

Rosemount™ 9732 Magnetic Flow Meter Transmitter



ROSEMOUNT™


EMERSON™

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1 Before beginning

1.1 About this manual

This manual helps configure, commission, use, maintain, and troubleshoot Rosemount 9732 transmitters and Rosemount 9000 Series magnetic flow meter sensors.

Important

This manual assumes that:

- The transmitter has been installed correctly and completely according to the instructions in the *Rosemount 9732 Magnetic Flow Transmitter Quick Start Guide*.
 - The sensor has been installed correctly and completely according to the instructions in the *Rosemount 9000 Series Magnetic Flow Sensor Quick Start Guide*.
 - Users understand basic transmitter and sensor installation, configuration, and maintenance concepts and procedures.
-

1.2 Hazard messages

This document uses the following criteria for hazard messages based on ANSI standards Z535.6-2011 (R2017).

DANGER

Serious injury or death will occur if a hazardous situation is not avoided.

WARNING

Serious injury or death could occur if a hazardous situation is not avoided.

CAUTION

Minor or moderate injury will or could occur if a hazardous situation is not avoided.

CAUTION

Perform a pre-installation meter check

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

NOTICE

Data loss, property damage, hardware damage, or software damage can occur if a situation is not avoided. There is no credible risk of physical injury.

1.2.1 Physical access

WARNING

Unauthorized personnel can potentially cause significant damage and/or misconfiguration of end users' equipment. Protect against all intentional or unintentional unauthorized use.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access to protect users' assets. This is true for all systems used within the facility.

1.3 Safety messages

DANGER

Powering up the transmitter

For hazardous area installations, applying power while housing covers are removed or loose can cause an explosion.

To prevent ignition of flammable or combustible atmospheres, ensure that all covers and seals are tightly closed.

WARNING

Ground the meter components

Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion causing death or serious injury.

WARNING

Wiring output

Meter installation and wiring should be performed only by suitably-trained personnel using the appropriate government and corporate safety standards.

Disconnect power before servicing. If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

If the transmitter is in a hazardous area, do not reapply power to the transmitter with the housing cover removed. Reapplying power to the transmitter while the housing cover is removed could cause an explosion.

ELECTRIC SHOCK HAZARD: Power off before lifting unit.

⚠ CAUTION

Potential equipment damage

Installing the transmitter with the conduit openings or transmitter display facing upward risks condensation moisture entering the transmitter housing, which could damage the transmitter.

Do not rotate the housing more than 270°. Excessive rotation can damage the wiring and cause measurement error or flow meter failure.

Ensure that the connection between the transmitter and the sensor is moisture-proof. Inspect and grease all gaskets and O-rings. Moisture in the electronics can cause measurement error or flow meter failure.

Replacement not to be performed unless the area is confirmed to be non-hazardous.

Replacement not intended to be performed in the field or a location subject to either rain or weather conditions.

ESD protection methods required to avoid damage to sensitive electronics.

NOTICE

Ground the meter components

Improper grounding could cause inaccurate measurements or meter failure.

NOTICE

Configure Discrete Output Fault Action

Do not use Discrete Output Source as a fault indicator. This may result in a situation where a fault condition is not distinguishable from a normal operating condition. If the Discrete Output needs to be used as a fault indicator, see [Fault indication with a Discrete Output](#).

1.4 Cybersecurity

1.4.1 Defense-in-depth strategy

Security capabilities

The Rosemount 9732 transmitter has several features that can help to protect it against either intentional or unintentional access and configuration changes. For each input and output, the secure set up is described:

- Configuration Audit Trail log stored by the system (refer to [Generate service files](#))
- Rosemount 9732 signed firmware (refer to [Upgrade the transmitter firmware](#))
- Write protect physical lock switch (refer to [Configure security for the display](#))
- If the Bluetooth® display option is ordered, the system includes:
 - Device allowing only one Bluetooth® communication connection at a time.
 - System containing Factory Admin, Administrator, and Maintenance role-based permissions for the Bluetooth connection
 - Password requirements on the AMS Device Configurator application to connect through Bluetooth® communication for each configuration role
 - Encrypted communications
 - Encrypted and signed firmware updates
 - Unique session keys

Mitigation strategies

Any device in the field is prone to a physical attack, which must be mitigated by physical security controls. If a device can access the worldwide internet, then it can be discoverable by malicious actors. As a result, field devices must be in a dedicated and actively-managed network. If an input or an output is described as insecure, it means that it is unencrypted (available in clear text) and does not have access control capabilities (for example there is no way to tell who is communicating with the transmitter).

The following are inputs and outputs of the device that can be utilized for the Rosemount 9732 device. If there are cyber-security concerns, the following communication interfaces can be disabled to reduce attack surface once device is fully commissioned and in operation:

Note

If a protocol is licensed, contact Emerson support to have it disabled. If a protocol is not licensed, it is disabled. (Refer to [View the licensed features \(optional\)](#)).

- Local Operator Interface (LOI) – four-character passcode (refer to [Configure security for the display](#))
- USB service port – disable option (refer to [Disable USB-A service port](#))
- For the inputs and outputs available on this transmitter with different channels, refer to [Channel combinations](#).
- Both HART and RS-485 Modbus are unencrypted and unauthenticated. As a result, Emerson recommends using these protocols while the transmitter is within a physically secure environment, according to a company's security policy.
- Bluetooth® display: Emerson allows for the Bluetooth display to be disabled, if desired (refer to [Disabling Bluetooth communication](#))

The physical write protect switch controls all the interfaces. The physical write protect (dip) switch is located behind the display. More information can be found in [Display Security and Write Protection](#).

Security defense-in-depth measures

The device is not intended to be directly connected to an enterprise or to an internet-facing network without a compensating control in place. Do not connect the device without mitigation measures in place.

1.4.2 Security hardening guidelines

Product integration

The device has optional applications for configuration and data viewing. When such applications are used, they must run on devices that are configured according to the security policy of the company using the device.

Defense-in-depth strategy

This transmitter device has been developed using secure coding principals and procedures, including threat modeling and security specific testing. It has several interfaces developed using the Secure Development Lifecycle (SDL), according to IEC 62443-4-1, which is the recognized standard for the oil and gas, and manufacturing industries.

Configuring the device

There are multiple ways to configure the Rosemount 9732 device securely including:

Issue:	Local display allows the user a default passcode that is known publicly. Anyone in physical proximity to the device could log into it.
	Note The local display has only has one access role, unlike the three roles for Bluetooth® configuration (Factory Admin, Administrator, and Maintenance).
Resolution:	Change the passcode upon the first use and do not share passcodes.

Issue:	Bluetooth communication provides a local wireless connection to the device for configuration. This connection can present a risk to the device, therefore Emerson recommends disabling this option, if it is not needed. If the Bluetooth connection is used, Emerson recommends providing mitigating physical controls. Refer to Mitigation strategies .
Resolution:	Bluetooth connectivity works best when closest to the device, but can connect up to a distance of ~175 ft (~55m). It works better within ~50 ft (~18m). To avoid wireless attacks, Emerson recommends providing physical security mitigations within the radius of ~175 ft (~55m). When not needed, Emerson recommends disabling the Bluetooth® communication. Refer to Disabling Bluetooth communication .

Issue:	The USB service port is enabled by default. If a malicious actor has a physical access to the device, then they can install unauthorized software.
Resolution:	Emerson recommends disabling Bluetooth communication when not needed and operating the device within a secure physical environment (refer to Disable USB-A service port).

Defaults

If the customer orders the Bluetooth® communication option with the unit, the Rosemount 9732 will be shipped with Bluetooth communication enabled by default. Configure Bluetooth communication according to the end user's company's security policy.

This transmitter is equipped with a Universal Service Port that works with USB type A connections, including compatible flash drives. There are multiple levels of security built into the transmitter service port that can be configured according to the application's needs and security standards.

The service port offers the following features that enhance interface security:

- The service port is inaccessible without physical access to the transmitter and requires removal of the terminal cover.
- The service port can be disabled from the transmitter through software (refer to [Disable USB-A service port](#)).
- The transmitter has a non-traditional operating system that is neither designed to execute programs nor to run scripts.
- The display can be passcode protected to limit access to the USB file menu.
- Overall transmitter security switches such as the write protect (dip) switch disallows configuration changes from all interfaces, including the Universal Service Port. More information can be found in [Display Security and Write Protection](#).

This transmitter is :

- Designed to be implemented in an industrial automation control system (Level 1 of the Purdue Reference Architecture Model), with defense-in-depth security controls.
- Not intended to be directly connected to an enterprise or to an internet-facing network without a compensating control in place.

1.4.3 Secure operation guidelines

Operation of product

Best practices of product operation:

- Operate the device within a controlled and secured physical environment.
- Operate the device within a controlled and secured network environment.
- Manage all the accounts on the device according to the security policy of the end user's company.

Reporting security vulnerabilities

Use [Report a Vulnerability](#) on Emerson.com for reporting vulnerabilities back to Emerson.

Best security practices

Best practices of product operation:

- Do not connect the device to the worldwide net.
- Apply security patches and updates as they are released. Maintain power to the device during the entire firmware update.
- Change the passcodes and passwords frequently (at least once a month).
- When entering the local display passcode, ensure no one else can view the passcode.
- Do not share passwords, passcodes, or other protected information.
- For the Bluetooth® communication configuration, use longer passwords with special characters.

1.4.4 Bluetooth® role management

Bluetooth® connectivity on Emerson devices supports three different role types that can establish an authenticated connection. Different security permissions are associated with each role.

Role	Default status from Factory	Password	Role permissions
Factory Admin	Enabled (Can be disabled by the Administrator role.)	Factory key	• Read/write device parameters • Modify Bluetooth security settings • Install firmware updates
Administrator	Disabled	User-defined	• Read/write device parameters • Modify Bluetooth security settings • Install firmware updates
Maintenance	Disabled	User-defined	• Read/write device parameters

Provisioning

When received from the factory, the only security role enabled is the Factory Admin role. In order to make a secure connection with the field device, the user must identify the device Unique Identifier (UID) and enter the factory key into the AMS Device Configurator application. Refer to [Bluetooth UID and key](#) for where to locate this information. Once a secure connection is made, the Administrator and Maintenance roles can be enabled with user-defined passwords. Once an Administrator role is enabled, the Factory Admin role can optionally be disabled.

Change Bluetooth role password

Refer to [Change Bluetooth role password](#).

Reset Bluetooth security settings

Bluetooth security settings can be reset by two methods:

- Authenticated Bluetooth communication
- Local device access

Refer to [Reset Bluetooth Security Settings](#) for the reset procedures.

1.4.5 Secure product disposal guidelines

Instructions for product removal

When the device needs to be disposed of, consider the following aspects of device removal:

- Identify whether the device can be reused in another part of the process for either testing or training purposes.
- Identify what data is stored on the device and sanitize this data using the end user's security policy. Consider restoring the factory configuration (see [Restore the factory configuration](#)).
 - Verify that the local display passcode is set to the default "AAAA".
 - If the product has a Bluetooth option, reset the Bluetooth security prior to disposal (see either [Change Bluetooth role password](#) or [Reset Bluetooth Security Settings](#)).
- If the device is ready for disposal, then it can be discarded or physically destroyed using the end user's security policy.

1.5 Related product training

To ensure that your training efforts continually evolve with technology, Emerson offers a broad portfolio of different solutions and delivery methods that can be easily adapted to help meet your business needs. Our scalable, customizable training packages let you match the right training solutions to your operational needs and budget.

To learn more, visit [Emerson Training](#).

For the best user experience, log into [MyTraining.Emerson.com](#)

1.6 Related documentation

See the approval documentation shipped with the transmitter, or download the appropriate documentation from the Rosemount web site:

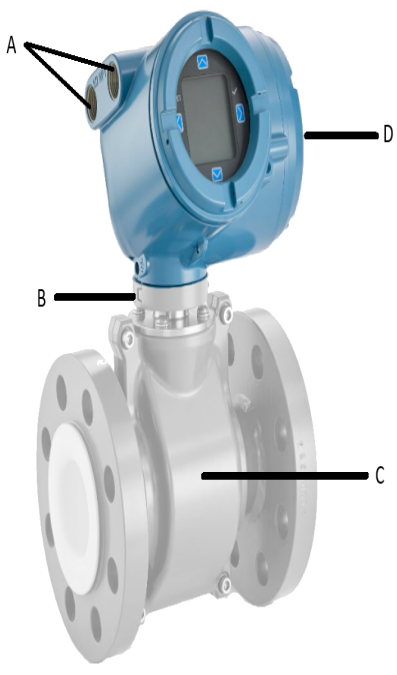
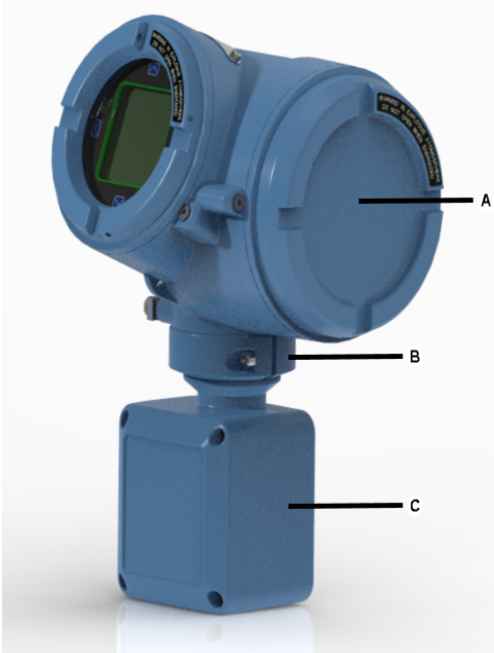
- *Rosemount 9732 Magnetic Flow Transmitter Quick Start Guide*, MS-00825-0100-9732
- *Rosemount 9000 Series Transmitter with Configurable Inputs and Outputs Product Data Sheet*, MS-00813-0100-9001
- *Rosemount 9000 Series Sensor Quick Start Guide*, MS-00825-0100-9000
- *Rosemount 9000 Series Sensor Product Data Sheet*, MS-00813-0100-9000
- [ProLink III with ProcessViz Software User Manual](#)
- FMEDA report for Magnetic Flow Meter with Rosemount 9732 Transmitter, prepared for Emerson by exida.com LLC

1.7 Mounting configurations

The Rosemount 9732 magnetic flow transmitter is available for integral mount or remote mount installations.

The sixth character of the transmitter model number indicates the installation type.

Installation type indication for the 9732 transmitter: **9732ATxxxxxxxxxx**

Transmitter Painted Aluminum - 9732 Integral Field Mount	Transmitter Painted Aluminum - 9732 Remote Field Mount
 A. Conduit openings B. Clamping ring C. Sensor case D. Transmitter housing cover (hidden from view)	 A. Transmitter housing cover B. Clamping ring C. Junction box

For both integral mount and remote mount, the power supply and inputs/outputs (I/O) must be field wired to the transmitter.

For remote mount configurations, the transmitter must be wired to the sensor with connecting cable. If the transmitter is installed remotely from the sensor, the remote cable connection between the sensor and transmitter must be field wired.

1.8 Communication tools and protocols

Several different communications tools and protocols are available for interfacing with the transmitter. Use different tools in different locations, or use different tools for different tasks.

Tool	Supported protocols
Display	Available with Bluetooth® communication locally at display.
AMS Device Configurator Application	Available with an optional Bluetooth-enabled display: Configure via Bluetooth wireless technology.

Tool	Supported protocols
ProLink™ III	• HART • HART®/Bell 202 • HART®/RS-485 • Modbus® /RS-485 • Service Port (USB-A)
Field communicator	HART/Bell 202

For information about how to use the communication tools, see the appendices in this manual.

Note

Some configuration and administrative procedures can be performed through the display menus. However, for complete access to transmitter functions, Emerson recommends setting up and using an administrative connection.

Note

The use of other communications tools, such as AMS™ Suite: Intelligent Device Manager, or the Smart Wireless THUM™ Adapter is possible. Use of AMS or the Smart Wireless THUM Adapter is not discussed in this manual. For more information on the Smart Wireless THUM Adapter, refer to the documentation available at [Emerson.com/global](https://emerson.com/global).

2 Mounting and sensor wiring

2.1 Mounting and sensor wiring for integral-mount transmitters

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

2.2 Mount the remote transmitter to a wall, instrument pole, or 2-inch pipe stand

There are two options available for mounting the transmitter:

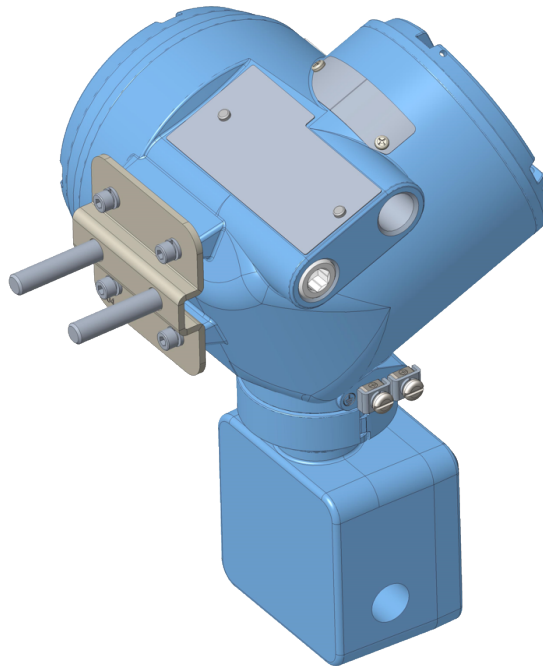
- Mount the transmitter to a wall or flat surface.
- Mount the transmitter to an instrument pole or 2-inch pipe stand.

Prerequisites

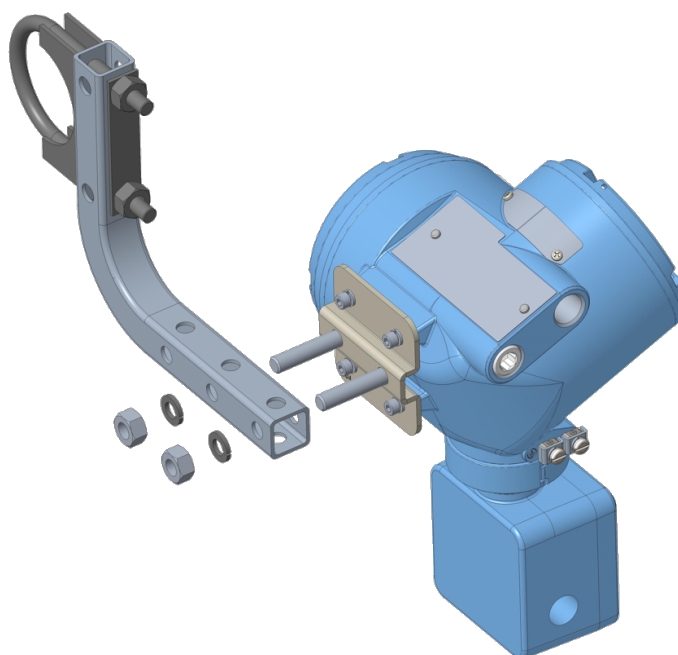
- If mounting the transmitter to a wall or flat surface:
 - Emerson recommends 5/16-18 (M8X1.25) fasteners that can withstand the process environment. Emerson does not supply bolts or nuts as part of the standard offering (general purpose bolts and nuts are available as an option).
 - Ensure that the surface is flat and rigid and that it does not vibrate or move excessively.
 - Confirm that the necessary tools are available and the mounting kit shipped with the transmitter.
 - Confirm that the mounting surface, method, and surface structure ensures sufficient strength to secure the transmitter (for example, when mounting to drywall use a toggle type drywall anchor).
- If mounting the transmitter to an instrument pole or 2-inch pipe stand:
 - Ensure that the instrument pole extends at least 12 in (300 mm) from a rigid base and is no more than 2.55 m in (63 mm) in diameter.
 - Confirm that the necessary tools are available, and the mounting kit shipped with the transmitter.
 - Ensure the instrument pole or 2-inch pipe stand is rigid and does not vibrate or move excessively.

Procedure

1. Insert both large mounting bolts into the mounting plate, then secure the mounting plate to the transmitter.
2. Using a 4 mm (5/32 in) hex key, tighten all four smaller bolts securing the mounting plate to the transmitter.

Figure 2-1: Mounting plate to a transmitter

-
3. Using a wall-mount or pole/pipe-mount:
 - For wall-mount installations, secure the mounting bracket to the prepared surface.
 - For pole/pipe-mount installations, attach the U-bolt mounting piece to the instrument pole or 2-inch pipe stand.
 4. Place and attach the transmitter-mounting plate to the mounting bracket secured to the wall, instrument pole, or 2-inch pipe stand.
-

Figure 2-2: Attaching and securing a transmitter to mounting bracket

2.3 Ground the meter components

Prerequisites

Refer to the [Safety messages](#) section for product-specific safety messages.
If national standards are not in effect, adhere to the following guidelines for grounding:

- Use copper wire, 14 AWG (2.08 mm²) or larger wire size.
- Keep all ground leads as short as possible, less than 1 Ω impedance.
- Connect ground leads directly to earth, or follow plant standards.

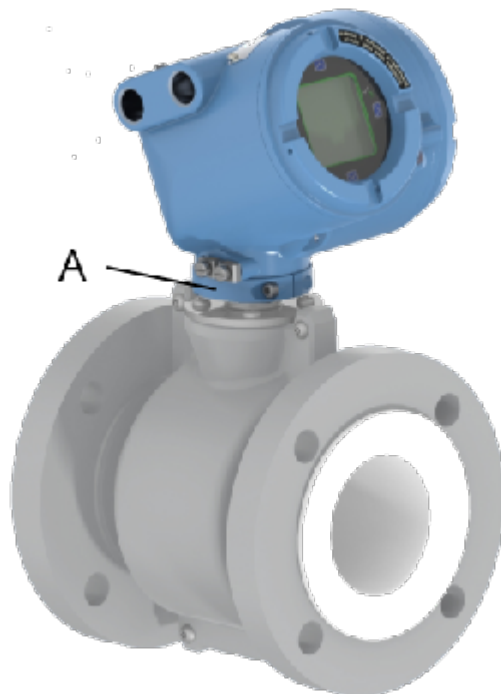
Procedure

1. Ground the sensor according to the instructions in the sensor documentation.
 - The earth ground is provided by the power cable connections for integral mount transmitters.
2. Ground the transmitter according to applicable local standards, using the transmitter's internal or external ground screw.
 - The earth ground terminal is located inside the power wiring compartment.
 - The external ground screw is located on the side of the transmitter located below the transmitter tag.
 - Ensure the clamp screw is fully tightened to maintain secure grounding to the sensor.

2.4 Rotate the transmitter on the sensor

For easier access to the user interface or the wiring terminals, the transmitter can be rotated on the sensor.

Figure 2-3: Rotating 9732 Transmitter



A. Clamping ring

Prerequisites

Refer to the [Safety messages](#) section for product-specific safety messages.

Procedure

1. Disconnect power before rotating the transmitter.

2. Loosen the metal clamping ring from the base of the feed through using a 4 mm hex (5/32 in) wrench.
3. Rotate the transmitter to the desired position. Do not rotate more than 270°.
4. Tighten the clamping ring on the mounting interface. Tighten the screw to 30 in-lb (3.4 N m) to 32 in-lb (3.62 N m).
5. Reconnect power to the transmitter.

3 Wiring the channels

3.1 Available channels

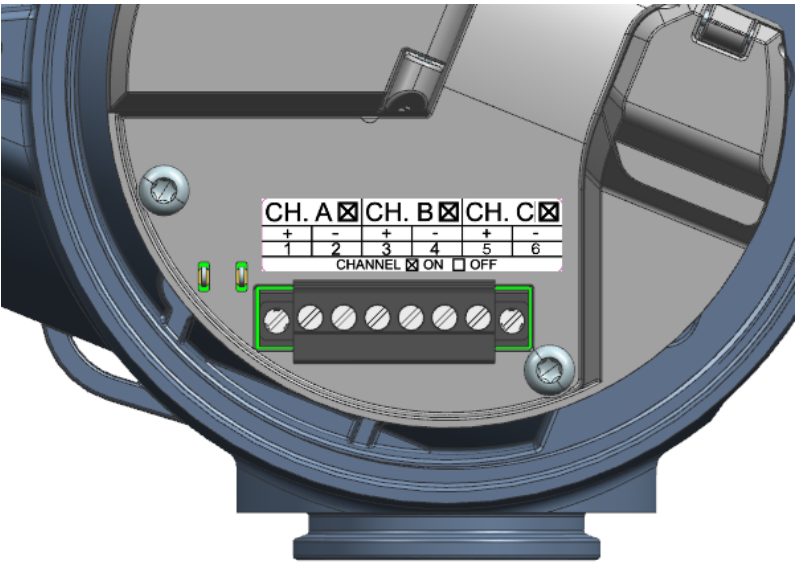
Signal	Channel A		Channel B		Channel C	
Wiring terminals	1	2	3	4	5	6
Analog and digital outputs	Analog Output 1 (HART®)		Analog Output 2		RS-485	
Frequency outputs	Frequency Output 2		Frequency Output 1			
Discrete outputs	Discrete Output 2		Discrete Output 1			
Discrete inputs			Discrete Input 1			

3.2 Access the wiring channels

Procedure

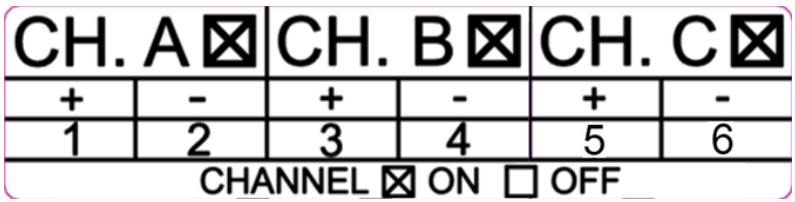
1. Remove the wiring access cover to reveal the I/O wiring terminal block connectors.

Figure 3-1: Channels on the transmitter terminal



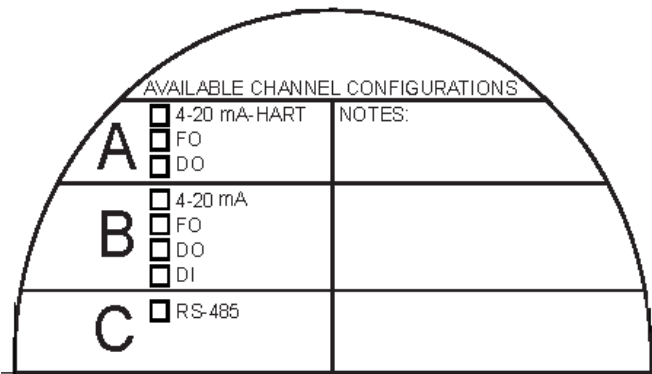
2. Confirm which transmitter channels are activated, or **ON**, and identify the type of wiring configuration based on the options available.

Figure 3-2: Activated channel identification



3. (Recommended) Record the channel and wiring configuration on the label provided inside the transmitter housing cover.

Figure 3-3: Channel and wiring configurations label



3.3 Wire the analog output

Wire the analog output in explosion-proof, nonincendive, or nonhazardous installations.

Important

Meter installation and wiring should be performed only by suitably-trained personnel.

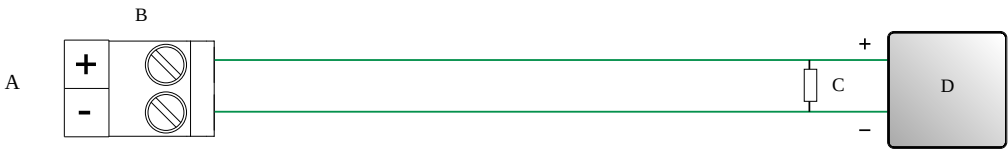
Refer to the [Safety messages](#) section for product-specific safety messages.

3.3.1 Wire the analog output (internally powered)

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-4: Analog output wiring (internally powered)

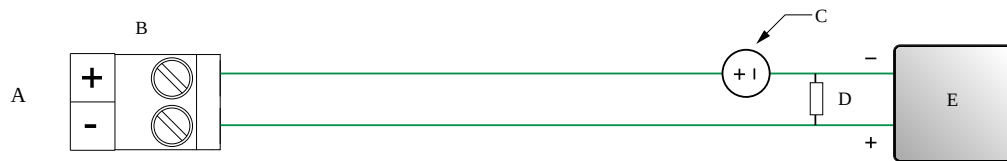


- A. Analog output
- B. Channel A or B
- C. 820 Ω maximum loop resistance
- D. Signal device

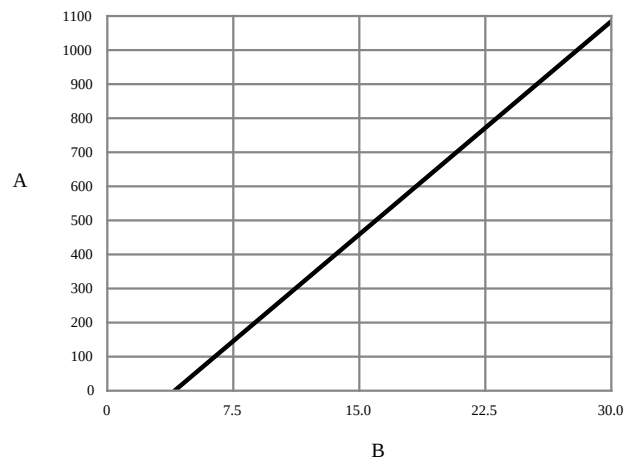
3.3.2 Wire Analogoutput (externally powered)

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-5: Analog Output Wiring (Externally Powered)

- A. Analog output
- B. Channel A or B
- C. 5–30 Vdc (maximum)
- D. See Figure 3-6 for maximum loop resistance
- E. Signal device

Figure 3-6: Externally-Powered Analog Output: Maximum Loop Resistance

- A. Maximum resistance (Ω)
- B. External supply voltage (V)

3.4 Wire the analog/HART® output

Wire the analog/HART output in explosion-proof, nonincendive, or nonhazardous installations.

Important

Meter installation and wiring should be performed only by suitably-trained personnel.

