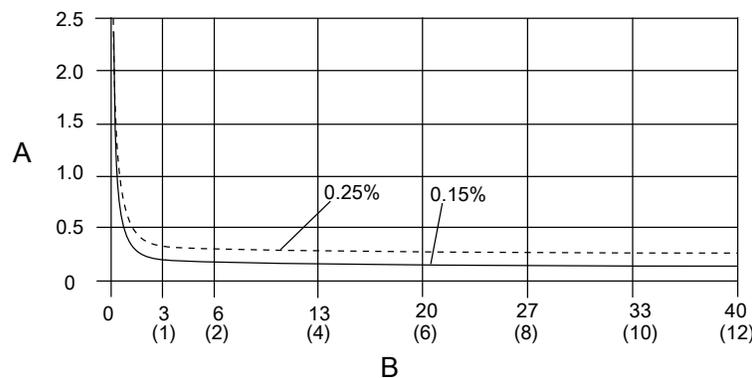
System specifications are given using the frequency output and with the unit at reference conditions.

### Accuracy

Includes the combined effects of linearity, hysteresis, and repeatability.

#### Rosemount 8705-M Sensor

- Standard system accuracy:
  - $\pm 0.25\%$  of rate  $\pm 1.0$  mm/sec from 0.04 to 6 ft/s (0.01 to 2 m/s)
  - $\pm 0.25\%$  of rate  $\pm 1.5$  mm/sec above 6 ft/s (2 m/s)
- Optional high accuracy:<sup>(2)</sup>
  - $\pm 0.15\%$  of rate  $\pm 1.0$  mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s)
  - $\pm 0.18\%$  of rate above 13 ft/s (4 m/s)

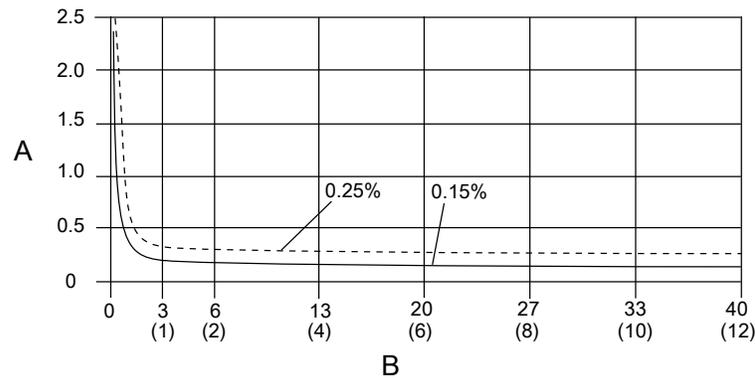


A. Percentage of rate  
B. Velocity in ft/s (m/s)

#### Rosemount 8711-M/L Sensor

- Standard system accuracy:
  - $\pm 0.25\%$  of rate  $\pm 2.0$  mm/sec from 0.04 to 39 ft/s (0.01 to 12 m/s)
- Optional high accuracy:
  - $\pm 0.15\%$  of rate  $\pm 1.0$  mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s)
  - $\pm 0.18\%$  of rate above 13 ft/s (4 m/s)

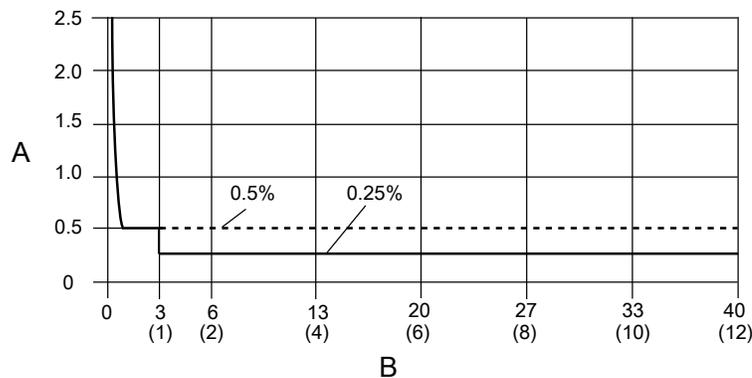
<sup>(2)</sup> For sensor sizes greater than 12 in. (300 mm) the high accuracy is  $\pm 0.25\%$  of rate from 3 to 39 ft/sec (1 to 12 m/sec).



A. Percentage of rate  
 B. Velocity in ft/s (m/s)

**Rosemount 8721 Sensor**

- Standard system accuracy:
  - $\pm 0.5\%$  of rate from 0.04 to 1.0 ft/s (0.01 and 0.3 m/s)
  - $\pm 0.5\%$  of rate  $\pm 1.5$  mm/s from 1 to 39 ft/s (0.3 to 12 m/s)
- Optional high accuracy:
  - $\pm 0.25\%$  of rate from 3 to 39 ft/s (1 to 12 m/s):



A. Percentage of rate  
 B. Velocity in ft/s (m/s)

**Other manufacturers' sensors**

- When calibrated in the Rosemount Flow Facility, system accuracies as good as 0.5% of rate can be attained.
- There is no accuracy specification for other manufacturers' sensors calibrated in the process line.

**Analog output effects**

Analog output has the same accuracy as frequency output plus an additional  $\pm 4 \mu A$  at room temperature.

|                               |   |
|-------------------------------|---|
| Repeatability                 | ±0.1% of reading                                |
| Response time (analog output) | 20 ms max response time to step change in input |
| Stability                     | ±0.1% of rate over six months                   |
| Ambient temperature effect    | ±0.25% change over operating temperature range  |

## A.2.5 Field mount transmitter physical specifications

### Materials of construction

|                  |  |
|------------------|--|
| Standard housing | Low copper aluminum<br>Type 4X and IEC 60529 IP66                |
| Paint            | Polyurethane coat (1.8 to 2.2 mils thick)                        |
| Optional housing | 316/316L unpainted, option code SH<br>Type 4X and IEC 60529 IP66 |
| Cover gasket     | Aluminum housing: Buna-N   |

### Ingress protection

Consult Emerson for installations requiring IP67/IP68/IP69K.

### Electrical connections

|                         |  |
|-------------------------|--|
| Conduit entries         | Available in 1/2 inch NPT or M20. See ordering table footnotes for details |
| Terminal block screws   | 6-32 (No. 6) suitable for up to 14 AWG wire                                |
| Safety grounding screws | External stainless assembly, M5; internal 8-32 (No. 8)                     |

### Vibration rating

|                |                  |
|----------------|------------------|
| Integral mount | 2G per IEC 61298 |
| Remote mount   | 5G per IEC 61298 |

### Dimensions

#### Weight

|                              |                     |                                 |
|------------------------------|---------------------|---------------------------------|
| Field mount transmitter only | Aluminum            | Approximately 7 lbs. (3.2 kg)   |
|                              | 316 stainless steel | Approximately 23 lbs. (10.5 kg) |

Add 1 pound (0.5 kg) for LOI/Display.

## A.3 8705-M Flanged Sensor Specifications



### A.3.1 Functional specifications

#### Service

Conductive liquids and slurries

#### Line sizes

½ -in. to 36-in. (15 mm to 900 mm)

#### Sensor coil resistance

7 - 16 Ω

#### Interchangeability

Rosemount 8705-M sensors are interchangeable with 8712EM and 8732EM transmitters. System accuracy is maintained regardless of line size or optional features. Each sensor nameplate has a sixteen-digit calibration number that can be entered into a transmitter during configuration.

#### Upper range limit

39.37 ft/s (12 m/s)

#### Ambient temperature limits

- -20 to 140 °F (-29 to 60 °C) standard design
- -58 to 140 °F (-50 to 60 °C) with "SH" all stainless design<sup>(3)</sup>

#### Pressure limits

See [Process temperature limits](#).

#### Vacuum limits

|  |  |
|--|--|
| PTFE lining                                | Full vacuum to +350 °F (+177 °C) through 4-in. (100 mm) line sizes. Consult Technical Support for vacuum applications with line sizes of 6 inches (150 mm) or larger |
| All other standard sensor lining materials | Full vacuum to maximum material temperature limits for all available line sizes.   |

<sup>(3)</sup> Not available for Class/Div approval codes N5, N6, K5, KU.

### Submergence protection IP68

The remote mount sensor is rated IP68 for submergence to a depth of 33 ft (10 m) for a period of 48 hours. IP68 rating requires that the transmitter must be remote mount. Installer must use IP68 approved cable glands, conduit connections, and/or conduit plugs.

For more details on proper installation techniques for IP68, reference Rosemount Technical Note 00840-0100-4750 available on [www.emerson.com](http://www.emerson.com).

### Conductivity limits

Process liquid must have a minimum conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater.

### Process temperature limits

|                     |                                 |
|---------------------|---------------------------------|
| PTFE lining         | -58 to +350 °F (-50 to +177 °C) |
| ETFE lining         | -58 to +300 °F (-50 to +149 °C) |
| PFA and PFA+ lining | -58 to +350 °F (-50 to +177 °C) |
| Polyurethane lining | 0 to +140 °F (-18 to +60 °C)    |
| Neoprene lining     | 0 to +176 °F (-18 to +80 °C)    |
| Linatex lining      | 0 to +158 °F (-18 to +70 °C)    |
| Adiprene lining     | 0 to +200 °F (-18 to +93 °C)    |

**Table A-9: Temperature vs. Pressure Limits for ASME B16.5 class flanges <sup>(1)</sup>**

| Sensor temperature vs. pressure limits for ASME B16.5 class flanges ( ½ -in. to 36-in. Line Sizes) <sup>(2)</sup> |                          |                                |                  |                   |                   |
|---|--------------------------|--------------------------------|------------------|-------------------|-------------------|
| Flange material   | Flange rating            | Pressure                       |                  |                   |                   |
|   |                          | @ -20 to 100 °F (-29 to 38 °C) | @ 200 °F (93 °C) | @ 300 °F (149 °C) | @ 350 °F (177 °C) |
| Carbon Steel  | Class 150                | 285 psi                        | 260 psi          | 230 psi           | 215 psi           |
|   | Class 300                | 740 psi                        | 675 psi          | 655 psi           | 645 psi           |
|   | Class 600 <sup>(3)</sup> | 1000 psi                       | 800 psi          | 700 psi           | 650 psi           |
|   | Class 600 <sup>(4)</sup> | 1480 psi                       | 1350 psi         | 1315 psi          | 1292 psi          |
|   | Class 900                | 2220 psi                       | 2025 psi         | 1970 psi          | 1935 psi          |
|   | Class 1500               | 3705 psi                       | 3375 psi         | 3280 psi          | 3225 psi          |
|   | Class 2500               | 6170 psi                       | 5625 psi         | 5470 psi          | 5375 psi          |
| 304 Stainless Steel   | Class 150                | 275 psi                        | 235 psi          | 205 psi           | 190 psi           |
|   | Class 300                | 720 psi                        | 600 psi          | 530 psi           | 500 psi           |
|   | Class 600 <sup>(5)</sup> | 1000 psi                       | 800 psi          | 700 psi           | 650 psi           |
|   | Class 600 <sup>(6)</sup> | 1440 psi                       | 1200 psi         | 1055 psi          | 997 psi           |
|   | Class 900                | 2160 psi                       | 1800 psi         | 1585 psi          | 1497 psi          |
|   | Class 1500               | 3600 psi                       | 3000 psi         | 2640 psi          | 2495 psi          |

**Table A-9: Temperature vs. Pressure Limits for ASME B16.5 class flanges <sup>(1)</sup> (continued)**

| Sensor temperature vs. pressure limits for ASME B16.5 class flanges ( ½ -in. to 36-in. Line Sizes) <sup>(2)</sup> |               |                                   |                  |                   |                   |
|---|---------------|-----------------------------------|------------------|-------------------|-------------------|
| Flange material   | Flange rating | Pressure                          |                  |                   |                   |
|   |               | @ -20 to 100 °F<br>(-29 to 38 °C) | @ 200 °F (93 °C) | @ 300 °F (149 °C) | @ 350 °F (177 °C) |
|   | Class 2500    | 6000 psi                          | 5000 psi         | 4400 psi          | 4160 psi          |

(1) Liner temperature limits must also be considered.

(2) 30-in. and 36-in. AWWA C207 Class D rated to 150 psi at atmospheric temperature.

(3) Option Code C6.

(4) Option Code C7.

(5) Option Code S6.

(6) Option Code S7.

**Table A-10: Temperature vs. Pressure Limits for AS2129 Table D and E flanges <sup>(1)</sup>**

| Sensor temperature vs. pressure limits for AS2129 Table D and E flanges (4-in. to 24-in. line sizes) |               |                                   |                   |                   |                   |
|--|---------------|-----------------------------------|-------------------|-------------------|-------------------|
| Flange Material  | Flange Rating | Pressure                          |                   |                   |                   |
|  |               | @ -29 to 50 °C<br>(-20 to 122 °F) | @ 100 °C (212 °F) | @ 150 °C (302 °F) | @ 200 °C (392 °F) |
| Carbon Steel   | D             | 101.6 psi                         | 101.6 psi         | 101.6 psi         | 94.3 psi          |
|  | E             | 203.1 psi                         | 203.1 psi         | 203.1 psi         | 188.6 psi         |

(1) Liner temperature limits must also be considered.

**Table A-11: Temperature vs. Pressure Limits for EN 1092-1 flanges <sup>(1)</sup>**

| Sensor temperature vs. pressure limits for EN 1092-1 flanges (15 mm to 600 mm Line Sizes) |               |                                   |                   |                   |                   |
|---|---------------|-----------------------------------|-------------------|-------------------|-------------------|
| Flange material   | Flange rating | Pressure                          |                   |                   |                   |
|   |               | @ -29 to 50 °C<br>(-20 to 122 °F) | @ 100 °C (212 °F) | @ 150 °C (302 °F) | @ 175 °C (347 °F) |
| Carbon Steel  | PN 10         | 10 bar                            | 10 bar            | 9.7 bar           | 9.5 bar           |
|   | PN 16         | 16 bar                            | 16 bar            | 15.6 bar          | 15.3 bar          |
|   | PN 25         | 25 bar                            | 25 bar            | 24.4 bar          | 24.0 bar          |
|   | PN 40         | 40 bar                            | 40 bar            | 39.1 bar          | 38.5 bar          |
| 304 Stainless Steel   | PN 10         | 9.1 bar                           | 7.5 bar           | 6.8 bar           | 6.5 bar           |
|   | PN 16         | 14.7 bar                          | 12.1 bar          | 11.0 bar          | 10.6 bar          |
|   | PN 25         | 23 bar                            | 18.9 bar          | 17.2 bar          | 16.6 bar          |
|   | PN 40         | 36.8 bar                          | 30.3 bar          | 27.5 bar          | 26.5 bar          |

(1) Liner temperature limits must also be considered.

## A.3.2 Physical specifications

### Non-wetted materials

|                       |   |
|-----------------------|---|
| Sensor Pipe           | Type 304/304L SST or Type 316/316L SST                |
| Flanges               | Carbon steel, Type 304/304L SST, or Type 316/316L SST |
| Coil housing          | Rolled carbon steel                                   |
| Paint                 | Polyurethane coat (2.6 mils or greater)               |
| Optional coil housing | 316/316L unpainted, option code SH                    |

### Process-wetted materials

|            |   |
|------------|---|
| Lining     | PTFE, ETFE, PFA, Polyurethane, Neoprene, Linatex, Adiprene, PFA+                      |
| Electrodes | 316L SST, Nickel Alloy 276 (UNS N10276), Tantalum, 80% Platinum-20% Iridium, Titanium |

### Flat-faced flanges

Sensors ordered with flat-faced flanges and Neoprene or Linatex liners are manufactured with the liner extending to the outer dimension of the flange. All other liner selections extend to the diameter of raised face dimension and create a raised surface on the flange face.