3.4.1 Wire the analog/HART® output (internally powered)

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-7: Analog/HART Output Wiring (Internally Powered)



3.4.2 Wire analog/HART[®] output (externally powered)

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-8: Analog/HART Output Wiring (Externally Powered)

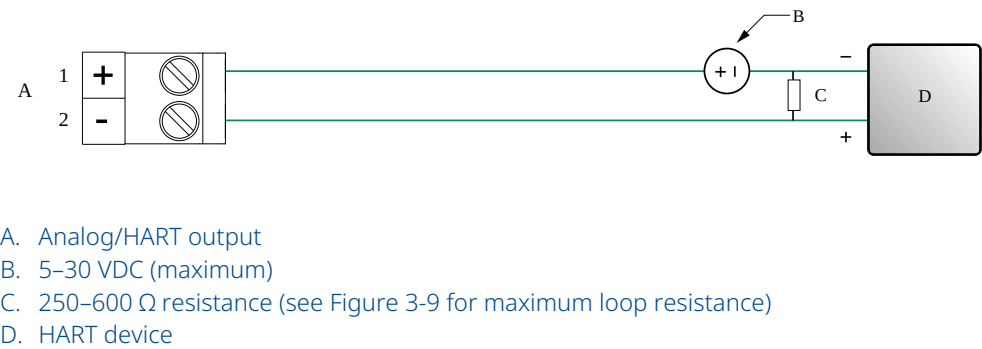
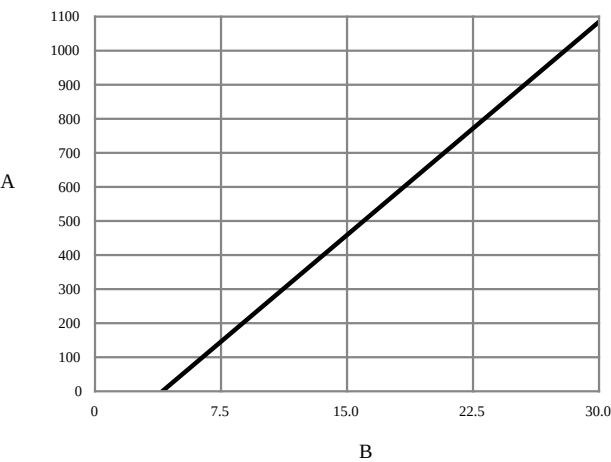


Figure 3-9: Externally-powered analog/HART output: maximum loop resistance



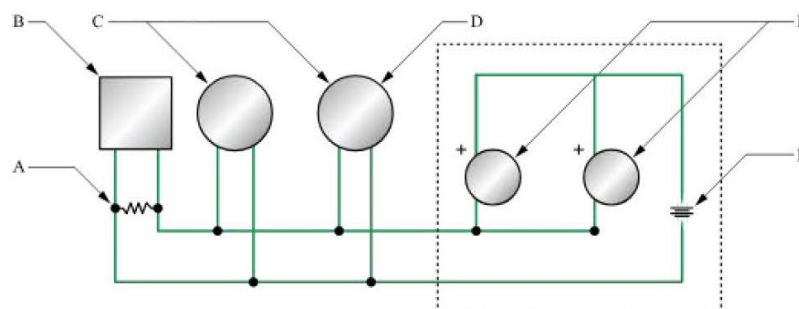
- A. Maximum resistance (Ω)
B. External supply voltage (V)

3.4.3 Wire the analog/HART® multidrop installation (internally or externally powered)

Procedure

See the [Figure 3-6](#) for information on wiring an analog HART multidrop installation.

Figure 3-10: Analog/HART multidrop wiring



- A. 250–600 Ω resistance
- B. HART-compatible host or controller
- C. HART-compatible transmitter (internally powered)
- D. Magnetic Flow 9732 transmitter (internally powered) analog/HART connections
- E. SMART FAMILY™ transmitters
- F. 24 VDC loop power supply required for external transmitter

3.5 Wire Frequency Output/Discrete Output/Discrete Input

Use this procedure to wire the Frequency Output and Discrete Output for both Channel A and Channel B, and the Discrete Input for Channel B.

Refer to the [Safety messages](#) section for product-specific safety messages.

Channel	Option	Location
A	FO2	Wire the frequency output (internally powered) Wire the frequency output (externally powered)
B	FO1	Wire the frequency output (internally powered Channel B) Wire the frequency output (externally powered Channel B)
A	DO2	Wire the discrete output (internally powered)
B	DO1	Wire the discrete output (externally powered) Channel A or Channel B
B	DI	Wire the discrete input (internally powered) Wire the discrete input (externally powered)

3.5.1 Wire the frequency output (Channel A)

Use this section to wire the frequency output in explosion-proof, nonincendive, or nonhazardous installations.

Important

Meter installation and wiring should be performed only by suitably-trained personnel.

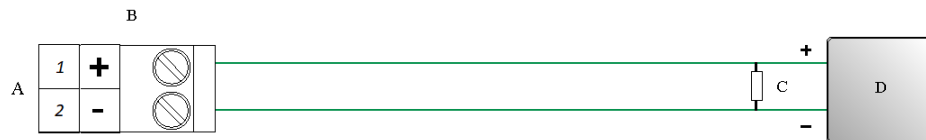
Wire the frequency output (internally powered)

Use this procedure to wire the internally-powered frequency output for Channel A.

Procedure

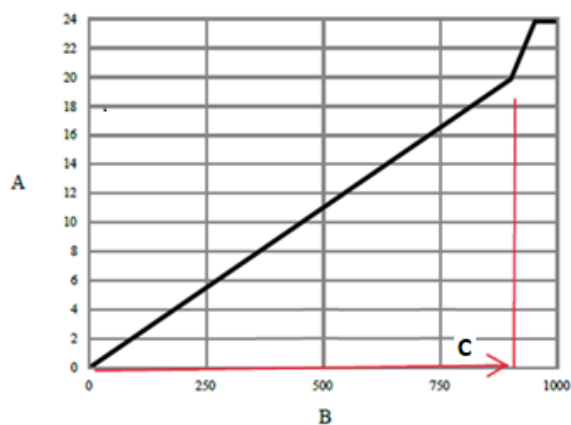
Wire to the appropriate output terminal and pins.

Figure 3-11: Frequency output wiring (internally powered)



- A. Frequency output
- B. Channel A
- C. See Figure 3-12 for output amplitude versus load resistance
- D. Counter

Figure 3-12: Internally powered frequency output: output amplitude versus load resistance [24 VDC (Nom) open circuit]



- A. Output amplitude (V) where $V = 22\text{mA} \times \text{Load Resistor}$ in Linear Range
- B. Load resistor (Ω)
- C. Linear Range

Wire the frequency output (externally powered)

Use this procedure to wire the externally-powered frequency output for Channel A.

Procedure

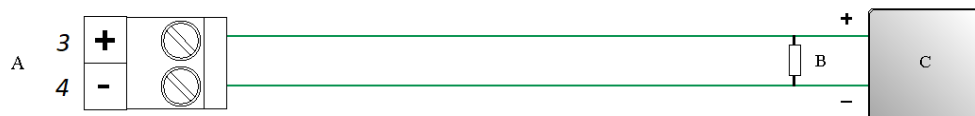
Wire to the appropriate output terminal and pins.

Figure 3-13: Frequency output wiring (externally powered)

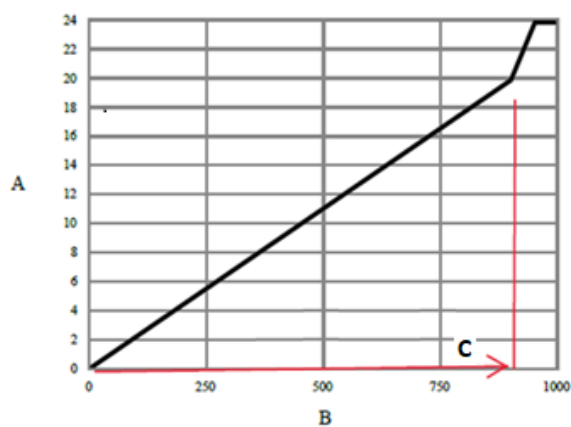
- A. Frequency output
- B. Channel A
- C. 3-30 VDC (maximum)
- D. Rload: Maximum sinking current = 500mA
- E. Signal device

Wire the frequency output (internally powered Channel B)**Procedure**

Wire to the appropriate output terminal and pins.

Figure 3-14: Frequency output wiring (internally powered)

- A. Frequency output
- B. See for output amplitude versus load resistance
- C. Counter

Figure 3-15: Internally powered frequency output: output amplitude versus load resistance [24 VDC (Nom) open circuit]

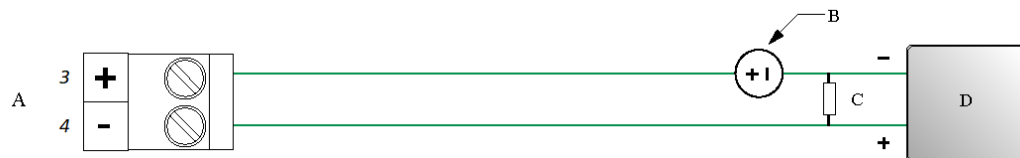
- A. Output amplitude (V) where $V = 22\text{mA} \times \text{Load Resistor}$ in Linear Range
- B. Load resistor (Ω)
- C. Linear Range

Wire the frequency output (externally powered Channel B)

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-16: Frequency output wiring (externally powered)



- A. Frequency output
- B. 3–30 VDC (maximum)
- C. Rload: Maximum sinking current = 500mA
- D. Signal device

3.5.2 Wire the discrete output (internally powered)

Use this procedure to wire the internally-powered discrete output for Channel A or B.

Procedure

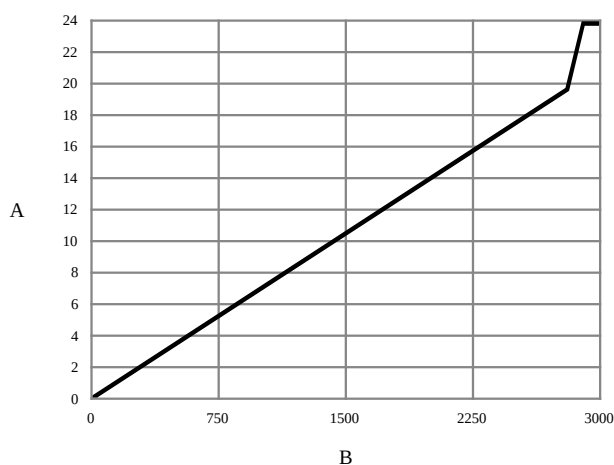
Wire to the appropriate output terminal and pins.

Figure 3-17: Discrete output wiring (internally powered)



- A. Discrete output
- B. Channel A (Pins 1 and 2) or Channel B (Pins 3 and 4)
- C. See Figure 3-18 for output amplitude versus load resistance
- D. Counter

Figure 3-18: Internally powered discrete output: output amplitude versus load resistance [24 VDC (Nom) open circuit]



- A. Output amplitude (V)
B. Load resistor (Ω)

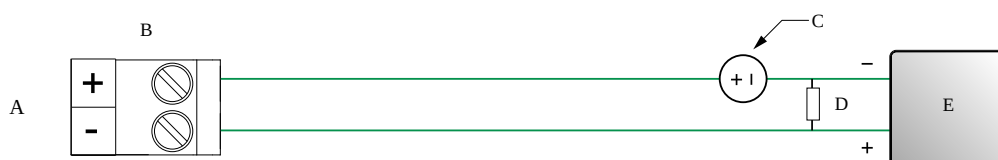
3.5.3 Wire the discrete output (externally powered) Channel A or Channel B

Use this procedure to wire the externally-powered discrete output.

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-19: Discrete output wiring (externally powered)



- A. Discrete output
B. Channel A (Pins 1 and 2) or Channel B (Pins 3 and 4)
C. 3–30 VDC (maximum)
D. Rload: Maximum sinking current = 500mA
E. Counter

3.5.4 Wire the discrete input (Channel B)

Use this section to wire the discrete input in explosion-proof, nonincendive, or nonhazardous installations.

Important

Meter installation and wiring should be performed only by suitably-trained personnel.

Wire the discrete input (internally powered)

Procedure

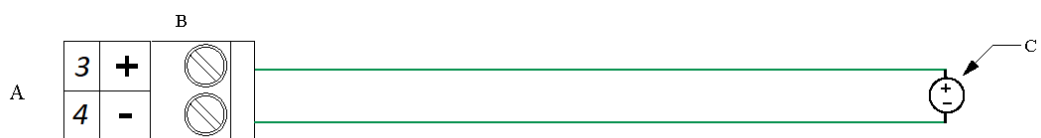
Wire to the appropriate input terminal and pins.

Figure 3-20: Discrete input Input Wiring (Internally Powered)

- A. Discrete input
 B. Channel B
 C. Mechanical Switch (Push-Button or Relay)

Wire the discrete input (externally powered)**Procedure**

Wire to the appropriate input terminal and pins.

Figure 3-21: Discrete input wiring (externally powered)

- A. Discrete input
 B. Channel B
 C. 30 VDC (maximum)

Note

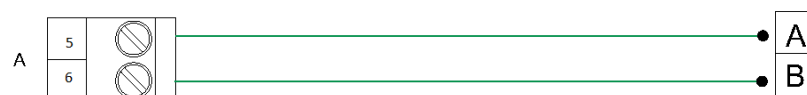
- Maximum positive threshold is 3 VDC.
- Minimum negative threshold is 0.6 VDC.

3.6 Wire the RS-485 output (Channel C)

Use this section to wire the RS-485 output in explosion-proof, nonincendive, or nonhazardous installations.

Procedure

Wire to the appropriate output terminal and pins.

Figure 3-22: RS-485 output wiring

- A. RS-485 output

Note

The transmitter does not provide any RS-485 termination resistance.

4 Quick start

4.1 Applying power

The transmitter must be powered up for all configuration and commissioning tasks or for process measurement.

Procedure

1. Verify that the cables are connected to the transmitter as described in the installation manual.
2. Verify that all transmitter and sensor covers and seals are closed.

Warning

To prevent ignition of flammable or combustible atmospheres, ensure that all covers and seals are tightly closed. For hazardous area installations, applying power while housing covers are removed or loose can cause an explosion.

3. Turn on the electrical power at the power supply.
The transmitter will automatically perform diagnostic routines. During this period, the **Transmitter Initializing** alert is active. The diagnostic routines should complete in approximately 30 seconds.

After completing the task:

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to 3 minutes to reach thermal equilibrium. Therefore, if this is the initial startup, or if power has been off long enough to allow components to reach ambient temperature, allow the electronics to warm up for approximately 3 minutes before relying on process measurements. During this warm-up period, minor measurement instability or inaccuracy may be observed.

When the flow meter has completed its power-up sequence, if the default settings are in effect:

- The display will show the current volume flow rate and measurement unit.
- If there are any active fault or informational alarms, the alert banner displays until the alert has been manually acknowledged.
- If the alert has been acknowledged but is still active, the alert icon displays above the menu button, and the **Alert List** menu appears at the top of the main menu.

4.2 Check meter status

Check the meter for any error conditions that require user action or that affect measurement accuracy.

Procedure

Wait for the power-up sequence to complete.

Immediately after power-up, the transmitter runs through diagnostic routines and checks for error conditions. During the power-up sequence, the **Transmitter Initializing** alert is active. This alert should clear automatically when the power-up sequence is complete.

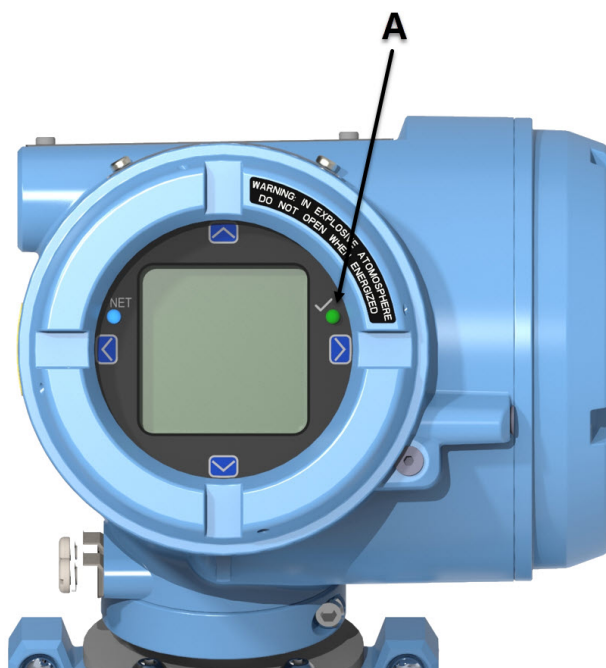
4.2.1 Display status LED and device status

The status LED on the display provides a quick indication of device status by changing color and flashing.

Device status LED condition	Device status
Off	No power to display
Solid green	Transmitter operating correctly
Solid yellow	Function check

Device status LED condition	Device status
	Maintenance required
Blinking yellow	Trim or Smart Meter Verification command is running Programming is being performed
Solid red	Device failure

Figure 4-1: Transmitter Status LEDs



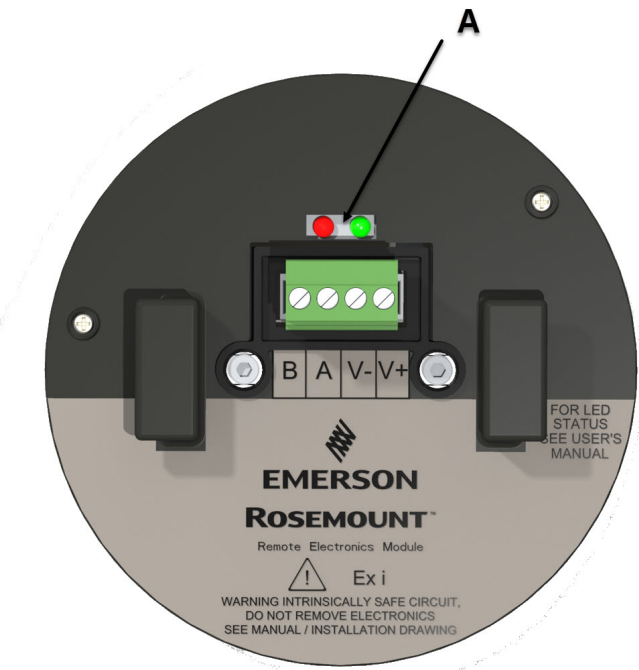
A. Device Status LED

4.2.2 Core processor assembly status LEDs and device status

The status LEDs on the core processor assembly located in the sensor junction box for remote mount installations provides a quick indication of device status by changing color and flashing.

Device status LED condition	Device status
Off	No power to core processor assembly
Solid green	Core processor assembly operating correctly
Flashing green/red	Trim or Smart Meter Verification command is running. Programming is being performed.
Solid red	Device failure

Figure 4-2: Core Processor Status LEDs



A. Core Processor LEDs

4.3 Commissioning wizards

The transmitter menu includes a *Guided Setup* to help move quickly through the most common configuration parameters. ProLink III™ also provides a commissioning wizard.

By default, when the transmitter starts up, the Guided Setup menu is offered. Guided Setup is an optional feature and doesn't have to be used. The transmitter can also be configured to not display Guided Setup automatically on start up.

- To enter Guided Setup:
 - During transmitter setup, choose **Yes** at the prompt.
 - After transmitter setup, **Menu → Main Menu → Startup Tasks → Guided Setup**
- To control the automatic display of Guided Setup, choose **Menu → Main Menu → Configuration → Guided Setup**.

For information on the ProLink III commissioning wizard, see the [Micro Motion ProLink III with ProcessViz Software User Manual](#).

As the commissioning wizards are self guided, they are not documented in detail.

4.4 Make a startup connection to the transmitter

For all configuration tools except the display, an active connection to the transmitter must exist in order to configure the transmitter.

Procedure

Identify the connection type to use and follow the instructions for that connection type in the appropriate appendix.

Communications tool	Connection type to use	Instructions
ProLink III™	HART®	Basic information about ProLink III

Communications tool	Connection type to use	Instructions
Field communicator	HART	Basic information about field communicators

4.5 Set the transmitter clock

The transmitter clock provides timestamp data for alerts, service logs, history logs, and all other timers and dates in the system. Set the clock for local time or for any standard time desired.

Note

It might be convenient to set all of the transmitter clocks to the same time, even if the transmitters are in different time zones.

To aid in record keeping convenience, set transmitter clocks located in different time zones to the same time.

Display	Menu → Main Menu → Configuration → Basic Setup → Time/Date/Tag
ProLink III	Device Tools → Configuration → Transmitter Clock
Field communicator	Device Settings → Setup Overview → Configure Transmitter Clock

Procedure

1. Select the desired time zone.
2. If a custom time zone is required, select **Special Time Zone** and enter the time zone as a difference from UTC (Coordinated Universal Time).
3. Set the time appropriately.

Note

The transmitter does not adjust for Daylight Savings Time. To observe Daylight Savings Time, reset the transmitter clock manually.

4. Set the month, day, and year.
The transmitter tracks the year and automatically adds a day for leap years.

4.6 View the licensed features (optional)

The transmitter license controls the features that are enabled on the transmitter, including both software applications and I/O channels. The licensed features can be viewed to ensure that the transmitter was ordered with the required features.

Display	Menu → Main Menu → About → Licenses → Licensed Features
ProLink III	Device Tools → Device Information → Licensed Features
Field communicator	Device Settings → Device Information → Licenses → Permanent Feature Set and Temporary Feature Set

Licensed features are purchased and available for permanent use. The model code options represent the licensed features.

A trial or temporary license allows for the exploration of features before purchasing. The trial license enables the specified features for a limited number of days. This number is displayed for reference. At the end of this period, the feature will no longer be available.

To purchase additional features or request a trial license, either write down or record the Unique ID Number and current license key from the transmitter and then contact customer service. To enable the additional features or trial license, a new license will need to be configured in the transmitter.

4.7 Set informational parameters

Several parameters that identify or describe the transmitter and sensor can be set. These parameters are not used in processing and are not required.

Display	Menu → Main Menu → Configuration → Device Information
ProLink III	Device Tools → Configuration → Informational Parameters
Field communicator	Device Settings → Device Information → Materials and Device Settings → Identification → Device Identification

Procedure

1. Set informational parameters for the transmitter.
 - a. Set **Transmitter Serial Number** to the serial number of the transmitter.
The transmitter serial number is provided on the metal tag that is attached to the transmitter housing.
 - b. Set **Descriptor** to any desired description of this transmitter or measurement point.
 - c. Set **Message** to any desired message.
 - d. Verify that **Model Code (Base)** is set to the base model code of the transmitter.
The base model code completely describes the transmitter, except for the features that can be licensed independently. The base model code is set at the factory.
 - e. Set **Model Code (Options)** to the options model code of the transmitter.
The options model code describes the independent features that have been licensed for this transmitter. The original options model code is set at the factory. If additional options are licensed for this transmitter, Emerson will supply an updated options model code.

For a field communicator, configuring model code options is not available for this release.
2. Set informational parameters for the sensor.
 - a. Set **Sensor Serial Number** to the serial number of the sensor connected to this transmitter.
The sensor serial number is provided on the metal tag that is attached to the sensor case.
 - b. Set **Tag** to the text associated with the sensor. Set the following parameters according to the model code options.

Set the following parameters according to the model code options:

 - a. Set **Liner Material**.
 - b. Set **Electrode Type**.
 - c. Set **Electrode Material**.
 - d. Set **Flange Type**.
 - e. Set **Flange Material**.

Sensor Type is set or derived during characterization.

4.8 Characterize the meter (if required)

Characterizing the meter adjusts the transmitter to match the unique traits of the sensor it is paired with.

If the transmitter was ordered with a sensor, it was characterized at the factory; however, it is best practice to always verify the characterization parameters and sensor size.

4.8.1 Calibration data

The characterization parameters (also called calibration parameters) describe the sensor's gain, offset, and key calibration characteristics of the sensor.

Display	Menu → Main Menu → Configuration → Basic Setup → Calibration Data
ProLink III	Device Tools → Configuration → Process Measurement → Calibration Data
Field communicator	Device Settings → Setup Overview → Configure Sensor

Values for the sensor are provided on the sensor tag or the calibration certificate.

4.8.2 Sensor size

Determine the sensor size by reviewing the model number.

The model number is provided on the sensor tag or the calibration certificate.

Example model number: 9205020ATSACA1A0TZ1N5 where 020 designates a 2-inch sensor size.

Display	Menu → Main Menu → Configuration → Basic Setup → Sensor Size
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Line Size
Field communicator	Device Settings → Sensor Configuration → Sensor Size

4.8.3 Sample sensor tag

Figure 4-3: Sensor Tag



4.9 Verify volume flow measurement

Check to see that the volume flow rate reported by the transmitter is accurate by using one of the methods below.

Procedure

- Read the value for **Volume Flow Rate** on the transmitter display, which is the default initial display.

- Connect to the transmitter with ProLink III and read the value for **Volume Flow Rate** in the *Process Variables* panel.
- Connect to the transmitter with a field communicator and read the value for **Volume Flow Rate**.

After completing the task:

If the reported volume flow rate is not accurate:

- Check the characterization parameters.
- Review the troubleshooting suggestions for flow measurement issues.

5 Introduction to configuration and commissioning

5.1 Display Security and Write Protection

The transmitter has several features that can help to protect it against intentional or unintentional access and configuration changes.

- When enabled, the software setting **Write Protection** prevents any configuration changes. When enabled, a lock icon displays at the top of the home screen of the display.
- When enabled, the display option **Display Security** prevents any configuration changes being made from the display unless the display passcode is entered. **Display Security** does not prevent configuration changes from other interfaces.

5.1.1 Enable or disable software write protection

When enabled, write protection prevents changes to the transmitter configuration. Some transmitter functions can be performed and transmitter configuration parameters can be viewed while write protection is enabled.

Write protection is enabled by toggling the physical write protect (dip) switch (identified by a lock icon) located behind the display module.

Figure 5-1: Write Protect (Dip) Switch behind the Display Module

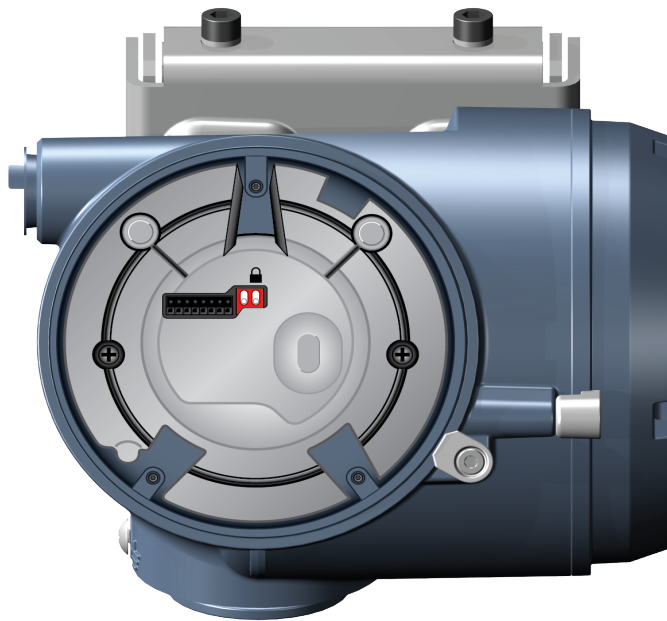


Figure 5-2: Write Protect on the Display (Upper Right Corner)

Users cannot change write protection from any host configuration tool.

Note

Write protecting the transmitter primarily prevents accidental changes to configuration, not intentional changes. Any user who can change the switch can disable write protection.

5.1.2 Configure security for the display

Display	Menu → Main Menu → Configuration → Security → Display Security
ProLink III	Device Tools → Configuration → Transmitter Display → Display Security
Field communicator	Device Settings → Display → Display Security → Password Required

When using the display, a passcode can be set which can be required to do any of the following tasks:

- Enter the main menu
- Change a parameter
- Access alert data through the display
- Start, stop, or reset totalizers or inventories via the context menu

ProLink™ III, HART®, and Bluetooth® communication can be used to enable security on the local display. At that time, the local display passcode can also be changed.

The display passcode can be the same or different from the totalizer/inventory context menu control password. If different, the display passcode is used to reset, start, and stop totalizers or inventories using **Menu → Main Menu → Operations → Totalizers**.

Procedure

1. Configure **Password Required** as desired.

Option	Description
At Write	When a user chooses an action that leads to a configuration change, they are prompted to enter the display passcode.
Enter Menu	When the menu is selected from the process variable screen, the display passcode will be immediately required if Password Required is set.
Never (default)	When a user chooses an action that leads to a configuration change, they are prompted to enter a specific button sequence (↵⇓⇓⇓⇓⇓⇓). This is designed to protect against accidental changes to configuration. It is not a security measure.

2. If the **At Write** or **Enter Menu** option was selected, enable or disable alert security as desired.

Option	Description
Enabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display but the alert banner is not displayed. If the operator attempts to enter the alert menu, they are prompted to enter the display passcode.
Disabled	If an alert is active, the alert symbol ⓘ is shown above the Menu button on the display but the alert banner is not displayed. No passcode or confirmation is required to enter the alert menu.

Restriction:

Password Required cannot be set to **Never** and have alert security enabled.

- If **Password Required** is not enabled, alert security is disabled and cannot be enabled.
- Alert security is disabled automatically if the user sets **Password Required** to **Never** after:
 - **Password Required** is initially set to either **At Write** or **Enter Menu**.
 - Alert security is enabled.

3. If **Password Required** has been set to **At Write** or **Enter Menu**, the user is prompted to enter the desired passcode.

- Default: AAAA
- Range: Any four alphanumeric characters
- **Password Required** must be set to **At Write** or **Enter Menu** to enable the totalizer/inventory control context menu password option.

Important

If **Password Required** is enabled, but the display passcode is not changed, the transmitter will post a configuration alert.

4. Configure **Main Menu Available** as desired.

Enabled	The local display Menu option from the process variable screen will be accessible.
Disabled	The local display Menu option from the process variable screen will not be accessible.

Important

Once **Main Menu Available** is disabled, it cannot be enabled from the local display. Use another configuration tool, such as ProLink III, to re-enable main menu access from the local display.

5.1.3 Disable USB-A service port

Display	Menu → Main Menu → Configuration → Security → Service Port
ProLink III	Device Tools → Configuration → Informational Parameters → Transmitter → Identification → Transmitter USB Port
Field communicator	Device Settings → Communication → Modbus → Service Port Setup → Enable/Disable Service Port

When using the display or ProLink III a user can use the appropriate path to disable the USB-A service port:

Note

The USB service port can only be disabled when connected to Channel C (RS-485). In other instances, the path to disable will not be available.

Procedure

1. Disable the service port using the appropriate path for the device.
2. Once at the proper location, select Disable from the table below.

Option	Description
Enabled	The service port will remain enabled.
Disabled	The service port is disabled.

5.1.4 Disabling Bluetooth® communication

Display	Menu → Main Menu → Configuration → Bluetooth Settings → Radio → Disable
ProLink III	Device Tools → Configuration → Communications → Communication (Bluetooth)
Field communicator	Device Settings → Communication → Bluetooth → Bluetooth Radio

Bluetooth communication can be disabled by disabling the **Bluetooth Radio**.

Prerequisites

Note

Bluetooth communication can also be disabled through the AMS Device Configurator application when connected over Bluetooth communication.

Procedure

Disable the **Bluetooth Radio** using the paths described above, depending on the communications device used.

Important

Once **Bluetooth Radio** is disabled, it cannot be enabled from the local display. For instructions to reset Bluetooth security, refer to both [Change Bluetooth role password](#) and [Reset Bluetooth security settings](#), depending on the type of connection.

5.2 Work with configuration files

The current transmitter configuration can be saved in two forms: a backup file and a replication file.

Tip

A saved configuration file can be used to change the nature of the transmitter quickly. This might be convenient if the transmitter is used for different applications or different process fluids.

Backup files	Contain all parameters. They are used to restore the current device if required. The <i>.spare</i> extension is used to identify backup files.
Replication files	Contain all parameters except the device-specific parameters, e.g., calibration factors or meter factors. They are used to replicate the transmitter configuration to other devices. The <i>.xfer</i> extension is used to identify replication files.

5.2.1 Save a configuration file using ProLink III

The current transmitter configuration can be saved to a PC. The ProLink PC file format is supported.

Procedure

1. Choose **Device Tools** → **Configuration Transfer** → **Save Configuration**.
2. Select the type of configuration file and where to save it.
3. Select **Next**.
4. If a device file format is selected, choose the type of file.
 - A backup file is a full configuration designed for full transmitter replacement.
 - A replication file contains all parameters except for device-specific parameters and is intended to duplicate the setup onto other transmitters that will be used in similar applications.
5. Select **Save**.
6. Browse to the desired location, then enter the name for this configuration file.
7. Select **Save**.
The configuration file is saved to the specified location as *name.pcfg*.
8. Wait for the file save to complete.
A progress bar will show percent complete.
9. Click **OK** to close the **Data Transfer Completed Successfully** window.

5.2.2 Load a configuration file using ProLink III

A user with appropriate authority can load a configuration file to the transmitter's working memory. The ProLink III PC file format is supported.

When using ProLink III format for configuration files, a user with appropriate authority can specify configuration parameters individually or by groups, using this format for both backup and replication.

Procedure

1. Choose **Device Tools** → **Configuration Transfer** → **Load Configuration**.
2. Select **On my computer** in **ProLink III file format** and click **Next**.
3. Select the parameters to load.
4. Select **Load**.
5. Select the **File name** of the **Configure file** (*** .pcfg**) to load and click **Open**.
6. Select **Start**.
The parameters are written to working memory, and the new settings become effectively immediately.

5.2.3 Restore the factory configuration

A file containing the factory configuration is always saved in the transmitter's internal memory and is available for use.

Display	Menu → Main Menu → Configuration → Save/Restore Config → Restore Config from Memory → FactoryConfig
ProLink™ III	Device Tools → Configuration Transfer → Restore Factory Configuration
Field communicator	Device Settings → Restore/Restart → Restore Factory Configuration

This action is typically used for error recovery or for repurposing a transmitter.

If the factory configuration is restored, the real-time clock, the audit trail, the historian, and other logs are not reset.

6 Configure process measurement

6.1 Configure Sensor Flow Direction Arrow

Sensor Flow Direction Arrow is used to accommodate installations in which the Flow arrow on the sensor does not match the majority of the process flow. This typically happens when the sensor is accidentally installed backwards.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Sensor Direction
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Sensor Direction
Field communicator	Device Settings → Process Measurement → Flow → Sensor Setup → Sensor Direction

Sensor Flow Direction Arrow interacts with **mA Output Direction**, **Frequency Output Direction**, and **Totalizer Direction** to control how flow is reported by the outputs and accumulated by the totalizers and inventories.

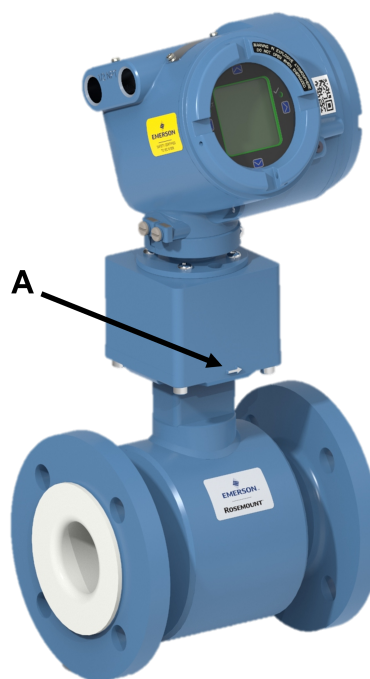
Sensor Flow Direction Arrow also affects how flow is reported on the transmitter display and via digital communications. This includes ProLink III and a field communicator.

Figure 6-1: Flow arrow on 9205 sensor



A. Flow arrow and direction

Figure 6-2: Flow arrow on 8795 sensor



A. Flow arrow and direction

Procedure

Set **Sensor Flow Direction Arrow** as appropriate.

Option	Description
Normal	The majority of flow through the sensor matches the flow arrow on the sensor. Actual forward flow is processed as forward flow.
Reverse	The majority of flow through the sensor is opposite to the flow arrow on the sensor. Actual forward flow is processed as reverse flow.

Tip

Rosemount Magnetic sensors are bidirectional. Measurement accuracy is not affected by actual flow direction or the setting of **Sensor Flow Direction Arrow**. **Sensor Flow Direction Arrow** controls only whether actual flow is processed as forward flow or reverse flow.

6.2 Configure Volume Flow Measurement Unit

Volume Flow Measurement Unit controls the measurement unit used to report volume flow rate.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Volume Flow Settings
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Volume Flow Rate Unit
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Volume Flow → Volume Flow Rate Unit

Procedure

Set **Volume Flow Unit** to the desired unit.
Default: gal/min

Tip

If the desired volume flow measurement unit is not available, a special volume flow unit can be defined.

6.2.1 Options for Volume Flow Unit

The transmitter provides a standard set of measurement units for volume flow units. Different communications tools may use different labels.

Unit description	Label		
	Display	ProLink III	Field communicator
Liters per second	L/s	L/sec	L/s
Liters per minute	L/min	L/min	L/min
Liters per hour	L/h	L/hr	L/h
Liters per day	L/day	l/day	L/d
Million Liters per day	MML/d	mil l/day	MML/d
Cubic Meter per second	m3/s	m3/sec	Cum/s
Cubic meter per minute	m3/min	m3/min	Cum/min
Cubic meter per hour	m3/hr	m3/hr	Cum/h
Cubic meter per day	m3/d	m3/day	Cum/d
Cubic feet per second	ft3/s	ft3/sec	Cuft/s
Cubic feet per minute	ft3/min	ft3/min	Cuft/min
Cubic feet per hour	ft3/h	ft3/hr	Cuft/h
Cubic feet per day	ft3/d	ft3/day	Cuft/d
Cubic centimeters per min	cm3/min	cm3/min	CuCm/min
Gallons per second	gal/s	US gal/sec	gal/s
Gallons per minute	gal/min	US gal/min	gal/min
Gallons per hour	gal/h	US gal/hr	gal/h
Gallons per day	gal/d	US gal/day	gal/d
Million Gallons per day	MMgal/d	mil US gal/day	Mgal/d
Imperial Gallons per second	Impgal/s	Imp gal/sec	Impgal/s
Imperial Gallons per min	Impgal/min	Imp gal/min	Impgal/min
Imperial Gallons per hour	Impgal/h	Imp gal/hr	Impgal/h
Imperial Gallons per day	Impgal/d	Imp gal/day	Mgal/d
Barrels per second	bbl/s	barrels/sec	bbl/s
Barrels per second	bbl/min	barrels/min	bbl/min
Barrels per second	bbl/h	barrels/hr	bbl/h
Barrels per day	bbl/d	barrels/day	bbl/d
Beer barrels per second	Beer bbl/s	barrels 31/sec	bbl 31/s
Beer barrels per minute	Beer bbl/min	barrels 31/min	bbl 31/min
Beer barrels per hour	Beer bbl/h	barrels 31/hr	bbl 31/h
Beer barrels per day	Beer bbl/d	barrels 31/day	bbl 31/d
Special volume unit	SPECIAL	Special	Spcl

6.2.2 Define a special measurement unit for volume flow

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Volume Flow Settings → Units → SPECIAL
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Volume Flow Rate Unit → Special
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Volume Flow → Special Volume Units

Procedure

1. Specify **Base Volume Unit**.
Base Volume Unit is the existing volume unit that the special unit will be based on.
2. Specify **Base Time Unit**.
Base Time Unit is the existing time unit that the special unit will be based on.
3. Calculate **Volume Flow Conversion Factor** as follows:
 - a. $x \text{ base units} = y \text{ special units}$
 - b. **Volume Flow Conversion Factor** = $x \div y$
4. Enter volume flow rate **Conversion Factor**.
The original volume flow rate value is divided by this value.
5. Set the **Special Volume Flow Rate Unit** to the desired name for the volume flow unit.
6. Set **Special Volume Total Label** to the desired name for the volume total and volume inventory unit.

The special volume unit is stored in the transmitter. The transmitter can be configured to use the special volume unit at any time.

Example: Defining a special measurement unit for volume flow

To measure volume flow in thousand gallons per hour (kgal/hr):

1. Set **Base Volume Unit** to Gallons (gal).
2. Set **Base Time Unit** to Hours (h).
3. Calculate **Volume Flow Conversion Factor**:
 - a. $1 \text{ gallon (gal)} = 0.001 \text{ thousand gallons (kgal)}$
 - b. **Volume Flow Conversion Factor** = $1 \div 0.001 = 1000$
4. Set **Volume Flow Conversion Factor** to 1000.
5. Set **Special Volume Flow Rate Unit** to kgal/hr.
6. Set **Special Volume Total Unit** to kgal.

6.3 Configure mass flow measurement unit

The mass flow measurement parameters control how mass flow is measured and reported. The mass total and mass inventory are derived from the mass flow data.

6.3.1 Configure Mass Flow Measurement Unit

Mass Flow Measurement Unit specifies the unit of measure that will be used for the mass flow rate. The default unit used for total and mass inventory is derived from this unit.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Mass Flow Settings → Units
---------	--

ProLink III	Device Tools → Configuration → Process Measurement → Flow → Mass Flow Rate Unit
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Mass Flow → Mass Flow Rate Unit

Procedure

Set **Mass Flow Measurement Unit** to the desired unit.
Default: lb/min (pounds per minute)

Tip

If the desired measurement unit is not available, a user with appropriate authority can define a special measurement unit.

Options for Mass Flow Measurement Unit

The transmitter provides a standard set of measurement units for **Mass Flow Measurement Unit**, plus one user-defined special measurement unit. Different communications tools may use different labels for the units.

Unit description	Label		
	Display	ProLink III	Field communicator
Grams per second	grams	g/sec	g/s
Grams per minute	gram/min	g/min	g/min
Grams per hour	gram/h	g/hr	g/h
Kilograms per second	kg/s	kg/sec	kg/s
Kilograms per minute	kg/min	kg/min	kg/min
Kilograms per hour	kg/h	kg/hr	kg/h
Kilograms per day	kg/d	kg/day	kg/d
Metric tons per minute	MetTon/min	mTon/min	MetTon/min
Metric tons per hour	MetTon/h	mTon/hr	MetTon/h
Metric tons per day	MetTon/d	mTon/day	MetTon/d
Pounds per second	lb/s	lbs/sec	lb/s
Pounds per minute	lb/min	lbs/min	lb/min
Pounds per hour	lb/h	lbs/day	lb/h
Pounds per day	lb/d	lbs/day	lb/d
Short tons (2000 pounds) per minute	STon/min	sTon/min	STon/min
Short tons (2000 pounds) per hour	STon/h	sTon/hr	STon/h
Short tons (2000 pounds) per day	STon/d	sTon/day	STon/d
Long tons (2240 pounds) per hour	LTon/h	ITon/hr	LTon/h
Long tons (2240 pounds) per day	LTon/d	ITon/day	LTon/d
Special mass unit	SPECIAL	Special	Special

Define a special measurement unit for mass flow

Display	Menu → Main Menu → Configuration → Process Measurement → Flow Variables → Mass Flow Settings → Units → SPECIAL
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Special Unit → Mass Flow Rate
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Mass Flow → Special Mass Units

Procedure

- Specify **Base Mass Unit**.
Base Mass Unit is the existing mass unit that the special unit will be based on.
- Specify **Base Mass Time Unit**.
Base Mass Time Unit is the existing time unit that the special unit will be based on.
- Calculate Mass Flow Conversion Factor as follows:
 - $x \text{ base units} = y \text{ special units}$
 - $\text{Mass Flow Conversion Factor} = x \div y$
- Enter mass flow rate **Conversion Factor**.
The original mass flow rate value is divided by this value.
- Set **Special Mass Flow Rate Unit** to the desired name for the mass flow unit.
- Set **Special Mass Total Unit** to the desired name for the mass total and mass inventory unit.

The special mass measurement unit is stored in the transmitter. The transmitter can be configured to use the special measurement unit at any time.

Example: Defining a special measurement unit for mass flow

To measure mass flow in ounces per second (oz/sec):

- Set **Base Mass Unit** to **Pounds (lb)**.
- Set **Base Mass Time Unit** to **Seconds (sec)**.
- Calculate Mass Flow Conversion Factor:
 - $1 \text{ lb/sec} = 16 \text{ oz/sec}$
 - $\text{Mass Flow Conversion Factor} = 1 \div 16 = 0.0625$
- Set Mass Flow Rate **Conversion Factor** to **0.0625**.
- Set **Special Mass Flow Rate Unit** to **oz/sec**.
- Set **Special Mass Total Unit** to **oz**.

6.4 Configure Velocity Measurement Unit

Velocity Measurement Unit controls the measurement unit used to report velocity.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Velocity Flow Settings → Units
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Velocity Flow Rate → Velocity Flow Rate Unit
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Velocity Flow → Velocity Flow Rate Unit

Procedure

Set **Velocity Measurement Unit** to the desired unit.
Default: ft/sec

Tip

If the desired velocity flow measurement unit is not available, a special velocity flow unit can be defined.

6.4.1 Options for Velocity Measurement Unit

The transmitter provides a standard set of measurement units for **Velocity Measurement Unit**. Different communications tools may use different labels.

Unit description	Label		
	Display	ProLink III	Field communicator
Feet per minute	ft/min	ft/min	ft/min
Feet per second	ft/s	ft/sec	ft/s
Inches per minute	in/min	in/min	in/min
Inches per second	in/s	in/sec	in/s
Meters per hour	m/h	m/hr	m/h
Meters per second	m/s	m/sec	m/s

6.4.2 Define a special measurement unit for velocity flow

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Velocity Flow Settings → Units → SPECIAL
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Special Unit → Velocity Flow Rate
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Velocity Flow → Special Velocity Units

Procedure

- Specify **Base Velocity Unit**.
Base Velocity Unit is the existing velocity unit that the special unit will be based on.
- Specify **Base Velocity Time Unit**.
Base Velocity Time Unit is the existing time unit that the special unit will be based on.
- Calculate Velocity Flow Conversion Factor as follows:
 - $x \text{ base units} = y \text{ special units}$
 - $\text{Velocity Flow Conversion Factor} = x \div y$
- Enter velocity flow rate **Conversion Factor**.
The original velocity flow rate value is divided by this value.
- Set **Special Velocity Flow Rate Unit** to the desired name for the special velocity flow unit.
- Set **Special Velocity Total Unit** to the desired name for the velocity total and velocity inventory unit.

The special velocity unit is stored in the transmitter. The transmitter can be configured to use the special velocity unit at any time.

Example: Defining a special measurement unit for Velocity flow

To measure velocity flow in miles per hour (mph):

1. Set **Base Velocity Unit** to **Feet (ft)**.
2. Set **Base Velocity Time Unit** to **Hours (h)**.
3. Calculate Velocity Flow Conversion Factor:
 - a. 5280 feet (ft) = 1 mile
 - b. Velocity Flow Conversion Factor = $5280 \div 1 = 5280$
4. Set velocity flow **Conversion Factor** to **5280**.
5. Set **Special Velocity Flow Rate Unit** to **mph**.
6. Set **Special Velocity Flow Unit** to **mile**.

6.5 Configure Flow Damping overview

Flow Damping controls the amount of damping that will be applied to the measured flow rate. It affects flow rate process variables that are based on the measured flow rate. This includes volume, mass, and velocity flow rates. Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value of the process variable (the damped value) will reflect 63% of the change in the actual measured value.

6.5.1 Configure Flow Damping

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Flow Damping
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Flow Rate Damping
Field communicator	Device Settings → Process Measurement → Flow → Damping → Flow Damping

Procedure

Set **Flow Damping** to the desired value.

- Default: 2 seconds
- Range: 0 seconds to 256 seconds

Note

If a number greater than 256 is entered, it is automatically changed to 256.

Note

- A high damping value can make the process variable appear smoother because the reported value changes slowly.
- A low damping value can make the process variable appear more erratic because the reported value changes more quickly.
- If variable flow rate is the result of process noise, set **Coil Drive Frequency** to High.
- If setting **Coil Drive Frequency** to High does not improve flow reading stability, consult the Advanced Digital Signal Processing (ADSP) section.
- The combination of a high damping value and rapid, large changes in flow rate can result in increased measurement error.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.
- The transmitter automatically rounds off any entered damping value to the nearest valid value.

Interaction between Flow Damping and mA Output Damping

In some circumstances, both **Flow Damping** and **mA Output Damping** are applied to the reported flow value.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Inputs/Outputs → Channel X → I/O Settings → AO Damping
ProLink III	Inputs/Outputs → Analog Output X → Setup → Analog Output Damping

Flow Damping controls the rate of change in flow process variables. **mA Output Damping** controls the rate of change reported through mA Output. If **mA Output Process Variable** is set to **Volume Flow Rate**, and both **Flow Damping** and **mA Output Damping** are set to non-zero values, flow damping is applied first, and the added damping calculation is applied to the result of the first calculation.

6.6 Configure Low Flow Cutoff overview

Low Flow Cutoff specifies the lowest flow rate that will be reported by the transmitter. All flow rates below this cutoff will be reported as 0. **Low Flow Cutoff** will be set for all flow variables (Volume, Mass, and Velocity).

6.6.1 Configure Low Flow Cutoff

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Flow Settings (Volume, Mass, or Velocity) → Low Flow Cutoff
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Volume Flow Cutoff, Mass Flow Cutoff, or Velocity Flow Cutoff
Field communicator	Device Settings → Process Measurement → Flow → Flow Units and Cutoff → Volume Flow → Volume Low Flow Cutoff/Velocity Flow → Velocity Low Flow Cutoff/Mass Flow → Mass Low Flow Cutoff

Procedure

Set **Low Flow Cutoff** to the desired value.

Important

Volume Flow Cutoff, **Mass Flow Cutoff**, and **Velocity Flow Cutoff** are linked. If one is changed, the other two will automatically be recalculated and changed accordingly.

7 Configure advanced options for process measurement

7.1 Configure a discrete event

A discrete event is used to provide notification of process changes and, optionally, to perform specific transmitter actions if the event occurs. An discrete event occurs (is ON) if the real-time value of a user-specified process variable moves above (HI) or below (LO) a user-defined setpoint, or in range (IN) or out of range (OUT) with respect to two user-defined setpoints.

Display	Menu → Main Menu → Configuration → Alert Setup → Discrete Events
ProLink III	Device Tools → Configuration → Events → Discrete Events
Field communicator	Device Settings → Alerts → Alert Setup → Event Configuration/Event and Action Configuration

Up to five discrete events can be defined. For each discrete event, assign one or more actions that the transmitter will perform if the discrete event occurs.

Procedure

1. Select the discrete event (Discrete Event 1 through 5) to configure.
2. Assign a process variable to the event.
3. Specify **Event Type**.

> Setpoint A	$x > A$ The event occurs when the value of the assigned process variable (x) is greater than the setpoint (Setpoint A), endpoint not included.
< Setpoint A	$x < A$ The event occurs when the value of the assigned process variable (x) is less than the setpoint (Setpoint A), endpoint not included.
Between Setpoint A and Setpoint B	$A \leq x \leq B$ The event occurs when the value of the assigned process variable (x) is <i>in range</i> , that is, between Setpoint A and Setpoint B , endpoints included.
< Setpoint A or > Setpoint B	$x \leq A$ or $x \geq B$ The event occurs when the value of the assigned process variable (x) is <i>out of range</i> , that is, less than Setpoint A or greater than Setpoint B , endpoints included.

4. Set values for the required setpoints.
 - For > Setpoint A and < Setpoint A discrete events, set **Setpoint A**.
 - For Between Setpoint A and Setpoint B and < Setpoint A or > Setpoint B discrete events, set **Setpoint A** and **Setpoint B**.
5. Set the User-defined label.
6. Configure a Discrete Output to switch states in response to the event status.
7. Specify the action or actions that the transmitter will perform when the event occurs.

Display	Menu → Main Menu → Configuration → Alert Setup → Discrete Events, select any enhanced event, and choose Assign Actions
ProLink III	Device Tools → Configuration → I/O → Inputs → Action Assignment
Field communicator	Device Settings → Alerts → Alert Setup → Discrete Events

7.1.1 Options for Enhanced Event Action

Action	Label		
	Display	ProLink III	Field communicator
Start/stop all totalizers and inventories	Start/stop all totalizers	Start or Stop All Totalizers	Start/Stop All Totals
Reset totalizer X	Reset Total X	Reset Totalizer X	Reset Total X
Reset all totalizers and inventories	Reset All Totals	Reset All Totals	Reset All Totals

7.2 Configure totalizers and inventories

The transmitter provides seven configurable totalizers and seven configurable inventories. Each totalizer and each inventory can be configured independently.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Totalizers & Inventories
ProLink III	Device Tools → Configuration → Configure Totalizers or Configure Inventories
Field communicator	Inputs/Outputs → Totalizers → Setup Totalizers (1-7) and Setup Inventories (1-7)

Totalizers track the process since the last totalizer reset. Inventories track the process since the last inventory reset. Inventories are typically used to track the process across totalizer resets.

Prerequisites

Before configuring the totalizers and inventories, ensure that the process variables are available on the transmitter.

Procedure

1. Select the totalizer or inventory to configure.
2. Set **Totalizer Source** or **Inventory Source** to the process variable that the totalizer or inventory will track.

Option	Description
Volume flow	The totalizer or inventory will track Volume Flow Rate and calculate total volume since the last reset.
Mass flow	The totalizer or inventory will track Mass Flow Rate and calculate total mass since the last reset.
Velocity flow rate	The totalizer or inventory will track Velocity Flow Rate and calculate total distance since the last reset.

Note

The totalizer/inventory value will not automatically be reset when the source is changed. The user must manually reset the totalizer/inventory.

3. Set **Totalizer Direction** to specify how the totalizer or inventory will respond to forward or reverse flow.

Option	Flow direction	Totalizer and inventory behavior
Forward	Forward	Totals increment
	Reverse	Totals do not change
Reverse	Forward	Totals do not change
	Reverse	Totals increment
Bidirectional	Forward	Totals increment
	Reverse	Totals decrement
Absolute Value	Forward	Totals increment
	Reverse	Totals increment

Important

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 7-1: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	With Arrow	Forward
	Against Arrow	Reverse
Reverse (opposite from Flow arrow on sensor)	With Arrow	Reverse
	Against Arrow	Forward

4. Set **User Name** to the desired name for the inventory or totalizer.
User-Defined Label can have a maximum of 16 characters.
The transmitter automatically generates a name for each totalizer and inventory, based on its source, direction, and type.

- **Source**=Mass Flow
- **Direction**=Forward Only
- **User-Defined Label**=Mass Fwd Total
- **Source**=Volume Flow Rate
- **Direction**=Bidirectional
- **User-Defined Label** = Vol Bidir Inv

The specified name is used on the transmitter display and on all interfaces that support it. If **User Name** contains only spaces, the transmitter-generated name is used. Not all interfaces support totalizer and inventory names.

7.2.1 Example: Checking for backflow

There is a significant amount of backflow through the sensor. To collect data, configure two totalizers as follows:

- **Source**=Volume-Flow, **Direction**=Forward Only
- **Source**=Volume-Flow, **Direction**=Reverse Only

Reset both totalizers, allow them to run for an appropriate period, then look at the amount of reverse flow as a percentage of forward flow.

7.2.2 Example: Tracking three different process fluids

Three tanks are connected to a loading dock through a single meter. Each tank contains a different process fluid. Track each process fluid separately.

1. Set up three totalizers, one for each tank.
2. Name the totalizers **Tank 1**, **Tank 2**, and **Tank 3**.
3. Configure each totalizer as required for the corresponding process fluid.
4. Stop and reset all three totalizers to ensure that the beginning values are 0.
5. When loading from a tank, start the corresponding totalizer, and stop it when the load is finished.

7.2.3 Default settings for totalizers and inventories

Totalizer or inventory	Source (process variable assignment)	Direction	Name of totalizer Name of inventory
1	Volume flow	Forward Only	Vol Fwd Total Vol Fwd Inv
2	Mass flow	Forward Only	Mass Fwd Total Mass Fwd Inv
3	Velocity flow	Forward Only	Vel Fwd Total Vel Fwd Inv
4	Volume flow	Forward Only	Vol Fwd Total Vol Fwd Inv
5	Volume flow	Forward Only	Vol Fwd Total Vol Fwd Inv
6	Volume flow	Forward Only	Vol Fwd Total Vol Fwd Inv
7	Volume flow	Forward Only	Vol Fwd Total Vol Fwd Inv

7.3 Configure logging for totalizers and inventories

The transmitter can write the current value of four totalizers or inventories to a log, at user-specified intervals. A log file can be generated from this data for viewing and analysis.

Display	Menu → Main Menu → Configuration → Totalizer Log
ProLink III	Not available
Field Communicator	Not available

Note

Both **Log Total 1** and **Log Total 2** are defaulted to **Totalizer 1 - Vol Fwd Total** and **Inventory 1 - Vol Fwd Inv**, respectively.

Procedure

1. Specify the date on which totalizer logging will begin.
A future date must be specified. If the current date is specified, the transmitter rejects the setting.
2. Specify the time at which totalizer logging will begin.
3. Specify the number of hours between records.
4. Select up to four totalizers or inventories to be logged.

7.4 Configure Digital Communications Fault Action

Digital Communications Fault Action specifies the values that will be reported via the display and digital communications if the device encounters a fault condition. The values are also sent to the outputs for processing against their configured fault actions.

Display	Menu → Main Menu → Configuration → Alert Setup → Output Fault Actions
ProLink III	Device Tools → Configuration → Fault Processing
Field communicator	Device Settings → Alerts → Alert Setup → Output Fault Actions → Channel C → Fault Action

Procedure

Set **Digital Communications Fault Action** as desired.

Default:None

Restriction:

If **Digital Communications Fault Action** is set to **NAN**, the **Analog Output Fault Action** or **Frequency Output Fault Action** cannot be set to **None**. If this setting is attempted, the transmitter will not accept the configuration.

Important

- To have mA Output continue reporting process data during fault conditions, both **Digital Communications Fault Action** and **Analog Output Fault Action** must be set to **None**. If **Analog Output Fault Action** is set to **None** and **Digital Communications Fault Action** is set to any other option, the Analog Output will produce the signal associated with the selection.
- To have the Frequency Output continue reporting process data during fault conditions, both **Digital Communications Fault Action** and **Frequency Output Fault Action** must be set to **None**. If **Frequency Output Fault Action** is set to **None** and **Digital Communications Fault Action** is set to any other option, the Frequency Output will produce the signal associated with the selection.

7.4.1 Options for Digital Communications Fault Action

Label			Description
Display	ProLink III	Field communicator	
Upscale	Upscale	Upscale	- Digital Communications values indicate that the value is greater than the upper sensor limit. - Totalizers stop incrementing.
Downscale	Downscale	Downscale	- Digital Communications values indicate that the value is lower than the lower sensor limit. - Totalizers stop incrementing.
Zero	Zero	IntZero-All 0	- Flow rate variables go to the value that represents a flow rate of 0 (zero). - Totalizers stop incrementing.
Not-a-Number (NaN)	Not a Number	Not-a-Number	- Digital Communications are reported as IEEE NaN. - Modbus® scaled integers are reported as Max Int. - Totalizers stop incrementing.
Flow to Zero	Flow to Zero	IntZero-Flow 0	- Flow rates are reported as 0. - Other Digital Communications are reported as measured. - Totalizers stop incrementing.
None (default)	None (default)	None (default)	- All Digital Communications are reported as measured. - Totalizers increment if they are running.

7.4.2 Interaction between Digital Communications Fault Action and other fault actions

The setting of **Digital Communications Fault Action** affects the operation of the Analog Outputs, Frequency Outputs, and Discrete Outputs if the corresponding output fault actions are set to **None**.

Interaction between Digital Communications Fault Action and Analog Output Fault Action

If **Analog Output Fault Action** is set to **None**, the Analog Output signal depends on the setting of **Digital Communications Fault Action**.

If the device detects a fault condition:

1. **Digital Communications Fault Action** is evaluated and applied.
2. **Analog Output Fault Action** is evaluated.
 - If it is set to **None**, the output reports the value associated with the setting of **Digital Communications Fault Action**.
 - If it is set to any other option, the output performs the specified fault action.

To have the Analog Output to continue to report process data during fault conditions, both **Analog Output Fault Action** and **Digital Communications Fault Action** must be set to **None**.

Interaction between Digital Communications Fault Action and Frequency Output Fault Action

If **Frequency Output Fault Action** is set to **None**, the Frequency Output signal depends on the setting of **Digital Communications Fault Action**.

If the device detects a fault condition:

1. **Digital Communications Fault Action** is evaluated and applied.
2. **Frequency Output Fault Action** is evaluated.
 - If it is set to **None**, the output reports the value associated with the setting of **Digital Communications Fault Action**.
 - If it is set to any other option, the output performs the specified fault action.

To have the Frequency Output continue to report process data during fault conditions, both **Frequency Output Fault Action** and **Digital Communications Fault Action** must be set to **None**.

Interaction between Digital Communications Fault Action and Discrete Output Fault Action

If **Discrete Output Fault Action** is set to **None** and **Discrete Output Source** is set to **Zero Flow**, the Discrete Output state during a fault depends on the setting of **Digital Communications Fault Action**.

If the device detects a fault condition:

1. **Digital Communications Fault Action** is evaluated and applied.
2. **Discrete Output Fault Action** is evaluated.
 - If it is set to **None**, and **Discrete Output Source** is set to **Zero Flow**, the Discrete Output will use the value determined by the current setting of **Digital Communications Fault Action** to determine if a zero flow condition has occurred.
 - If **Discrete Output Source** is set to any other option, the setting of **Digital Communications Fault Action** is irrelevant to the behavior of the Discrete Output during fault conditions. The Discrete Output is set to the specified fault action.

To have the Discrete Output to report a zero flow condition appropriately during fault conditions, both **Discrete Output Fault Action** and **Digital Communications Fault Action** must be set to **None**.

7.5 Configure AC line filter

This advanced transmitter function can be used to stabilize erratic flow readings caused by common mode or AC line noise.

Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → AC Line Filter
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → AC Line Filter
Field Communicator	Device Settings → Process Measurement → Detailed Setup → AC Line Noise

Table 7-2: AC Line Filter Settings

AC line filter setting	Description
Standard (default)	Provides signal processing filters for removing 50 and 60 Hz waveform noise.
50 HZ	Provides signal processing filters focused on removing 50 Hz waveform noise
60 HZ	Provides signal processing filters focused on removing 60 Hz waveform noise
Off	The AC line filter is turned off.

Note

The **Standard** setting is recommended for most applications.

7.6 Configuring Advanced Digital Signal Processing

7.6.1 Introduction

Magnetic flow meters 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 (High Frequency vs. Low Frequency) to isolate the flow signal from the process noise, the microprocessor has *Digital Signal Processing* (DSP) 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.

7.6.2 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 flow meter, hydraulic pumps, and slurry flows with low concentrations of particles in the stream. The particles bounce on 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 flow meter 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.

7.6.3 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 noise amplitude adjacent to the Low and High coil drive frequencies. The noise values are used to calculate a signal-to-noise ratio for both drive frequencies. If the signal-to-noise ratio is less than **Process Noise Trigger Level** at the currently selected coil drive frequency, the high process noise diagnostic will trip, indicating that the flow signal may be compromised.