### Process connections

|             |   |
|-------------|---|
| ASME B16.5  | <ul style="list-style-type: none"> <li>Class 150: ½-in. to 24-in. (15 mm to 600 mm)</li> <li>Class 300: ½-in. to 24-in. (15 mm to 600 mm)</li> <li>Class 600: ½-in. to 24-in. (15 mm to 600 mm)<sup>(1)</sup></li> <li>Class 900: 1-in. to 12-in. (25 mm to 300 mm)<sup>(2)</sup></li> <li>Class 1500: 1½-in. to 12-in. (40 mm to 300 mm)<sup>(2)</sup></li> <li>1½-in. to 6-in. (40 mm to 150 mm)<sup>(2)</sup></li> </ul> |
| ASME B16.47 | <ul style="list-style-type: none"> <li>Class 150: 30-in. to 36-in. (750 mm to 900 mm)</li> <li>Class 300: 30-in. to 36-in. (750 mm to 900 mm)</li> </ul>  |
| AWWA C207   | <ul style="list-style-type: none"> <li>Class D: 30-in. and 36-in. (750 mm and 900 mm)</li> </ul>  |
| MSS SP44    | <ul style="list-style-type: none"> <li>Class 150: 30-in. to 36-in. (750 mm to 900 mm)</li> </ul>  |
| EN 1092-1   | <ul style="list-style-type: none"> <li>PN10: 200 mm to 900 mm (8-in. to 36-in.)</li> <li>PN16: 100 mm to 900 mm (4-in. to 36-in.)</li> <li>PN25: 200 mm to 900 mm (8-in. to 36-in.)</li> <li>PN40: 15 mm to 900 mm (½-in. to 36-in.)</li> </ul>   |
| AS2129      | <ul style="list-style-type: none"> <li>Table D and Table E: 15 mm to 900 mm (½-in. to 36-in.)</li> </ul>  |
| AS4087      | <ul style="list-style-type: none"> <li>PN16, PN21, PN35: 50 mm to 600 mm (2-in. to 24-in.)</li> </ul>   |

|           |   |
|-----------|---|
| JIS B2220 | <ul style="list-style-type: none"> <li>• 10K, 20K, 40K: 15 mm to 200 mm (½-in. to 8-in.)</li> </ul> |
|-----------|---|

- (1) For PTFE, PFA, PFA+, and ETFE, maximum working pressure is derated to 1000 psig.
- (2) For Class 900 and higher flange ratings, liner selection is limited to resilient liners.

**Electrical connections**

|                         |  |
|-------------------------|--|
| Conduit entries         | Available with 1/2 inch NPT and M20                    |
| Terminal block screws   | 6-32 (No. 6) suitable for up to 14 AWG wire            |
| Safety grounding screws | External stainless assembly, M5; internal 8-32 (No. 8) |

**Process reference electrode (optional)**

A process reference electrode can be installed similarly to the measurement electrodes through the sensor lining. It will be made of the same material as the measurement electrodes.

**Grounding rings (optional)**

Grounding rings can be installed between the flange and the sensor face on both ends of the sensor. Single ground rings can be installed on either end of the sensor. They have an I.D. slightly larger than the sensor I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST, Nickel Alloy 276 (UNS N10276), titanium, and tantalum. See Product Data Sheet.

**Lining protectors (optional)**

Lining protectors can be installed between the flange and the sensor face on both ends of the sensor. The leading edge of lining material is protected by the lining protector; lining protectors cannot be removed once they are installed. Lining protectors are available in 316L SST, Nickel Alloy 276 (UNS N10276), and titanium. See Product Data Sheet..

**Dimensions**

See Product Data Sheet.

**Weight**

See Product Data Sheet.

## A.4 8711-M/L Wafer Sensor Specifications



## A.4.1 Functional specifications

### Service

Conductive liquids and slurries

### Line sizes

1.5-in. to 8-in. (40 mm to 200 mm)

### Sensor coil resistance

10 - 18  $\Omega$

### Interchangeability

Rosemount 8711-M/L Sensors are interchangeable with 8712EM and 8732EM Transmitters. System accuracy is maintained regardless of line size or optional features. Each sensor nameplate has a sixteen-digit calibration number that can be entered into a transmitter during configuration.

### Upper range limit

39.37 ft/s (12 m/s)

### Process temperature limits

|             |                               |
|-------------|-------------------------------|
| ETFE lining | -20 to 300 °F (-29 to 149 °C) |
| PTFE lining | -20 to 350 °F (-29 to 177 °C) |

### Ambient temperature limits

-20 to 140 °F (-29 to 60 °C)

### Maximum safe working pressure at 100 °F (38 °C)

|             |  |
|-------------|--|
| ETFE lining | Full vacuum to 740 psi (5.1 MPa)   |
| PTFE lining | <ul style="list-style-type: none"> <li>Line sizes 1.5-in. (40 mm) through 4-in. (100 mm); Full vacuum to 740 psi (5.1 MPa)</li> <li>Consult Technical Support for vacuum applications with line sizes of 6-in. (150 mm) or larger</li> </ul> |

### Submergence protection IP68

The remote mount 8711-M/L sensor is rated IP68 for submergence to a depth of 33 ft (10 m) for a period of 48 hours. IP68 rating requires that the transmitter must be remote mount. Installer must use IP68 approved cable glands, conduit connections, and/or conduit plugs. For more details on proper installation techniques for IP68, reference Rosemount Technical Document 00840-0100-4750 available on [www.rosemount.com](http://www.rosemount.com).

### Conductivity limits

Process liquid must have a minimum conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater for 8711.

## A.4.2 Physical specifications

### Non-wetted materials

|              |  |
|--------------|--|
| Sensor body  | <ul style="list-style-type: none"> <li>• 303 SST</li> <li>• CF3M or CF8M</li> <li>• Type 304/304L</li> </ul> |
| Coil housing | Rolled carbon steel  |
| Paint        | Polyurethane coat (2.6 mils or greater)  |

### Process-wetted materials

|            |   |
|------------|---|
| Lining     | PTFE, ETFE  |
| Electrodes | 316L SST, Nickel Alloy 276 (UNS N10276), Tantalum, 80% Platinum—20% Iridium, Titanium |

### Electrical connections

|                         |   |
|-------------------------|---|
| Conduit entries         | Available with 1/2 inch NPT and M20. See ordering table footnotes for details |
| Terminal block screws   | 6-32 (No. 6) suitable for up to 14 AWG wire                                   |
| Safety grounding screws | External stainless assembly, M5; internal 8-32 (No. 8)                        |

### Process reference electrode (optional)

A process reference electrode can be installed similarly to the measurement electrodes through the sensor lining. It will be made of the same material as the measurement electrodes.

### Grounding rings (optional)

Grounding rings can be installed between the flange and the sensor face on both ends of the sensor. They have an I.D. slightly smaller than the sensor I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST, Nickel Alloy 276 (UNS N10276), titanium, and tantalum.

### Dimensions

See Product Data Sheet.

### Weight

See Product Data Sheet.

### Process connections—Mounts between these flange configurations

|            |                        |
|------------|------------------------|
| ASME B16.5 | Class 150, 300         |
| EN 1092-1  | PN10, PN16, PN25, PN40 |
| JIS B2220  | 10K, 20K               |

|        |                  |
|--------|------------------|
| AS4087 | PN16, PN21, PN35 |
|--------|------------------|

### Studs, nuts, and washers—MK2-carbon steel

| Component          | ASME B16.5                                    | EN1092-1                             |
|--------------------|---|--------------------------------------|
| Studs, full thread | CS, ASTM A193, Grade B7                       | CS, ASTM A193, Grade B7              |
| Hex nuts           | ASTM A194 Grade 2H                            | ASTM A194 Grade 2H; DIN 934<br>H = D |
| Flat washers       | CS, Type A, Series N, SAE per<br>ANSI B18.2.1 | CS, DIN 125                          |
| All items          | Clear, chromate zinc-plated                   | Yellow zinc-plated                   |

### Studs, nuts, and washers—MK3-316 SST

| Component          | ASME B16.5   | EN1092-1                             |
|--------------------|--|--------------------------------------|
| Studs, full thread | ASTM A193, Grade B8M Class 1                       | ASTM A193, Grade B8M Class 1         |
| Hex nuts           | ASTM A194 Grade 8M                                 | ASTM A194 Grade 8M; DIN 934<br>H = D |
| Flat washers       | 316 SST, Type A, Series N, SAE<br>per ANSI B18.2.1 | 316 SST, DIN 125                     |

## A.5 8721 Hygienic (Sanitary) Sensor Specifications



### A.5.1 Functional specifications

#### Service

Conductive liquids and slurries

#### Line sizes

1/2 -in. to 4-in. (15 mm to 100 mm)

#### Sensor coil resistance

5 -10 Ω

### Interchangeability

Rosemount 8721 sensors are interchangeable with Rosemount 8712EM and 8732EM transmitters. System accuracy is maintained regardless of line size or optional features. Each sensor label has a 16 digit calibration number that can be entered into the transmitter during configuration.

### Conductivity limits

Process liquid must have a minimum conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater. Excludes the effect of interconnecting cable length in remote mount transmitter installations.

### Flow rate range

Capable of processing signals from fluids that are traveling between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/s).

### Sensor ambient temperature limits

14 to 140 °F (-15 to 60 °C)

### Process temperature limits

**PFA lining** -20 to 350 °F (-29 to 177 °C)

**Table A-12: Pressure limits**

| Line size          | Max working pressure | CE mark max. working pressure |
|--------------------|----------------------|-------------------------------|
| 1/2 -in. (15 mm)   | 300 psi (20.7 bar)   | 300 psi (20.7 bar)            |
| 1-in. (25 mm)      | 300 psi (20.7 bar)   | 300 psi (20.7 bar)            |
| 1 1/2 -in. (40 mm) | 300 psi (20.7 bar)   | 300 psi (20.7 bar)            |
| 2-in. (50 mm)      | 300 psi (20.7 bar)   | 300 psi (20.7 bar)            |
| 2 1/2 -in. (65 mm) | 300 psi (20.7 bar)   | 240 psi (16.5 bar)            |
| 3 -in. (80 mm)     | 300 psi (20.7 bar)   | 198 psi (13.7 bar)            |
| 4-in. (100 mm)     | 210 psi (14.5 bar)   | 148 psi (10.2 bar)            |

### Vacuum limits

Full vacuum at maximum lining material temperature; consult Technical Support.

### Submergence protection IP68

The remote mount 8721 sensor is rated IP68 for submergence to a depth of 33 ft (10 m) for a period of 48 hours. IP68 rating requires that the transmitter must be remote mount. Installer must use IP68 approved cable glands, conduit connections, and/or conduit plugs. For more details on proper installation techniques for IP68, reference Rosemount Technical Note 00840-0100-4750 available on [www.rosemount.com](http://www.rosemount.com).

### Sanitary fitting torque

Hand tighten IDF nut to approximately 50 in-lbs [5 1/2 Newton-meters (N-m)] of torque. Re-tighten after a few minutes until there are no leaks (up to 130 in-lbs [14 1/2 Newton-meters (N-m)] of torque).

Fittings that continue to leak at a higher torque may be distorted or damaged.

## A.5.2 Physical specifications

### Mounting

Integrally mounted transmitters are factory-wired and do not require interconnecting cables. The transmitter can rotate in 90° increments. Remote mounted transmitters require only a single conduit connection to the sensor.

### Non-wetted materials

|                       |   |
|-----------------------|---|
| Sensor                | 304 Stainless Steel (wrapper), 304 Stainless Steel (pipe) |
| Terminal junction box | Low copper aluminum<br>Optional: 304 Stainless Steel      |

### Process wetted materials (sensor)

|            |  |
|------------|--|
| Liner      | PFA with Ra < 32µ in. (0.81 µm)  |
| Electrodes | <ul style="list-style-type: none"> <li>• 316L SST with Ra &lt; 15µ in. (0.38 µm)</li> <li>• Nickel Alloy 276 (UNS N10276) with Ra &lt; 15µ in. (0.38 µm)</li> <li>• 80% Platinum-20% Iridium with Ra &lt; 15µ in. (0.38 µm)</li> </ul> |

### Process connections

The Rosemount 8721 Sanitary Sensor is designed using a standard IDF fitting as the basis for providing a flexible, hygienic interface for a variety of process connections. The Rosemount 8721 Sensor has the threaded or “male” end of the IDF fitting on the ends of the base sensor. The sensor can be directly connected with user supplied IDF fittings and gaskets. If other process connections are needed, the IDF fittings and gaskets can be provided and welded directly into the sanitary process tubing, or can be supplied with adapters to standard Tri Clamp process connections. All connections are PED compliant for group 2 fluids.

|                             |  |
|-----------------------------|--|
| Tri Clamp sanitary coupling | <ul style="list-style-type: none"> <li>• IDF Sanitary Coupling (screw type)</li> <li>• IDF specification per BS4825 part 4</li> <li>• ANSI Weld Nipple</li> <li>• DIN 11850 Weld Nipple</li> <li>• DIN 11851 (Imperial and Metric)</li> <li>• DIN 11864-1 form A</li> <li>• DIN 11864-2 form A</li> <li>• SMS 1145</li> <li>• Cherry-Burrell I-Line</li> </ul> |
|-----------------------------|--|

**Process connection material**

- 316L Stainless Steel with Ra < 32µ in. (0.81µm)
- Optional Electropolished Surface Finish with Ra < 15µ in. (0.38µ m)

**Process connection gasket material**

- Silicone
- EPDM
- Viton

**Electrical connections**

|                         |  |
|-------------------------|--|
| Conduit entries         | 1/2 -in. NPT standard, M20 adapters                    |
| Terminal block screws   | M3   |
| Safety grounding screws | External stainless assembly, M5; internal 6-32 (No. 6) |

**Dimensions**

See Product Data Sheet.

**Weight**

**Table A-13: 8721 Sensor Weight**

| Line size          | Sensor only         | 008721-0350 Tri Clamp fitting (Each) |
|--------------------|---------------------|--------------------------------------|
| 1/2 -in. (15 mm)   | 4.84 lbs (2.20 kg)  | 0.58 lbs (0.263 kg)                  |
| 1-in. (25 mm)      | 4.52 lbs (2.05 kg)  | 0.68 lbs (0.309 kg)                  |
| 1 1/2 -in. (40 mm) | 5.52 lbs (2.51 kg)  | 0.88 lbs (0.400 kg)                  |
| 2-in. (50 mm)      | 6.78 lbs (3.08 kg)  | 1.30 lbs (0.591 kg)                  |
| 2 1/2 -in. (65 mm) | 8.79 lbs (4.00 kg)  | 1.66 lbs (0.727 kg)                  |
| 3 -in. (80 mm)     | 13.26 lbs (6.03 kg) | 2.22 lbs (1.01 kg)                   |
| 4-in. (100 mm)     | 21.04 lbs (9.56 kg) | 3.28 lbs (1.49 kg)                   |

|                              |  |
|------------------------------|--|
| Aluminum remote junction box | <ul style="list-style-type: none"><li>• Approximately 1 lb. (0.45 kg)</li><li>• Paint - Polyurethane (1.3 to 5 mils)</li></ul> |
| SST remote junction box      | <ul style="list-style-type: none"><li>• Approximately 2.5 lbs. (1.13 kg)</li><li>• Unpainted</li></ul>                         |



## B Product Certifications

For detailed approval certification information and installation drawings, please see the appropriate document listed below:

- Document number 00825-MA00-0001: *Rosemount 8700M Approval Document - IECEx and ATEX*
- Document number 00825-MA00-0002: *Rosemount 8700M Approval Document – Class Division*
- Document number 00825-MA00-0003: *Rosemount 8700M Approval Document - North America Zone*
- Document number 00825-MA00-0007: *Rosemount 8700M Approval Document - NEPSI EN Zone 1 China*



# C Transducer block

This section contains information on the flowmeter transducer block. Descriptions of all transducer block parameters, errors, and diagnostics are listed. Also, the modes, alarm detection, status handling, application information, and troubleshooting are discussed.

## Quick transducer block configuration guide

Proper configuration of the flowmeter is essential for accurate performance. The following is a quick configuration guide for those already familiar with magnetic flowmeters.

For most parameters configured in the flowmeter, the transmitter must perform extensive calculations to derive internal parameters used to accurately measure flow. It is recommended that each parameter in the Transducer Block be configured and sent to the transmitter individually. If too many parameter changes are sent to the transmitter at one time, the transmitter will return an error. The parameters not accepted will have to be re-sent.

## Parameters and descriptions

**Table C-1: Fieldbus standard parameters**

| TB Index | Parameter Name       | Description  |
|----------|----------------------|--|
| 1        | ST_REV               | Static Revision. Incremented when parameter changed.   |
| 2        | TAG_DESC             | Static Tag. ASCII character string.  |
| 3        | STRATEGY             | Can be used to help group the blocks. Not checked or processed by the block.   |
| 4        | ALERT_KEY            | ID number of the transmitter. May be used on the host for sorting alarms.  |
| 5        | MODE_BLK             | Mode of the record of the block. Contains the actual, target, permitted and normal modes.  |
| 6        | BLOCK_ERR            | Reflects the error status associated with hardware or software components associated with a block.   |
| 7        | UPDATE_EVT           | Update event   |
| 8        | BLOCK_ALM            | Block Alarm  |
| 9        | TRANSDUCER_DIRECTORY | Directory that specifies the number and starting indices of the transducers in the transducer block  |
| 10       | TRANSDUCER_TYPE      | Identifies the transducer  |
| 11       | TRANSDUCER_TYPE_VER  | The version of the transducer identified by TRANSDUCER_TYPE in the form 0xAABB where AA is the major revision of the transducer specification on which the transducer is based, and BB is a revision number assigned and controlled by the manufacturer of the device. |
| 12       | XD_ERROR             | Transducer Error   |
| 13       | COLLECTION_DIRECTORY | A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer within a transducer block.  |

Table C-2: Device specific parameters

| TB Index | Parameter Name        | Description   |
|----------|-----------------------|---|
| 14       | PRIMARY_VALUE_TYPE    | The type of measurement represented by the primary value. Parameter is RW but only value accepted is 101  |
| 15       | PRIMARY_VALUE         | The measured value and status available to the Function Blocks  |
| 16       | PRIMARY_VALUE_RANGE   | The High and Low Range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the primary value. See <a href="#">Engineering Units</a> , for supported unit codes.<br><br><b>Note</b><br>The units are changed from the AI block. The unit code must be sent to SENSOR_RANGE simultaneously. |
| 17       | SECONDARY_VALUE_TYPE  | Selects the type of measurement represented in SECONDARY_VALUE. This will be the Pulse Output only. Parameter is RW but only value accepted is 101  |
| 18       | SECONDARY_VALUE       | The secondary value, related to the sensor.   |
| 19       | SECONDARY_VALUE_RANGE | The engineering units to be used with SECONDARY_VALUE.  |
| 20       | XD_OPTS               | Options which the user may select to alter transducer behavior.   |
| 21       | SENSOR_TYPE           | Sensor type. Parameter is read/write, but only 102: electromagnetic is accepted   |
| 22       | SENSOR_RANGE          | The high and low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the sensor. See <a href="#">Table C-6</a> for supported unit codes.<br><br><b>Note</b><br>The units are changed from the AI block. The unit code must be sent to PRIMARY_VALUE_RANGE simultaneously.                            |
| 23       | SENSOR_SN             | The sensor serial number.<br><br><b>Note</b><br>This parameter should not be used. The parameter FLOW_TUBE_SERIAL NUMBER is used to store the flow tube (sensor) serial number.   |
| 24       | SENSOR_CAL_METHOD     | The method of the last sensor calibration. ISO defines several standard methods of calibration. This parameter is intended to record that method or if some other method was used.  |
| 25       | SENSOR_CAL_LOC        | The location of the last sensor calibration. This describes the physical location at which the calibration was performed.   |
| 26       | SENSOR_CAL_DATE       | The date of the last sensor calibration. This is intended to reflect the calibration of the sensor.   |
| 27       | SENSOR_CAL_WHO        | The name of the person responsible for the last sensor calibration.   |
| 28       | BLOCK_ERR_DESC_1      | These parameters are used by a device to report more specific details regarding persistent errors that are reported through BLOCK_ERR.  |

Table C-2: Device specific parameters (continued)

| TB Index | Parameter Name         | Description   |
|----------|------------------------|---|
| 29       | TOTAL_A_VALUE          | Totalizer A Value: This is the accumulated volumetric flow stored in totalizer A.   |
| 30       | TOTAL_B_VALUE          | Totalizer B Value: This is the accumulated volumetric flow stored in totalizer B.   |
| 31       | TOTAL_C_VALUE          | Totalizer C Value: This is the accumulated volumetric flow stored in totalizer C.   |
| 32       | DAMPING_CONSTANT       | Damping filter value in seconds   |
| 33       | DENSITY_CONSTANT_UNITS | The units will be in kg/m <sup>3</sup> or lbs/ft <sup>3</sup> , depending on whether the flow value is in Metric or English units. The user can not write directly to this parameter. |
| 34       | DENSITY_CONSTANT       | User entered density value to be used when calculating flow in mass flow units  |
| 35       | FLOW_TUBE_CAL_NUM      | Flow tube (sensor) gain and zero offset number used in flow calculation. Number entered is located on physical tag of the sensor body.  |
| 36       | TUBE_SIZE              | Sensor Size. See for actual line sizes.   |
| 37       | COIL_DRIVE_FREQ        | Coil Drive Frequency<br><br><b>Note</b><br>This parameter may change or be changed by other parameters.   |
| 38       | PULSE_CONFIGURATION    | Pulse Configuration: Parameters needed to configure the pulse output feature of the device.   |
|          | FACTOR                 | Factor: Factor value for the Pulse Output   |
|          | FACTOR_UNITS           | Pulse Factor Units are derived from PV Range units.   |
|          | PULSE_WIDTH            | Pulse Width: Pulse Width rounded to the nearest 0.1 ms  |
|          | FIXED_FREQUENCY        | Fixed Frequency: Pulse Output Fixed Frequency   |
| 39       | RESET_TOTAL_A_IN       | Reset Total A Input: Resets totalizer A value through a channel output from a function block.   |
| 40       | RESET_TOTAL_B_IN       | Reset Total B Input: Resets totalizer A value through a channel output from a function block.   |
| 41       | RESET_TOTAL_C_IN       | Reset Total C Input: Resets totalizer A value through a channel output from a function block.   |
| 42       | TOTALIZER_CONTROL      | Totalizer Control: This will allow all totalizers to be enabled/disabled or reset.  |
|          | ENABLE_ALL             | Enable: This will enable or disable all 3 totalizers in the device.   |
|          | RESET_ALL              | Reset All: If this is selected, all resettable totalizers will be returned to zero.   |
| 43       | TOTALIZER_A_CONFIG     | Totalizer A Config: Parameters needed to configure or reset the value for totalizer A.  |

**Table C-2: Device specific parameters (continued)**

| TB Index | Parameter Name        | Description   |
|----------|-----------------------|---|
|          | UNITS                 | Units: The units used by totalizer. These units are independent of the flow units and the other 2 totalizers. The totalizer units are R/W until you use the AI block XD_SCALE to change the units. After the AI has configured the units of a particular totalizer, the units in the TB totalizer parameter become Read Only. |
|          | FLOW_DIRECTION        | Flow Direction: Determines if the totalizer value will be accumulated based on the net flow, forward only flow or the reverse only flow.  |
|          | RESET                 | Reset: Individual totalizer will be reset. Parameter value will return to completed after totalizer is reset.   |
|          | ALLOW_RESET           | Allow Reset: Allows or disallows the resetting of the totalizer.  |
| 44       | TOTALIZER_B_CONFIG:   | Totalizer B Config: Parameters needed to configure or reset the value for totalizer B.  |
|          | UNITS                 | Units: The units used by totalizer. These units are independent of the flow units and the other 2 totalizers. The totalizer units are R/W until you use the AI block XD_SCALE to change the units. After the AI has configured the units of a particular totalizer, the units in the TB totalizer parameter become Read Only. |
|          | FLOW_DIRECTION        | Flow Direction B: Determines if the totalizer value will be accumulated based on the net flow, forward only flow or the reverse only flow.  |
|          | RESET                 | Reset: Individual totalizer will be reset. Parameter value will return to completed after totalizer is reset.   |
|          | ALLOW_RESET           | Allow Reset B: Allows or disallows the resetting of the totalizer.  |
| 45       | TOTALIZER_C_CONFIG:   | Totalizer C Config: Parameters needed to configure or reset the value for totalizer C.  |
|          | UNITS                 | Units: The units used by totalizer. These units are independent of the flow units and the other 2 totalizers. The totalizer units are R/W until you use the AI block XD_SCALE to change the units. After the AI has configured the units of a particular totalizer, the units in the TB totalizer parameter become Read Only. |
|          | FLOW_DIRECTION        | Flow Direction C: Determines if the totalizer value will be accumulated based on the net flow, forward only flow or the reverse only flow.  |
|          | RESET                 | Reset: Individual totalizer will be reset. Parameter value will return to completed after totalizer is reset.   |
|          | ALLOW_RESET           | Allow Reset C: Allows or disallows the resetting of the totalizer.  |
|          |                       |   |
| 46       | ELECTRODE_COATING_CFG | Electrode Coating Cfg: Parameters needed to configure or reset the monitoring values for electrode coating.   |
|          | LEVEL_1               | Level 1: Electrode Coating Threshold Level 1 (kOhms) Note: Electrode Coating Level 2 must be greater or equal to Electrode Coating Level 1.   |

Table C-2: Device specific parameters (continued)

| TB Index | Parameter Name         | Description  |
|----------|------------------------|--|
|          | LEVEL_2                | Level 2: Electrode Coating Threshold Level 2 (kOhms) Note: Electrode Coating Level 2 must be greater or equal to Electrode Coating Level 1.  |
|          | CLEAR_MAX              | Clear Max: Reset the Electrode Coating Max Value.  |
| 47       | ELECTRODE_COATING      | Electrode Coating: The current and maximum values for the electrode coating resistance values.   |
|          | CURRENT_VALUE          | Current Value: The current electrode coating resistance value in kOhms.  |
|          | MAX_VALUE              | Max Value: The maximum Electrode Coating Resistance value.   |
| 48       | DIAG_SIG_POWER         | Signal power at current coil drive frequency.  |
| 49       | LOW_FLOW_CUTOFF        | When flow rate is less than this entered value, flow rate output will be set to 0.0 flow.  |
| 50       | DETAILED_STATUS        | Detailed Status: Provides information on error/status conditions in the transducer block. For information about how DETAILED_STATUS affects Field Diagnostic Alerts see <a href="#">Table C-8</a>  |
| 51       | CALIBRATION_STATUS     | Calibration Status: Provides information on calibration (digital, auto and universal) error/status conditions in the transducer block.   |
| 52       | CONTINUOUS_MV_RESULTS  | Continuous MV Results: Result values from the continuous meter verification.   |
|          | INTERNAL_SIM_VALUE     | Internal Sim Value: Continuous Internal Flow Simulator Measurement.  |
|          | INTERNAL_SIM_DEVIATION | Internal Sim Deviation: Continuous meter verification Internal Flow Simulator Deviation from reference.  |
|          | COIL_INDUCT_VALUE      | Coil Induct Value: Continuous meter verification coil inductance measurement. (MB: COIL_INDUCT_CONT_VALUE).  |
|          | COIL_INDUCT_DEVIATION  | Coil Induct Deviation: Continuous meter verification coil Inductance deviation from reference.   |
|          | COIL_RESIST_VALUE      | Coil Resist Value: Continuous meter verification coil resistance measurement.  |
|          | ELECTRODE_RESIST_VALUE | Electrode Resist Val: Continuous meter verification electrode resistance measurement.  |
| 53       | LOI_CONFIGURATION      | LOI/Display Configuration: Parameters needed to configure the LOI/Display display.   |
|          | LANGUAGE               | Language: Selects the language to be used on the LOI/Display for status and diagnostics messages.  |
|          | PV_LOI_TIME            | PV LOI/Display Time: Time in seconds for which the LOI/Display should show the value of volume flow. 0 indicates that the volume flow shall not be displayed on the LOI/Display. If all the LOI/Display display timings in this LOI/Display configuration record are also 0, then the LOI/Display shall show only volume flow value. |

**Table C-2: Device specific parameters (continued)**

| TB Index | Parameter Name           | Description  |
|----------|--------------------------|--|
|          | TA_LOI_TIME              | TA LOI/Display Time: Time in seconds for which the LOI/Display should show the value of totalizer A. 0 indicates that the totalizer A shall not be displayed on the LOI/Display.                             |
|          | TB_LOI_TIME              | TB LOI/Display Time: Time in seconds for which the LOI/Display should show the value of totalizer B. 0 indicates that the totalizer B shall not be displayed on the LOI/Display.                             |
|          | TC_LOI_TIME              | TC LOI/Display Time: Time in seconds for which the LOI/Display should show the value of totalizer C. 0 indicates that the totalizer C shall not be displayed on the LOI/Display.                             |
|          | BACKLIGHT                | Backlight: The keys on the FF version of the transmitter are disabled so the backlight will only have the option of being on or off.   |
| 54       | EP_TRIG_COUNTS           | Number of EP measurements that must be above the trigger level to set empty pipe.  |
| 55       | EP_TRIG_LEVEL            | Empty Pipe Trigger Level.  |
| 56       | EP_VALUE                 | Value of the Empty Pipe measurement (Same scale as EP_TRIG_LEVEL).   |
| 57       | ELECT_TEMP               | Compensated electronics temperature. The ELECT_TEMP value will be in units (°C or °F) depending on whether the flow value is in Metric or English units.   |
| 58       | TEMPERATURE_UNITS        | The units will be in °C or °F, depending on whether the flow value is in Metric or English units. The user can not write directly to this parameter.   |
| 59       | DSP_SOFTWARE_REV_NUM     | DSP software Rev Number – The unsigned bit number consist of 2 parts; The Transmitter specific revision and the software revision code. Essentially a “major” and a “minor” revision number.                 |
| 60       | PERFORM_AUTO_ZERO        | Perform auto zero calibration routine.<br><br><b>Note</b><br>Writing anything but a 2 has no effect and any greater than 2 will return an error for out of range value. Reads will always return a 1 or a 2. |
| 61       | PERFORM_ELECTRONICS_TRIM | Perform input trim calibration routine.  |
| 62       | FLOW_TUBE_TAG            | Text string identifier of sensor.  |
| 63       | FLOW_TUBE_SERIAL_NUMBER  | Sensor serial number from physical tag on sensor body.   |
| 64       | LINER_MATERIAL           | Enumerated string indicating liner material of installed sensor.   |
| 65       | ELECTRODE_MATERIAL       | Enumerated string indicating electrode material of installed sensor.   |
| 66       | ELECTRODE_TYPE           | Enumerated string indicating electrode type of installed sensor.   |
| 67       | FLANGE_TYPE              | Enumerated string indicating flange type of installed sensor.  |
| 68       | FLANGE_MATERIAL          | Enumerated string indicating flange material of installed sensor.  |
| 69       | DIAG_SNR_5HZ             | Signal to Noise ratio at 5 Hz.   |
| 70       | DIAG_SNR_37HZ            | Signal to Noise ratio at 37.5 Hz.  |

Table C-2: Device specific parameters (continued)

| TB Index | Parameter Name         | Description  |
|----------|------------------------|--|
| 71       | UPDATE_IN_PROGRESS     | This parameter is used to tell when a long command, such as electronics trim, is running. This is very similar to the "Update in Progress" HART response code returned with command 48 when a long command is running.   |
| 72       | LINE_NOISE             | 50/60 Hz line noise  |
| 73       | DIAGNOSTIC_HANDLING    | On/off handling for diagnostics.<br><br><b>Note</b><br>The DD uses the defines found in the Diagnostic Conditions table and then translate those to the 16 bits that are sent to the PIC32 through the IPC write. This also happens when the bits are read from the PIC32. |
| 74       | U_FLOW_RATE            | Flow rate used in Universal Trim.  |
| 75       | REVERSE_FLOW           | Enable/disable the reading of reverse flow.  |
| 76       | PERFORM_UNIVERSAL_TRIM | Perform universal trim calibration routine.<br><br><b>Note</b><br>See Perform a Long Duration Activity for an example.   |
| 77       | SP_CONTROL             | Signal Processing Control Code.<br><br><b>Note</b><br>This parameter may change or be changed by other parameters.   |
| 78       | SP_NOISE_MODE          | Noise Mode.<br><br><b>Note</b><br>This parameter may change or be changed by other parameters.   |
| 79       | SP_NUM_SAMPS           | Signal Processing Number of Samples.<br><br><b>Note</b><br>This parameter may be changed by other parameters.  |
| 80       | SP_PERCENT_LIMIT       | Signal Processing Percent Limit.<br><br><b>Note</b><br>Stored in tenths of percent as a U16 on the DSP. This parameter may be changed by other parameters.   |
| 81       | SP_TIME_LIMIT          | Signal Processing Time Limit.<br><br><b>Note</b><br>Stored in tenths of a second as a U16 on the DSP. This parameter may be changed by other parameters.   |
| 82       | LICENSE_KEY            | Key/password to enable diagnostic features. Any changes to the licensing will be shown in the LICENSE_STATUS parameter.  |