7.6.4 Optimizing flow reading in noisy applications

If the flow reading is unstable, first check the wiring, grounding, and process reference associated with the flow meter. 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 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 increasing the coil drive frequency above the 15 Hz region. The coil drive frequency is optimized by sensor size at the factory to run at the highest frequency with a minimal zero offset. Coil drive mode is selectable between standard Low frequency and noise-reducing High frequency.

Coil drive frequency

Display	Menu → Main Menu → Configuration → Detailed Setup → Coil Drive Frequency
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Coil Drive Frequency
Field Communicator	Device Settings → Process Measurement → Digital Setup → Coil Drive → Coil Drive Frequency

This parameter changes the drive frequency of the magnetic coils.

Low

The standard coil drive frequency is Low. This is the recommended coil drive frequency setting for most applications.

High

If the process fluid causes a noisy or unstable flow reading, increase the coil drive frequency to High.

7.6.5 Other signal processing tools

The transmitter contains several advanced functions that can be used to stabilize erratic flow readings caused by process noise. If the High coil drive frequency has been set, and the flow reading is still unstable, the damping and signal processing functions should be adjusted. It is best to set the coil drive frequency to High to increase the flow sampling rate. In addition to selecting a higher coil drive frequency (High vs. Low) to isolate the flow signal from the process noise, the transmitter can measure the noise level and automatically adjust and analyze each input based on user defined parameters to reject the noise specific to the application.

Signal processing mode

Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → Signal Processing
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Select Level of Advanced Signal Processing
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Digital Signal Processing → Mode

The signal processing mode is the primary way the user should adjust the signal processing. The signal processing modes in [Table 7-3](#) automatically configure the signal processing settings.

Table 7-3: Signal processing modes

Signal processing mode	Description
Off	Signal processing is disabled.
Minimal (default)	Provides a minimal amount of signal processing to remove spike noise with the fastest response.
Standard	Appropriate for most applications as a starting place.
Increased	Minimizes the noise but does not respond as quickly to process flow step changes.
Maximum	Sets the maximum amount of filtering.
Custom	Allows the maximum amount of filtering. This is the only signal processing mode setting that allows the user to adjust the individual signal processing settings.

The following parameters are configurable only when **Custom** is selected as the signal processing mode:

Averaging time

Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → Custom Config → Averaging Time
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Averaging Time
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Digital Signal Processing → Settings → Averaging Time

The Averaging Time sets the amount of time that inputs are collected and used to calculate the running average value. This parameter can be configured for a value between 0.1 seconds and 10 seconds. The default value is 1 second.

Process noise factor

Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → Custom Config → Noise Factor
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Averaging Time → Process Noise Factor
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Digital Signal Processing → Settings → Process Noise Factor

This parameter will set the tolerance band around the running average. The tolerance band dynamically changes based on the process noise level and the process noise factor. Flow values within the limit are accepted while values outside the limit are scrutinized to determine if they are a noise spike or an actual flow change. This parameter can be configured for a value between 0.5 and 20. The default value is 2.0.

- As the process noise factor is decreased, the flow measurement will be more steady but will react slower to changing process flow rates.
- As the process noise factor is increased, the flow measurement could become less stable but will react faster to changing process flow rates.

Scan time

Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → Custom Config → Scan Time
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Scan Time
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Digital Signal Processing → Settings → Scan Time

This setting allows signal processing to scan the flow and provide a more stable output. The default setting is 0.5 seconds; the range is 0 to 1.0 seconds. Setting Scan Time to zero disables this feature.

- A shorter Scan Time can increase response time but may introduce more noise into the flow reading.
- A longer Scan Time can decrease response time but may provide a more stable flow reading.

Time limit

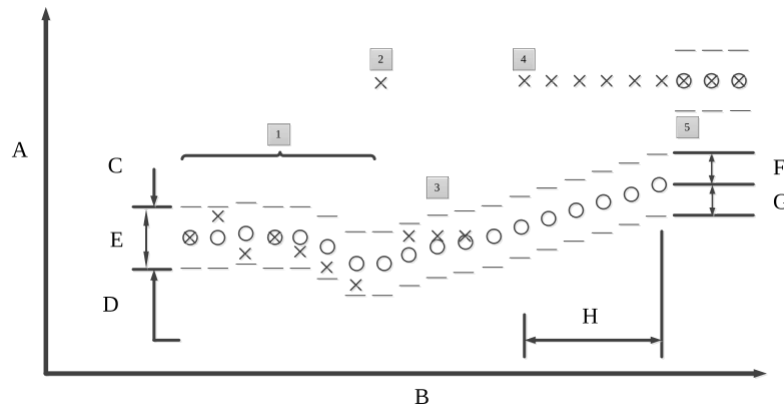
Display	Menu → Main Menu → Configuration → Detailed Setup → Signal Processing → Time Limit
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Time Limit
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Digital Signal Processing → Settings → Time Limit

Time Limit is always configurable. 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 average time is 10 seconds, 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 2 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.

7.6.6 Explanation of signal processing algorithm

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

Figure 7-1: Signal Processing Functionality



- A. Flow rate
- B. Time
- 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.

7.7 Configuring Short Run Install

Short Run Installation is a licensable feature that improves flow measurement performance in installations with reduced upstream and downstream straight piping.

Display	Menu → Main Menu → Configuration → Detailed Setup → Short Run Install
ProLink III	Device Tools → Configuration → Process Measurement → Detailed Setup → Short Run Install
Field Communicator	Device Settings → Process Measurement → Detailed Setup → Short Run Install

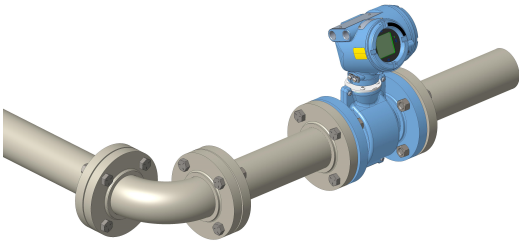
By applying a proprietary compensation algorithm based on installation conditions, the transmitter can reduce the impact of upstream disturbances on measurement accuracy. When enabled, Short Run Install applies an additional installation effect to the base accuracy specification, allowing for reliable and repeatable performance in space-constrained or non-ideal piping configurations without requiring additional hardware.

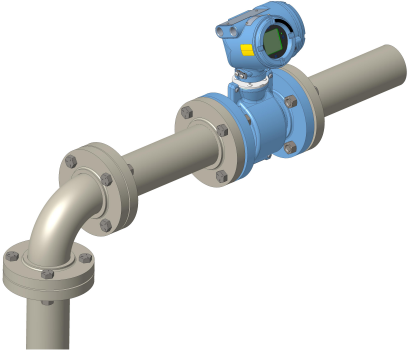
7.7.1 Configuring disturbance type

Short Run Install has three disturbance types:

1. Off
2. 90° In Plane
3. 90° Out of Plane

If Short Run Install (SR1 option) was ordered, then the Short Run Install will be available, but is turned "off" from the factory. If SR1 was not ordered or licensed, this feature is not available

Disturbance type	Example of disturbance
Off	Off
90° In Plane	

Disturbance type	Example of disturbance
90° Out of Plane	

7.7.2 Configuring distance unit

Short Run Install has two distance units – inch and centimeter. Set the units used for calculating the short run installation distance for Short Run Install.

7.7.3 Configuring upstream distance

Upstream Distance sets the distance from the sensor flange to the closest flange of the disturbance.

8 Configuring diagnostics for process management

8.1 Rosemount diagnostics reduce cost & improve output by enabling new practices

Rosemount Magnetic Flow Meters 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 Flow Meter diagnostics enabled, plant availability and throughput can be improved, and costs through simplified installation, maintenance and troubleshooting can be reduced.

Table 8-1: Magnetic Flow Meter Diagnostics

Diagnostic name	Diagnostic category	9205 Product capability	8795 Product capability
Basic diagnostics			
Empty Pipe	Process	Standard	Standard
Reverse Flow	Process	Standard	Standard
Grounding/Wiring	Installation/process	Standard	Standard
Transmitter Fault	Meter Health	Standard	Standard
Basic Smart Meter Verification	Meter Health	Standard	Standard
Sensor Health Tests	Sensor Health	Standard	Standard
Electronics Temperature	Meter Health	Standard	Standard
Coil Circuit Fault	Meter Health	Standard	Standard
Advanced diagnostics			
High Process Noise	Process	Suite 1 (DS1)	N/A
Coated Electrode Detection	Process	Suite 1 (DS1)	N/A
Smart Fluid Diagnostic	Process	Suite 1 (DS1)	N/A
Commanded Smart Meter Verification	Meter Health	Suite 2 (MV)	Suite 2 (MV)
Continuous Smart Meter Verification	Meter Health	Suite 2 (MV)	Suite 2 (MV)
4–20 mA Loop Verification	Installation	Suite 2 (MV)	Suite 2 (MV)

8.2 Options for accessing diagnostics

Rosemount magnetic flow meter diagnostics can be accessed through the Local Operator Interface (LOI), ProLink™ III Software, a HART® Communicator (including AMS Trex™ Device Communicator), and AMS Device Manager. Contact an Emerson Flow representative (see back page) to activate diagnostics or for diagnostic availability on existing transmitters.

Rosemount magnetic flow meter diagnostics can be accessed through the LOI/Display, a Field Communicator, and AMS Device Manager

Rosemount magnetic flow meter 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.

8.2.1 Access diagnostics with the LOI for installation, maintenance, and meter verification

Rosemount magnetic flow meter diagnostics are available through the LOI to simplify maintenance

8.2.2 Access diagnostics through ProLink[™] III Software

Simplify maintenance and troubleshooting practices by utilizing ProLink III Software to access diagnostics and troubleshooting information, log variable data, run Smart Meter Verification, and print verification reports.

8.3 Access information when you need it with asset tags

Newly shipped devices include a unique QR code asset tag that enables you to access serialized information directly from the device. With this capability, you can:

- Access device drawings, diagrams, technical documentation, and troubleshooting information in your MyEmerson account
- Improve mean time to repair and maintain efficiency
- Ensure confidence that you have located the correct device
- Eliminate the time-consuming process of locating and transcribing nameplates to view asset information.

8.4 Licensing and enabling diagnostics

All advanced diagnostics are licensed by ordering option code MV or DS1. If a diagnostic option is not ordered, advanced diagnostics can be licensed in the field using a license key. Each transmitter has unique license keys specific to the diagnostic option code or other licensable features.

Display	Menu → Main Menu → Service Tools → License Manager → Licenses → Unique ID
ProLink III	Device Tools → Configuration → Feature Licenses → Unique ID
Field Communicator	Device Settings → Device Information → Licenses → License Upgrade → Device UID

Note

A trial license is also available to enable the advanced diagnostics using a temporary license key. See the detailed procedures below for entering the license key and enabling the advanced diagnostics. To obtain a permanent or trial license key, contact an Emerson representative.

Prerequisites

Obtain a license key for the desired diagnostics or other licensable features by contacting an Emerson representative. This will require knowing the transmitter's **Unique ID**.

Procedure

1. Power up the transmitter.
2. Enter the license key obtained from Emerson.

Display	Menu → Main Menu → Service Tools → License Manager → Enter Permanent License
ProLink III	Device Tools → Configuration → Feature Licenses → License Key

Field Communicator	Device Settings → Device Information → Licenses → License Upgrade → Update License
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Note

Some diagnostics will need to be turned on after licensing to enable the feature.

8.5 Configuring tunable empty pipe detection diagnostics

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.

8.5.1 Turning empty pipe on/off

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.

Display	Menu → Main Menu → Configuration → Diagnostics → Empty Pipe → EP Control
ProLink III	Device Tools → Configuration → Advanced Diagnostics → Empty Pipe Detection
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Enabled Diagnostics → Empty Pipe

8.5.2 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.

8.5.3 Empty pipe (EP) value

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 time, then the empty pipe diagnostic alert will activate.

Display	Menu → Main Menu → Service Tools → Service Data → View Diagnostic Variables → Empty Pipe → EP Value
ProLink III	Device Tools → Configuration → Diagnostics → Empty Pipe Value
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Empty Pipe → Empty Pipe Value

8.5.4 Empty pipe (EP) trigger level

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.

Display	Menu → Main Menu → Configuration → Diagnostics → Empty Pipe → EP Trigger Level
ProLink III	Device Tools → Configuration → Diagnostics → Empty Pipe Trigger Level
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Empty Pipe → Empty Pipe Trigger Level

8.5.5 Empty pipe (EP) trigger time

Empty pipe trigger time is the amount of time that the transmitter must receive an empty pipe value that exceeds the empty pipe trigger level before the empty pipe diagnostic alert activates. The default setting from the factory is 5.

Display	Menu → Main Menu → Configuration → Diagnostics → Empty Pipe → EP Trigger Time
ProLink III	Device Tools → Configuration → Diagnostics → Empty Pipe Trigger Time
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Empty Pipe → Empty Pipe Trigger Time

Note

EP trigger time limits: 2 to 50.

8.5.6 Optimizing tunable empty pipe

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

Procedure

1. Record the empty pipe value with a full pipe condition.
Full reading = 0.2 to 0.6
2. Record the empty pipe value with an empty pipe condition.
Empty reading = 80.0 to 87.0
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 highest full pipe value.
Set the trigger level to 20.0
4. Set the empty pipe trigger time 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 trigger time to 10

8.6 Electronics temperature

The transmitter continuously monitors the temperature of the IO board and the core board. If the measured temperature exceeds the operating limits of -70 to 197 °F (-57 to 92 °C) the transmitter will go into alarm and generate an alert.

8.6.1 Turning electronics temperature on/off

The electronics temperature diagnostic is always turned on and can't be turned off.

8.6.2 Electronics temperature parameters

The electronics temperature diagnostic has two read-only parameters. It does not have any configurable parameters. The parameters show the current temperature of the electronics.

Display	Menu → Main Menu → Service Tools → Service Data → View Diagnostic Variables → IO Board Temperature and Core Board Temperature
ProLink III	Device Tools → Configuration → Diagnostics → IO Board Temperature and Core Board Temperature
Field Communicator	Diagnostics → Variables → Diagnostics → Electronics → IO Board Temperature and Core Board Temperature

8.7 Configuring reverse flow

Use reverse flow to enable or disable the transmitter's ability to read flow in the opposite direction of the flow direction arrow (see [Configure Sensor Flow Direction Arrow](#)). This may occur when the process has bi-directional flow. This also enables totalizers and inventories to count in the reverse direction.

Display	Menu → Main Menu → Configuration → Diagnostics → Reverse Flow
ProLink III	Device Tools → Configuration → Diagnostics → Reverse Flow Mode
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Enabled Diagnostics → Reverse Flow

Note

If reverse flow is disabled, the transmitter will report a flow rate of zero under reverse flow conditions, reverse totalizers/inventories will not increment, and net totalizers/inventories will not decrement.

8.8 Configuring grounding/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 the sensitivity level, that is an indication that there is a grounding or wiring issue and that stray electrical signals are getting into the transmitter and could be causing erratic flow readings. The diagnostic alert will activate indicating that the grounding and wiring of the installation should be carefully reviewed.

The grounding/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.

8.8.1 Tuning grounding or wiring fault either on or off

The grounding or wiring fault detection diagnostic can be turned either on or off as required by the application.

Display	Menu → Main Menu → Configuration → Diagnostics → Grounding/Wiring → Control
ProLink III	Device Tools → Configuration → Diagnostics → Grounding/Wiring Fault Detection
Field Communicator	Device Settings → Advanced Diagnosis → Process Diagnostics → Enabled Diagnostics → Grounding/Wiring

8.8.2 Grounding/wiring fault parameters

The ground/wiring fault detection diagnostic has one read-only parameter and a configurable sensitivity level.

8.8.3 Line noise

The line noise parameter shows the amplitude of the line noise in millivolts (mV). 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 the sensitivity level, then the grounding/wiring fault diagnostic alert will activate.

Display	Menu → Main Menu → Service Tools → Service Data → View Noise Analysis → Line Noise
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ProLink III	Device Tools → Configuration → Diagnostics → Grounding/Wiring Fault Detection
Field Communicator	Device Settings → Advanced Diagnosis → Process Diagnostics → Grounding/Wiring → Line Noise

8.8.4 Sensitivity level

The sensitivity level sets the allowed amount of line noise before the alert will be activated. There are three preconfigured levels and a selection to allow for a custom trigger level. The default setting is **Control Level**.

Display	Menu → Main Menu → Diagnostics → Ground/Wiring → Sensitivity Level
ProLink III	Device Tools → Configuration → Diagnostics → Ground/Wiring → Sensitivity Level
Field Communicator	Device Settings → Advanced Diagnosis → Process Diagnostics → Grounding/Wiring → Line Noise Sensitivity Level

The sensitivity levels have different preset trigger levels to optimize the diagnostic for the application requirements. If the application requires high performance, set the sensitivity level to **High Accuracy** for a low trigger level. If the application is only used for monitoring flow, set the sensitivity level to **Monitor Only** for a high trigger level. If the application requires a unique trigger level, set the sensitivity level to **Custom**.

Sensitivity level	Trigger level
High Accuracy	0.2
Control Level (default)	2
Monitor Only	5
Custom	0 to 10000 (user defined)

8.9 Configuring 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.

8.9.1 Turning high process noise on/off

The high process noise diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DS1 Option) was ordered, then the high process noise diagnostic will be turned on. If DS1 was not ordered or licensed, this diagnostic is not available

Display	Menu → Main Menu → Configuration → Diagnostics → Process Noise → Control
ProLink III	Device Tools → Configuration → Diagnostics → Process Noise Mode
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Enabled Diagnostics → High Process Noise

8.9.2 High process noise parameters

The high process noise diagnostic has two read-only parameters. It does not have any configurable parameters and a configurable sensitivity level. This diagnostic requires that flow be

present in the pipe and the velocity be greater than 1 ft/s (0.3 m/s). The low and high frequency signal values depend on the line size.

8.9.3 Low frequency signal to noise ratio (SNR)

Display	Menu → Main Menu → Service Tools → Service Data → View Noise Analysis → Low Freq SNR
ProLink III	Device Tools → Configuration → Diagnostics → Low Frequency SNR
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → High Process Noise → Low Frequency Signal-to-Noise Ratio

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

8.9.4 High frequency signal to noise ratio (SNR)

Display	Menu → Main Menu → Service Tools → Service Data → View Noise Analysis → High Freq SNR
ProLink III	Device Tools → Configuration → Diagnostics → High Frequency SNR
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → High Process Noise → High Frequency Signal-to-Noise Ratio

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

8.9.5 Sensitivity level

The sensitivity level sets the allowed amount of process noise before the alert will be activated. There are three preconfigured levels and a selection to allow for a custom trigger level. The default setting is **Control Level**.

Display	Menu → Main Menu → Configuration → Diagnostics → Process Noise → Sensitivity Level
ProLink III	Device Tools → Configuration → Diagnostics → Process Noise Sensitivity Level
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → High Process Noise → Process Noise Sensitivity Level

The sensitivity levels have different preset trigger levels to optimize the diagnostic for the application requirements. If the application requires high performance, set the sensitivity level to **High Accuracy** for a high trigger level. If the application is only used for monitoring flow, set the sensitivity level to **Monitor Only** for a low trigger level. If the application requires a unique trigger level, set the sensitivity level to **Custom**.

Sensitivity level	Trigger level
High Accuracy	100
Control Level (default)	25
Monitor Only	5
Custom	0 to 10000 (user defined)

8.10 Coated electrode detection diagnostics

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.

8.10.1 Turning coated electrode detection on/off

The coated electrode detection diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DS1 option) was ordered, then the coated electrode detection diagnostic will be turned on. If DS1 was not ordered or licensed, this diagnostic is not available.

Display	Menu → Main Menu → Configuration → Diagnostics → Electrode Coating → EC Control
ProLink III	Device Tools → Configuration → Diagnostics → Electrode Coating
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Enabled Diagnostics → Electrode Coating

8.10.2 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.

Table 8-2: Electrode coating (EC) value

Display	Menu → Main Menu → Service Tools → Service Data → View Electrode Coating → EC Current Value
ProLink III	Device Tools → Configuration → Diagnostics → Electrode Coating Value
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Electrode Coating → Electrode Coating Value

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

Electrode coating (EC) level 1 limit

Table 8-3: Electrode coating (EC) value

Display	Menu → Main Menu → Configuration → Diagnostics → Electrode Coating → EC Limit 1
ProLink III	Device Tools → Configuration → Diagnostics → Level 1 Limit
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Electrode Coating → Electrode Coating Level 1 Limit

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 kOhm

Electrode coating (EC) level 2 limit

Table 8-4: Electrode coating (EC) value

Display	Menu → Main Menu → Configuration → Diagnostics → Electrode Coating → EC Limit 2
ProLink III	Device Tools → Configuration → Diagnostics → Level 2 Limit
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Electrode Coating → Electrode Coating Level 2 Limit

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 kOhm.

Maximum electrode coating (EC)

Table 8-5: Maximum electrode coating (EC)

Display	Menu → Main Menu → Service Tools → Service Data → View Electrode Coating → EC Max Value
ProLink III	Device Tools → Configuration → Diagnostics → Maximum Value
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Electrode Coating → Maximum Value

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

8.10.3 Reset maximum electrode coating value

Use this method to reset the maximum electrode coating value.

Display	Menu → Main Menu → Configuration → Diagnostics → Electrode Coating → Reset Max Value
ProLink III	Device Tools → Configuration → Diagnostics → Maximum Value
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Electrode Coating → Reset Maximum Coating Value

8.11 Smart fluid diagnostic

The Smart Fluid Diagnostic can be used to monitor and send an alert based on relative levels of process noise. Process noise can be created by a number of conditions including chemical mixing, entrained air/gas, slurry particles, and solids.

8.11.1 Configuring the smart fluid diagnostic mode

The smart fluid diagnostic has three operating modes:

1. Off
2. Monitor value
3. Alert enable

If the advanced diagnostics suite 1 (DS1 option) was ordered, then the smart fluid diagnostic will be available, but is turned "off" from the factory. If DS1 was not ordered or licensed, this diagnostic is not available.

Mode	Description
Feature off	The process noise level value will show a value of NAN (Not A Number) and no alert will be generated.
Monitor value	The process noise level value will have non-zero value but no alert will be generated if the value exceeds the trigger level.
Alert enable	The process noise level value will have non-zero value and a status alert will be generated if the value exceeds the trigger level for a period longer than the trigger time.

8.11.2 Smart fluid diagnostic parameters

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

8.11.3 Process noise level

This parameter shows the current process noise level. This is a read-only value.

This number is a unitless number and is calculated based on overall process noise spectrum. Process noise can be created by several conditions including chemical mixing, entrained air/gas, slurry particles, and solids. As the conditions that create process noise become more severe, the process noise level value will increase. If the process noise level value exceeds the trigger level for the specified trigger time, then the smart fluid diagnostic alert will activate (If the mode is set to Alert Enable).

Display	Menu → Main Menu → Service Tools → Service Data → View Noise Analysis → Process Noise Level
ProLink III	Device Tools → Configuration → Diagnostics → Process Noise Level
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Smart Fluid Diagnostic → Process Noise Level

8.11.4 Trigger level

Smart fluid diagnostic trigger level is the threshold limit that the process noise level value must exceed before the smart fluid diagnostic alert activates. The default setting from the factory is 500. The mode must also be set to Alert Enable to activate the alert

Display	Menu → Main Menu → Configuration → Diagnostics → Smart Fluid Diagnostic → Trigger Level
ProLink III	Device Tools → Configuration → Diagnostics → Smart Fluid Diagnostic → Trigger Level
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Smart Fluid Diagnostic → Trigger Level

8.11.5 Trigger time

Smart fluid diagnostic trigger time is the amount of time that the transmitter must receive a process noise level value that exceeds the trigger level before the smart fluid diagnostic alert activates. Once the alert is active the process noise level value must be below the trigger level for this amount of time for the alert to deactivate. The default setting from the factory is 10 seconds

Display	Menu → Main Menu → Configuration → Diagnostics → Smart Fluid Diagnostic → Trigger Time
ProLink III	Device Tools → Configuration → Diagnostics → Smart Fluid Diagnostic → Trigger Time
Field Communicator	Device Settings → Advanced Diagnostics → Process Diagnostics → Smart Fluid Diagnostic → Trigger Time

8.11.6 Optimizing smart fluid diagnostic

The smart fluid diagnostic is turned off from the factory because every application is unique. The following procedure can be followed to help optimize the smart fluid diagnostic for the application.

1. Record the process noise level with a normal flow condition.
Example: Normal reading = 0.6 to 1.4
2. Record the process noise level with an active process upset condition that is causing unwanted instability in the flow reading value.
Example: Process upset reading = 80.0 to 90.0
3. Set the trigger level to a value between the normal and upset readings. For increased sensitivity to upset conditions, set the trigger level to a value closer to the highest normal value.
Example: Set the trigger level to 20.0
4. Set the trigger time to a value corresponding to the desired sensitivity level for the diagnostic. For applications with periodic upsets that need to be ignored, less sensitivity may be desired.
Example: Set the trigger time to 60 seconds

8.12 Smart Meter Verification diagnostics

The Smart Meter Verification diagnostic provides a means of verifying the flow meter is within calibration without removing the sensor from the process.

If Smart Meter Verification Professional (MV option) was ordered, then all Smart Meter Verification functionality will be available. If MV was not ordered or licensed, then only limited basic Smart Meter Verification functionality will be available.

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 baseline 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 manually initiated or scheduled as required by the application. With basic Smart Meter Verification, the diagnostic can only be manually initiated.

8.12.1 Sensor baseline 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 baseline 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 baseline when first installed will provide the baseline for the verification tests that are done in the future. There are several specific measurements that are stored in the transmitter's non-volatile memory that are used when performing the calibration verification.

Coil circuit resistance

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Baseline Values → Coil Resistance
ProLink III	Device Tools → Diagnostics → Meter Verification → Sensor Baseline → Coil Resistance
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Coil Resistance Baseline

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

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Baseline Values → Coil Inductance
ProLink III	Device Tools → Diagnostics → Meter Verification → Sensor Baseline → Coil Inductance
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Coil Inductance Baseline

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

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Baseline Values → Electrode Resistance
ProLink III	Device Tools → Diagnostics → Meter Verification → Sensor Baseline → Electrode Resistance
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Electrode Resistance Baseline

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.

Additional electrode resistance values

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Baseline Values → Electrode CM Resistance, Electrode Positive Resistance, Electrode Negative Resistance, Electrode HF Diff Resistance, Electrode HF CM Resistance
ProLink III	Device Tools → Diagnostics → Meter Verification → Sensor Baseline → Electrode CM Resistance, Electrode Positive Resistance, Electrode Negative Resistance, Electrode HF Diff Resistance, Electrode HF CM Resistance
Field Communicator	Configure → Manual Setup → Diagnostics → Meter Verify → Baseline Values → Electrode CM Resistance, Electrode Positive Resistance, Electrode Negative Resistance, Electrode HF Diff Resistance, Electrode HF CM Resistance

The additional electrode resistance values are informational only. They are not used as part of Smart Meter Verification. These values can be useful for troubleshooting potential sensor issues. The additional electrode resistance values include the following:

- Electrode Common Mode Resistance
- Electrode Positive Resistance
- Electrode Negative Resistance
- Electrode High Frequency Differential Resistance
- Electrode High Frequency Common Mode Resistance

8.12.2 Establishing the sensor baseline

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-baseline sensor)

Display	Menu → Main Menu → Operations → Smart Meter Verification → Perform Baseline
ProLink III	Device Tools → Diagnostics → Meter Verification → Re-Baseline Sensor
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Re-Baseline Sensor

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.

Note

For high temperature applications, it is a best practice to take the sensor baseline when the process fluid and sensor have reached their normal operating temperature if that will be the operating condition during test measurements.

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 manual, continuous, and scheduled Smart Meter Verification. The sensor baseline is also required for the Sensor Health Test that is part of basic Smart Meter Verification.

Recall values (recall last saved)

Display	Menu → Main Menu → Operations → Smart Meter Verification → Recall Previous Baseline
ProLink III	Device Tools → Diagnostics → Meter Verification → Recall Last Baseline
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Recall Last Baseline

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

8.12.3 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.

Commanded meter verification limit

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Commanded Verification Limit
ProLink III	Device Tools → Diagnostics → Meter Verification → Commanded Smart Meter Verification → Meter Verification Limit
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Sensor Baseline → Recall Last Baseline

Set the test criteria for the commanded and scheduled Smart Meter Verification tests. The factory default for this value is set to five percent (5%) with limits configurable between two and ten percent.

This parameter applies to manually initiated and scheduled calibration verification tests only.

Continuous Meter Verification limit

Display	Menu → Main Menu → Configuration → Diagnostics → Meter Verification → Continual Verification Limit
ProLink III	Device Tools → Diagnostics → Meter Verification → Continuous Smart Meter Verification → Continuous Verification Limit
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Meter Verification Limits → Commanded Verification Limit

Set the test criteria for the continuous Smart Meter Verification diagnostic. The factory default for this value is set to five percent (5%) with limits configurable between two and ten percent.

NOTICE

If the verification limit is set too low, under empty pipe conditions or noisy flowing conditions, a false failure of the transmitter test may occur.

8.12.4 Run commanded Smart Meter Verification

Display	Menu → Main Menu → Operations → Smart Meter Verification → Run Meter Verification
ProLink III	Device Tools → Diagnostics → Run Meter Verification
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Run Meter Verification

This method initiates the commanded meter verification test.

Note

If the MV option code was not ordered or licensed, then only limited basic Smart Meter Verification functionality will be available. Running commanded Smart Meter Verification will only provide results for the Sensor Health Test.

Commanded Meter Verification Test through the display

Procedure

1. Select the desired Test Scope from the available options.

Test scope	Test performed
Both	Sensor calibration verification, transmitter calibration verification, coil health check, electrode health check
Transmitter	Transmitter calibration verification
Sensor	Sensor calibration verification, coil health check, electrode health check

2. Wait for the tests to be completed.

Commanded Meter Verification Test through ProLink III

Procedure

1. Enter the optional Customer Identification information as desired and select the **Next** button.
2. Select the system components to verify from the available options..

Test scope	Test performed
Sensor and transmitter	Sensor calibration verification, transmitter calibration verification, coil health check, electrode health check
Sensor only	Sensor calibration verification, coil health check, electrode health check
Transmitter only	Transmitter calibration verification

3. Select the **Start Meter Verification** button.
4. Wait for the tests to be completed and select the **Finish** button.

Note

If sensor tests are run during empty pipe conditions, the electrode health checks will not be performed. The results will indicate **NaN** (Not a Number) for those tests.

8.12.5 Run scheduled Smart Meter Verification

A commanded Smart Meter Verification can be scheduled to run at a specific time and set to repeat at a specific time interval.

Display	Menu → Main Menu → Operations → Smart Meter Verification → Schedule Verification
ProLink III	Device Tools → Diagnostics → Schedule Meter Verification
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Schedule

Schedule a commanded meter verification test through the display

Procedure

1. Enter the desired number of hours before the first test starts using the **Set Hours To 1st Run** parameter.
2. Enter the desired number of hours between tests using the **Set Hours Between Runs** parameter.
The time between runs must be at least one hour.
The time to the next run in hours is displayed by the **Hours to Next Run** parameter.