**Table C-2: Device specific parameters (continued)**

| TB Index | Parameter Name            | Description  |
|----------|---------------------------|--|
| 83       | LICENSE_STATUS            | Bit mask that shows which diagnostics are licensed. Parameter is writable in the factory.<br><br><b>Note</b><br>The license status can be written directly via the factory info parameters.              |
| 84       | CONT_METER_VERIFY_LIMIT   | Test Limit Percentage for Continuous Flowmeter Verification Tests. This parameter's Valid Values depend on the value of XMTR_MODE.   |
| 85       | CONT_METER_VERIFY_ENABLE  | Cont Meter Verify Enable: Enable Continuous Flowmeter Verification. Individual meter verification can be enabled.  |
| 86       | METER_VERIF_TEST_SCOPE    | Scope of the Flowmeter Verification Test.<br><br><b>Note</b><br>This parameter needs to be configured before the Meter Verification is started via the PERFORM_METER_VERIFY parameter.                   |
| 87       | METER_VERIF_TEST_COND_IN  | Incoming Test Condition of the Flowmeter Verification Test.<br><br><b>Note</b><br>This parameter needs to be configured before the Meter Verification is started via the PERFORM_METER_VERIFY parameter. |
| 88       | METER_VERIF_TEST_COND_OUT | Actual Test Condition of the Flowmeter Verification Test   |
| 89       | METER_VERIF_CRITERIA      | Test limits that the Flowmeter Verification Test was ran against.  |
| 90       | METER_VERIF_RESULT        | Flowmeter Verification Test summary result.  |
| 91       | COIL_RESIST_RESULT        | Coil Resistance Test Result, part of the Flowmeter Verification Test.  |
| 92       | COIL_INDUCT_RESULT        | Coil Inductance Test Result, part of the Flowmeter Verification Test.  |
| 93       | ELECT_RESIST_RESULT       | Electrode Resistance Test Result, part of the Flowmeter Verification Test.   |
| 94       | INT_SIM_RESULT            | Internal Simulator Test Result, part of the Flowmeter Verification Test.   |
| 95       | CLEAR_FINGERPRINT_VALUES  | Perform the Clear Fingerprint Values command. Do not use.  |
| 96       | COIL_INDUCT_VALUE         | Coil Inductance value.   |
| 97       | COIL_INDUCT_DEVIATION     | Coil Inductance Deviation.   |
| 98       | COIL_INDUCT_FINGERPRINT   | Coil Inductance Fingerprint. Read only.  |
| 99       | COIL_RESIST_VALUE         | Coil Resistance value.   |
| 100      | COIL_RESIST_FINGERPRINT   | Coil Resistance Fingerprint. Read only.  |
| 101      | ELECT_RESIST_VALUE        | Electrode Resistance value.  |
| 102      | ELECT_RESIST_FINGERPRINT  | Electrode Resistance Fingerprint. Read only.   |
| 103      | INT_SIM_DEVIATION         | The internal flow simulator reading as a percent deviation from the reference value.   |

**Table C-2: Device specific parameters (continued)**

| TB Index | Parameter Name                 | Description   |
|----------|--------------------------------|---|
| 104      | INT_SIM_REF_VALUE              | Internal Flow Simulator Reference Value.  |
| 105      | INT_SIM_VALUE                  | The internal flow simulator reading.  |
| 106      | METER_VERIF_EP_LIM             | Flowmeter Verification Limit – Empty Pipe condition.  |
| 107      | METER_VERIF_FLOWING_LIM        | Flowmeter Verification Limit – Flowing condition.   |
| 108      | METER_VERIF_NO_FLOW_LIM        | Flowmeter Verification Limit – No Flow condition.   |
| 109      | RECALL_FINGERPRINT_VALUES      | Perform a recall of the previous fingerprint values.  |
| 110      | PERFORM_REFINGERPRINT_FLOWTUBE | Perform the re-fingerprint command.<br><b>Note</b><br>The parameter FINGERPRINT_SELECT needs to be configured before the Refingerprint operation is started.                                      |
| 111      | PERFORM_METER_VERIFY           | Perform the meter verification command.<br><b>Note</b><br>The parameter METER_VERIF_TEST_SCOPE and METER_VERIF_TEST_COND_IN needs to be configured before the Refingerprint operation is started. |
| 112      | FINGERPRINT_SELECT             | Components to re-fingerprint.<br><b>Note</b><br>This parameter needs to be configured before the Refingerprint operation is started via the PERFORM_REFINGERPRINT_FLOWTUBE parameter.             |
| 113      | COIL_CURRENT_VALUE             | Coil Current Value: Coil current measurement.   |
| 114      | 37HZ_AUTOZERO_OFFSET           | 37Hz Auto Zero Offset: Auto Zero Offset at 37.5 Hz  |
| 115      | SERIAL_NUMBER                  | This parameter reads directly from Resource Block parameter OUTPUT_BOARD_SN.  |

**Block/transducer errors**

The BLOCK\_ERR conditions are listed in the table below. The XD\_ERROR conditions are listed in [Table C-3](#).

**Table C-3: BLOCK\_ERR conditions**

| Condition number | Condition name and description                |
|------------------|---|
| 3                | Simulate active                               |
| 6                | Device needs maintenance soon                 |
| 7                | Input failure/process variable has bad status |
| 13               | Device needs maintenance now                  |
| 14               | Power up: the device was just powered up      |

**Table C-4: XD\_ERR conditions**

| Condition number | Condition name and description  |
|------------------|---|
| 15               | Out of Service: The actual mode is out of service.  |
| 16               | Unspecified error: An unidentified error occurred.  |
| 17               | General Error: A general error that cannot be specified below occurred.   |
| 18               | Calibration Error: An error occurred during calibration of the device, or a calibration error was detected during normal operations.                      |
| 19               | Configuration Error: An error occurred during configuration of the device, or a configuration error was detected during normal operations.                |
| 20               | Electronics Failure: An electrical component failed.  |
| 21               | Mechanical Failure: A mechanical component failed.  |
| 22               | I/O Failure: An I/O failure occurred.   |
| 23               | Data Integrity Error: Data stored in the device are no longer valid due to a nonvolatile memory checksum failure, a data verify after write failure, etc. |
| 24               | Software Error: The software has detected an error due to an improper interrupt service routine, an arithmetic overflow, a watchdog time-out, etc.        |
| 25               | Algorithm Error: The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.                          |

**Flow-specific block configuration values**

Once the transmitter is installed and communication is established, configuration must be completed. Three parameters must be entered for proper configuration:

- Sensor calibration number
- Engineering units (configured via AI block)
- Sensor size

The sensor calibration number can be found on the sensor nameplate. A list of all possible sensor sizes and engineering units are listed in [Table C-5](#) and [Table C-6](#), respectively. Mass units (lb, kg, ton, and ston) require configuration of the DENSITY\_VALUE.

**Table C-5: Supported line sizes**

| Fieldbus code | Line size         | Fieldbus code | Line size         |
|---------------|-------------------|---------------|-------------------|
| 1             | 0.1 inch (3 mm)   | 20            | 18 inch (450 mm)  |
| 2             | 0.15 inch (4 mm)  | 21            | 20 inch (500 mm)  |
| 3             | 0.25 inch (6 mm)  | 22            | 24 inch (600 mm)  |
| 4             | 0.3 in (8 mm)     | 23            | 28 inch (700 mm)  |
| 5             | 0.5 inch (15 mm)  | 24            | 30 inch (750 mm)  |
| 6             | 0.75 inch (20 mm) | 25            | 32 inch (800 mm)  |
| 7             | 1 inch (25 mm)    | 26            | 36 inch (900 mm)  |
| 8             | 1.5 inch (40 mm)  | 27            | 40 inch (1000 mm) |

**Table C-5: Supported line sizes (continued)**

| Fieldbus code | Line size        | Fieldbus code | Line size         |
|---------------|------------------|---------------|-------------------|
| 9             | 2 inch (50 mm)   | 28            | 42 inch (1050 mm) |
| 10            | 2.5 inch (65 mm) | 29            | 44 inch (1100 mm) |
| 11            | 3 inch (80 mm)   | 30            | 48 inch (1200 mm) |
| 12            | 4 inch (100 mm)  | 31            | 54 inch (1350 mm) |
| 13            | 5 inch (125 mm)  | 32            | 56 inch (1400 mm) |
| 14            | 6 inch (150 mm)  | 33            | 60 inch (1500 mm) |
| 15            | 8 inch (200 mm)  | 34            | 64 inch (1600 mm) |
| 16            | 10 inch (250 mm) | 35            | 66 inch (1660 mm) |
| 17            | 12 inch (300 mm) | 36            | 72 inch (1800 mm) |
| 18            | 14 inch (350 mm) | 37            | 78 inch (1950 mm) |
| 19            | 16 inch (400 mm) | 38            | 80 inch (2000 mm) |

**Table C-6: Engineering units for PRIMARY\_VALUE, PRIMARY\_VALUE\_RANGE, SENSOR\_RANGE, LOW\_FLOW\_CUTOFF**

| Fieldbus code | Unit              | Fieldbus code | Unit                  |
|---------------|-------------------|---------------|-----------------------|
| 1362          | US gallons/sec    | 1369          | imperial gallons/hr   |
| 1363          | US gallons/min    | 1370          | imperial gallons/d    |
| 1364          | US gallons/hr     | 1511          | cubic centimeters/sec |
| 1365          | US gallons/d      | 1512          | cubic centimeters/min |
| 1366          | Mega US gallons/d | 1513          | cubic centimeters/hr  |
| 1351          | liters/sec        | 1514          | cubic centimeters/d   |
| 1352          | liters/min        | 1067          | ft/sec                |
| 1353          | liters/hr         | 1070          | ft/min                |
| 1354          | liters/day        | 1073          | ft/hr                 |
| 1347          | cubic meters/sec  | 1061          | meters/sec            |
| 1348          | cubic meters/min  | 1063          | meters/hour           |
| 1349          | cubic meters/hr   | 1330          | Pounds/second         |
| 1350          | cubic meters/d    | 1331          | Pounds/minute         |
| 1356          | cubic ft/sec      | 1332          | Pounds/hour           |
| 1357          | cubic ft/min      | 1333          | Pounds/day            |
| 1358          | cubic ft/hr       | 1334          | Short tons/second     |
| 1359          | cubic ft/d        | 1335          | Short tons/minute     |
| 1371          | barrels/sec       | 1336          | Short tons/hour       |
| 1372          | barrels/min       | 1337          | Short tons/day        |

**Table C-6: Engineering units for PRIMARY\_VALUE, PRIMARY\_VALUE\_RANGE, SENSOR\_RANGE, LOW\_FLOW\_CUTOFF (continued)**

| Fieldbus code | Unit                  | Fieldbus code | Unit               |
|---------------|-----------------------|---------------|--------------------|
| 1373          | barrels/hr            | 1322          | Kilograms/second   |
| 1374          | barrels/day           | 1323          | Kilograms/minute   |
| 1634          | barrels (US Beer)/sec | 1324          | Kilograms/hour     |
| 1633          | barrels (US Beer)/min | 1325          | Kilograms/day      |
| 1632          | barrels (US Beer)/hr  | 1326          | Metric tons/second |
| 1631          | barrels (US Beer)/d   | 1327          | Metric tons/minute |
| 1367          | imperial gallons/sec  | 1328          | Metric tons/hour   |
| 1368          | imperial gallons/min  | 1329          | Metric tons/day    |

**Table C-7: Engineering units for TOTAL\_A\_VALUE, TOTAL\_B\_VALUE, TOTAL\_C\_VALUE, PULSE\_CONFIGURATION: FACTOR\_UNITS**

| Fieldbus code | Unit         | Fieldbus code | Unit              |
|---------------|--------------|---------------|-------------------|
| 1048          | US gallons   | 1052          | barrels (US Beer) |
| 1667          | Megagallons  | 1049          | imperial gallons  |
| 1038          | liters       | 1036          | cubic centimeters |
| 1034          | cubic meters | 1094          | Pounds            |
| 1043          | cubic ft     | 1095          | Short tons        |
| 1018          | feet         | 1088          | Kilograms         |
| 1010          | meters       | 1092          | Metric tons       |
| 1051          | barrels      |               |                   |

### Diagnostics

In addition to the BLOCK\_ERR and XD\_ERROR parameters, more detailed information on the measurement status can be obtained through the TB\_ELECTRONICS\_STATUS. lists the potential errors and the possible corrective actions for the given values.

**Table C-8: Diagnostics**

| XMTR STATUS REG            | Description                                 | Local display error message |
|----------------------------|---|-----------------------------|
| NA                         | Fieldbus Processor Not Communicating        | NA                          |
|                            | Transducer Block Out of Service             | Out of Service              |
| IPC_IDX_U16_DSP_SW_REV_NUM | PIC32 Hardware not compatible with software | Incompatible SW             |
| [2] bit 8                  | Electronics Failure                         | Elect Failure               |
| [0] bit 14                 | Coil Drive Current is Zero                  | Coil Open Ckt               |
| [0] bit 1                  | Empty Pipe Detected                         | Empty Pipe                  |

**Table C-8: Diagnostics (continued)**

| <b>XMTR STATUS REG</b> | <b>Description</b>                   | <b>Local display error message</b>                      |
|------------------------|--------------------------------------|---|
| [2] bit 13             | Electrode Resistance Error           | Elect Resist Err  |
| [2] bit 10             | Coil Inductance Error                | Coil Induct Err   |
| [0] bit 0              | Sensor Out of Range                  | Flow > Sens limit                                       |
| Hornet detects         | Sensor Processor Not Communicating   | Sensor Comm Err   |
| [2] bit 9              | Coil Resistance Error                | Coil Resist Err   |
| [0] bit 15             | Reverse Flow Rate Detected           | Flashing "R" on LOI/Display if Reverse Flow is disabled |
| [1] bit 15             | Electronics Temperature Out of Range | Temp out of range                                       |
| [0] bit 12             | Continuous Meter Verification Error  | Meter Verify Err  |
| [0] bit 3              | Pulse Output, Out of Range           | Pulse out of range                                      |
| [1] bit 14             | High Process Noise                   | Hi Process Noise  |
| [2] bit 12             | Reverse Flow Detected                | Flashing "R" on LOI/Display if reverse flow is enabled  |
| [1] bit 13             | Grounding/Wiring Fault               | Grnd/Wire Fault   |
| [0] bit 7              | Pulse Output Fixed                   | Pulse Out Fixed   |
| [1] bit 0              | Internal Flow Simulation Test Error  | Int Flow Sim Err  |
| [1] bit 8              | Electrode Coated Limit 1             | Elec Coat 1   |
| [1] bit 9              | Electrode Coated Limit 2             | Elec Coat 2   |
| [2] bit 5              | Coil Over Current Detected           | Coil Over Curr  |
| [2] bit 6              | Sensor Electrode Saturated           | Sensr Elec Sat  |
| [2] bit 7              | Coil Power Limit                     | Coil Power Lim  |

**Table C-9: Calibration conditions**

| <b>XMTR STATUS REG</b> | <b>Description</b>                         | <b>Local Display Error Message</b> |
|------------------------|--|------------------------------------|
| [2] bit 11             | Digital Trim Failure                       | Dig Trim Failure                   |
| [2] bit 14             | Auto Zero Failure                          | Auto Zero Fail                     |
| [1] bit 5              | Universal Trim Failure                     | Auto Trim Fail                     |
| [1] bit 1              | Excess Auto Zero Correction, ZR too Low    |                                    |
| [1] bit 2              | Excess Auto Zero Correction, ZR too High   |                                    |
| [1] bit 3              | Auto Zero attempt with nonzero flow.       |                                    |
| [1] bit 10             | Excess Calibration Correction, GN too Low  |                                    |
| [1] bit 11             | Excess Calibration Correction, GN too High |                                    |

**Table C-9: Calibration conditions (continued)**

| XMTR STATUS REG | Description                            | Local Display Error Message |
|-----------------|--|-----------------------------|
| [1] bit 12      | Calibration Attempt Without Calibrator |                             |

### Modes

The resource block supports two modes of operation as defined by the MODE\_BLK parameter:

- Automatic (Auto)**      The block is processing its normal background memory checks.
- Out of Service (O/S)**      The block is not processed. Channel outputs are not updated and the status is set to BAD: OUT OF SERVICE for each channel. The BLOCK\_ERR parameter shows OUT OF SERVICE. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

### Alarm detection

Alarms are not generated by the transducer block. By correctly handling the status of the channel values, the down stream block (AI) will generate the necessary alarms for the measurement. The error that generated this alarm can be determined by looking at BLOCK\_ERR and XD\_ERROR.

### Status handling

Normally, the status of the output channels reflects the status of the measurement value, the operating condition of the measurement electronics card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the output channels.

### Troubleshooting

**Table C-10: Troubleshooting**

| Symptom                 | Possible causes     | Corrective action  |
|-------------------------|---------------------|--|
| Mode will not leave OOS | Target mode not set | Set target mode to something other than OOS.                                       |
|                         | Resource block      | The actual mode of the resource block is OOS. See <a href="#">Resource block</a> . |
| PV or SV is BAD         | Measurement         | See <a href="#">Table C-8</a> .  |
|                         |                     | Flow is above SENSOR_RANGE.EU1.  |
| PV or SV is UNCERTAIN   | Measurement         | Flow is above PRIMARY_VALUE_RANGE.EU100.   |

# D Resource block

This section contains information on the resource block. Descriptions of all resource block parameters, errors, and diagnostics are included. Also, the modes, alarm detection, status handling, virtual communication relationships (VCRs), and troubleshooting are discussed.

## Definition

The resource block defines the physical resources of the device, such as measurement and memory. The resource block also handles functionality, such as shed times, that is common across multiple blocks. The block has no linkable inputs or outputs, and it performs memory-level diagnostics.

## Parameters and descriptions

The following table lists all of the configurable parameters of the resource block, including the descriptions and index numbers for each parameter. Newer software revisions have added functionality and some index numbers have changed. To determine the software revision of a transmitter, check the parameter SOFTWARE\_REVISION\_MAJOR. The most recent transmitters have a label on the electronic board stack. Seven views are defined for the resource block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes. Many of the parameters are common to all fieldbus devices. Definitions for these parameters are available in the referenced fieldbus specification.

**Table D-1: Resource block parameters and views**

| Index | Parameter | View |   |   |     |   |     |     | Description   |
|-------|-----------|------|---|---|-----|---|-----|-----|---|
|       |           | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |   |
| 1     | ST_REV    | 2    | 2 | 2 | 2   | 2 | 2   | 2   | The revision level of the static data associated with the function block.   |
| 2     | TAG_DESC  |      |   |   |     |   |     |     | The user description of the intended application of the block.  |
| 3     | STRATEGY  |      |   |   |     | 2 |     |     | The strategy field can be used to identify grouping of blocks.  |
| 4     | ALERT_KEY |      |   |   |     | 1 |     |     | The identification number of the plant unit.  |
| 5     | MODE_BLK  | 4    |   | 4 |     |   |     |     | The actual, target, permitted, and normal modes of the block.<br><br><b>Note</b><br>When Acutal is O/S the Acutal mode of all other blocks will be changed to O/S.              |
| 6     | BLOCK_ERR | 2    |   | 2 |     |   |     |     | This parameter reflects the error status associated with the hardware or software components associated with a block. it is a bit string, so that multiple errors may be shown. |
| 7     | RS_STATE  | 1    |   | 1 |     |   |     |     | State of the function block application state machine.  |

Table D-1: Resource block parameters and views (continued)

| Index | Parameter   | View |   |   |     |   |     |     | Description   |
|-------|-------------|------|---|---|-----|---|-----|-----|---|
|       |             | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |   |
| 8     | TEST_RW     |      |   |   |     |   |     |     | Read/write test parameter - used only for conformance testing.  |
| 9     | DD_RESOURCE |      |   |   |     |   |     |     | String identifying the tag of the resource which contains the Device Description for the resource.  |
| 10    | MANUFAC_ID  |      |   |   |     | 4 |     |     | Manufacturer identification number - used by an interface device to locate the DD file for the resource.  |
| 11    | DEV_TYPE    |      |   |   |     | 2 |     |     | Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.                    |
| 12    | DEV_REV     |      |   |   |     | 1 |     |     | Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.                 |
| 13    | DD_REV[1]   |      |   |   |     | 1 |     |     | Revision of the DD associated with the resource - used by the interface device to locate the DD file for the resource.                          |
| 14    | GRANT_DENY  |      | 2 |   |     |   |     |     | Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.                |
| 15    | HARD_TYPES  |      |   |   |     | 2 |     |     | The types of hardware available as channel numbers. The supported hardware types are: SCALAR_INPUT  |
| 16    | RESTART     |      |   |   |     |   |     |     | Allows a manual restart to be initiated.<br>Note: Setting Restart to 4 will also restart the DSP.   |
| 17    | FEATURES    |      |   |   |     | 2 |     |     | Used to show supported resource block options.  |
| 18    | FEATURE_SEL |      | 2 |   |     |   |     |     | Used to select resource block options.  |
| 19    | CYCLE_TYPE  |      |   |   |     | 2 |     |     | Identifies the block execution methods available for this resource. The supported cycle types are: SCHEDULED, and COMPLETION_OF_BLOCK_EXECUTION |
| 20    | CYCLE_SEL   |      | 2 |   |     |   |     |     | Used to select the block execution method for this resource.  |
| 21    | MIN_CYCLE_T |      |   |   |     | 4 |     |     | Time duration of the shortest cycle interval of which the resource is capable.  |
| 22    | MEMORY_SIZE |      |   |   |     | 2 |     |     | Available configuration memory in the empty resource. To be checked before attempting a download.   |

Table D-1: Resource block parameters and views (continued)

| Index | Parameter    | View |   |   |     |   |     |     | Description   |
|-------|--------------|------|---|---|-----|---|-----|-----|---|
|       |              | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |   |
| 23    | NV_CYCLE_T   |      | 4 |   |     |   |     |     | Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. Zero means it will never be automatically copied. At the end of NV_CYCLE_T, only those parameters which have changed need to be updated in NVRAM. |
| 24    | FREE_SPACE   |      | 4 |   |     |   |     |     | Percent of memory available for further configuration. Zero in preconfigured resource.  |
| 25    | FREE_TIME    | 4    |   | 4 |     |   |     |     | Percent of the block processing time that is free to process additional blocks.   |
| 26    | SHED_RCAS    |      | 4 |   |     |   |     |     | Time duration at which to give up on computer writes to function block RCAs locations. Shed from RCAs will never happen when SHED_RCAS = 0.   |
| 27    | SHED_ROUT    |      | 4 |   |     |   |     |     | Time duration at which to give up on computer writes to function block ROut locations. Shed from ROut will never happen when SHED_ROUT = 0.   |
| 28    | FAULT_STATE  | 1    |   | 1 |     |   |     |     | Condition set by loss of communication to an output block, fault promoted to an output block or a physical contact. When Fault State condition is set, then output function blocks will perform their FSTATE actions.   |
| 29    | SET_FSTATE   |      |   |   |     |   |     |     | Allows the Fault State condition to be manually initiated by selecting Set.   |
| 30    | CLR_FSTATE   |      |   |   |     |   |     |     | Writing a Clear to this parameter will clear the device fault state if the field condition, if any, has cleared.  |
| 31    | MAX_NOTIFY   |      |   |   |     | 1 |     |     | Maximum number of unconfirmed notify messages possible.   |
| 32    | LIM_NOTIFY   |      | 1 |   |     |   |     |     | Maximum number of unconfirmed alert notify messages allowed.  |
| 33    | CONFIRM_TIME |      | 4 |   |     |   |     |     | The time the resource will wait for confirmation of receipt of a report before trying again. Retry will not happen when CONFIRM_TIME=0.   |
| 34    | WRITE_LOCK   |      | 1 |   |     |   |     |     | If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.  |
| 35    | UPDATE_EVT   |      |   |   |     |   |     |     | This alert is generated by any change to the static data.   |

Table D-1: Resource block parameters and views (continued)

| Index | Parameter         | View |   |   |     |   |     |     | Description   |
|-------|-------------------|------|---|---|-----|---|-----|-----|---|
|       |                   | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |   |
| 36    | BLOCK_ALM         |      |   |   |     |   |     |     | The BLOCK_ALM is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the sub code field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the sub code has changed. |
| 37    | ALARM_SUM         | 8    |   | 8 |     |   |     |     | The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.   |
| 38    | ACK_OPTION        |      |   |   |     | 2 |     |     | Selection of whether alarms associated with the block will be automatically acknowledged.   |
| 39    | WRITE_PRI         |      |   |   |     | 1 |     |     | Priority of the alarm generated by clearing the write lock.   |
| 40    | WRITE_ALM         |      |   |   |     |   |     |     | This alert is generated if the write lock parameter is cleared.   |
| 41    | ITK_VER           |      |   |   |     | 2 |     |     | Major revision number of the interoperability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus Foundation.  |
| 42    | FD_VER            |      |   |   |     | 2 |     |     | Major version of the Field Diagnostics specification for this device revision   |
| 43    | FD_FAIL_ACTIVE    | 4    |   | 4 |     |   |     |     | This parameter reflects the error conditions that are being detected as active for FD_FAIL category. It is a bit string, so that multiple conditions may be shown.  |
| 44    | FD_OFFSPEC_ACTIVE | 4    |   | 4 |     |   |     |     | This parameter reflects the error conditions that are being detected as active for FD_OFFSPEC category. It is a bit string, so that multiple conditions may be shown.   |
| 45    | FD_MAINT_ACTIVE   | 4    |   | 4 |     |   |     |     | This parameter reflects the error conditions that are being detected as active for FD_MAINT category. It is a bit string, so that multiple conditions may be shown  |
| 46    | FD_CHECK_ACTIVE   | 4    |   | 4 |     |   |     |     | This parameter reflects the error conditions that are being detected as active for FD_CHECK category. It is a bit string, so that multiple conditions may be shown  |
| 47    | FD_FAIL_MAP       |      |   |   |     | 4 |     |     | This parameter maps conditions to be detected as active for FD_FAIL alarm category.   |

Table D-1: Resource block parameters and views (continued)

| Index | Parameter       | View |   |   |     |   |     |     | Description  |
|-------|-----------------|------|---|---|-----|---|-----|-----|--|
|       |                 | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |  |
| 48    | FD_OFFSPEC_MAP  |      |   |   |     | 4 |     |     | This parameter maps conditions to be detected as active for FD_OFFSPEC alarm category.   |
| 49    | FD_MAINT_MAP    |      |   |   |     | 4 |     |     | This parameter maps conditions to be detected as active for FD_MAINT alarm category.   |
| 50    | FD_CHECK_MAP    |      |   |   |     | 4 |     |     | This parameter maps conditions to be detected as active for FD_CHECK alarm category.   |
| 51    | FD_FAIL_MASK    |      |   |   |     | 4 |     |     | This parameter allows the user to suppress any single or multiple conditions that are active in FD_FAIL category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask, i.e., inhibit the broadcast of a condition, and a bit equal to '0' will unmask, i.e., allow broadcast of a condition.    |
| 52    | FD_OFFSPEC_MASK |      |   |   |     | 4 |     |     | This parameter allows the user to suppress any single or multiple conditions that are active in FD_OFFSPEC category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask, i.e., inhibit the broadcast of a condition, and a bit equal to '0' will unmask, i.e., allow broadcast of a condition. |
| 53    | FD_MAINT_MASK   |      |   |   |     | 4 |     |     | This parameter allows the user to suppress any single or multiple conditions that are active in FD_MAINT category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask, i.e., inhibit the broadcast of a condition, and a bit equal to '0' will unmask, i.e., allow broadcast of a condition.   |
| 54    | FD_CHECK_MASK   |      |   |   |     | 4 |     |     | This parameter allows the user to suppress any single or multiple conditions that are active in FD_CHECK category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask, i.e., inhibit the broadcast of a condition, and a bit equal to '0' will unmask, i.e., allow broadcast of a condition.   |
| 55    | FD_FAIL_ALM     |      |   |   |     |   |     |     | This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.  |
| 56    | FD_OFFSPEC_ALM  |      |   |   |     |   |     |     | This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.  |
| 57    | FD_MAINT_ALM    |      |   |   |     |   |     |     | This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.  |

**Table D-1: Resource block parameters and views (continued)**

| Index | Parameter          | View |   |   |     |   |     |     | Description  |
|-------|--------------------|------|---|---|-----|---|-----|-----|--|
|       |                    | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |  |
| 58    | FD_CHECK_ALM       |      |   |   |     |   |     |     | This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.  |
| 59    | FD_FAIL_PRI        |      |   |   |     | 1 |     |     | This parameter allows the user to specify the priority of FD_FAIL alarm  |
| 60    | FD_OFFSPEC_PRI     |      |   |   |     | 1 |     |     | This parameter allows the user to specify the priority of FD_OFFSPEC alarm   |
| 61    | FD_MAINT_PRI       |      |   |   |     | 1 |     |     | This parameter allows the user to specify the priority of FD_MAINT alarm   |
| 62    | FD_CHECK_PRI       |      |   |   |     | 1 |     |     | This parameter allows the user to specify the priority of FD_CHECK alarm.  |
| 63    | FD_SIMULATE        |      |   | 9 |     |   |     |     | This parameter allows the conditions to be manually supplied when simulation is enabled. When simulation is disabled both the diagnostic simulate value and the diagnostic value track the actual conditions. The simulate jumper is required for simulation to be enabled and while simulation is enabled the recommended action will show that simulation is active. |
| 64    | FD_RECOMMEN_ACT    | 2    |   | 2 |     |   |     |     | This parameter is a device enumerated summarization of the most severe condition or conditions detected.   |
| 65    | FD_EXTENDED_ACTIVE | 4    |   | 4 |     |   |     |     | An optional parameter to allow the user finer detail on conditions causing an active condition in the FD_*_ACTIVE parameters.  |
| 66    | FD_EXTENDED_MAP    |      |   |   |     | 4 |     |     | An optional parameter to allow the user finer control on enabling conditions contributing to the conditions in FD_*_ACTIVE parameters.   |
| 67    | COMPATIBILITY_REV  |      |   |   |     |   |     |     | This parameter is used when replacing field devices. The correct value of this parameter is the DEV_REV value of the replaced device.  |
| 68    | HARDWARE_REVISION  |      |   |   |     |   |     |     | Hardware revision of the device  |
| 69    | SOFTWARE_REV       |      |   |   |     |   |     |     | Software revision of the firmware  |
| 70    | PD_TAG             |      |   |   |     |   | 32  |     | PD tag description of device.  |
| 71    | DEV_STRING         |      |   |   |     |   | 32  |     | This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.  |
| 72    | DEV_OPTIONS        |      |   |   |     |   | 4   |     | Indicates which miscellaneous device licensing options are enabled.  |
| 73    | OUTPUT_BOARD_SN    |      |   |   |     |   | 4   |     | Output board serial number.  |

Table D-1: Resource block parameters and views (continued)

| Index | Parameter          | View |   |   |     |   |     |     | Description  |
|-------|--------------------|------|---|---|-----|---|-----|-----|--|
|       |                    | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |  |
| 74    | FINAL_ASSY_NUM     |      |   |   |     |   | 4   |     | The same final assembly number placed on the neck label.   |
| 75    | DOWNLOAD_MODE      |      |   |   |     |   |     |     | Gives access to the boot block code for downloading new firmware image to device   |
| 76    | HEALTH_INDEX       |      |   | 1 |     |   |     |     | Parameter representing the overall health of the device, 100 being perfect.  |
| 77    | CAPABILITY_LEV     |      |   |   |     |   |     | 1   | This parameter may be included in a device to indicate the capability level supported by a device.   |
| 78    | FAILED_PRI         |      |   |   |     |   |     | 1   | Designates the alarming priority of the PWA FAILED_ALM and also used as switch b/w FD and legacy PWA. If value is greater than or equal to 1 then PWA alerts will be active in device else device will have FD alerts. |
| 79    | RECOMMENDED_ACTION |      |   |   | 2   |   |     |     | Enumerated list of recommended actions displayed with a device alert.  |
| 80    | FAILED_ALM         |      |   |   |     |   |     |     | Alarm indicating a failure within a device which makes the device non-operational.   |
| 81    | MAINT_ALM          |      |   |   |     |   |     |     | Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.  |
| 82    | ADVISE_ALM         |      |   |   |     |   |     |     | Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.   |
| 83    | FAILED_ENABLE      |      |   |   |     |   |     | 4   | Alarm enable parameter for PWA FAILED_ALM. This parameter is the Read Only copy of FD_FAIL_MAP.  |
| 84    | FAILED_MASK        |      |   |   |     |   |     | 4   | Mask parameter for PWA FAILED_ALM. This parameter is the Read Only copy of FD_FAIL_MASK.   |
| 85    | FAILED_ACTIVE      |      |   |   | 4   |   |     |     | Enumerated list of failed conditions within a device.<br>This parameter is the Read Only copy of FD_FAIL_ACTIVE.   |
| 86    | MAINT_PRI          |      |   |   |     |   |     | 1   | Designates the alarm priority of the PWA MAINT_ALM.  |
| 87    | MAINT_ENABLE       |      |   |   |     |   |     | 4   | Alarm enable parameter for PWA MAINT_ALM.. This parameter is the Read Only copy of FD_OFFSPEC_MAP  |
| 88    | MAINT_MASK         |      |   |   |     |   |     | 4   | Mask parameter for PWA MAINT_ALM. This parameter is the Read Only copy of FD_OFFSPEC_MASK  |

**Table D-1: Resource block parameters and views (continued)**

| Index | Parameter     | View |   |   |     |   |     |     | Description  |
|-------|---------------|------|---|---|-----|---|-----|-----|--|
|       |               | 1    | 2 | 3 | 3_1 | 4 | 4_1 | 4_2 |  |
| 89    | MAINT_ACTIVE  |      |   |   | 4   |   |     |     | Enumerated list of maintenance needed conditions within a device.<br>This parameter is the Read Only copy of FD_OFFSPEC_ACTIVE       |
| 90    | ADVISE_PRI    |      |   |   |     |   |     | 1   | Designates the alarm priority of the PWA ADVISE_ALM.   |
| 91    | ADVISE_ENABLE |      |   |   |     |   |     | 4   | Alarm enable parameter for PWA ADVISE_ALM.<br>This parameter is the Read Only copy of FD_MAINT_MAP & FD_CHECK_MAP                    |
| 92    | ADVISE_MASK   |      |   |   |     |   |     | 4   | Mask parameter for PWA ADVISE_ALM.<br>This parameter is the Read Only copy of FD_MAINT_MASK & FD_CHECK_MASK                          |
| 93    | ADVISE_ACTIVE |      |   |   | 4   |   |     |     | Enumerated list of advisory conditions within a device.<br>This parameter is the Read Only copy of FD_MAINT_ACTIVE & FD_CHECK_ACTIVE |

### Resource block errors

The following table lists conditions that can be reported in the BLOCK\_ERR parameter.