Schedule a commanded meter verification test through ProLink III

Procedure

1. Enter the desired number of days, hours, and minutes before the next test starts.
2. Enter the desired number of days, hours, and minutes between tests.
The time between runs must be at least one hour.
3. Select the **Apply** button to start the times

8.12.6 Continuous SMART™ Meter Verification

Continuous SMART Meter Verification can be used to monitor and verify the health of the flow meter 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.

Test scope

Continuous Smart Meter Verification can be configured to monitor the sensor coils, electrodes, transmitter calibration, and analog output (if applicable). All of these parameters can be individually enabled or disabled.

These parameters apply to continuous Smart Meter Verification only.

Display	Menu → Main Menu → Configuration → Diagnostics → Cont Meter Verificaton
ProLink III	Device Tools → Diagnostics → Meter Verification → Continuous Smart Meter Verification
Field Communicator	Device Settings → Advanced Diagnostics → Meter Verification → Continuous Meter Verification → Meter Verification → Enable Parameters

8.12.7 Smart Meter Verification test results

If the Smart Meter Verification test is initiated by command, 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 [Table 8-6](#) form if Smart Meter Verification Professional (MV option) was ordered or licensed. Print the "Commanded Calibration Verification Results" form and enter the test results as displayed. The completed form 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. When using the display, the results from one of the last 20 tests can be selected and scrolled through using the down arrow button. When using ProLink III, a report can generated after running a Commanded Smart Meter Verification or previous test reports can be viewed.

Table 8-6: Manual Smart Meter Verification Test Parameters

Parameter	Display (Menu → Main Menu → Operations → Smart Meter Verification → Read Verification History → select test date)	ProLink III (Device Tools → Diagnostics → Meter Verification → Commanded Sensor Measurements)
Overall Test Result	Result	Go to View Previous Test Results .
Test Condition	SMV Run Condition	Go to View Previous Test Results .
Flow Simulation Result	Flow Sim Result	Go to View Previous Test Results .
Flow Simulation Value	Flow Sim Value	Internal Flow Simulator Value
Flow Simulation Deviation	Flow Sim Deviation	Internal Flow Simulator Commanded Deviation
Coil Resistance Result	Coil Resistance Result	Go to View Previous Test Results .
Measured Coil Resistance	Coil Resistance	Coil Resistance
Measured Coil Inductance	Coil Inductance	Coil Inductance.
Coil Inductance Deviation	Coil Inductance Deviation	Coil Inductance Deviation
Electrode Resistance Result	Electrode Resistance Result	Go to View Previous Test Results .
Measured Electrode Resistance	Electrode Resistance	Electrode Resistance
Electrode Common Mode Resistance	Electrode CM Resistance	Electrode CM Resistance
Positive Electrode Resistance	Electrode Pos Resistance	Electrode Positive Resistance
Negative Electrode Resistance	Electrode Neg Resistance	Electrode Negative Resistance
Electrode High Frequency Differential Resistance	Electrode HF Diff Resistance	Electrode HF Diff Resistance
Electrode High Frequency Common Mode Resistance	Electrode HF CM Resistance	Electrode HF CM Resistance

If MV was not ordered or licensed, then running commanded Smart Meter Verification will only provide results for the Sensor Health Test. 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 using the display or ProLink III

Table 8-7: Sensor Health Test Results

Parameter	Display (Menu → Main Menu → Service Tools → Service Data → View Sensor Health Test)	ProLink III (Device Tools → Diagnostics → Sensor Health Test)
Sensor Health Test		
Test Condition	Test Condition	Test Condition
Coil Inductance (mH)	Coil Inductance	Coil Inductance
Coil Resistance (Ohms)	Coil Resistance	Coil Resistance
Internal Flow Simulator (ft/sec)	Flow Sim Value	Internal Flow Simulator
Electrode Resistance Values (kOhms)		
Differential	Electrode Resistance	Electrode Differential Resistance
Common Mode	Electrode CM Resistance	Electrode Common Mode Resistance
Positive Electrode	Electrode Pos Resistance	Electrode Positive Resistance
Negative Electrode	Electrode Neg Resistance	Electrode Negative Resistance
High Frequency Differential	Electrode HF Diff Resistance	Electrode High Frequency Differential Resistance
High Frequency Common Mode	Electrode HF CM Resistance	Electrode High Frequency Common Mode Resistance
Electrode Capacitance Values (nF)		
Differential	Electrode Diff Capacitance	Electrode Differential Capacitance
Common Mode	Electrode CM Capacitance	Electrode Common Mode Capacitance
Positive Electrode	Electrode Pos Capacitance	Electrode Positive Capacitance
Negative Electrode	Electrode Neg Capacitance	Electrode Negative Capacitance
High Frequency Differential	Electrode HF Diff Capacitance	Electrode High Frequency Differential Capacitance
High Frequency Common Mode	Electrode HF CM Capacitance	Electrode High Frequency Common Mode Capacitance

8.12.8 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 inductance

The coil inductance is a measurement of the magnetic field strength. This value is compared to the coil inductance baseline measurement taken during the sensor baseline process to

determine sensor calibration deviation. This value can be continuously monitored using continuous Smart Meter Verification.

Coil inductance deviation

The coil inductance deviation is a measurement of the percent difference between the measured coil inductance and the baseline coil inductance from the sensor calibration verification test. This value can be continuously monitored using continuous Smart Meter Verification.

Electrode circuit resistance

Electrode circuit resistance is a measurement of the electrode circuit health. This value is compared to the electrode circuit resistance baseline 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

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

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.

8.12.9 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 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 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. Set the test criteria to three percent, and it should be noted that the electrode circuit health cannot be verified. |

8.13 The 4-20 mA loop verification

The 4-20 mA loop verification diagnostic provides a means of verifying the analog output loop is functioning properly.

This is a manually initiated diagnostic test. This diagnostic checks the integrity of the analog loop and provides a health status of the circuit. If the verification does not pass, this will be highlighted in the results given at the end of the check

The 4-20 mA loop verification diagnostic is useful for testing the analog output when errors are suspected. The diagnostic tests the analog loop at five different mA output levels:

- 4 mA
- 12 mA
- 20 mA
- Low alarm level
- High alarm level

8.13.1 Initiating 4-20 mA loop verification

Display	Menu → Main Menu → Service Tools → 4-20 mA Verify → Run 4-20 mA Verify
ProLink III	Device Tools → DIagnostics → 4-20 mA Verification → Run 4-20 mA Verification
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → 4-20 mA Verification → Run 4-20 mA Verification

If Smart Meter Verification Professional (**MV** Option) was ordered, then the 4-20 mA loop verification diagnostic will be available. If **MV** was not ordered or licensed, this diagnostic is not available.

8.13.2 4-20 mA loop verification parameters

Display	Menu → Main Menu → Service Tools → 4-20 mA Verify → View Results
ProLink III	Device Tools → Diagnostics → 4-20 mA Verification
Field Communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → 4-20 mA Verification → Measurements

The 4-20 mA loop verification diagnostic has five read-only parameters plus an overall test result. It does not have any configurable parameters.

9 Configure device options and preferences

9.1 Configure the transmitter display

Select the language used on the display, the process variables shown on the display, and a variety of display behaviors.

9.1.1 Configure the language used on the display

Language controls the language that the display uses for process data, menus, and information.

Display	Menu → Main Menu → Configuration → Detailed Setup → Display Settings → Language
ProLink III	Device Tools → Configuration → Transmitter Display → General → Language
Field communicator	Device Settings → Display → General Settings → Language

The languages available depend on the transmitter model and version.

Procedure

Set **Language** to the desired language.

9.1.2 Configure the rotation used on the display

Select a direction for the top of the screen.

Display	Menu → Main Menu → Configuration → Detailed Setup → Display Settings → Display Variable
ProLink III	Device Tools → Configuration → Transmitter Display → General → LCD Software Rotation
Field communicator	Device Settings → Display → General Settings → LCD Rotation

Note

For ProLink III, 0, 90, 180, and 270 degrees are supported values.

9.1.3 Configure the process variables shown on the display

Select the process variables shown on the display and the order in which they appear. The display can scroll through up to 15 process variables in any order. This configuration applies to both auto-scroll and manual scrolling.

Display	Menu → Configuration → Display Settings → Display Variables
ProLink III	Device Tools → Configuration → Transmitter Display → Display Variables
Field communicator	Device Settings → Display → Display Variables

Restriction:

At least one display variable must be configured.

Note

If the process variable becomes unavailable due to changes in configuration, the transmitter will not display that variable.

Procedure

For each display variable, select the process variable to be shown in that position in the rotation. Positions can be skipped and process variables can be repeated.

Table 9-1: Default configuration for display variables

Display variable	Process variable assignment
Display Variable 1	Volume flow rate
Display Variable 2	Totalizer 1
Display Variable 3	Mass flow rate
Display Variable 4	Totalizer 2
Display Variable 5	Velocity Flow Rate
Display Variable 6	Totalizer 3
Display Variable 7	Core Board Temperature
Display Variable 8	None
Display Variable 9	None
Display Variable 10	None
Display Variable 11	None
Display Variable 12	None
Display Variable 13	None
Display Variable 14	None
Display Variable 15	None

9.1.4 Configure the number of decimal places (precision) shown on the display

Specify the precision (the number of decimal places) that the display uses for each display variable. Set the precision independently for each display variable.

Display	Menu → Main Menu → Configuration → Detailed Setup → Display Settings → Decimals on Display
ProLink III	Device Tools → Configuration → Transmitter Display → Display Variables → Decimal Places for x
Field communicator	Device Settings → Display → Decimal Places

The display precision does not affect the actual value of the variable, the value used in calculations, or the value reported via outputs or digital communications.

Procedure

1. Select a process variable or a diagnostic variable.
A user can configure the precision for all variables, whether or not they are assigned as display variables. The configured precision will be stored and used when applicable.

2. Set **Number of Decimal Places** to the number of decimal places to be used when this variable is shown on the display.
 - Default:
 - Temperature variables: 2
 - All other variables: 4
 - Range: 0 to 5

Tip

The lower the precision, the greater the change must be for it to be reflected on the display. Do not set **Number of Decimal Places** too low to be useful.

9.1.5 Turn on and turn off automatic scrolling through the display variables

Configure the display to automatically scroll through the list of display variables or to show a single display variable until the operator activates **Scroll**. If **Auto Scroll** is turned on, a user can configure the number of seconds that each display variable will be shown.

Display	Menu → Main Menu → Configuration → Detailed Setup → Display Settings → Auto Scroll
ProLink III	Device Tools → Configuration → Transmitter Display → General → Auto Scroll
Field communicator	Device Settings → Display → General Settings → Scroll Option → Auto Scroll

Procedure

1. Turn on or turn off **Auto Scroll** as desired.

Option	Description
On	The display automatically shows each display variable for the number of seconds specified by Scroll Rate , then shows the next display variable. The operator can move to the next display variable at any time by activating Scroll .
Off	The display shows Display Variable 1 and does not scroll automatically. The operator can move to the next display variable at any time by activating Scroll .

Default: Off

2. Once **Auto Scroll** is turned on, set **Scroll Rate** as desired.
 - Default: 10
 - Range: 1 to 30 seconds

9.1.6 Configure the display backlight

Set the backlight on the display's LCD panel to either ON or OFF.

Display	Menu → Main Menu → Configuration → Detailed Setup → Display Settings → Backlight
ProLink III	Device Tools → Configuration → Transmitter Display → General → Backlight
Field communicator	Device Settings → Display → General Settings → Backlight

9.1.7 Configure totalizer control from the display

Enable or disable the operator's ability to start, stop, or reset totalizers from the display.

Display	Menu → Main Menu → Configuration → Security → Display Security → Totalizer & Inventories → Totalizer Reset or Totalizer Start/Stop
ProLink III	Device Tools → Configuration → Totalizer Control Methods
Field communicator	Device Settings → Display → Display Security → Totalizer and Inventory Controls → Totalizer Reset or Start/Stop Totalizers

Note

Totalizers can be stopped, started, and reset as a group or independently.

This parameter does not affect the operator's ability to start, stop, or reset totalizers using another tool.

Procedure

1. Enable (On) or disable (Off) **Reset Totalizers**, as desired.
2. Enable (On) or disable (Off) **Start/Stop Totalizers**, as desired.

9.1.8 Configure inventory control from the display

Enable or disable the operator's ability to start, stop, or reset inventories from the display.

Display	Menu → Main Menu → Configuration → Security → Display Security Totalizers & Inventories → Inventory Reset or Inventory Start/Stop
ProLink III	Device Tools → Configuration → Totalizer Control Methods
Field communicator	Device Settings → Display → Display Security → Totalizer and Inventory Controls → Inventory Reset or Start/Stop Inventories

Note

Inventories can be stopped, started, and reset as a group or independently.

This parameter does not affect the operator's ability to start, stop, or reset inventories using another tool.

Procedure

1. Enable or disable **Reset Inventories**, as desired.
2. Enable or disable **Start/Stop Inventories**, as desired.

9.1.9 Configure security for the display

Configure a display passcode, and require the operator to enter the passcode to make any changes to configuration through the display, or to access alert data through the display.

Display	Menu → Main Menu → Configuration → Security → Display Security
ProLink III	Device Tools → Configuration → Transmitter Display → Display Security
Field communicator	Device Settings → Display → Display Security → Password Required

The operator always has read-only access to the configuration menus.

Procedure

1. Enable or disable display security as desired.

Option	Description
Never/No Password	When an operator chooses an action that leads to a configuration change, they are prompted to activate ⇐⇑⇓⇒. This is designed to protect against accidental changes to configuration. It is not a security measure.
At Write/Password at Write	When an operator chooses an action that leads to a configuration change, they are prompted to enter the display passcode.
Enter Menu/Password When Entering Menu	When an operator enters a configuration menu, they are prompted to enter the display passcode.

2. If display security is enabled, enable or disable alert security as desired.

Option	Description
Enabled	If an alert is active, the alert symbol ⓘ is shown above the Menu button on the display but the alert banner is not displayed. If the operator attempts to enter the alert menu, they are prompted to enter the display passcode.
Disabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display and the alert banner is displayed automatically. No passcode or confirmation is required to enter the alert menu.

Restriction:

- If display security is disabled, alert security cannot be enabled.
- If both display security and alert security are enabled, and then display security is disabled, alert security is disabled automatically.

3. Set the display passcode to the desired value.

- Default: AAAA
- Range: Any four alphanumeric characters

If display security is enabled and the display passcode is not changed, the transmitter will post a configuration alert.

9.2 Configure the transmitter's response to alerts

The transmitter's response to some alerts can be changed by setting the alert severity. The transmitter can also be configured to ignore some alerts and conditions.

Prerequisites

The transmitter implements the NAMUR NE 107 specification for alerts. NAMUR NE 107 categorizes alerts by the suggested operator action, not by cause or symptom. Each alert has one or more associated conditions.

Display	Menu → Main Menu → Configuration → Alert Setup → Response to Alerts
ProLink III	Device Tools → Configuration → Alert Severity
Field Communicator	Device Settings → Alerts → Alert Setup → Alert Severity Configuration

9.2.1 Configure the transmitter's response to alerts using the display

Display	Menu → Main Menu → Configuration → Alert Setup → Response to Alerts
ProLink III	Device Tools → Configuration → Alert Severity
AMS	Device Settings → Alerts → Alert Setup → Alert Severity Configuration

Procedure

- To change the severity of an alert:
 - Select an alert.
 - Select **Alert Severity** and set as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.
FunctionCheck	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure

- To ignore an alert:
 - Select an alert.
 - Set **Alert Detection** to **Ignore**.

If an alert is ignored, any occurrence of this alert is not posted to the alert list and the alert banner is not shown on the display.

- To ignore a condition:
 - Select the alert associated with the condition.
 - Select **Condition Detection**.
 - Select the condition to **Ignore**.

If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

9.2.2 Configure the transmitter's response to alerts using ProLink III

Procedure

- To change the severity of an alert:
 - Select the alert.
 - Set the severity as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.

Option	Description
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process.
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.
Function Check	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure.

- To ignore an alert:
 - Select the alert.
 - Set the severity to **Ignore**.

If an alert is ignored, any occurrence of this alert is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

- To ignore a condition:
 - Select the alert associated with the condition and expand it.
 - Select the condition and set it to **Ignore**.

If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

9.2.3 Configure the transmitter response to alerts using a field communicator Procedure

- To change the severity of an alert:
 - Choose the category of the alert: Sensor, Configuration, Process, or Output.
 - Select the alert.
 - Set the severity as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process.
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.
Function Check	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure.

- To ignore an alert:
 - Choose the category of the alert: Sensor, Configuration, Process, or Output.
 - Select the alert.
 - Set the severity to **No Effect**.

If an alert is ignored, any occurrence of this alert is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

- To ignore a condition:
 - Choose the category of the alert: Sensor, Configuration, Process, or Output.
 - Select the alert.
 - Choose **Set Conditions**.
 - Select the condition and set it to **OFF**.

If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

9.2.4 Configure Fault Timeout

Fault Timeout controls the delay before fault actions are performed.

Display	Menu → Main Menu → Configuration → Alert Setup → Output Fault Actions → Fault Timeout (sec)
ProLink III	Device Tools → Configuration → Fault Processing → Fault Timeout
Field communicator	Device Settings → Alerts → Alert Setup → Output Fault Action → General → Fault Timeout

The fault timeout period begins when the transmitter detects an alert condition.

- During the fault timeout period, the transmitter continues to report its last valid measurements.
- If the fault timeout period expires while the alert is still active, the fault actions are performed.
- If the alert condition clears before the fault timeout expires, no fault actions are performed.

Restriction:

- Fault Timeout** is not applied to all alerts. For some alerts, fault actions are performed as soon as the alert condition is detected. For details, see the list of alerts and conditions in [Alerts, conditions, and configuration options](#).
- Fault Timeout** is applicable only when **Alert Severity** = Failure. For all other settings of **Alert Severity**, **Fault Timeout** is irrelevant.

Procedure

Set **Fault Timeout** as desired.

- Default: 0 seconds
- Range: 0 to 60 seconds

If **Fault Timeout** is set to 0, fault actions are performed as soon as the alert condition is detected.

10 Integrate the meter with the control system

10.1 Channel combinations

Use these rules to determine what channel types and channel combinations are valid on the transmitter.

Rule number	Rule
1	Channel A can be either 4-20mA/HART, Frequency Output, or Discrete Output.
2	Channel B can be either 4-20mA, Frequency Output, Discrete Output, or Discrete Input.
3	Channel C is always RS-485 (Modbus).

10.2 Configure the transmitter channels

The transmitter uses Channels A, B and C to support the control system and communications. Channel A and Channel B are configurable.

Display	Menu → Main Menu → Basic Setup → Configuration → Inputs/Outputs → Channel <i>x</i>
ProLink	Device Tools → Configuration → I/O → Channels → Channel <i>x</i>
Field communicator	Device Settings → Inputs/Outputs → Channels

Depending on the options ordered, some channels may not be activated. To see which channels are activated:

- Using the display: **Menu → Main Menu → About → Licenses**
- Using ProLink: **Device Information**
- Using a field communicator: **Device Settings → Device Information → Licenses → Permanent Feature Set → Output Channels**

To activate additional channels, contact customer service.

The channel configuration must match the I/O wiring.

Prerequisites

Important

To avoid causing process errors:

- Configure the channels before configuring the outputs.
- Before changing the channel configuration, ensure that all control loops affected by the channel are under manual control.

Procedure

1. Identify the channels that are activated on the device.
2. For Channel A, if activated, set **Channel Type** as desired.

Channel	Options
Channel A	• Analog Output 1 / HART(default) • Frequency Output 2 • Discrete Output 2

3. For Channel B, if activated, set **Channel Type** as desired.

Channel	Options
Channel B	- Analog Output 2 - Frequency Output 1(default) - Discrete Output 1 - Discrete Input 1 - None

4. For Channel C, if activated, **Channel Type** is RS-485.

Channel	Option
Channel C	RS-485 Modbus

After completing the task:

For each channel configured, perform or verify the corresponding output configuration. When the configuration of a channel is changed, the channel's behavior will be controlled by the configuration that is stored for the selected output type, and the stored configuration may not be appropriate.

After verifying channel and output configuration, return the control loop to automatic control.

10.3 Configure the Analog Outputs

The Analog Outputs are used to report current values of process variables. The analog signal varies between 4 mA and 20 mA in proportion to the current value of the assigned process variable.

Depending the options ordered and channel configuration, the transmitter may have either 1 or 2 Analog Outputs. If assigned as an analog output, Channel A is Analog Output 1. If assigned as an analog output, Channel B is Analog Output 2.

Note

Channel A also supports HART/Bell 202 communications, superimposed on the analog signal. HART is not available on Channel B.

10.3.1 Configure Analog Output Source

Analog Output Source specifies the process variable that is reported by an Analog Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Source
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output x → Source
Field communicator	Device Settings → Inputs/Outputs → Mapping/Source → Inputs/Outputs → Output Source → Analog Output 1 (Primary) Source and Analog Output 2 Source

Prerequisites

- If the output is configured to report mass flow, ensure that **Process Density** has been set.
- If the HART variables are being used, be aware that changing the configuration of **Analog Output 1 Source** will change the configuration of the HART Primary Variable (PV).

Note

Analog Output 2 Source is not tied to the HART secondary variable. HART variables can be configured independently from Analog Output 2.

Procedure

Set **Analog Output Process Source** as desired.
Default: Analog Output 1:Volume Flow Rate

After completing the task:

If the configuration of **Analog Output Source** is changed, verify the settings of **Lower Range Value** and **Upper Range Value**. The transmitter automatically loads a set of values, and these values may not be appropriate for the application.

Options for Analog Output Source

The transmitter provides a basic set of options for **Analog Output Source**. Different communications tools may use different labels for the options.

Process variable	Label		
	Display	ProLink III	Field communicator
Volume flow rate	Volume Flow Rate	Volume Flow Rate	Volume Flow Rate
Mass flow rate	Mass Flow Rate	Mass Flow Rate	Mass Flow Rate
Velocity flow rate	Velocity Flow Rate	Velocity Flow Rate	Velocity Flow Rate

10.3.2 Configure Lower Range Value (LRV) and Upper Range Value (URV) for an Analog Output

The **Lower Range Value** (LRV) and **Upper Range Value** (URV) are used to scale an Analog Output, that is, to define the relationship between **Analog Output Source** and the Analog Output signal.

Display	Menu → Main Menu → Configuration → Basic setup → Channel <i>x</i> → I/O Settings → Lower Range Value/Upper Range Value
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output <i>x</i> → I/O Settings → Lower Range Value/Upper Range Value
Field communicator	Device Settings → Inputs/Outputs → Analog Output <i>x</i> → Setup → Lower Range Value/Upper Range Value

LRV is the value of **Analog Output Source** represented by an output of 4 mA. URV is the value of **Analog Output Source** represented by an output of 20 mA. Between LRV and URV, an Analog Output is linear with the process variable. If the process variable drops below LRV or rises above URV, the transmitter posts an output saturation alert.

Procedure

Set **LRV** and **URV** as desired.
Enter **LRV** and **URV** in the measurement units used for **Analog Output Source**.

- Defaults: Specific to each process variable
- Range: +/- 12 m/s (39.37 ft/s)

Note

URV can be set below **LRV**. For example, **URV** can be set to 50 and **LRV** to 100. If this is done, the Analog Output will be inversely proportional to the value of **Analog Output Source**.

10.3.3 Configure Analog Output Direction

Analog Output Direction controls how conditions of forward flow and reverse flow affect the flow rates reported by an Analog Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel <i>x</i> → I/O Settings → Direction
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output <i>x</i> → Direction
Field communicator	Device Settings → Inputs/Outputs → Analog Output <i>x</i> → Direction → Direction

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 10-1: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	Normal	Forward
	Reverse	Reverse
Reverse (opposite from Flow arrow on sensor)	Normal	Reverse
	Reverse	Forward

Procedure

Set **Analog Output Direction** as desired.

Option	Description
Normal(default)	Appropriate when the application needs to distinguish between forward flow and reverse flow.
Absolute Value	Appropriate when the application does not need to distinguish between forward flow and reverse flow.

Important

Analog Output Direction interacts with **Lower Range Value (LRV)**. The effect of **Analog Output Direction** on an Analog Output varies, depending on whether $LRV < 0$ or $LRV \geq 0$.

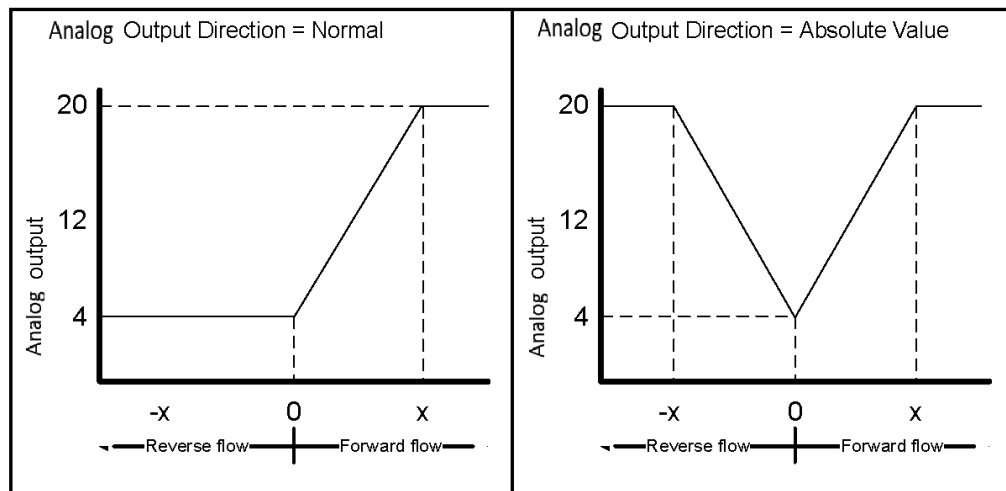
Effect of Analog Output Direction on an Analog Output

Analog Output Direction affects how the transmitter reports flow values via an Analog Output.

The effect of **Analog Output Direction** depends on the setting of **Lower Range Value (LRV)**.

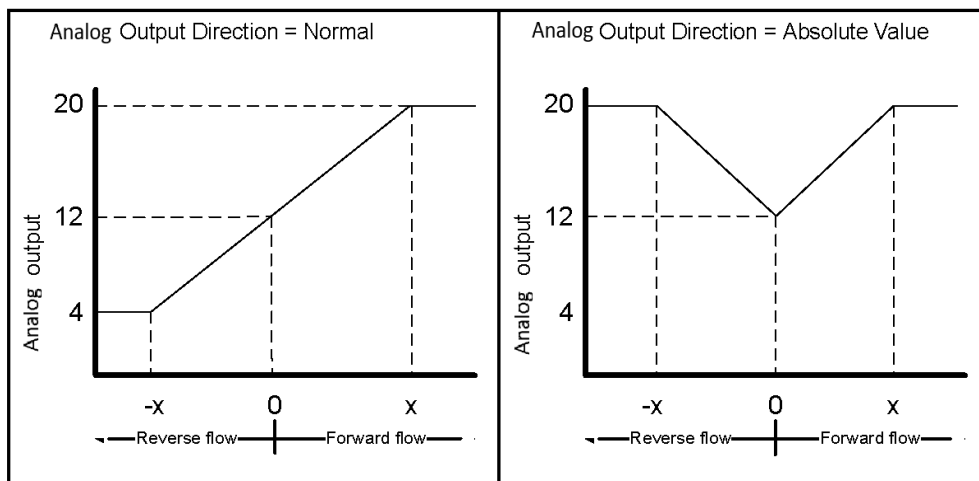
- If **Lower Range Value** = 0, see [Figure 10-1](#).
- If **Lower Range Value** > 0, see [Figure 10-1](#) and adapt the chart.
- If **Lower Range Value** < 0, see [Figure 10-2](#).

Figure 10-1: Effect of Analog Output Direction on an Analog Output: Lower Range Value = 0



- Lower Range Value = 0
- Upper Range Value = x

Figure 10-2: Effect of Analog Output Direction on an Analog Output: Lower Range Value < 0



- Lower Range Value = -x
- Upper Range Value = x

Example: Analog Output Direction = Normal and Lower Range Value = 0

Configuration:

- Analog Output Direction = Normal
- Lower Range Value = 0 gal/min (l/min)
- Upper Range Value = 100 gal/min (l/min)

Result:

- Under conditions of reverse flow or zero flow, an Analog Output is 4 mA.
- Under conditions of forward flow, up to a flow rate of 100 gal/min (l/min), an Analog Output varies between 4 mA and 20 mA in proportion to the flow rate.
- Under conditions of forward flow, if the flow rate equals or exceeds 100 gal/min (l/min), an Analog Output will be proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.

Example: **Analog Output Direction = Normal** and **Lower Range Value < 0**

Configuration:

- **Analog Output Direction** = Normal
- **Lower Range Value** = -100 gal/min (l/min)
- **Upper Range Value** = +100 gal/min (l/min)

Result:

- Under conditions of zero flow, an Analog Output is 12 mA.
- Under conditions of forward flow, for flow rates between 0 and +100 gal/min (l/min), an Analog Output varies between 12 mA and 20 mA in proportion to (the absolute value of) the flow rate.
- Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 100 gal/min (l/min), an Analog Output is proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.
- Under conditions of reverse flow, for flow rates between 0 and -100 gal/min (l/min), an Analog Output varies between 4 mA and 12 mA in inverse proportion to the absolute value of the flow rate.
- Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 gal/min (l/min), an Analog Output is inversely proportional to the flow rate down to 3.8 mA, and will be level at 3.8 mA at higher absolute values.

10.3.4 Configure Analog Output Cutoff

Analog Output Cutoff specifies the lowest flow rate that will be reported through an Analog Output. All flow rates below the specified value are reported as 0.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → AO Cutoff
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output x → Flow Rate Cutoff
Field communicator	Device Settings → Inputs/Outputs → Analog Output x → Setup → Analog Output Cutoff

Procedure

Set **Analog Output Cutoff** as desired.

Set **Analog Output Cutoff** in the measurement units used for the process variable. If the measurement unit is changed, **Analog Output Cutoff** is adjusted automatically.

- Default: 0
- Range: 0 to sensor higher flow limit

Tip

For most applications, the default value of **Analog Output Cutoff** should be used. Contact customer service before changing **Analog Output Cutoff**.

Interaction between Low Flow Cutoff and Analog Output Cutoff

Low Flow Cutoff defines the lowest flow value that the transmitter will report as measured. **Analog Output Cutoff** defines the lowest flow rate that will be reported through an Analog Output. If **Analog Output Source** is set to **Volume Flow Rate**, the flow rate reported through an Analog Output is controlled by the higher of the two cutoff values.

Low Flow Cutoff affects all reported values and values used in other transmitter behavior (e.g., events defined on any flow configuration).

Analog Output Cutoff affects any values reported through an Analog Output.

Example: Cutoff interaction with Analog Output Cutoff lower than Low Flow Cutoff

Configuration:

- **Analog Output Source:** Volume Flow Rate
- **Frequency Output Source:** Volume Flow Rate
- **Analog Output Cutoff:** 10 gal/min
- **Low Flow Cutoff:** 15 gal/min

Result: If the volume flow rate drops below 15 gal/min, volume flow will be reported as 0, and 0 will be used in all internal processing.