**Table D-2: Resource BLOCK\_ERR conditions**

| Number | Name                      | Description   |
|--------|---------------------------|---|
| 1      | Block Configuration Error | A feature in FEATURES_SEL is set that is not supported by FEATURES or an execution cycle in CYCLE_SEL is set that is not supported by CYCLE_TYPE. |
| 2      | Link Configuration Error  | A link used in one of the function blocks is improperly configured.   |
| 3      | Simulate Active           | The simulation jumper is in place. Simulate active is not an indication that the I/O blocks are using simulated data.                             |
| 9      | Memory Failure            | A memory failure has occurred in FLASH, RAM, or EEPROM memory.  |
| 10     | Lost Static Data          | Static data that are stored in nonvolatile memory have been lost.   |
| 11     | Lost NV Data              | Nonvolatile data that are stored in nonvolatile memory have been lost.  |
| 13     |                           | Device Needs Maintenance Now  |
| 14     | Power Up                  | The device was just powered-up.   |
| 15     | Out of Service            | The actual mode is out of service.  |

### Modes

The resource block supports two modes of operation as defined by the MODE\_BLK parameter:

**Automatic (Auto)**

The block is processing its normal background memory checks.

**Out of Service (O/S)** The block is not processing its tasks. When the resource block is in O/S, all blocks within the resource (device) are forced into O/S. The BLOCK\_ERR parameter shows OUT OF SERVICE. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

### Alarm detection

A block alarm will be generated whenever the BLOCK\_ERR has an error bit set. The types of block error for the resource block are defined in Table D-2. A write alarm is generated whenever the WRITE\_LOCK parameter is cleared. The priority of the write alarm is set in the WRITE\_PRI parameter. Alarms are grouped into five levels of priority, as shown in Table D-3.

**Table D-3: Alarm priorities**

| Priority number | Priority description  |
|-----------------|---|
| 0               | The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.   |
| 1               | An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.   |
| 2               | An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts). |
| 3-7             | Alarm conditions of priority 3-7 are advisory alarms of increasing priority.  |
| 8-15            | Alarm conditions of priority 8-15 are critical alarms of increasing priority.   |

### Status handling

There are no status parameters associated with the resource block.

### VCR

The number of configurable virtual communication relationships or VCRs is 18. The parameter is not contained or viewable within the resource block, but it does apply to all blocks.

### Troubleshooting

Refer to Table D-4 to troubleshoot resource block problems.

**Table D-4: Troubleshooting**

| Symptom                 | Possible causes     | Corrective action  |
|-------------------------|---------------------|--|
| Mode will not leave OOS | Target mode not set | Set target mode to something other than OOS.   |
|                         | Memory failure      | BLOCK_ERR will show the lost NV Data or Lost Static Data bit set. Restart the device by setting RESTART to Processor. If the block error does not clear, call the factory. |

**Table D-4: Troubleshooting** *(continued)*

| Symptom                    | Possible causes | Corrective action   |
|----------------------------|-----------------|---|
| Block alarms will not work | Features        | FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.                                   |
|                            | Notification    | LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.   |
|                            | Status options  | STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur. |

# E Analog Input (AI) Function Block

This section defines the parameters of the transmitter's four Analog Input function blocks.

**Table E-1: AI block parameters**

| Index | Parameter | Available values               | Units                    | Default        | Read/write     | Description   |
|-------|-----------|--------------------------------|--------------------------|----------------|----------------|---|
| 01    | ST_REV    | Not applicable                 | None                     | 0              | Read only      | The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.  |
| 02    | TAG_DESC  | 32 text characters             | None                     | none           | Read and Write | The user description of the intended application of the block.  |
| 03    | STRATEGY  | 0 – 65535                      | None                     | 0              | Read and Write | The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.  |
| 04    | ALERT_KEY | 1– 255                         | None                     | 0              | Read and Write | The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.  |
| 05    | MODE_BLK  | Auto Manual Out of Service     | None                     | Not applicable | Read and Write | The actual, target, permitted, and normal modes of the block. Target: The mode to “ go to ” Actual: The mode the “ block is currently in ” Permitted: Allowed modes that target may take on Normal: Most common mode for target |
| 06    | BLOCK_ERR | Not applicable                 | None                     | Not applicable | Read only      | This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.   |
| 07    | PV        | Not applicable                 | Out_Scale <sup>(1)</sup> | Not applicable | Read only      | The process variable used in block execution.   |
| 08    | OUT       | Out_Scale <sup>(1)</sup> ± 10% | Out_Scale <sup>(1)</sup> | Not applicable | Read and Write | The block output value and status.  |

Table E-1: AI block parameters (continued)

| Index | Parameter       | Available values   | Units | Default   | Read/write     | Description  |
|-------|-----------------|--|-------|---|----------------|--|
| 09    | SIMULATE        | Not applicable   | None  | Disable   | Read and Write | A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.  |
| 10    | XD_SCALE        | See Table C-6.   |       | -39.37,<br>-39.37, ft/<br>sec, 2                                | Read and Write | Transducer scaling (XD_SCALE) is applied to the value from the transducer block channel to produce the FIELD_VAL. The AI Block XD_SCALE units code is used to set the units code in the Transducer Block as these unit codes must be compatible. |
| 11    | OUT_SCALE       |  |       | EU_100: 100<br>EU_0: 0<br>UNITS_INDE<br>X: 0x053E<br>DECIMAL: 0 | Read and Write | OUT_SCALE provides scaling for the AI OUT. The AI Block OUT_SCALE parameter determines the conversion of the AI Block FIELD_VAL to OUT if the L_TYPE parameter is set to Indirect.   |
| 12    | GRANT_DENY      | Program Tune<br>Alarm Local  | None  | Not applicable  | Read and Write | Normally the operator has permission to write to parameter values, but Program or Local remove that permission and give it to the host controller or a local control panel.  |
| 13    | IO_OPTS         | Low Cutoff<br>Enable/Disable   | None  | Disable   | Read and Write | Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.   |
| 14    | STATUS_OPTS     | Propagate fault forward<br>Uncertain if Limited<br>Bad if Limited<br>Uncertain if Man Mode |       | 0   | Read and Write |  |
| 15    | CHANNEL for AI1 | 1: Flow  |       | 1: Flow   | Read and Write | The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to   |
|       | CHANNEL for AI2 | 2: Totalizer A   |       | 2: Totalizer A  | Read and Write |  |

Table E-1: AI block parameters (continued)

| Index | Parameter       | Available values                            | Units                    | Default        | Read/write     | Description  |
|-------|-----------------|---|--------------------------|----------------|----------------|--|
|       | CHANNEL for AI3 | 3: Totalizer B                              |                          | 3: Totalizer B | Read and Write | be used going to or from the physical world.   |
|       | CHANNEL for AI4 | 4: Totalizer C                              |                          | 4: Totalizer C | Read and Write |  |
| 16    | L_TYPE          | 1: Direct<br>2: Indirect<br>3: Ind Sqr Root |                          | 1: Direct      | Read and Write | Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined by the transducer and the associated output range.  |
| 17    | LOW_CUT         | $\geq 0$                                    | Out_Scale <sup>(1)</sup> | 0              | Read and Write | If percentage value of transducer input fails below this, PV = 0.  |
| 18    | PV_FTIME        | $\geq 0$                                    | Seconds                  | 0              | Read and Write | The time constant of the first-order PV filter. It is the time required for a 63% change in the IN value.  |
| 19    | FIELD_VAL       | 0 – 100                                     | Percent                  | Not applicable | Read only      | The value and status from the transducer block or from the simulated input when simulation is enabled.   |
| 20    | UPDATE_EVT      | Not applicable                              | None                     | Not applicable | Read only      | This alert is generated by any change to the static data.  |
| 21    | BLOCK_ALM       | Not applicable                              | None                     | Not applicable | Read only      | The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed. |

Table E-1: AI block parameters (continued)

| Index | Parameter  | Available values                            | Units                    | Default        | Read/write     | Description  |
|-------|------------|---|--------------------------|----------------|----------------|--|
| 22    | ALARM_SUM  | Enable/Disable                              | None                     | Enable         | Read and Write | The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed. |
| 23    | ACK_OPTION | 0= Auto Ack Disabled<br>1= Auto Ack Enabled | None                     | 0 all Disabled | Read and Write | Used to set auto acknowledgment of alarms.   |
| 24    | ALARM_HYS  | 0– 50                                       | Percent                  | 0.5            | Read and Write | The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.   |
| 25    | HI_HI_PRI  | 0 – 15                                      | None                     | 0              | Read and Write | The priority of the HI HI alarm.   |
| 26    | HI_HI_LIM  | Out_Scale <sup>(1)</sup>                    | Out_Scale <sup>(1)</sup> | + infinity     | Read and Write | The setting for the alarm limit used to detect the HI HI alarm condition.  |
| 27    | HI_PRI     | 0 – 15                                      | None                     | 0              | Read and Write | The priority of the HI alarm.  |
| 28    | HI_LIM     | Out_Scale <sup>(1)</sup>                    | Out_Scale <sup>(1)</sup> | + infinity     | Read and Write | The setting for the alarm limit used to detect the HI alarm condition.   |
| 29    | LO_PRI     | 0 – 15                                      | None                     | 0              | Read and Write | The priority of the LO alarm.  |
| 30    | LO_LIM     | Out_Scale <sup>(1)</sup>                    | Out_Scale <sup>(1)</sup> | - infinity     | Read and Write | The setting for the alarm limit used to detect the LO alarm condition.   |
| 31    | LO_LO_PRI  | 0 – 15                                      | None                     | 0              | Read and Write | The priority of the LO LO alarm.   |
| 32    | LO_LO_LIM  | Out_Scale <sup>(1)</sup>                    | Out_Scale <sup>(1)</sup> | - infinity     | Read and Write | The setting for the alarm limit used to detect the LO LO alarm condition.  |

Table E-1: AI block parameters (continued)

| Index | Parameter  | Available values      | Units   | Default       | Read/write     | Description  |
|-------|------------|-----------------------|---------|---------------|----------------|--|
| 33    | HI_HI_ALM  | Not applicable        | None    | Uninitialized | Read only      | The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.     |
| 34    | HI_ALM     | Not applicable        | None    | Uninitialized | Read only      | The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.        |
| 35    | LO_ALM     | Not applicable        | None    | Uninitialized | Read only      | The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.        |
| 36    | LO_LO_ALM  | Not applicable        | None    | Uninitialized | Read only      | The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.     |
| 37    | OUT_D      | Discrete_State 1 – 16 | None    | Disabled      | Read and Write | Discrete output to indicate a selected alarm condition.  |
| 38    | ALARM_SEL  | HI_HI, HI, LO, LO_LO  | None    | Nonselected   | Read and Write | Used to select the process alarm conditions that will cause the OUT_D parameter to be set.                           |
| 39    | STDDEV     | 0 – 100               | Percent | 0             | Read and Write | The average absolute error between the PV and its previous mean value over that evaluation time defined by VAR_SCAN. |
| 40    | CAP_STDDEV | ≥ 0                   | Seconds | 0             | Read and Write | The time over which the VAR_INDEX is evaluated.  |

(1) Assume that when L\_Type = Direct, the user configures Out\_Scale which is equal to XD\_Scale.



# F Implementing a Universal Transmitter

## F.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please read the following safety messages before performing any operation described in this section.

 **WARNING**

The transmitter has not been evaluated for use with other manufacturers' magnetic flowmeter sensors in hazardous (Ex or Classified) areas. Special care should be taken by the end-user and installer that the transmitter meets the safety and performance requirements of the other manufacturer's equipment.

## F.2 Universal capability

The transmitter has the ability to drive other manufacturers' sensors. In addition to providing a flow measurement, all diagnostic functionality is available. This capability can provide additional information about the installation, the process, and the health of the sensor. Universal capabilities enable a common maintenance practice for all magnetic flowmeter installations and help reduce spares inventory of magnetic flowmeter transmitters.

This section provides wiring diagrams for connecting the transmitter to other manufacturers' sensors, and describes how to configure the universal capabilities.

## F.3 Three step process

There are three steps to implementing a universal transmitter:

1. Review the existing application. Verify that the existing sensor is in good working order, and that it is compatible with a universal transmitter.

Locate the wiring diagram (in this Appendix) that applies to your sensor. While the Universal transmitter may be able to drive the existing sensor, if the sensor is not in good working order, the universal transmitter may not function correctly.

2. Connect the universal transmitter to the existing sensor using the appropriate wiring diagram from this appendix.

If the sensor you are using is not listed in this appendix, contact Rosemount technical support for more details on the application of the universal capabilities.

3. Configure the transmitter following the guidelines in [Operation](#) and [Advanced Configuration Functionality](#), setting up parameters as needed.

One of the key configuration parameters is the sensor calibration number. There are several methods to determine the calibration number, but the most common method will be to use the universal trim capability. This functionality is detailed in this appendix. Accuracy of the meter when the universal trim is used to determine the calibration number will be dependent on the accuracy of the known flow rate used in the trim process.

In addition to the universal trim, there are two other methodologies for determining a calibration number for the sensor:

Method 1: Have the sensor sent to a Rosemount service center for determination of a calibration number compatible with the universal transmitter. This is the most accurate method for determining the calibration number and will provide a  $\pm 0.5\%$  of rate measurement accuracy from 3 to 40 fps (1-10 m/s).

Method 2: Involves the conversion of the existing sensor calibration number / meter factors to an equivalent Rosemount 16-digit calibration number. Accuracy of the meter using this methodology is estimated to be in the range of 2-3%. Contact the Rosemount technical support for more information on this method or to determine a calibration number for the existing sensor.

Once these steps are completed, the meter will begin measuring flow. Verify the measured flow rate is within the expected range and that the output correctly corresponds to the measured flow rate. Also verify the reading in the control system matches the reading at the transmitter. Once these items have been verified, the loop can be placed into automatic control as needed.

### F.3.1 Universal trim

The universal auto trim function enables the transmitter to determine a calibration number for sensors that were not calibrated at the factory. See [Universal trim](#).

## F.4 Wiring the universal transmitter

The wiring diagrams in this section illustrate the proper connections between the transmitter and most sensors currently on the market. Specific diagrams are included for most models, and where information for a particular model of a manufacturer is not available, a generic drawing pertaining to that manufacturer's sensors is provided. If the manufacturer for the existing sensor is not included, see the drawing for generic connections.

Any trademarks used herein regarding sensors not manufactured by Rosemount are owned by the particular manufacturer of the sensor.

## F.5 Rosemount sensors

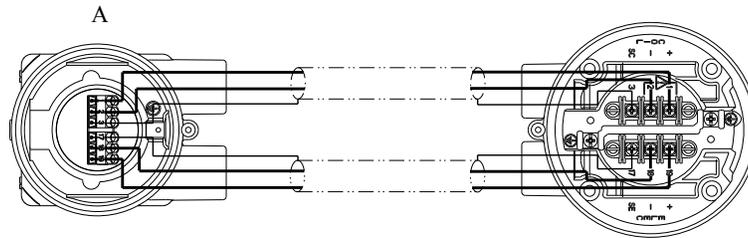
### F.5.1 8705/8707/8711/8721 Sensors to 8732 Transmitter

To connect a Rosemount 8705/8707/8711/8721 Sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-1](#).