Example: Cutoff interaction with Analog Output Cutoff higher than Low Flow Cutoff

Configuration:

- **Analog Output Source:** Volume Flow Rate
- **Frequency Output Source:** Volume Flow Rate
- **Analog Output Cutoff:** 15 gal/min
- **Low Flow Cutoff:** 10 gal/min

Result:

- If the volume flow rate drops below 15 gal/min but not below 10 gal/min:
 - The Analog Output will report zero flow.
 - The Frequency Output will report the actual flow rate, and the actual flow rate will be used in all internal processing.
- If the volume flow rate drops below 10 gal/min, both outputs will report zero flow, and 0 will be used in all internal processing.

10.3.5 Configure Analog Output Damping

Analog Output Damping controls the amount of damping that will be applied to the Analog Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → AO Damping
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output x → Damping
Field communicator	Device Settings → Inputs/Outputs → Analog Output x → Setup → Analog Output Damping

Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable. At the end of the interval, the value reported by an Analog Output will reflect 63% of the change in the actual measured value.

Analog Output Damping affects a process variable only when it is reported via the Analog Output. If the process variable is read from the display or digitally, **Analog Output Damping** is not applied.

Procedure

Set **Analog Output Damping** to the desired value.

- Default: 0.0 seconds
- Range: 0.0 to 440 seconds

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value can make the process variable appear more erratic because the reported value changes more quickly
- The combination of a high damping value and rapid, large changes in the process variable assigned to an Analog Output can result in increased measurement error.
- Whenever the damping value is non-zero, the damped value will lag the actual measurement because the damped value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the damped value.

Interaction between Analog Output Damping and process variable damping

If multiple damping parameters are applicable, the effect of damping the process variable is calculated first, and the Analog Output damping calculation is applied to the result of that calculation

Damping interaction

Configuration:

- **Flow Damping** = 2 seconds
- **Analog Output Source** = Volume Flow Rate
- **Analog Output Damping** = 2 seconds

Result: A change in the volume flow rate will be reflected in the Analog Output over a time period that is greater than 4 seconds. The exact time period is calculated by the transmitter according to internal algorithms which are not configurable.

10.3.6 Configure Analog Output Fault Action

Analog Output Fault Action controls the behavior of the Analog Output if the transmitter detects a fault condition.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Fault Action
ProLink III	Device Tools → Configuration → I/O → Outputs → Analog Output x → Fault Action
Field communicator	Device Settings → Inputs/Outputs → Analog Output x → mAO Fault Setup → Fault Action

Important

- The fault action is implemented only if **Alert Severity** is set to **Failure**. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

Procedure

1. Set **Analog Output Fault Action** as desired.
Default: **Downscale**

Important

If **Analog Output Fault Action** is set to **None**, the Analog Output will be controlled by the setting of **Process Variable Fault Action**. In most cases, if **Analog Output Fault Action** is set to **None**, **Process Variable Fault Action** should also be set to **None**.

2. If **Analog Output Fault Action** is set to **Upscale** or **Downscale**, set **Analog Output Fault Level** to the signal that the Analog Output will produce during a fault.

Options for Analog Output Fault Action and Analog Fault Level

Option	Analog Output behavior	Analog Output Fault Level
Upscale	Goes to the configured fault level	Default: 22.0 mA Range: 21.0 to 23.0 mA
Downscale(default)	Goes to the configured fault level	Default: 2.0 mA Range: 1.0 to 3.6 mA
Internal Zero	Goes to the Analog Output level associated with a process variable value of 0 (zero), as determined by Lower Range Value and Upper Range Value settings	Not applicable
None	Determined by the setting of Process Variable Fault Action	Not applicable

10.4 Configure the Frequency Output

The Frequency Output is used to report current values of process variables. The frequency varies between 0 Hz and 10,000 Hz in proportion to the current value of the assigned process variable.

Channel A can be configured as Frequency Output 2. Channel B can be configured as Frequency Output 1.

10.4.1 Configure Frequency Output Source

Frequency Output Source specifies the process variable that is reported by the Frequency Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Source
ProLink III	Device Tools → Configuration → I/O → Outputs → Frequency Output x → Source
Field communicator	Device Settings → Inputs/Outputs → Mapping/Source → Output Source → Frequency Output X Source

Procedure

Set **Frequency Output Source** as desired.

After completing the task:

If the configuration of **Frequency Output Source** is changed, verify the Frequency Output scaling. The transmitter automatically loads the most recent values for the scaling parameters, and they may not be appropriate for the application.

Options for Frequency Output Source

The transmitter provides a basic set of options for **Frequency Output Source**. Different communications tools may use different labels for the options.

Process variable	Label		
	Display	ProLink III	Field communicator
Volume flow rate	Volume Flow Rate	Volume Flow Rate	Volume Flow Rate
Mass flow rate	Mass Flow Rate	Mass Flow Rate	Mass Flow Rate
Velocity flow rate	Velocity Flow Rate	Velocity Flow Rate	Velocity Flow Rate

10.4.2 Configure Frequency Output Scaling

Frequency output scaling defines the relationship between **Frequency Output Source** and the pulse of the Frequency Output. Scale the Frequency Output to provide the data in the form required by the frequency receiving device.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Scaling Method
ProLink III	Device Tools → Configuration → I/O → Outputs → Frequency Output x → Scaling Method
Field communicator	Device Settings → Inputs/Outputs → Frequency Output XScaling → Set Frequency Output Scaling

Procedure

1. Set Frequency Output Scaling Method.

Option	Description
Frequency = Flow (default)	Frequency calculated from flow rate
Pulses/Unit	A user-specified number of pulses represents one flow unit
Units/Pulse	A pulse represents a user-specified number of flow units

2. Set additional required parameters.
 - If **Frequency Output Scaling Method** is set to **Frequency=Flow**, set **Rate Factor** and **Frequency Factor**.
 - If **Frequency Output Scaling Method** is set to **Pulses/Unit**, define the number of pulses that will represent one flow unit.
 - If **Frequency Output Scaling Method** is set to **Units/Pulse**, define the number of units that each pulse will indicate.

Calculate frequency from flow rate

The **Frequency = Flow** option is used to customize the Frequency Output for the application when appropriate values for **Units/Pulse** or **Pulses/Unit** are not known.

If **Frequency = Flow** is selected, values for **Rate Factor** and **Frequency Factor** must be provided:

Rate Factor The maximum flow rate for the Frequency Output to report.

Frequency Factor A value calculated as follows:

$$FrequencyFactor \frac{RateFactor}{T} \times N$$

where:

T	Factor to convert selected time base to seconds
N	Number of pulses per flow unit, as configured in the receiving device

The resulting **Frequency Factor** must be within the range of the Frequency Output .

- If **Frequency Factor** is less than 1 Hz, reconfigure the receiving device for a higher pulses/unit setting.

10.4.3 Configure Frequency Output Direction

Frequency Output Direction controls how conditions of forward flow and reverse flow affect the flow rates reported by the Frequency Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Direction
ProLink III	Device Tools → Configuration → I/O → Outputs → Frequency Output x → Direction
Field communicator	Device Settings → Inputs/Outputs → Frequency Output x → FO x Direction

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 10-2: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	Normal	Forward
	Reverse	Reverse
Reverse (opposite from Flow arrow on sensor)	Normal	Reverse
	Reverse	Forward

Procedure

Set **Frequency Output Direction** as desired.

Option	Description
Forward Flow	- Forward flow: The Frequency Output reports the flow rate according to the configured scaling method. - Reverse flow: The Frequency Output is 0 Hz.
Reverse Flow	- Forward flow: The Frequency Output is 0 Hz. - Reverse flow: The Frequency Output reports the absolute value of the flow rate according to the configured scaling method.
Absolute Flow	The Frequency Output reports the absolute value of the flow rate according to the configured scaling method. It is not possible to distinguish between forward flow and reverse flow from the Frequency Output alone. This setting is typically used in combination with a discrete output configured to report flow direction.

10.4.4 Configure Frequency Output Fault Action

Frequency Output Fault Action controls the behavior of the frequency output if the transmitter detects a fault condition.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Fault Action
ProLink III	Device Tools → Configuration → I/O → Outputs → Frequency Output x → Fault Action
Field communicator	Device Settings → Inputs/Outputs → Frequency Output x → Fault Setup → Fault Action

Important

- The fault action is implemented only if **Alert Severity** is set to Failure. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

Procedure

- Set **Frequency Output Fault Action** as desired.
 - Default: Downscale

Important

If the **Frequency Output Fault Action** is **None**, the frequency output will be controlled by the setting of **Process Variable Fault Action**. In most cases, if **Frequency Output Fault Action** is **None**, **Process Variable Fault Action** should be set to **None**.

- If **Frequency Output Fault Action** is set to **Upscale**, set **Frequency Fault Level** to the desired value.

- Default: 14500 Hz
- Range: 10 Hz to 14500 Hz

Options for Frequency Output Fault Action

Label	Frequency Output behavior
Upscale	• Default: 14500 Hz • Range: 10 Hz to 14500 Hz
Downscale(default)	0 Hz
Internal Zero	0 Hz
None	Determined by the setting of Process Variable Fault Action

10.5 Configure the Discrete Output

The Discrete Output is used to report specific meter or process conditions.

Channel A can be configured as Discrete Output 2 and Channel B can be configured as Discrete Output 1.

10.5.1 Configure Discrete Output Source

Discrete Output Source specifies the process condition or device condition that is reported by a Discrete Output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Source
ProLink III	Device Tools → Configuration → I/O → Outputs → Discrete Output → Source
Field communicator	Device Settings → Inputs/Outputs → Mapping Source → Output Source → Discrete Output x Source

Procedure

Set **Discrete Output Source** to the desired option.
Default: Forward/Reverse

After completing the task:

If **Discrete Output Source** is set to **Discrete Event x** or **Diagnostic Status Alert**, additional configuration is required.

Options for Discrete Output Source

Option	Label			State	Discrete Output voltage
	Display	ProLink III	Field communicator		
Discrete Event x	Discrete Event x	Enhanced Event x	Discrete Event x	ON	- Internally powered: 24 VDC - Externally powered: Site-specific
				OFF	0 V
Zero Flow	Zero Flow	Zero Flow	Zero Flow	Zero flow	- Internally powered: 24 VDC - Externally powered: Site-specific
				non-zero flow	0 V
Empty Pipe	Empty Pipe	Empty Pipe	Empty Pipe	Empty pipe	- Internally powered: 24 VDC - Externally powered: Site-specific
				Full pipe	0 V
Forward/Reverse Indicator	Flow Direction	Flow Direction	Flow Direction	Forward flow	0 V
				Reverse flow	- Internally powered: 24 VDC - Externally powered: Site-specific
Diagnostic Status Alert	Diag Status Alert	Diagnostic Status Alert	Diagnostic Status Alert	Alert active	- Internally powered: 24 VDC - Externally powered: Site-specific
				No active alert	0 V
Transmitter Fault	Fault	Transmitter Fault	Transmitter Fault	Fault active	- Internally powered: 24 VDC - Externally powered: Site-specific
				No Faults active	0 V
Meter Verification Failure	Meter Verification Failure	Meter Verification Failure	Meter Verification Failure	ON	- Internally powered: 24 VDC - Externally powered: Site-specific
				OFF	0 V
Not Used	Not Used	Not Used	Not Used	OFF	0 V

Important

- This table assumes that **Discrete Output Polarity** is set to Active High. If **Discrete Output Polarity** is set to Active Low, reverse the voltage values.
-

Table 10-3: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	Normal	Forward
	Reverse	Reverse
Reverse (opposite from Flow arrow on sensor)	Normal	Reverse
	Reverse	Forward

10.5.2 Configure Discrete Output Polarity

A Discrete Output has two states: Active Low and Active High. Two different voltages are used to represent these states. Discrete Output Polarity controls which voltage represents which state.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Polarity
ProLink III	Device Tools → Configuration → I/O → Outputs → Discrete Output → Polarity
Field communicator	Device Settings → Inputs/Outputs → Discrete Output x → Setup → Polarity

Procedure

Set **Discrete Output Polarity** as desired.

Default: **Active High**

10.5.3 Configure Discrete Output Fault Action

Discrete Output Fault Action controls the behavior of a Discrete Output if the transmitter detects a fault condition.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel x → I/O Settings → Fault Action
ProLink III	Device Tools → Configuration → I/O → Outputs → Discrete Output → Fault Action
Field communicator	Device Settings → Inputs/Outputs → Discrete Output x → Fault Setup → Fault Action

Important

- The fault action is implemented only if **Alert Severity** is set to Failure. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

NOTICE

A fault condition may not be distinguishable from a normal operating condition.

Do not use **Discrete Output Source** as a fault indicator. If Discrete Output is required as a fault indicator, see [Fault indication with a Discrete Output](#).

Procedure

Set **Discrete Output Fault Action** as desired.

Default: **None**

Options for Discrete Output Fault Action

Label	Discrete Output behavior	
	Polarity=Active High	Polarity=Active Low
Upscale	- Fault: Discrete Output is ON (24 VDC or site-specific voltage) - No fault: Discrete Output is controlled by its assignment	- Fault: Discrete Output is OFF (0 V) - No fault: Discrete Output is controlled by its assignment
Downscale	- Fault: Discrete Output is OFF (0 V) - No fault: Discrete Output is controlled by its assignment	- Fault: Discrete Output is ON (24 VDC or site-specific voltage) - No fault: Discrete Output is controlled by its assignment
None(default)	Discrete Output is controlled by its assignment	

Fault indication with a Discrete Output

To indicate faults via a Discrete Output, set **Discrete Output Source** to **Transmitter Fault**. Then, if a transmitter fault occurs, the Discrete Output is always ON and the setting of **Discrete Output Fault Action** is ignored.

10.5.4 Configure Diagnostic Status Alert

Diagnostic Status Alert allows for the selection of specific diagnostic statuses that will activate the discrete output.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel <i>x</i> → I/O Settings → Diag Status Alert
ProLink III	Device Tools → Configuration → I/O → Outputs → Discrete Output → Diagnostic Status Alert
Field communicator	Device Settings → Inputs/Outputs → Discrete Output <i>x</i> → Diagnostic Status Alert

Note

Available diagnostics to select:

Electronics Failure, Sensor Failure, Empty Pipe, Reverse Flow, Process Noise, Electronics Temperature, Electrode Coating 1, Electrode Coating 2, Continuous Smart Meter Verification, Smart Fluid Diagnostic

Procedure

Select the diagnostics that will activate discrete output when active.

Default: **None**

10.6 Configure a Discrete Input

Use a Discrete Input to initiate one or more transmitter actions from a remote input device.

Channel B must be activated to use Discrete Input functionality.

10.6.1 Configure Discrete Input Action

Discrete Input action assignment configuration controls the action or actions that the transmitter will perform when the Discrete Input transitions from OFF to ON.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel B → I/O Settings → Assign Actions
ProLink III	Device Tools → Configuration → I/O → Inputs → Action Assignment (button)
Field Communicator	Device Settings → Inputs/Outputs → Discrete Input 1 → Discrete Input Actions

Important

Before assigning actions to the Discrete Input, check the status of the remote input device. If it is ON, all assigned actions will be performed when the new configuration is implemented. If this is not acceptable, change the status of the remote input device or wait until an appropriate time to assign actions.

Procedure

Set Discrete Input action assignments as desired.

Default: not used

Options for Discrete Input Action

Action	Label		
	Display	ProLink III	Field Communicator
Totalizers			
Start/stop all totalizers and inventories	Start/stop all totalizers	Start or Stop All Totalizers	Start/Stop All Totals
Start/stop all totalizers and inventories	Start or Stop Totalizer X	Start or Stop All Totalizers	Start or Stop Totalizer X
Reset totalizer X	Reset Total X	Reset Totalizer	Reset Total X
Reset all totalizers	Reset All Totals	Reset All Totals	Reset All Totals
Start Smart Meter Verification test	Start SMV	Start Meter Verification	Start Smart Meter Verification

10.6.2 Configure Discrete Input Polarity

A Discrete Input has two states: ON and OFF. **Discrete Input Polarity** controls how the transmitter maps the input voltage to the ON and OFF states.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel B → I/O Settings → Polarity
---------	---

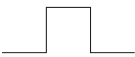
ProLink III	Device Tools → Configuration → I/O → Inputs → Discrete Input → Discrete Input Polarity
Field Communicator	Device Settings → Inputs/Outputs → Discrete Input 1 → Setup → Polarity

Procedure

Set **Discrete Input Polarity** as desired.

Default: **Active Low**

Options for Discrete Input Polarity

Polarity		Discrete Input power supply	Voltage	Status of Discrete Input at transmitter
Active High		Internal	Voltage across terminals is high	ON
			Voltage across terminals is 0 VDC	OFF
		External	Voltage applied across terminals is 3–30 VDC	ON
			Voltage applied across terminals is <0.8 VDC	OFF
Active Low		Internal	Voltage across terminals is 0 VDC	ON
			Voltage across terminals is high	OFF
		External	Voltage applied across terminals is <0.8 VDC	ON
			Voltage applied across terminals is 3–30 VDC	OFF

11 Configure digital communications

11.1 Configure HART parameters

HART® communication is only available on Channel A and only available if Channel A is set to Analog Output 1.

HART parameters include HART address and analog output action, HART tags, HART variables, and HART burst communications.

11.1.1 Configure HART address and Analog Output Action (multidrop)

HART address is used in multidrop installations.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel A → HART Settings → HART Address
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → HART Address
Field Communicator	Device Settings → Communication → HART → Communication Settings → Change Polling Address

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel A → HART Settings → Loop Current
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → Analog Output Action
Field Communicator	Device Settings → Setup Overview → Configure Input/Output Channels

Procedure

1. Set **HART Address** to a value that is unique on the network.

- Default: 0
- Range: 0 to 63

Tip

- The default address is typically used unless a multidrop environment is used.
- Devices using HART protocol to communicate with the transmitter may use either **HART Address**, **HART Tag**, or **HART Long Tag** to identify the transmitter. Configure any or all, as required by the other HART devices.

2. Ensure that **Analog Output Action** is configured appropriately.

Enabled (Live)	The Analog Output 1 reports process data as configured. This is the appropriate setting for a variable 4 to 20 mA output as applications.
Disabled (Fixed)	The Analog Output 1 channel is fixed at 4 mA.

Important

If ProLink III is used to set **HART Address** to 0, the program automatically enables **Analog Output Action**. If ProLink III is used to set **HART Address** to any other value, the program automatically disables **Analog Output Action**. This is designed to make it easier to configure the transmitter for legacy behavior. Always verify **Analog Output Action** after setting **HART Address**.

11.1.2 Configure HART address and Analog Output Action

Devices using HART protocol to communicate with the transmitter may use HART Short Tag, or HART Long Tag to identify the transmitter. Configure as required by the other HART devices.

Display	Menu → Mani Menu → Configuration → Basic Setup → Time/Date/Tag → Short Tag/Long Tag
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → HART Address
Field Communicator	Device Settings → Device Information → Identification → Device Identification → Tag/Long Tag

Procedure

1. Set **HART Short Tag** to a value that is unique to the network. Maximum character length is eight.
2. Set **HART Long Tag** to a value that is unique to the network. Maximum character length is 32.

Important

HART Long Tag is supported only by HART 7. If HART 5 is used, **HART Long Tag** cannot be used for network identification purposes.

3. Set the **Descriptor** and **Message**, if desired.

11.1.3 Configure HART® variables (PV, SV, TV, QV)

The HART variables are a set of four variables predefined for HART use. The HART variables include the Primary Variable (PV), Secondary Variable (SV), Tertiary Variable (TV), and Quaternary Variable (QV). Specific process variables can be assigned to the HART variables where HART methods can be used to read or broadcast the assigned process data.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel A → HART Settings → HART Variables
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → Variable Assignment
Field communicator	Device Settings → Inputs/Outputs → Mapping/Source → Variable Mapping

The default HART variables are as follows:

PV	Volume Flow Rate
SV	Totalizer 1
TV	Totalizer 2
QV	Inventory 1

Note

The Tertiary Variable and Quaternary Variable are also called the Third Variable (TV) and Fourth Variable (FV).

Restriction:

The Primary Variable is always the process variable assigned to **Analog Output 1**. If either of these assignments is changed, the other is changed automatically.

Procedure

Assign variables to the PV, SV, TV, and QV as desired.

Options for HART variables

Process variable	PV	SV	TV	QV
Standard				
Volume Flow Rate	✓	✓	✓	✓
Velocity Flow Rate	✓	✓	✓	✓
Mass Flow Rate	✓	✓	✓	✓
% of range		✓	✓	✓
Loop Current		✓	✓	✓
Totalizers and inventories				
Current value of any totalizer		✓	✓	✓
Current value of any inventory		✓	✓	✓
Diagnostics				
Core Board Temperature		✓	✓	✓
Line Noise		✓	✓	✓
Low Freq SNR		✓	✓	✓
High Freq SNR		✓	✓	✓
Signal Power		✓	✓	✓
Empty Pipe Value		✓	✓	✓
Electrode Coating Value		✓	✓	✓
Continuous Coil Resistance		✓	✓	✓
Continuous Coil Inductance		✓	✓	✓
Continuous Coil Inductance Deviation		✓	✓	✓
Continuous Electrode Resistance		✓	✓	✓
Continuous Electrode CM Resistance		✓	✓	✓
Continuous Electrode Positive Resistance		✓	✓	✓
Continuous Electrode Negative Resistance		✓	✓	✓
Continuous Electrode High Freq Diff Resistance		✓	✓	✓
Continuous Electrode High Freq CM Resistance		✓	✓	✓
Continuous Flow Simulation Deviation		✓	✓	✓
Continuous AO Feedback Deviation		✓	✓	✓
Smart Fluid Diagnostic Value		✓	✓	✓
Input Voltage		✓	✓	✓
IO Board Temperature		✓	✓	✓
AO1 Feedback Current		✓	✓	✓

Process variable	PV	SV	TV	QV
Not Used		✓	✓	✓

11.1.4 Configure burst communications

Burst mode is a mode of communication during which the transmitter regularly broadcasts HART® digital information to the network via the primary analog output.

Restriction:

Burst communications, including trigger mode and event notification, is not available on HART/RS-485. These features are supported only on HART/Bell 202.

Configure HART burst messages

Burst messages contain information on process variables or transmitter status. A user can configure up to three burst messages. Each message can contain different information. Burst messages also provide the mechanism for trigger mode and event notification.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel A → HART Settings → Burst Message x
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → Burst Mode
Field communicator	Device Settings → Communication → HART → Burst Configuration → Configure Burst Messages

Procedure

1. Navigate to the burst message intended for configuration.
2. Enable the burst message.
3. Set **Burst Option** to the desired content.

Table 11-1: Options for burst message contents

HART command	Label			Description
	Display	ProLink III	Field communicator	
1	CMD 1	Source (Primary Variable)	Primary Variable	The transmitter sends the primary variable (PV) in the configured measurement units in each burst message (for example, 5 gal/min, 10 gal/min, 15 gal/min).
2	CMD 2	Primary Variable (Percent Range/Current)	Cmd 2: Read Percent Range/Current	The transmitter sends the PV's actual mA level and the PV's percent of range in each burst message (for example, 11.0 mA 25%).
3	CMD 3	Process Variables/Current	Cmd 3: Read Dynamic Variables/Current	The transmitter sends the PV's actual milliamp reading and the PV, SV, TV, and QV values in measurement units in each burst message (for example, 11.8 mA, 10 gal/min, 15 ft/sec, 100 gal, 250 gal).
9	CMD 9	Read Device Variables with Status	Cmd 9: Read Device Variables with Status	The transmitter sends up to eight user-specified process variables in each burst message.

HART command	Label			Description
	Display	ProLink III	Field communicator	
33	CMD 33	Transmitter Variables	Cmd 33: Read Device Variables	The transmitter sends four user-specified process variables in each burst message.
48	CMD 48	Read Additional Transmitter Status	Cmd 48: Read Additional Device Status	The transmitter sends expanded device status information in each burst message.

- For HART Command 9, select up to eight user-specified process variables for the burst message. For HART Command 33, select four user-specified process variables for the burst message.

Configure HART trigger mode

Trigger mode uses the burst message mechanism to indicate that a process variable has changed. When trigger mode is implemented, the bursting interval (HART update rate) changes if Primary Variable or Burst Variable 0 moves above or below the user-specified trigger level. A different trigger can be set for each burst message.

Prerequisites

Before trigger mode can be configured, the corresponding HART burst message must be enabled.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel A → HART Settings → Burst Message <i>x</i> → Trigger Mode
ProLink III	Device Tools → Configuration → Communications → Communications (HART) → Trigger Mode
Field communicator	Device Settings → Communication → HART → Burst Configuration → View Message <i>x</i> → Configure Update Rate

Procedure

- Select the burst message intended for trigger mode.
- Set **Trigger Mode** to the type of trigger intended for use.

Option	Description
Continuous	The burst message is sent at Default Update Rate . The burst interval is not affected by changes in process variables.
Falling	- When the specified process variable is above Trigger Level, the burst message is sent at Default Update Rate. - When the specified process variable is below Trigger Level, the burst message is sent at Update Rate.
Rising	- When the specified process variable is below Trigger Level, the burst message is sent at Default Update Rate. - When the specified process variable is above Trigger Level, the burst message is sent at Update Rate.

Option	Description
Windowed	This option is used to communicate that the process variable is changing rapidly. Trigger Level defines a deadband around the most recently broadcast value. - If the process variable stays within this deadband, the burst message is sent at Default Update Rate. - If the process variable moves outside this deadband in either direction, the burst message is sent at Update Rate.
On Change	- If any value in the burst message changes, the burst message is sent at Update Rate. - If no values change, the burst message is sent at Default Update Rate.

- Set **Trigger Level** to the value of the process variable at which the trigger will be activated.
- Set **Default Update Rate** (or **Base Burst Rate**) to the burst interval to be used when the trigger is not active.
- Set **Update Rate** (or **Triggered Burst Rate**) to the burst interval to be used when the trigger is active.

11.2 Configure Modbus communications

Modbus communications parameters control Modbus communications with the transmitter.

Display	Menu → Main Menu → Configuration → Basic Setup → Inputs/Outputs → Channel C
ProLink III	Device Tools → Configuration → Communications → Communications (Modbus)
Field Communicator	Device Settings → Communication → Modbus → RS/485 Setup → Modbus Slave Address

Restriction:

The display only configures **Modbus Address** and **Floating Point Byte Order**. The Field Communicator only configures the **Modbus Address**.

For all other Modbus configuration, ProLink III must be used.

Modbus support is implemented on the RS-485 physical layer via Channel C.

Important

The device automatically accepts all connection requests within the following ranges:

- Protocol: Modbus RTU (8-bit) is disabled
- Parity: none, odd, or even
- Stop bits: 1 or 2
- Baud: 1200, 2400, 4800, 9600, 19200, 38400

There is no need to configure these communications parameters on the device.

Procedure

- Set **Modbus Address** to a unique value on the network.
- Set **Floating-Point Byte Order** to match the byte order used by the Modbus host.

Code	Byte order
0	1-2 3-4
1	3-4 1-2
2	2-1 4-3
3	4-3 2-1

See the following table for the bit structure of bytes 1, 2, 3, and 4.

Table 11-2: Bit structure of floating-point bytes

Byte	Bits	Definition
1	SEEEEEEE	S=Sign E=Exponent
2	EMMMMMMM	E=Exponent M=Mantissa
3-4	MMMMMMMM	M=Mantissa

3. Set **Double-Precision Byte Order** to match the byte order used by the Modbus host.

Code	Byte order
0	1-2-3-4 5-6-7-8
1	3-4-1-2 7-8-5-6
2	2-1-4-3 6-5-8-7
3	4-3-2-1 8-7-6-5
4	5-6-7-8 1-2-3-4
5	7-8-5-6 3-4-1-2
6	6-5-8-7 2-1-4-3
7	8-7-6-5 4-3-2-1

See the following table for the bit structure of bytes 1-8.

Table 11-3: Bit structure of double-precision bytes

Byte	Bits	Definition
1	SEEEEEEE	S=Sign E=Exponent
2	EEEEMMMM	E=Exponent M=Mantissa
3-8	MMMMMMMM	M=Mantissa

4. **Optional:** Set **Additional Communications Response Delay** in *delay units*.
A delay unit is $\frac{2}{3}$ of the time required to transmit one character, as calculated for the port currently in use and the character transmission parameters.
Additional Communications Response Delay is used to synchronize Modbus communications with hosts that operate at a slower speed than the device. The value specified here will be added to each response the device sends to the host.

- Default: 0
- Range: 0 to 255

Tip

Do not set **Additional Communications Response Delay** unless required by the Modbus host.

11.3 Wireless configuration via Bluetooth® technology

11.3.1 Download AMS Device Configurator

Procedure

Download and install the app.



11.3.2 Configure via Bluetooth® wireless technology

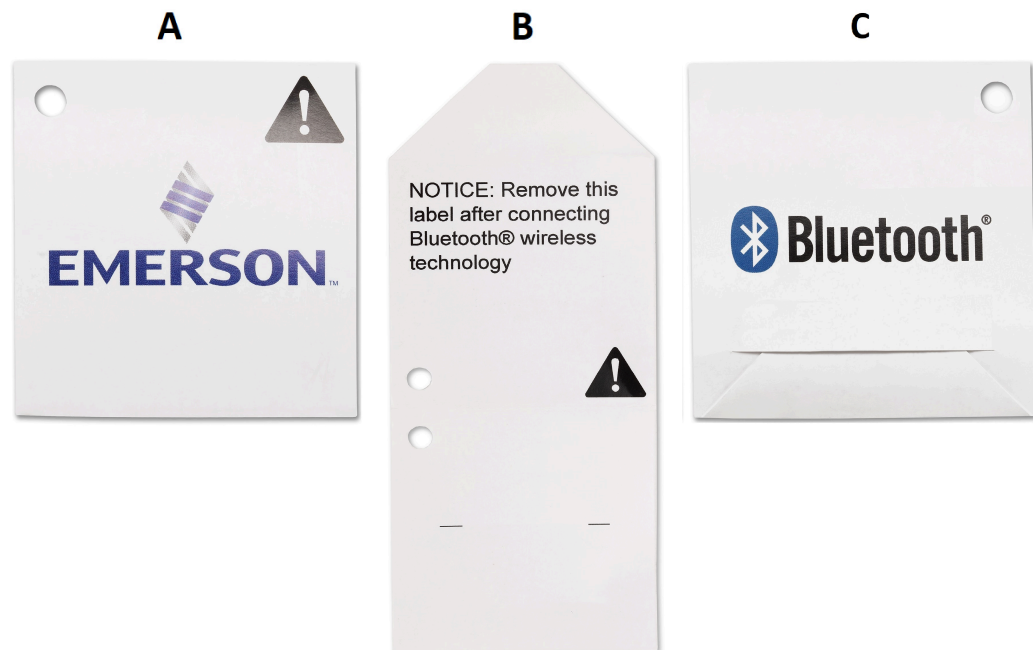
Procedure

1. Launch AMS Device Configurator.
2. Click on the device intended for connecting to.
3. On first connection, enter the key for this device.
4. At the top left, click the menu icon to navigate the desired device menu.

Bluetooth® UID and key

Locate the UID and key in 3 locations:

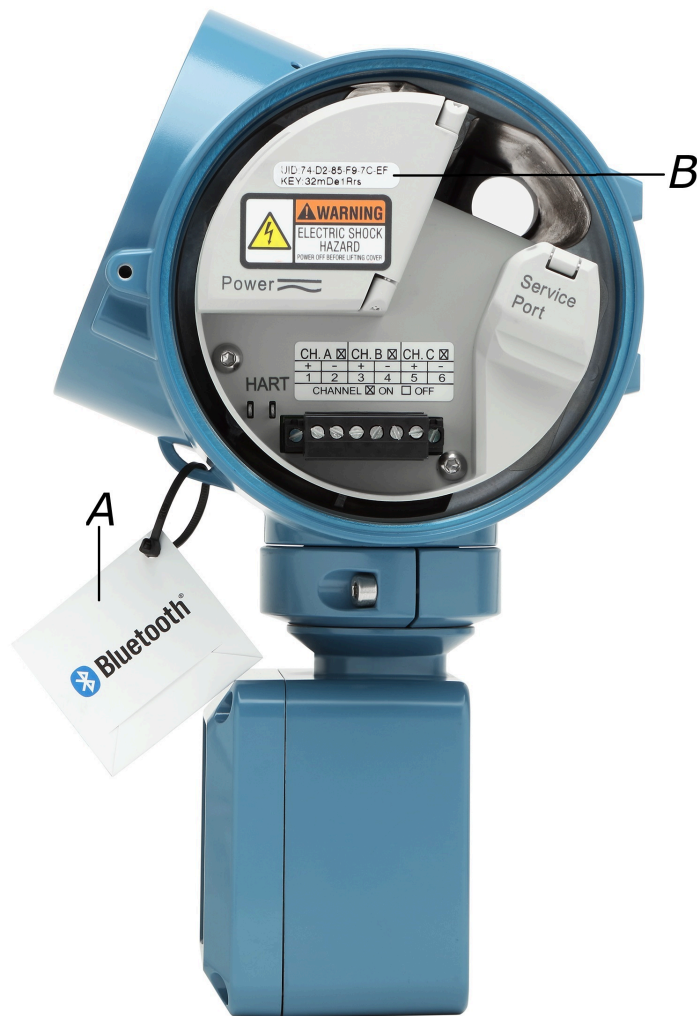
1. On the paper tag attached to the device
2. On the label inside the terminal cover
3. On the label on the outer edge within the display screen

Figure 11-1: Bluetooth Security Information

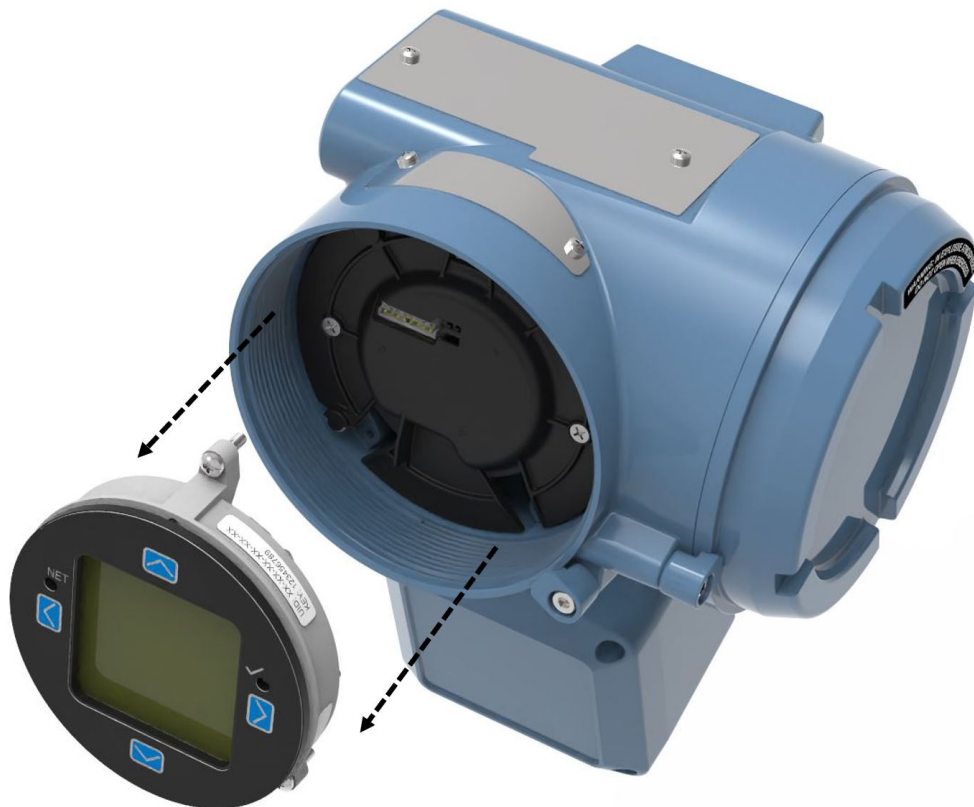
- A. Front Outside
- B. Back Inside with Sticker
- C. Back Outside

Important

If the display is replaced or added, only the label on the display will have the correct UID and Key for Bluetooth access.

Figure 11-2: Bluetooth UID and Key Locations (Paper Label and Terminal)

- A. Bluetooth Paper Label
- B. Bluetooth UID and Key Power Terminals cover

Figure 11-3: Bluetooth UID and Key Locations (Display)

11.3.3 Change Bluetooth® role password

Only the Administrator and Maintenance roles allow for user-defined passwords. Administrative rights to modify Bluetooth security settings, including role passwords, are granted under the Factory Admin and Administrator roles.

Prerequisites

If all user-defined passwords are lost or unknown and the Factory Admin role has been disabled, see [Reset Bluetooth security settings](#).

Procedure

1. Open the AMS Device Configurator application and select the intended field device.
2. Connect under either the Factory Admin or the Administrator role.
3. Open the menu and select **Bluetooth Security**.
4. Select **Modify Role**.
5. Select the role for which you would like to modify the password, and follow the prompts. Select **Update Password / Enable Role** when finished.

11.3.4 Reset Bluetooth Security Settings

This process resets Bluetooth security settings to factory conditions. In this state, only the Factory Admin role is enabled, and the Factory Key which is printed on a label on the transmitter, is needed to connect with a field device. This can be performed over the Bluetooth connection or through local access to the device.

- [Reset Bluetooth security settings through the local display](#)
- [Reset Bluetooth security settings through a wired connection](#)

Procedure

Reset Bluetooth® security settings through the local display

Procedure

1. Select the main menu: **Configuration** → **Security** → **Bluetooth Security** → **Reset Security**.
2. Select **Yes** and click **Finished**.
The user will have 15 minutes to establish Bluetooth communication with the field device using the Factory Admin role.
3. Open the AMS Device Configurator application and connect with the field device using the Factory Admin role.
This role requires the Factory Key, which is printed on a label on the field device (refer to [Bluetooth UID and key](#)).
When confirmed:
 - a. Both the Admin and Maintenance roles are disabled. Only the Factory Admin role is enabled.
 - b. Associated Admin and Maintenance passwords are erased.
 - c. The number of security resets increment.
 - d. Until the Administrator or Maintenance roles are re-configured, subsequent connection with the field device requires connection through the Factory Admin role.

Reset Bluetooth® security settings through a wired connection

Procedure

1. Navigate to the **Communications (Bluetooth)** screen by choosing **Device Settings** → **Security** → **Bluetooth**.
2. Select **Reset Bluetooth Security**.
The user will have 15 minutes to establish Bluetooth communication with the field device using the Factory Admin role.
3. Open the AMS Device Configurator application and connect with the field device using the Factory Admin role.
This role requires the Factory Key, which is printed on a label on the field device (refer to [Bluetooth UID and key](#)).
When a successful Bluetooth connection is established:
 - a. Both the Admin and Maintenance roles are disabled. Only the Factory Admin role is enabled.
 - b. Associated Admin and Maintenance passwords are erased.
 - c. The number of security resets increment.
 - d. Until the Administrator or Maintenance roles are re-configured, subsequent connection with the field device requires connection through the Factory Admin role.

Bluetooth® network status LED

The Bluetooth network status LED on the display provides a quick indication of Bluetooth network status by changing color and flashing.

Bluetooth network LED condition	Network status
Off	Disabled
Solid green	Enabled, no active connection
Blinking green	Enabled, active connection present

12 Complete the configuration

12.1 Flow rate simulation

Flow rate simulation allows the user to test the system or tune the loop without having to create the test conditions in the process. When flow rate simulation is enabled, the transmitter reports the simulated values for volume flow, velocity, and mass flow, and takes all appropriate actions. For example, the transmitter might apply a cutoff, activate an event, or post an alert.

When flow rate simulation is enabled, the simulated values are stored in the same memory locations used for process data from the sensor. The simulated values are then used throughout transmitter functioning. For example, flow rate simulation will affect:

- All flow rates displayed or reported via outputs or digital communications
- The total and inventory values
- All values logged to Data Historian

Flow rate simulation does not affect any diagnostic values.

12.1.1 Test or tune the system using flow rate simulation

Use flow rate simulation to test the system's response to a variety of process conditions, including boundary conditions, problem conditions, or alert conditions, or to tune the loop.

Display	Menu → Main Menu → Startup Tasks → Commissioning Tools → Flow Rate Simulation
ProLink III	Device Tools → Diagnostics → Testing → Flow Rate Simulation
Field communicator	Diagnostics → Simulation → Simulate Process Variables → Velocity Flow Rate Simulation Settings → Simulate Velocity Flow Rate

Prerequisites

Before enabling flow rate simulation, ensure that the process and system can tolerate the effects of the simulated process values.

Procedure

1. Enable flow rate simulation.
2. For flow, set **Wave Form** as desired and enter the required values.

Option	Required values
Fixed	Fixed Value
Sawtooth	Period Minimum Maximum
Sine	Period Minimum Maximum

3. Observe the system response to the simulated values and make any appropriate changes to the transmitter configuration or to the system.
4. Modify the simulated values and repeat.
5. When finished testing or tuning, disable flow rate simulation.

12.2 Enable or disable software write protection

When enabled, write protection prevents changes to the transmitter configuration. Some transmitter functions can be performed and transmitter configuration parameters can be viewed while write protection is enabled.

Write protection is enabled by toggling the physical write protect (dip) switch (identified by a lock icon) located behind the display module.

Figure 12-1: Write Protect (Dip) Switch behind the Display Module

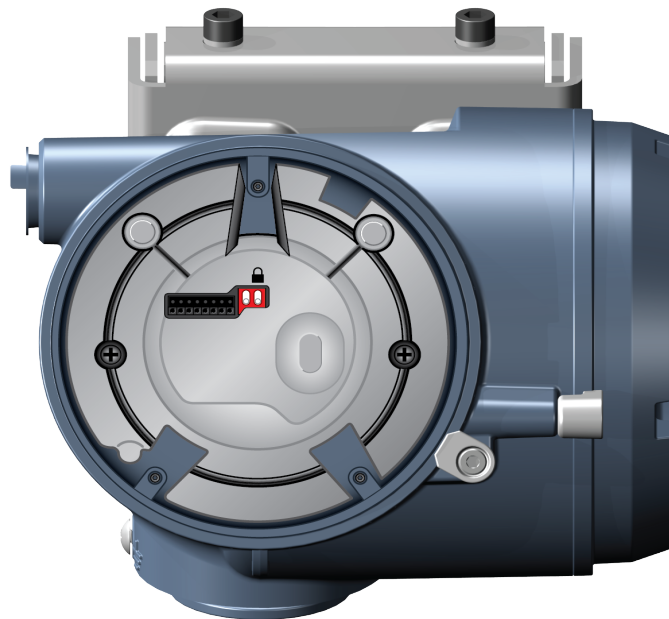


Figure 12-2: Write Protect on the Display (Upper Right Corner)

Users cannot change write protection from any host configuration tool.

Note

Write protecting the transmitter primarily prevents accidental changes to configuration, not intentional changes. Any user who can change the switch can disable write protection.

13 Transmitter operation

13.1 View process and diagnostic variables

Process variables provide information about the state of the process fluid. Diagnostic variables provide data about device operation. Use this data to monitor and troubleshoot an installation's process.

13.1.1 View process and diagnostic variables using the display

The display reports the name of the variable (for example, *Volume Flow Rate*), the current value of the variable, and the associated unit of measure (for example, gal/min).

To learn more about using the display, refer to [Components of the transmitter display](#).

To configure the process variables shown on the display, refer to [Configure the process variables shown on the display](#).

Prerequisites

For a process or diagnostic variable to be viewed on the home screen of the display, it must be configured as a display variable.

Procedure

- If **Auto Scroll** is not enabled, activate ↓ or ↑ to move through the list of display variables.
- If **Auto Scroll** is enabled, wait until the variable is displayed automatically or activate ↓ or ↑ to force the display to scroll.

13.1.2 View process variables and other data using ProLink III

Monitor process variables, diagnostic variables, and other data to maintain process quality.

ProLink III automatically displays process variables, diagnostic variables, and other data on the main screen.

Tip

ProLink III allows a user to choose the process variables that appear on the main screen. The user can also choose whether to view data in **Analog Gauge view** or digital view, and can customize the gauge settings. For more information, see the [ProLink III with ProcessViz Software User Manual](#).

13.1.3 View process variables and other data using a field communicator

Monitor process variables, diagnostic variables, and other data to maintain process quality.

Procedure

- To view a complete set of process variables, plus the current state of the outputs, choose **Process Variables** → **Variables**.
- To view diagnostic variables, choose **Process Variables** → **Variables** → **Diagnostic Variables**.

13.1.4 Effect of Sensor Flow Direction Arrow on digital communications

Flow rates on the transmitter display or reported via digital communications are shown as positive or negative. The sign depends on the interaction between **Sensor Flow Direction Arrow** and the actual flow direction.

This interaction affects flow rates shown on the transmitter display, ProLink III, and all other user interfaces.

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow rate value	
		Transmitter display	Digital communications
Forward (same direction as Flow arrow on sensor)	Normal	Positive (no sign)	Positive
	Reverse	Negative	Negative
Reverse (opposite from Flow arrow on sensor)	Normal	Negative	Negative
	Reverse	Positive (no sign)	Positive

13.2 View and acknowledge status alerts

The transmitter posts a status alert whenever one of the specified conditions occurs. A user can view active alerts and can acknowledge alerts. Alerts do not have to be acknowledged. The transmitter can perform normal measurement and reporting functions with unacknowledged alerts.

13.2.1 View and acknowledge alerts using the display

A user can view information about all active or unacknowledged alerts, and acknowledge alerts.

The display uses the alert banner and the alert symbol ⓘ to provide information about alerts.

Table 13-1: Alert information on display

Display status	Cause	User action
Alert banner	One or more alerts are active.	Resolve the conditions to clear the alert. When the alert is cleared or acknowledged, the banner will be removed.
Alert symbol ⓘ	One or more alerts are unacknowledged.	Acknowledge the alert. When all alerts are acknowledged, the alert icon will be removed.

If alert security is enabled, the alert banner is never displayed. To view detailed information, the alert menu must be used: **Menu → Main Menu → (i) Alert List**.

Note

Certain alerts do not clear unless the transmitter is rebooted.

Procedure

- If the alert banner appears:
 1. Activate **Info** to view information about the alert.
 2. Take appropriate steps to clear the alert.
 3. Activate **Ack** to acknowledge the alert.
- If ⓘ appears:
 1. Choose **Menu → Main Menu → (i) Alert List**.
 2. Select an alert to view more information about the specific alert or to acknowledge it individually.
 3. Choose **Acknowledge All Alerts** to acknowledge all alerts on the list.

13.2.2 View and acknowledge alerts using ProLink III

The user can view a list containing all alerts that are active, or inactive but unacknowledged. From this list, a user can acknowledge individual alerts or choose to acknowledge all alerts at once.

Note

Certain alerts do not clear unless the transmitter is rebooted.

Procedure

1. View alerts on the ProLink III main screen under **Alerts**.
All active or unacknowledged alerts are listed. Take appropriate steps to clear all active alerts.
2. To acknowledge a single alert, check the **Ack** check box for that alert. To acknowledge all alerts at once, select **Ack All**.

13.2.3 View alerts using a field communicator

The user can view a list containing all alerts that are active, or inactive but unacknowledged.

Restriction:

The user can only view alerts using a field communicator. To acknowledge alerts, use the display or make a connection to the transmitter using a different tool.

Procedure

- To view active or unacknowledged alerts, choose:
 - Process Variables → Device Overview → Device Status
 - Device Settings → Alerts → Active Alerts
 - Diagnostics → Alerts → Active Alerts

All active alerts and unacknowledged alerts are listed. Select an alert to view detailed information.
- To refresh the list, choose:
 - Process Variables → Device Overview → Device Status
 - Diagnostics → Alerts → Active Alerts

13.3 Read totalizer and inventory values

Totalizers keep track of the total amount of volume or mass measured by the transmitter since the last totalizer reset. Inventories keep track of the total amount of volume or mass measured by the transmitter since the last inventory reset.

Display	Menu → Main Menu → Operations → Totalizers → See Totals
ProLink III	Device Tools → Totalizer Control → Totalizers
	Device Tools → Totalizer Control → Inventories
Field communicator	Process Variables → Device Overview → Variables → Totalizers → View Totalizers (1-7) and View Inventories (1-7)

13.4 Start, stop, and reset totalizers and inventories

When a totalizer or inventory is started, its value increases or decreases depending on the interaction of the flow direction parameters. It continues tracking flow until it is stopped.

When a totalizer or inventory is reset, its value is set to 0. A user can reset a totalizer or inventory while it is started or while it is stopped.

- Each totalizer or inventory can be started, stopped, or reset independently.
- All totalizers or inventories can be started, stopped, or reset as a group.

13.4.1 Start, stop, and reset totalizers using the display

This procedure can be performed whether the totalizer or inventory is set or not set as a display variable.

Procedure

- To start, stop, or set a single totalizer or inventory when the totalizer or inventory is not set as a display variable:
 1. Choose **Menu** → **Main Menu** → **Operations** → **Totalizers** → **View Totals** → **Totalizer/Inventory X**.
 2. Choose either **Start**, **Stop**, or **Reset**.
- To start or stop all totalizers and inventories as a group:
 1. Choose **Menu** → **Operations** → **Totalizers**.
 2. Choose **Start** or **Stop**.
- To start, stop, or set a single totalizer or inventory when the totalizer or inventory is set as a display variable::

Note

Start, stop, and reset single or all totalizers and inventories using this procedure does not work when **2-Value View** is used. Refer to [when the inventory is not set as a display variable](#).

1. Wait or scroll until the totalizer or inventory appears on the display.
2. Choose **Start**, **Start**, or **Reset**.

13.4.2 Start, stop, and reset totalizers using ProLink III

Prerequisites

To reset an inventory using ProLink III, this function must be enabled. To enable inventory reset using ProLink III, choose **Tools** → **Options** and enable **Reset Inventories from ProLink III**. Note that this affects only ProLink III. Resetting inventories using other tools is not affected.

Procedure

- To start, stop, or reset a single totalizer or inventory:
 1. Choose either **Device Tools** → **Totalizer Control** → **Totalizer** or **Device Tools** → **Totalizer Control** → **Inventories**.
 2. Scroll to the desired totalizer and click **Start**, **Stop**, or **Reset**.
- To start, stop, or reset all totalizers or inventories as a group:
 1. Choose **Device Tools** → **Totalizer Control** → **Totalizers** or **Device Tools** → **Totalizer Control** → **Inventories**.
 2. Select **Start All Totals**, **Stop All Totals**, or **Reset All Totals**.

13.4.3 Start, stop, and reset totalizers using a Field Communicator

Procedure

- To start, stop, or set a single totalizer or inventory:
 1. Choose **Process Variables** → **Device Overview** → **Smart Meter Verification and Totalizer** → **Totalizer Control**.
 2. Scroll to the desired totalizer and click either **Start**, **Stop**, or **Reset**.
- To start or stop all totalizers and inventories as a group:
 1. Choose **Process Variables** → **Device Overview** → **Smart Meter Verification and Totalizer** → **Totalizer (1-7)**.
 2. Select **Start All Totals**, **Stop All Totals**, or **Reset All Totals**.

14 Measurement support

14.1 Use Smart Meter Verification

Smart Meter Verification (SMV) provides in-process flow meter health verification by analyzing the meter components related to measurement performance. A user can run Smart Meter Verification without stopping the process. Use this section to run a Smart Meter Verification test, view and interpret the results, set up automatic execution, and check if a field reference point has been established.

14.1.1 Smart Meter Verification capabilities

Table 14-1: Smart Meter Verification capabilities

Capability	Basic	Professional 90-day trial, licensed
SMV baseline	●	●
SMV pass/fail	●	●
SMV measurement values	●	●
Sensor Health Test	●	●
Configurable test criteria		●
Print previous 20 SMV reports		●
Schedulable SMV		●
Continuous SMV		●

14.1.2 Setting the baseline using the display

Prerequisites

Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).

Procedure

Choose **Menu** → **Main Menu** → **Operations** → **Smart Meter Verification** → **Perform Baseline**.

14.1.3 Setting the baseline using the ProLink III

Prerequisites

Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).

Procedure

Choose **Device Tools** → **Diagnostics** → **Meter Verification** → **Re-Baseline Sensor**.

Important

Verify the Electrode Resistance Baseline for the meter. The sensor must be full of process fluid to make valid Electrode Resistance baseline values.

NOTICE

If the meter has been installed for a long period of time, overwriting an existing baseline could mask issues, such as coating, corrosion, erosion, or other sensor damage, uncovered by SMV.

14.1.4 Setting the baseline using a Field Communicator

Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).

Procedure

Choose **Device Settings** → **Advanced Diagnostics** → **Smart Meter Verification** → **timmand Meter Verification** → **Sensor Baseline** → **Re-Baseline Sensor**

Important

Verify the Electrode Resistance Baseline for the meter. The sensor must be full of process fluid to make valid Electrode Resistance baseline values.

14.1.5 Check for a baseline

Use this procedure to check if a baseline was created.

Prerequisites

- Smart Meter Verification Professional
- ProLink III Basic or Professional

Procedure

1. From ProLink III Basic or Professional, specify **Device Tools** → **Diagnostics** → **Meter Verification** → **Sensor Baseline**.
2. Review the Sensor Baseline values for all of the baseline parameters.
If any values are NaN, a baseline for that parameter has not been completed.
3. If there are baseline values of NaN, use the **Re-Baseline Sensor** button to set baseline values.

Important

The sensor must be full of process fluid to make valid Electrode Resistance baseline values.

14.1.6 Run a Smart Meter Verification test

Run a Smart Meter Verification Basic or Professional test to diagnose the flow meter (and flow meter system) and verify if the flow meter is functioning properly and performing within factory specifications.

Run a Smart Meter Verification test using the display

Prerequisites

Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).

Procedure

1. Choose **Menu** → **Main Menu** → **Operations** → **Smart Meter Verification** → **Run Meter Verification**.
2. Select the desired scope of the meter verification test.

Option	Description
Both	The test will check all sensor parameters against the baseline values and perform a transmitter calibration test.
Transmitter	The test will only perform a transmitter calibration test.
Sensor	The test will check all sensor parameters against the baseline values.

The test starts immediately.

3. Wait for the test to complete.

Note

At any time during the process, a user can abort the test.

Run a Smart Meter Verification test using ProLink III Basic or Professional

Procedure

1. Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).
2. Run Smart Meter Verification using ProLink III Basic or Professional: **Device Tools** → **Diagnostics** → **Run Meter Verification**.
3. In the *Customer Identification* window, enter any desired information and click **Next**. None of this information is required. It does not affect Smart Meter Verification processing.
4. Select the desired components to verify.

Option	Description
Sensor and Transmitter	The test will check all sensor parameters against the baseline values and perform a transmitter calibration test.
Transmitter only	The test will only perform a transmitter calibration test.
Sensor only	The test will check all sensor parameters against the baseline values.

5. Select **Start Meter Verification** and wait for the test to complete.

Note

At any time during the process, a user can abort the test.

Run a Smart Meter Verification test using a field communicator

Field communicator	Device Settings → Advanced Diagnostics → Smart Meter Verification → Commanded Meter Verification → Run Meter Verification
--------------------	---

Procedure

1. Choose **Device Settings** → **Calibration** → **Smart Meter Verification** → **Run Meter Verification**.
2. Select the desired Components to test.

Option	Description
Both	The test will check all sensor parameters against the baseline values and perform a transmitter calibration test.
Transmitter	The test will only perform a transmitter calibration test.
Sensor	The test will check all sensor parameters against the baseline values.

The test starts immediately.

3. Wait for the test to complete.

Note

At any time during the process, a user can abort the test.

Run a Smart Meter Verification test from a Modbus host

Prerequisites

The Modbus host must be connected to the transmitter.

Procedure

1. Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).
2. Select the components to test from Register 5202.

0	Sensor and Transmitter
1	Sensor only
2	Transmitter

3. Use Coil 72 to start the test.

Note

At any time during the process, the test can be aborted using Coil 16.

4. Read Register To determine if the test is running, read Register 5183.

> 0 = Yes	Read the percent complete from Register 5183. Range: 0 to 100
0 = No	Continue to the next step.

5. Read Register 5191 for the overall test result.

Option	Description
0	Test was not run
1	Pass (All tests performed passed)
2	Fail (One or more of the tests performed failed) – Check status of individual tests
3	Test was aborted
4	SMV isn't licensed
5	Empty pipe condition occurred during test
6	No baseline was available for comparison

6. If the overall test result was a fail, read the individual test result registers to determine which test(s) caused the failed result.

Register	Description
5192	Coil inductance test for sensor calibration
5193	Coil Resistance test for sensor health
5194	Electrode Resistance test for sensor health
5195	Flow simulation test for transmitter calibration

Option	Description
1	Test was not run
2	Pass (All tests performed passed)
3	Fail (One or more of the tests performed failed) – Check status of individual tests
4	Test was aborted
4	SMV isn't licensed
5	Empty pipe condition occurred during test
6	No baseline was available for comparison

14.1.7 View Smart Meter Verification test results

When the Smart Meter Verification Basic test is complete, a pass/fail result is displayed. With Smart Meter Verification Professional, detailed results and reports are available.

Note

With Smart Meter Verification Professional, the twenty most recent results are available. If viewed using ProLink III Basic or Professional, results for all tests that are in the PC database are available.

View Smart Meter Verification test results using the display

Prerequisites

Read the Smart Meter Verification prerequisites in [Use Smart Meter Verification](#).

Procedure

1. Choose **Menu** → **Main Menu** → **Operations** → **Smart Meter Verification** → **Read Verification History**.
2. Select the desired test and scroll through the results.
The online version of the SMV report format can be found at [Rosemount Magnetic Flow Meter Calibration Verification Report](#).

View Smart Meter Verification test results using ProLink III Basic or Professional

Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

Procedure

1. Use the following path: **Device Tools** → **Diagnostics** → **View Previous Test Results**.

2. To view details, select the **Export Data to CSV file** and save the file to the PC. Open the file from the saved location to view the detailed results from all the available tests.
The online version of the SMV report format can be found at [Rosemount Magnetic Flow Meter Calibration Verification Report](#).
ProLink III displays a report containing details of the most recent tests. The report is automatically saved to the Smart Meter Verification database, and can be either printed or exported.

View Smart Meter Verification test results from a Modbus host

Prerequisites

To read test results, the Modbus host must be connected to the transmitter.

Procedure

1. Read the Modbus register values using the descriptions in the following table to see results from the last commanded test.

Register	Description
5191	Overall test result (see Results table for description of values)
5202	Test scope 0 = Both sensor and transmitter 1 = Sensor only 2 = Transmitter only
5203	Test condition 0 = Not run 1 = No flow, full pipe 2 = Flowing, full pipe 3 = Empty pipe
5200	Test criteria limit for calibration verification tests (%)
5192	Coil inductance test result for sensor calibration verification (see Results table for description of values)
5187	Coil inductance test deviation units (57 = %)
5212	Coil inductance test deviation value
5188	Coil inductance units (245 = mH)
5210	Coil inductance test value
401	Coil inductance baseline value
5193	Coil resistance test result for sensor health verification (see Results table for description of values)
5189	Coil resistance units (37 = ohms)
5214	Coil resistance test value
403	Coil resistance baseline value
5194	Electrode resistance test result for sensor health verification (see Results table for description of values)
5190	Electrode resistance units (163 = kohms)
5216	Electrode resistance test value
405	Electrode resistance baseline value
5195	Flow simulation test result for transmitter calibration (see Results table for description of values)

Register	Description
5186	Flow simulation test deviation units (57 = %)
5208	Flow simulation test deviation value
5185	Flow simulation test units (20 = ft/s)
5206	Flow simulation test value
5204	Flow simulation reference value (30 ft/s)

Test result value	Description
0	Test was not run
1	Pass
2	Fail
3	Test was aborted
4	SMV isn't licensed
5	Empty pipe condition occurred during test
6	No baseline was available for comparison

The online version of the SMV report format can be found at [Rosemount Magnetic Flow Meter Calibration Verification Report](#).

- To see results from previous tests write a value between 0 and 19 to Register 5779. 19 is the most recent test and 0 is the oldest saved test.
- Read the Modbus register values using the descriptions in the following table.

Register	Description
5783	Overall test result (see Results table for description of values)
5785	Test scope 0 = Both sensor and transmitter 1 = Sensor only 2 = Transmitter only
5786	Test condition 0 = Not run 1 = No flow, full pipe 2 = Flowing, full pipe 3 = Empty pipe
5784	Test criteria limit for calibration verification tests (%)
5811	Coil inductance test result for sensor calibration verification (see Results table for description of values)
5187	Coil inductance test deviation units (57 = %)
5795	Coil inductance test deviation value
5188	Coil inductance units (245 = mH)
5793	Coil inductance test value
5805	Coil inductance baseline value
5812	Coil resistance test result for sensor health verification (see Results table for description of values)

Register	Description
5789	Coil resistance units (37 = ohms)
5797	Coil resistance test value
5807	Coil resistance baseline value
5813	Electrode resistance test result for sensor health verification (see Results table for description of values)
5190	Electrode resistance units (163 = kohms)
5799	Electrode resistance test value
5809	Electrode resistance baseline value
5814	Flow simulation test result for transmitter calibration (see Results table for description of values)
5186	Flow simulation test deviation units (57 = %)
5791	Flow simulation test deviation value
5185	Flow simulation test units (20 = ft/s)
5789	Flow simulation test value
5787	Flow simulation reference value (30 ft/s)

Test result value	Description
0	Test was not run
1	Pass
2	Fail
3	Test was aborted
4	SMV isn't licensed
5	Empty pipe condition occurred during test
6	No baseline was available for comparison

View Smart Meter Verification test results using a field communicator

In addition to test results, some field communicator brands provide a trend chart. Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

Procedure

1. Choose **Device Settings** → **Advanced Diagnostics** → **Smart Meter Verification** → **Commanded Meter Verification** → **View Meter Verification Report**.
2. Choose **Most Recent Test Results**.
The field communicator stores only the most recent test result. To view earlier results, you must upload them from the device. They will be available only for the current session.
3. Choose **Most Recent Test Results**.
The online version of the SMV report format can be found at [Rosemount Magnetic Flow Meter Calibration Verification Report](#).
The field communicator displays detailed results for the first test.
4. Press **OK** to move through all test records in the local database.