**!** CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-1: Wiring Diagram for a Rosemount 8732 Transmitter**



A. Rosemount 8732 transmitter

**Table F-1: Rosemount 8705/8707/8711/8721 Sensor Wiring Connections**

| Rosemount 8732 Transmitters | Rosemount 8705/8707/8711/8721 Sensors |
|-----------------------------|---------------------------------------|
| 1                           | 1                                     |
| 2                           | 2                                     |
| 3                           | 3                                     |
| 17                          | 17                                    |
| 18                          | 18                                    |
| 19                          | 19                                    |

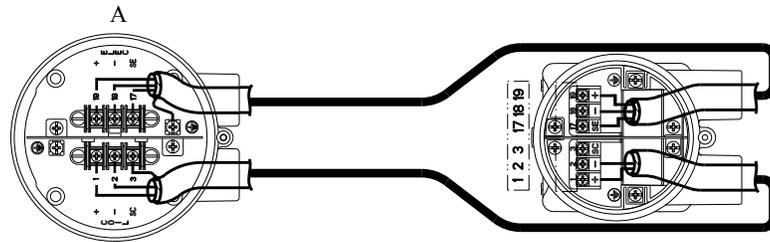
## F.5.2 8705 M and 8711 M/L Sensors to 8732EM Transmitter

To connect a Rosemount 8705 M or 8711 M/L Sensor to a Rosemount 8732EM Transmitter, connect coil drive and electrode cables as shown in [Figure F-2](#).

**!** CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-2: Wiring Diagram for a Rosemount 8732EM Transmitter**



A. Rosemount 8732 transmitter

**Table F-2: Rosemount 8705/8711 Sensor Wiring Connections**

| Rosemount 8732 Transmitters | Rosemount 8705/8711 Sensors |
|-----------------------------|-----------------------------|
| 1                           | 1 / +                       |
| 2                           | 2 / -                       |
| 3                           | 3 / SC                      |
| 17                          | 17 / SE                     |
| 18                          | 18 / -                      |
| 19                          | 19 / +                      |

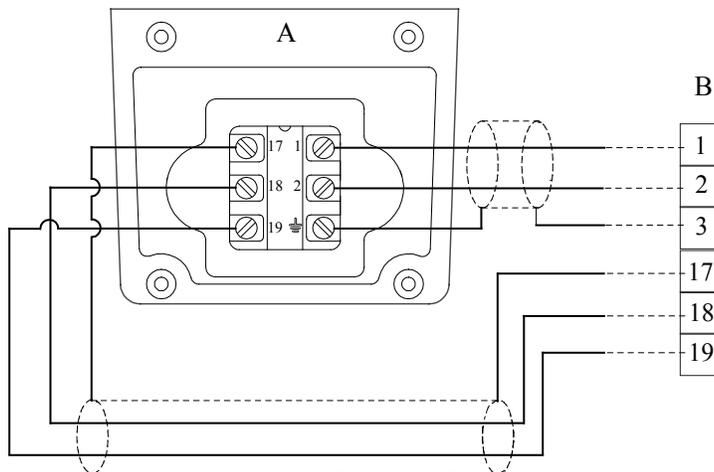
### F.5.3 8701 sensor to 8732 transmitter

To connect a Rosemount 8701 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-3](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-3: Wiring Diagram for Rosemount 8701 Sensor and Rosemount 8732 Transmitter**



- A. Rosemount 8701 sensor
- B. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-3: Rosemount 8701 Sensor Wiring Connections**

| Rosemount 8732 | Rosemount 8701 sensors |
|----------------|------------------------|
| 1              | 1                      |
| 2              | 2                      |
| 3              | 3                      |
| 17             | 17                     |
| 18             | 18                     |
| 19             | 19                     |

## F.5.4 Connecting sensors of other manufacturers

Before connecting another manufacturer’s sensor to the transmitter, it is necessary to perform the following functions.

**⚠ CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

1. Turn off the AC power to the sensor and transmitter.

 **CAUTION**

Failure to do so could result in electrical shock or damage to the transmitter.

2. Verify the coil drive cables between the sensor and the transmitter are not connected to any other equipment.
3. Label the coil drive cables and electrode cables for connection to the transmitter.
4. Disconnect the wires from the existing transmitter.
5. Remove the existing transmitter and then mount the new transmitter.

See [Remote Transmitter Installation](#).

6. Verify the sensor coil is configured for series connection.

Other manufacturers sensors may be wired in either a series or parallel circuit. All Rosemount magnetic sensors are wired in a series circuit. (Other manufacturers AC sensors (AC coils) wired for 220 V operation are typically wired in parallel and must be rewired in series.)

7. Use the manufacturer's recommended test procedure for verification of sensor condition to verify the sensor is in good working condition. Perform the basic checks:
  - a) Check the coils for shorts or open circuits.
  - b) Check the sensor liner for wear or damage.
  - c) Check the electrodes for shorts, leaks, or damage.

8. Connect the sensor to the transmitter in accordance with reference wiring diagrams.

See [Wiring Diagrams](#) for specific drawings.

9. Connect and verify all connections between the sensor and the transmitter, then apply power to the transmitter.
10. Perform the Universal Auto Trim function.

## F.6 Brooks sensors

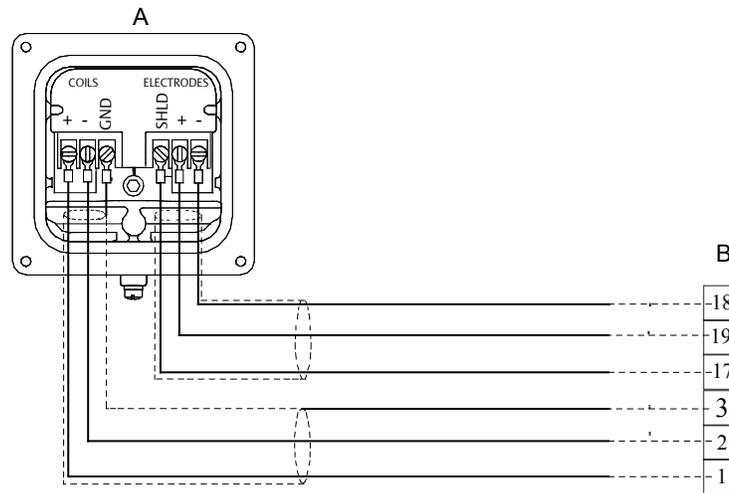
### F.6.1 Model 5000 sensor to 8732 Transmitter

To connect a Model 5000 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-4](#).

 **CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-4: Wiring Diagram for Brooks Sensor Model 5000 and Rosemount 8732**



- A. Brooks Model 5000
- B. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-4: Brooks Model 5000 Sensor Wiring Connections**

| Rosemount 8732 | Brooks sensors Model 5000 |
|----------------|---------------------------|
| 1              | COILS (+)                 |
| 2              | COILS (-)                 |
| 3              | COILS (GND)               |
| 17             | ELECTRODES (SHLD)         |
| 18             | ELECTRODES (-)            |
| 19             | ELECTRODES (+)            |

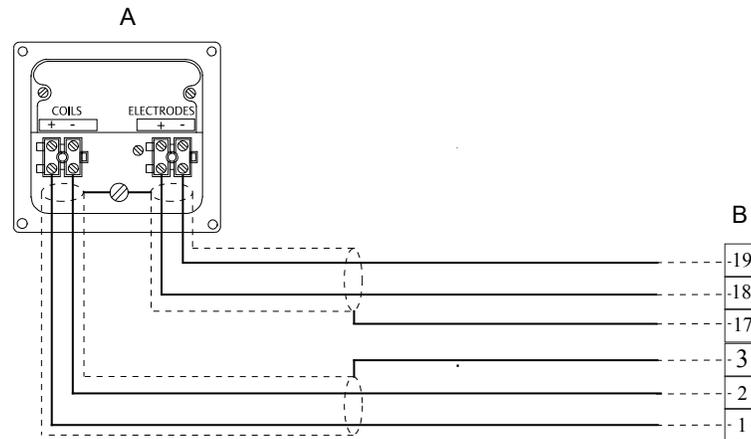
## F.6.2 Model 7400 sensor to 8732 Transmitter

To connect a Model 7400 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-5](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-5: Wiring Diagram for Brooks Sensor Model 7400 and Rosemount 8732**



- A. Brooks Model 7400
- B. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-5: Brooks Model 7400 sensor Wiring Connections**

| Rosemount 8732 | Brooks Sensors Model 7400 |
|----------------|---------------------------|
| 1              | Coils +                   |
| 2              | Coils -                   |
| 3              | 3                         |
| 17             | Shield                    |
| 18             | Electrode +               |
| 19             | Electrode -               |

## F.7 Endress and Hauser sensors

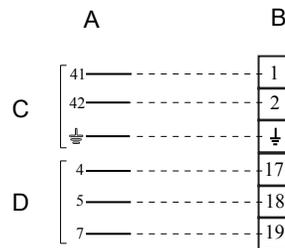
### F.7.1 Endress and Hauser sensor to 8732 Transmitter

To connect an Endress and Hauser sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-6](#).

**⚠ CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-6: Wiring Diagram for Endress and Hauser Sensors and Rosemount 8732**



- A. Endress and Hauser sensors
- B. Rosemount 8732 transmitter
- C. Coils
- D. Electrodes

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-6: Endress and Hauser Sensor Wiring Connections**

| Rosemount 8732 | Endress and Hauser sensors |
|----------------|----------------------------|
| 1              | 41                         |
| 2              | 42                         |
| 3              | 14                         |
| 17             | 4                          |
| 18             | 5                          |
| 19             | 7                          |

## F.8 Fischer and Porter sensors

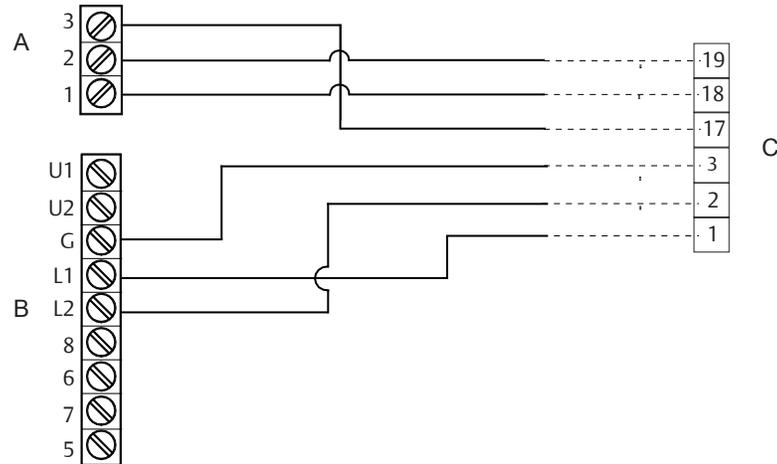
### F.8.1 Model 10D1418 sensor to 8732 Transmitter

To connect a Model 10D1418 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-7](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-7: Wiring Diagram for Fischer and Porter Sensor Model 10D1418 and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-7: Fischer and Porter Model 10D1418 Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter Model 10D1418 sensors |
|----------------|--|
| 1              | L1                                       |
| 2              | L2                                       |
| 3              | Chassis ground                           |
| 17             | 3  |
| 18             | 1  |
| 19             | 2  |

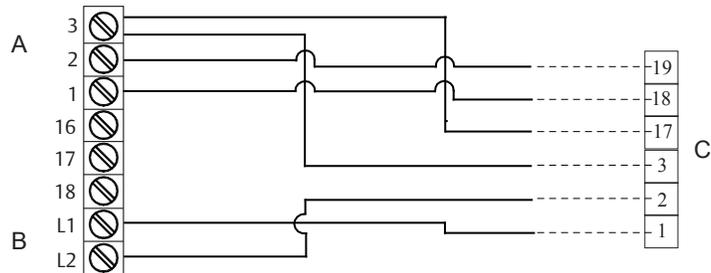
## F.8.2 Model 10D1419 sensor to 8732 Transmitter

To connect a Model 10D1419 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-8](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-8: Wiring Diagram for Fischer and Porter Sensor Model 10D1419 and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-8: Fischer and Porter Model 10D1419 Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter Model 10D1419 sensors |
|----------------|--|
| 1              | L1                                       |
| 2              | L2                                       |
| 3              | 3  |
| 17             | 3  |
| 18             | 1  |
| 19             | 2  |

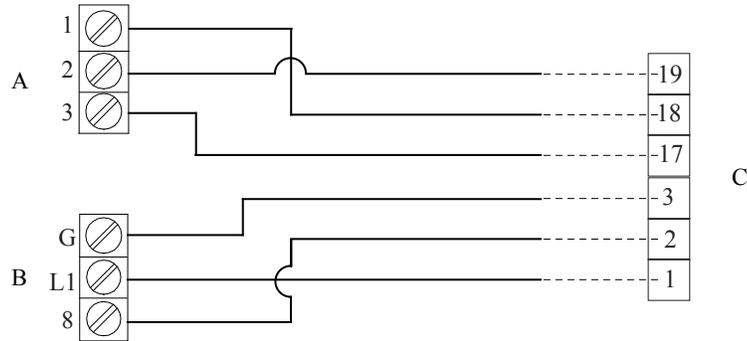
### F.8.3 Model 10D1430 sensor (remote) to 8732 Transmitter

To connect a Model 10D1430 sensor (remote) to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-9](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-9: Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Remote) and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-9: Fischer and Porter Model 10D1430 (Remote) Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter Model 10D1430 (Remote) sensors |
|----------------|---|
| 1              | L1  |
| 2              | 8   |
| 3              | G   |
| 17             | 3   |
| 18             | 1   |
| 19             | 2   |

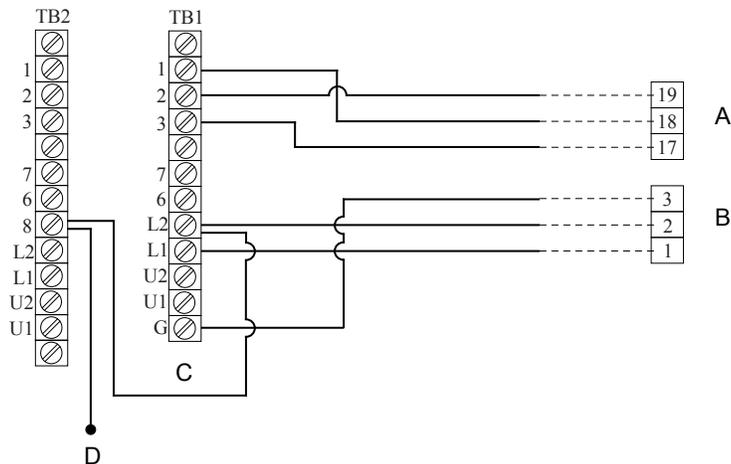
## F.8.4 Model 10D1430 sensor (integral) to 8732 Transmitter

To connect a Model 10D1430 sensor (integral) to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-10](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-10: Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Integral) and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. Blue
- D. To calibration device

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-10: Fischer and Porter Model 10D1430 (integral) Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter Model 10D1430 (Integral) sensors |
|----------------|---|
| 1              | L1  |
| 2              | L2  |
| 3              | G   |
| 17             | 3   |
| 18             | 1   |
| 19             | 2   |

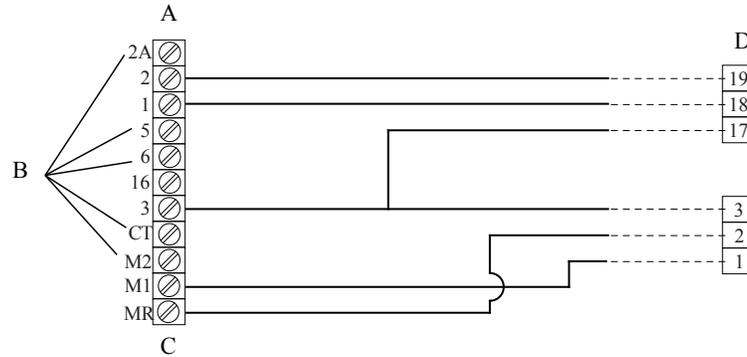
### F.8.5 Model 10D1465/10D1475 sensors to 8732 Transmitter

To connect a Model 10D1465 or 10D1475 sensor (integral) to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-11](#).

**⚠ CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-11: Wiring Diagram for Fischer and Porter Sensor Model 10D1465 and Model 10D1475 (integral) and Rosemount 8732**



- A. Electrode connections
- B. Disconnect
- C. Coil connections
- D. Rosemount 8732 transmitter

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-11: Fischer and Porter Model 10D1465 and 10D1475 Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter Model 10D1465 and 10D1475 sensors |
|----------------|--|
| 1              | M1   |
| 2              | MR   |
| 3              | 3  |
| 17             | 3  |
| 18             | 1  |
| 19             | 2  |

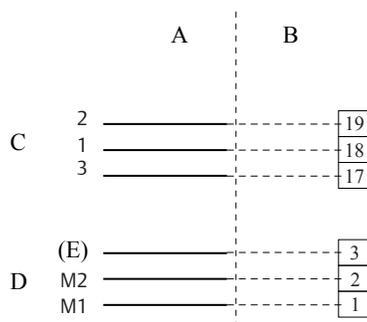
## F.8.6 Fischer and Porter sensor to 8732 Transmitter

To connect a Fischer and Porter sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-12](#).

**CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-12: Generic Wiring Diagram for Fischer and Porter Sensors and Rosemount 8732**



- A. Fischer and Porter sensors
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Coil connections
- E. Chassis

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-12: Fischer and Porter Generic Sensor Wiring Connections**

| Rosemount 8732 | Fischer and Porter sensors |
|----------------|----------------------------|
| 1              | M1                         |
| 2              | M2                         |
| 3              | Chassis ground             |
| 17             | 3                          |
| 18             | 1                          |
| 19             | 2                          |

## F.9 Foxboro sensors

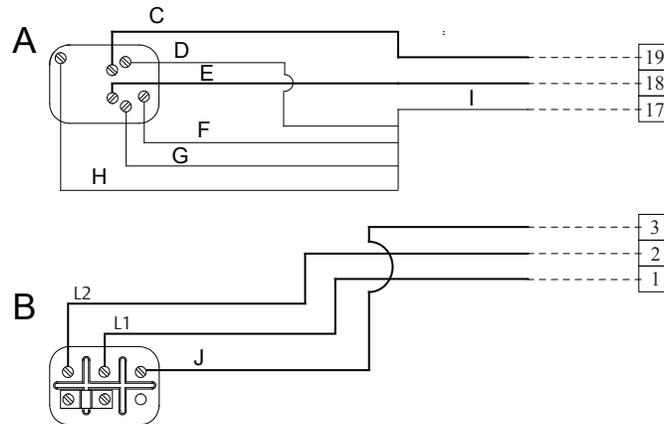
### F.9.1 Series 1800 sensor to 8732 Transmitter

To connect a Series 1800 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-13](#).

**⚠ CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-13: Wiring Diagram for Foxboro Series 1800 and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. White lead
- D. White shield
- E. Black lead
- F. Inner shield
- G. Black shield
- H. Outer shield
- I. Any shield
- J. Chassis ground

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-13: Foxboro Series 1800 Sensor Wiring Connections**

| Rosemount 8732 | Foxboro Series 1800 sensors |
|----------------|-----------------------------|
| 1              | L1                          |
| 2              | L2                          |
| 3              | Chassis ground              |
| 17             | Any shield                  |
| 18             | Black                       |
| 19             | White                       |

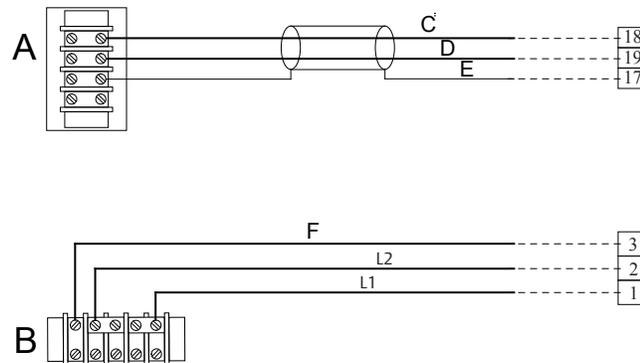
## F.9.2 Series 1800 (version 2) sensor to 8732 Transmitter

To connect a Series 1800 (version 2) sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-14](#).

**!** CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-14: Wiring Diagram for Foxboro Series 1800 (Version 2) and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. Black lead
- D. White lead
- E. Shield
- F. Chassis ground

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-14: Foxboro Series 1800 (Version 2) Sensor Wiring Connections**

| Rosemount 8732 | Foxboro Series 1800 sensors |
|----------------|-----------------------------|
| 1              | L1                          |
| 2              | L2                          |
| 3              | Chassis Ground              |
| 17             | Any Shield                  |
| 18             | Black                       |
| 19             | White                       |

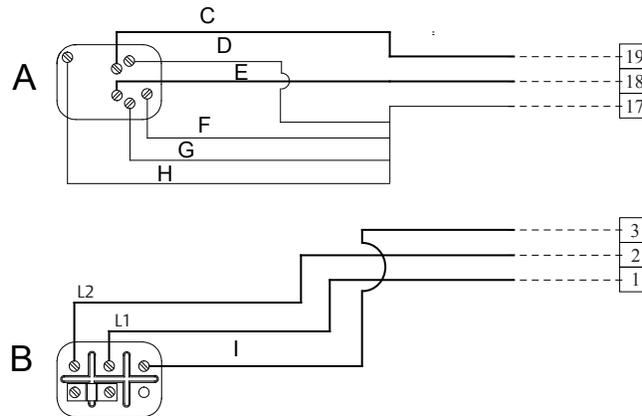
### F.9.3 Series 2800 Sensor to 8732 Transmitter

To connect a Series 2800 Sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-15](#).

**!** CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-15: Wiring Diagram for Foxboro Series 2800 and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. White lead
- D. Black lead
- E. Inner shield
- F. Black shield
- G. Outer shield
- H. Chassis ground

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-15: Foxboro Series 2800 Sensor Wiring Connections**

| Rosemount 8732 | Foxboro Series 2800 Sensors |
|----------------|-----------------------------|
| 1              | L1                          |
| 2              | L2                          |
| 3              | Chassis Ground              |
| 17             | Any Shield                  |
| 18             | Black                       |
| 19             | White                       |

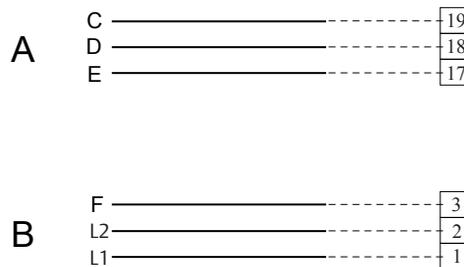
## F.9.4 Foxboro Sensor to 8732 Transmitter

To connect a Foxboro Sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-16](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-16: Generic Wiring Diagram for Foxboro Sensors and Rosemount 8732**



- A. Electrode connections
- B. Coil connections
- C. White
- D. Black
- E. Any shield
- F. Chassis ground

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-16: Foxboro Generic Sensor Wiring Connections**

| Rosemount 8732 | Foxboro sensors |
|----------------|-----------------|
| 1              | L1              |
| 2              | L2              |
| 3              | Chassis Ground  |
| 17             | Any Shield      |
| 18             | Black           |
| 19             | White           |

## F.10 Kent Veriflux VTC sensor

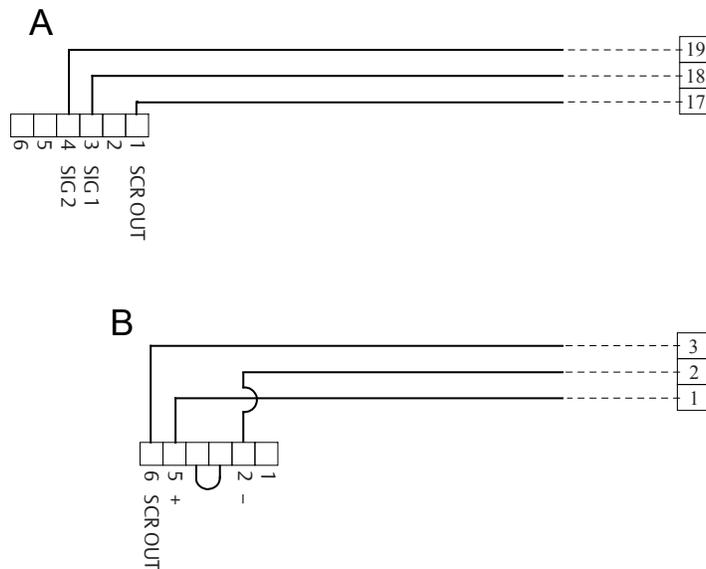
### F.10.1 Veriflux VTC sensor to 8732 Transmitter

To connect a Veriflux VTC sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-17](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-17: Wiring Diagram for Kent Veriflux VTC Sensor and Rosemount 8732**



- A. Electrode connections
- B. Coil connections

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-17: Kent Veriflux VTC Sensor Wiring Connections**

| Rosemount 8732 | Kent Veriflux VTC sensors |
|----------------|---------------------------|
| 1              | 2                         |
| 2              | 1                         |
| 3              | SCR OUT                   |
| 17             | SCR OUT                   |
| 18             | SIG1                      |
| 19             | SIG2                      |

## F.11 Kent sensors

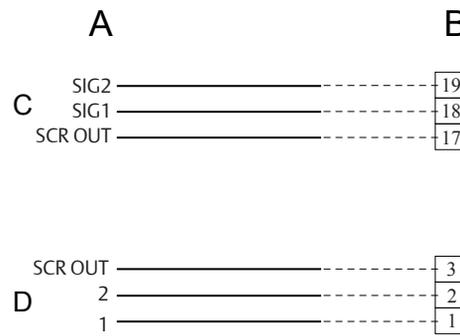
### F.11.1 Kent sensor to 8732 Transmitter

To connect a Kent sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-18](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-18: Generic Wiring Diagram for Kent Sensors and Rosemount 8732**



- A. Kent sensors
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Coil connections

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-18: Kent Sensor Wiring Connections**

| Rosemount 8732 | Kent sensors |
|----------------|--------------|
| 1              | 1            |
| 2              | 2            |
| 3              | SCR OUT      |
| 17             | SCR OUT      |
| 18             | SIG1         |
| 19             | SIG2         |

## F.12 Krohne sensors

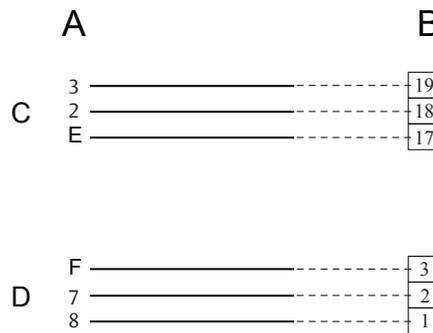
### F.12.1 Krohne sensor to 8732 Transmitter

To connect a Krohne sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-19](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-19: Generic Wiring Diagram for Krohne Sensors and Rosemount 8732**



- A. Kent sensors
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Coil connections
- E. Electrode shield
- F. Coil shield

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-19: Krohne Sensor Wiring Connections**

| Rosemount 8732 | Krohne sensors   |
|----------------|------------------|
| 1              | 8                |
| 2              | 7                |
| 3              | Coil Shield      |
| 17             | Electrode Shield |
| 18             | 2                |
| 19             | 3                |

## F.13 Taylor sensors

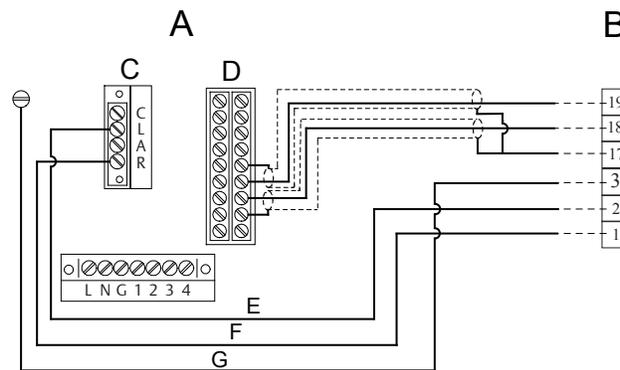
### F.13.1 Series 1100 sensor to 8732 Transmitter

To connect a Series 1100 sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-20](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-20: Wiring Diagram for Taylor Series 1100 Sensors and Rosemount 8732**



- A. Taylor Series 1100 sensor
- B. Rosemount 8732 transmitter
- C. Coil connections
- D. Electrode connections
- E. White
- F. Black
- G. Green

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-20: Taylor Series 1100 Sensor Wiring Connections**

| Rosemount 8732 | Taylor Series 1100 sensors |
|----------------|----------------------------|
| 1              | Black                      |
| 2              | White                      |
| 3              | Green                      |
| 17             | S1 and S2                  |
| 18             | E1                         |
| 19             | E2                         |

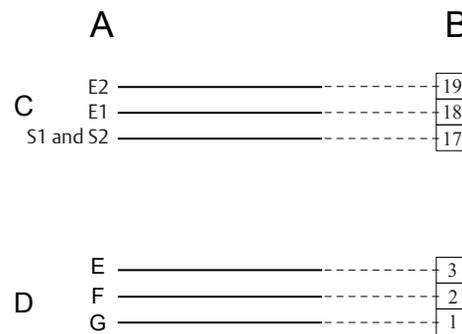
### F.13.2 Taylor sensor to 8732 Transmitter

To connect a Taylor sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-21](#).

**!** CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-21: Generic Wiring Diagram for Taylor Sensors and Rosemount 8732**



- A. Taylor sensor
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Coil connections
- E. Green
- F. White
- G. Black

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-21: Taylor Sensor Wiring Connections**

| Rosemount 8732 | Taylor sensors |
|----------------|----------------|
| 1              | Black          |
| 2              | White          |
| 3              | Green          |
| 17             | S1 and S2      |
| 18             | E1             |
| 19             | E2             |

## F.14 Yamatake Honeywell sensors

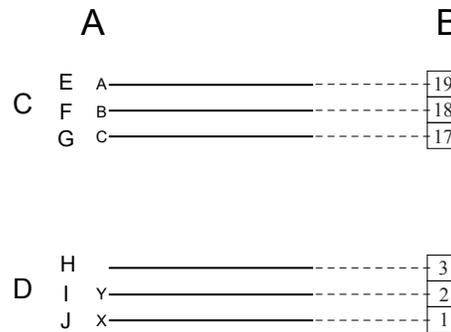
### F.14.1 Yamatake Honeywell sensor to 8732 Transmitter

To connect a Yamatake Honeywell sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-22](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-22: Generic Wiring Diagram for Yamatake Honeywell Sensors and Rosemount 8732**



- A. Yamatake Honeywell sensors
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Coil connections
- E. Terminal A
- F. Terminal B
- G. Terminal C
- H. Chassis ground
- I. Terminal Y
- J. Terminal X

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-22: Yamatake Honeywell Sensor Wiring Connections**

| Rosemount 8732 | Yamatake Honeywell sensors |
|----------------|----------------------------|
| 1              | X                          |
| 2              | Y                          |
| 3              | Chassis Ground             |
| 17             | C                          |
| 18             | B                          |
| 19             | A                          |

## F.15 Yokogawa sensors

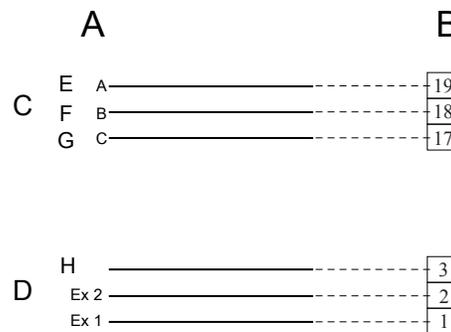
### F.15.1 Yokogawa sensor to 8732 Transmitter

To connect a Yokogawa sensor to a Rosemount 8732 Transmitter, connect coil drive and electrode cables as shown in [Figure F-23](#).

**! CAUTION**

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

**Figure F-23: Generic Wiring Diagram for Yokogawa Sensors and Rosemount 8732**



- A. Yokogawa sensors
- B. Rosemount 8732 transmitter
- C. Electrode connections
- D. Terminal A
- E. Terminal B
- F. Terminal C
- G. Chassis ground

**Note**

Refer to [Figure F-1](#) for actual terminal block configuration drawing.

**Table F-23: Yokogawa Sensor Wiring Connections**

| Rosemount 8732 | Yokogawa sensors |
|----------------|------------------|
| 1              | EX1              |
| 2              | EX2              |
| 3              | Chassis Ground   |
| 17             | C                |
| 18             | B                |
| 19             | A                |

## F.16 Generic manufacturer sensor to Transmitter

### F.16.1 Identify the terminals

First check the sensor manufacturer's manual to identify the appropriate terminals. Otherwise, perform the following procedure.

#### Identify coil and electrode terminals

1. Select a terminal and touch an ohmmeter probe to it.
2. Touch the second probe to each of the other terminals and record the results for each terminal.
3. Repeat the process and record the results for every terminal.

Coil terminals will have a resistance of approximately 3-300 ohms.

Electrode terminals will have an open circuit.

#### Identify a chassis ground

1. Touch one probe of an ohmmeter to the sensor chassis.
2. Touch the other probe to the each sensor terminal and the record the results for each terminal.

The chassis ground will have a resistance value of one ohm or less.

### F.16.2 Wiring connections

#### CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

1. Connect the electrode terminals to Rosemount 8732 terminals 18 and 19. The electrode shield should be connected to terminal 17.
2. Connect the coil terminals to Rosemount 8732 terminals 1, 2, and 3.
3. If the Rosemount 8732 Transmitter indicates a reverse flow condition, switch the coil wires connected to terminals 1 and 2.



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