Interpreting Smart Meter Verification results

When the Smart Meter Verification Basic or Professional test is completed, the result is reported as Pass, Fail, Abort, Empty pipe occurred, or No baseline. (Some tools report the Fail result as **Advisory** instead.)

Pass	The meter is performing within factory specifications.
Abort	The test was manually canceled using the abort function. A new test can be initiated without any further action. In all cases where a Smart Meter Verification Professional test aborts, no report will be generated.
Empty Pipe	An empty pipe condition was detected during the test. An empty pipe condition can invalidate the electrode resistance test and cause it to fail. Ensure a full pipe condition for the entire test.
No Baseline	The transmitter did not have a valid baseline stored for comparison during the test. Take a valid baseline before performing the test.
Fail	One or more of the tests failed. Refer to Resolve a failed Smart Meter Verification test .

14.1.8 Resolve a failed Smart Meter Verification test

Use this procedure if a Smart Meter Verification Basic or Professional test ran at normal operating temperature and density, and failed.

Procedure

1. Verify the sensor by performing a visual inspection, sensor health tests, or field proving.
2. If possible, run Smart Meter Verification Professional with ProLink III Basic or Professional and save the results as follows:
 - In a .csv file
 - In a report
 - If the transmitter has a historian, retrieve the Smart Meter Verification results from the service or historian files.
3. Contact technical support for further evaluation and instructions.

14.2 Auto zero trim

The flow meter has been calibrated from the factory and does not require an Auto Zero Trim for most applications. Auto Zero requires a full pipe and no flow.

Display	Menu → Main Menu → Service Tools → Trims → Auto Zero
ProLink III	Device Tools → Calibration → Auto Zero Trim
Field communicator	Device Settings → Calibration → Auto Zero → Auto Zero Method

If an Auto Zero Trim is needed, please consult Emerson Technical Support.

14.3 Validate the meter

Meter validation compares flow meter measurements reported by the transmitter to an external measurement standard. If the transmitter value for volume flow, mass flow, or velocity is significantly different from the external measurement standard, the meter factor can be adjusted. The flow meter's actual measurement is multiplied by the meter factor, and the resulting value is reported and used in further processing.

Display	Menu → Main Menu → Configuration → Basic Setup → Process Measurement → Flow Variables → Meter Factor
ProLink III	Device Tools → Configuration → Process Measurement → Flow → Meter Factor Correction
Field communicator	Device Settings → Process Measurement → Flow → Sensor Setup → Meter Factor

Prerequisites

Obtain a reference flow device (external flow measurement device) for the appropriate process variable.

Important

For good results, the reference device must be highly accurate.

Procedure

1. Determine the meter factor as follows:
 - a. Use the flow meter to take a sample measurement.
 - b. Measure the same sample using the reference device.
 - c. Calculate the meter factor using the following formula:

$$\text{NewMeterFactor} = \text{ConfiguredMeterFactor} \times \left(\frac{\text{ReferenceMeasurement}}{\text{FlowmeterMeasurement}} \right)$$
2. Ensure that the calculated meter factor does not fall outside 0.90 and 1.10. If the meter factor falls outside these limits, contact customer service.
3. Configure the meter factor in the transmitter.

14.3.1 Calculating the meter factor for volume flow

The flow meter is installed and validated for the first time. The volume flow measurement from the transmitter is 250.27 gal/min (l/min). The volume flow measurement from the reference device is 250 gal/min (l/min). The meter factor is calculated as follows:

$$\text{MeterFactor} = 1 \times \left(\frac{250}{250.27} \right) = 0.9989$$

The first meter factor is 0.9989.

One year later, the flow meter is validated again. The volume flow measurement from the transmitter is 250.07 gal/min (l/min). The volume flow measurement from the reference device is 250.25 gal/min (l/min). The new meter factor is calculated as follows:

$$\text{MeterFactor} = 0.9989 \times \left(\frac{250.25}{250.07} \right) = 0.9996$$

The new meter factor is 0.9996.

15 Maintenance

15.1 Activate a new transmitter license

When purchasing additional features or requesting a trial license, a new transmitter license must be entered. The new license makes the new features available in the transmitter.

Display	Menu → Quick Menu → Service Tools → License Manager
ProLink III	Device Tools → Configuration → Feature License
Field communicator	Device Settings → Device Information → Licenses → License Upgrade → Upgrade License

Prerequisites

A license file provided by Emerson:

- *perm.lic*: Permanent license file
- *temp.lic*: Temporary license file

Note

Manually enter the license key into either the display or ProLink III, or load the license directly through a USB drive to the USB-A service port.

Procedure

- To enter a license using the display:
 1. Choose **Menu → Quick Menu → Service Tools → License Manager**. Choose either **Enter Permanent License** or **Enter Trial License**.
 2. Use the arrow keys to enter the license key.
- To enter a license using ProLink III:
 1. Open the license file.
 2. Choose **Device Tools → Configuration → Feature License**.
 3. Copy the license from the file to the appropriate **License Key** field.

The features supported by the new license are displayed.

If installing a temporary license, the transmitter will revert to its original feature set when the license period has expired. To purchase a feature for permanent use, contact customer support.

After completing the task:

If installing a permanent license, update the options model code to match the new license. The options model code represents the installed features.

15.2 Upgrade the transmitter firmware

Upgrade the transmitter firmware to stay current with development and to take advantage of any new features.

15.2.1 Using a USB drive with the display

Only use firmware upgrade files provided by Emerson.

Prerequisites

The service port must be enabled. It is enabled by default. However, if the service port has been disabled, choose **Menu → Quick Menu → Configuration → Security** and set **Service Port** to On.

Procedure

1. Copy the folder containing the firmware upgrade files to a USB drive.
2. Open the wiring compartment and insert the USB drive into the service port.

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

3. Follow the prompts once the transmitter recognizes the USB drive.
4. Select **USB Drive → Transmitter**.
5. Select **Update Device Software**.
6. Select the firmware upgrade folder and follow the prompts.

Note

If required, the transmitter upgrade procedure automatically includes an upgrade to the core processor software.

To reboot the transmitter at a later date, reboot the transmitter from the menu or cycle power.

7. Verify the transmitter configuration and all safety parameters.
8. Enable write-protection.

15.2.2 Using the USB service port and ProLink™ III

Upgrade the transmitter firmware to stay current with development and to take advantage of any new features.

This procedure is not available over HART®. Use a service port.

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

Prerequisites

Only use firmware upgrade files provided by Emerson.

Procedure

1. In ProLink III, choose **Device Tools → Transmitter Software Update**.
2. Navigate to the folder containing the firmware upgrade files.
3. Select **Update**.

Note

If required, the transmitter upgrade procedure automatically includes an upgrade to the core processor software.

If the transmitter is to be rebooted at a later date, reboot the transmitter from the menu or cycle power.

4. Verify the transmitter configuration and all safety parameters.
5. Enable write-protection.

15.3 Reboot the transmitter

For certain configuration changes to take effect or to clear certain status alerts, the transmitter must be rebooted.

Display	Menu → Service Tools → Reboot Transmitter
ProLink III	Device Tools → Diagnostics → Testing → Reset Transmitter
Field communicator	Device Settings → Restore/Restart → Device Reset

Rebooting the transmitter has the same effect as power-cycling the transmitter.

Prerequisites

Follow appropriate procedures to select the appropriate time for rebooting the transmitter. The reboot typically takes about 10 seconds.

After completing the task:

Check the transmitter clock. During the reboot, the transmitter clock is powered by the battery, therefore the transmitter clock and all timestamps should be accurate. If the transmitter clock is not correct, the battery may need replacement.

15.4 Trim analog output

Trimming an analog output calibrates the transmitter analog output to the receiving device. If the current trim value is inaccurate, the transmitter will under-compensate or over-compensate the output.

15.4.1 Trim an analog output using the display

Trimming the analog output establishes a common measurement range between the transmitter and the device that receives the analog output.

Prerequisites

Ensure that the analog output is wired to the receiving device that will be used in production.

Procedure

1. Choose **Menu → Main Menu → Service Tools → Analog → Output Trim** and select the output to trim.
2. Follow the instructions in the guided method.
3. Check the trim results. If any trim result is less than -20 microamps or greater than +20 microamps, contact customer service.

15.4.2 Trim analog output using ProLink III

Trimming the analog output establishes a common measurement range between the transmitter and the device that receives the analog output.

Prerequisites

Ensure that the analog output is wired to the receiving device that will be used in production.

Procedure

1. Choose **Device Tools → Calibration → Analog Output Trim** and select the analog output to trim.
2. Follow the instructions in the guided method.

Important

If you are using a HART/Bell 202 connection, the HART signal over the primary analog output may affect the analog reading. Disconnect the wiring between ProLink III and the transmitter terminals when reading the primary analog Output at the receiving device. Reconnect to continue the trim.

3. Check the trim results. If any trim result is less than –20 microamps or greater than +20 microamps, contact customer service.

15.4.3 Trim analog outputs using a Field communicator

Trimming the analog output establishes a common measurement range between the transmitter and the device that receives the analog output.

Prerequisites

Ensure that the analog output is wired to the receiving device that will be used in production.

Important

Trim the output at both ends (4 mA and 20 mA) to ensure that it is compensated accurately across the entire output range.

Procedure

1. Choose **Device Settings** → **Calibration** → **Analog Output Calibration** → **Analog Output X** → **Analog Output X Calibration** and select the analog output to trim.
2. Follow the instructions in the guided method.

Important

The HART signal over the primary analog output may affect the analog reading. Disconnect the wiring between the Field communicator and the transmitter terminals when reading the primary analog output at the receiving device. Reconnect to continue the trim.

3. Check the trim results. If any trim result is less than –20 microamps or greater than +20 microamps, contact customer service

15.4.4 Scaled analog output trim using ProLink III

A scaled analog output trim enables calibration of the analog output using a different scale than the standard 4-20 mA output scale. Non-scaled analog output trimming (described above) is typically performed using an ammeter where values are entered in units of milliamperes (mA). Scaled analog output trimming enables trimming of the analog output using a scale that may be more convenient based up the method of measurement.

For example, it may be more convenient to make direct voltage readings across the loop resistor. If the loop resistor is 500 ohms, and trimming is done using voltage measurements across the resistor, the trim points can be rescaled from 4-20 mA to 2-10 VDC.

Prerequisites

Ensure that the analog output is wired to the receiving device that will be used in production.

Procedure

1. Choose **Device Tools** → **Calibration** → **Analog Output Trim** → **Scanned Analog xTrim** and select the analog output to trim.
2. Follow the instructions in the guided method ([Trim analog output using ProLink III](#)), being sure to enter the appropriate scaled trim set points.

Important

If you are using a HART/Bell 202 connection, the HART signal over the primary analog output may affect the mA reading. Disconnect the wiring between ProLink III and the transmitter terminals when reading the primary analog output at the receiving device. Reconnect to continue the trim.

3. Check the trim results.
If any trim result is off by more than ±0.5%, contact customer service.

15.5 Digital trim validate

The Digital Trim Validate function is a method used to check the measurement accuracy and linearity of the transmitter.

Display	Menu → Quick Menu → Service Tools → Trims → Digital Trim Validate
ProLink III	Device Tools → Calibration → Digital Trim → Start Digital Trim Validation

Procedure

1. While connected and using an 8714D, set the flow rate to the desired flowrate.
2. Run Validate.
3. View the results.
If results are not satisfactory, perform a digital trim.

15.6 Digital trim

Digital trim is the function used when 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.

Display	Menu → Main Menu → Service Tools → Trims → Digital Trim
ProLink III	Device Tools → Calibration → Digital Trim → Start Digital Trim Calibration

Prerequisites

- A Rosemount 8714D Calibration Standard is required to complete a digital trim.

Note

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

- Set the loop to manual (if necessary) and then complete the following procedure.

Procedure

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 not within this range, initiate a digital trim.
The digital trim takes about 90 seconds to complete. No transmitter adjustments are required.

15.7 Installing an LOI/display

Prerequisites

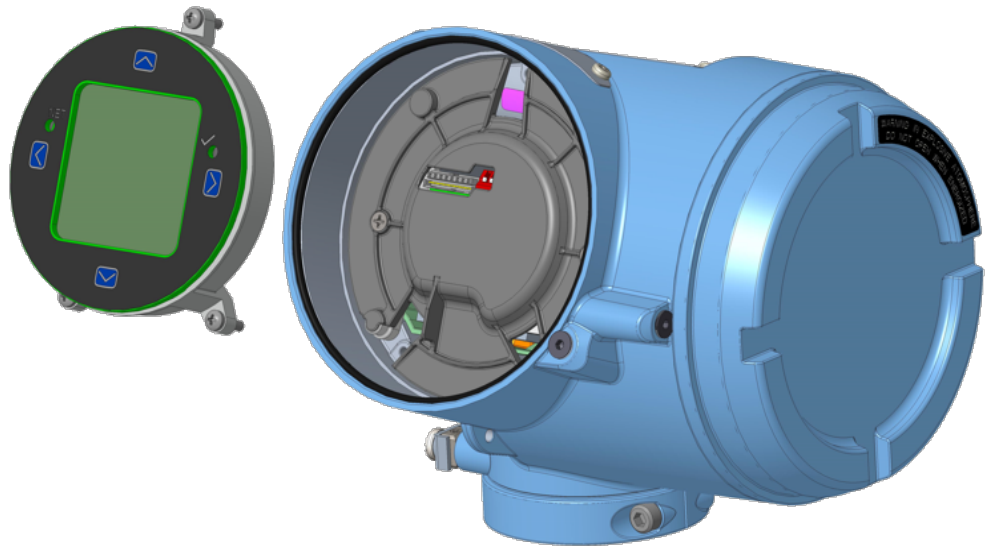
Replacing the LOI display will change the Bluetooth UID and Key for the device.

Refer to [Wireless configuration via Bluetooth technology](#) for configuring Bluetooth communications.

Procedure

1. If the transmitter is installed in a control loop, secure the loop.

Figure 15-1: Installing a LOI/Display



2. Remove power from the transmitter.
3. Remove the display cover on the electronics compartment of the transmitter housing.
4. Mount the display on the electronics board and secure it with three captive screws with a Philips screwdriver.
5. Re-install the display cover and tighten to metal-to-metal contact.
6. Re-install power to the transmitter.
7. If installed in a control loop, return the loop to automatic control.

15.8 Replacing an LOI/display

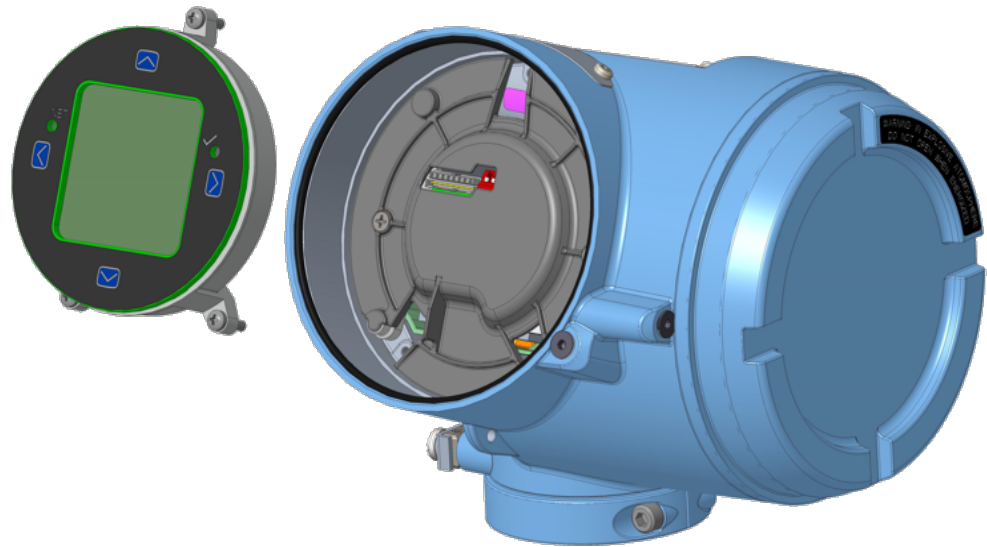
Prerequisites

Replacing the LOI display will change the Bluetooth UID and Key for the device.

Refer to [Wireless configuration via Bluetooth technology](#) for configuring Bluetooth communications.

Procedure

1. If the transmitter is installed in a control loop, secure the loop.

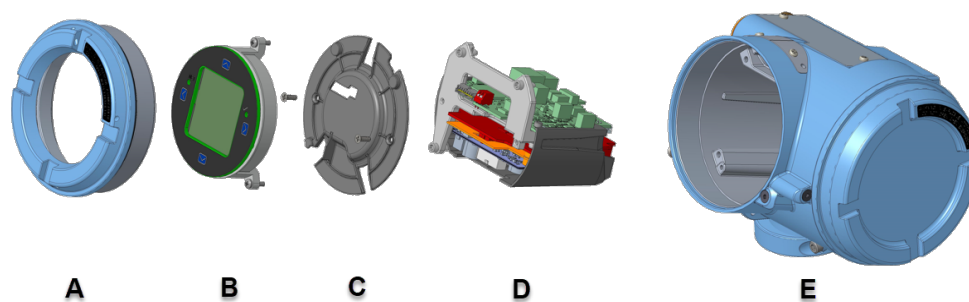
Figure 15-2: Installing a LOI/Display

-
2. Remove power from the transmitter.
 3. Remove the display cover on the electronics compartment of the transmitter housing.
 4. Use a Philips screwdriver to loosen the three screws securing the display to the electronics board, then remove the display.
 5. Mount the new display on the electronics board and secure it with three captive screws with a Philips screwdriver.
 6. Re-install the display cover and tighten to metal-to-metal contact.
 7. Re-install power to the transmitter.
 8. If installed in a control loop, return the loop to automatic control.

15.9 Replacing the electronics stack

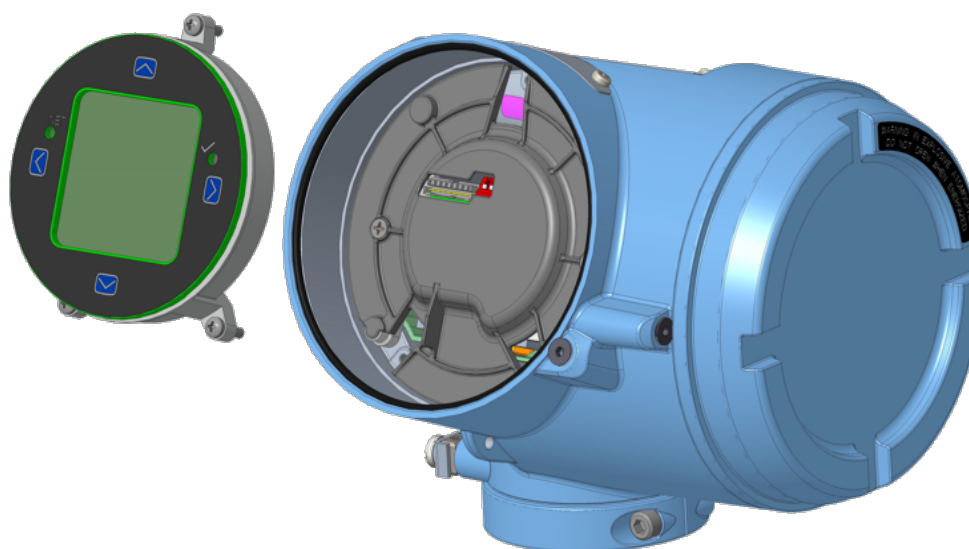
Procedure

1. If the transmitter is installed in a control loop, secure the loop.

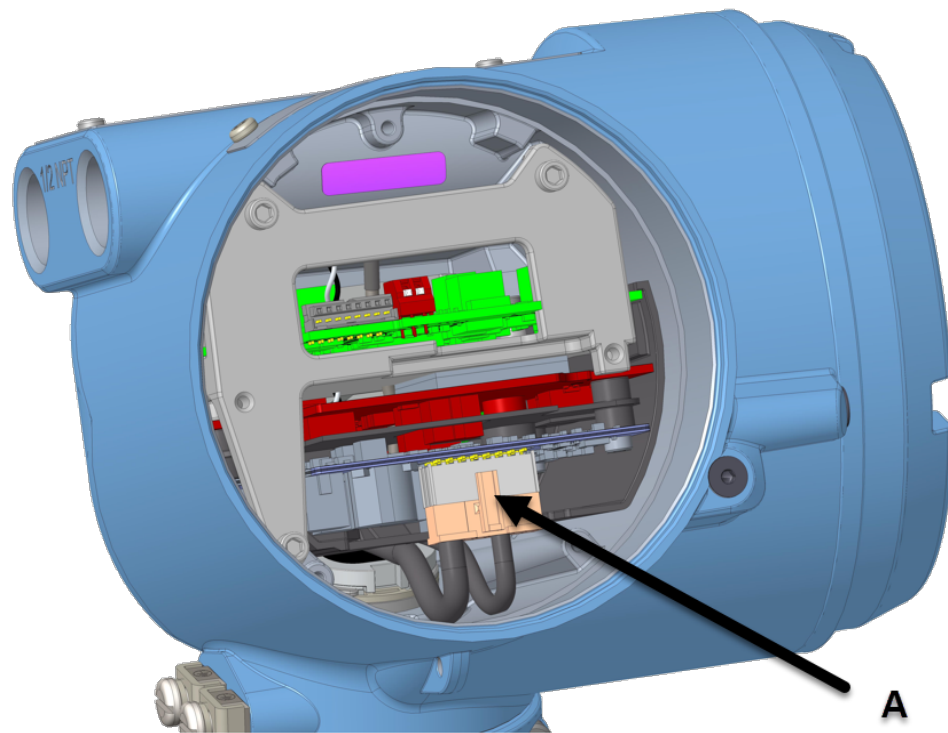
Figure 15-3: 9732 Integral Transmitter Exploded View

- A. Cover
- B. Display
- C. Sub Bezel
- D. Electronics Stack
- E. Transmitter Housing

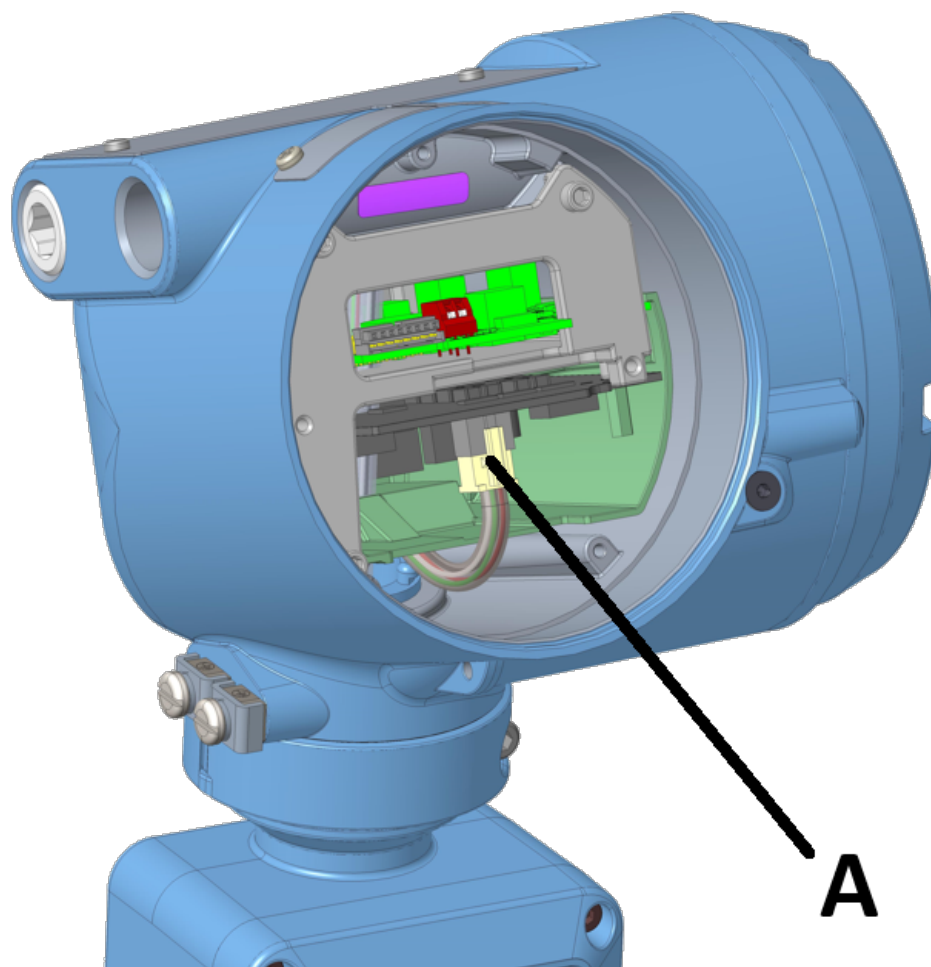
2. Remove power from the transmitter.
3. Remove the cover on the electronics compartment of the transmitter housing.
4. If necessary, use a Philips screwdriver to loosen the three screws securing the display to the electronics board, then remove the display.

Figure 15-4: Removing an LOI/Display

5. If necessary, use a Philips screwdriver to loosen the two screws that secure the sub bezel to the electronics board, then remove the sub bezel.
6. Disconnect the cable assembly connector from the electronics stack.

Figure 15-5: Disconnect Connector (Integral Mount)

A. Cable Assembly Connector

Figure 15-6: Disconnect Connector (Remote Mount)**A. Cable Assembly Connector**

7. Use a 1/8" (3mm) hex key to loosen the three screws that hold the electronics board stack to the transmitter housing.
8. Remove the electronics stack from the transmitter housing.
9. Install the new electronics stack into the transmitter housing.
10. Connect the cable assembly connector to the electronics stack.
11. Use a 1/8" (3mm) hex key to secure the three screws that hold the electronics board stack to the transmitter housing.
12. If necessary, utilize a Phillips screwdriver to fasten the two screws to secure the sub bezel to the electronics board.
13. If necessary, use a Philips screwdriver to mount the display on the electronics stack and secure it with three captive screws.
14. Re-install the cover on the electronics compartment of the transmitter housing.
15. Re-install power to the transmitter.
16. If installed in a control loop, return the loop to automatic control.

15.10 Battery replacement

The transmitter contains a battery that is used to power the clock when the transmitter is not powered up. Users cannot service or replace the battery. If the battery requires replacement, replace the electronics stack

If the battery is non-functional and the transmitter is powered down, then powered up, the clock will restart from the time of the power-down. All timestamps will be affected. A user can correct the issue by resetting the transmitter clock. For a permanent resolution, the 9732 electronics stack must be replaced.

15.11 Replacing the integral mount cable assembly on the 9205 sensor

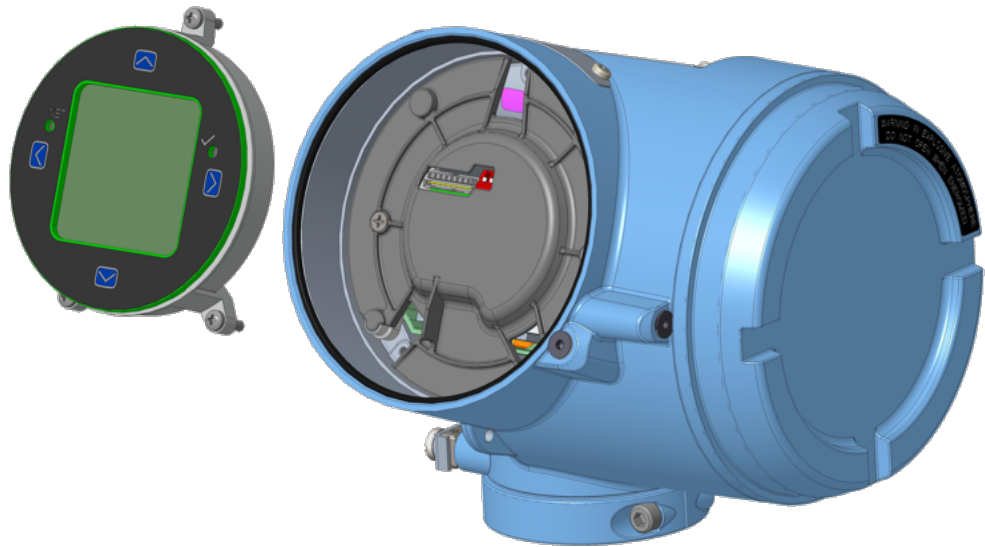
Procedure

1. If the transmitter is installed in a control loop, secure the loop.

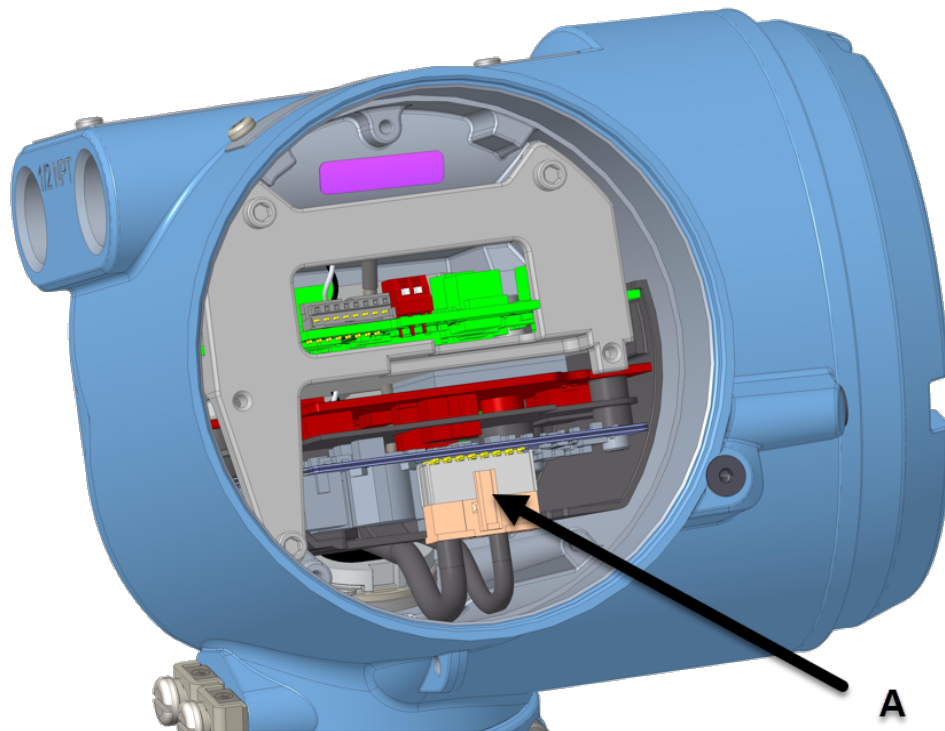
Figure 15-7: Integral Mount Cable Assembly



2. Remove power from the transmitter.
3. Remove the cover on the electronics compartment of the transmitter housing.
4. If necessary, use a Philips screwdriver to loosen the three screws securing the display to the electronics board then remove the display.

Figure 15-8: Removing an LOI/Display

5. If necessary, use a Philips screwdriver to loosen the two screws that secure the sub bezel to the electronics board, then remove the sub bezel.
6. Disconnect the connector from the electronics board stack.

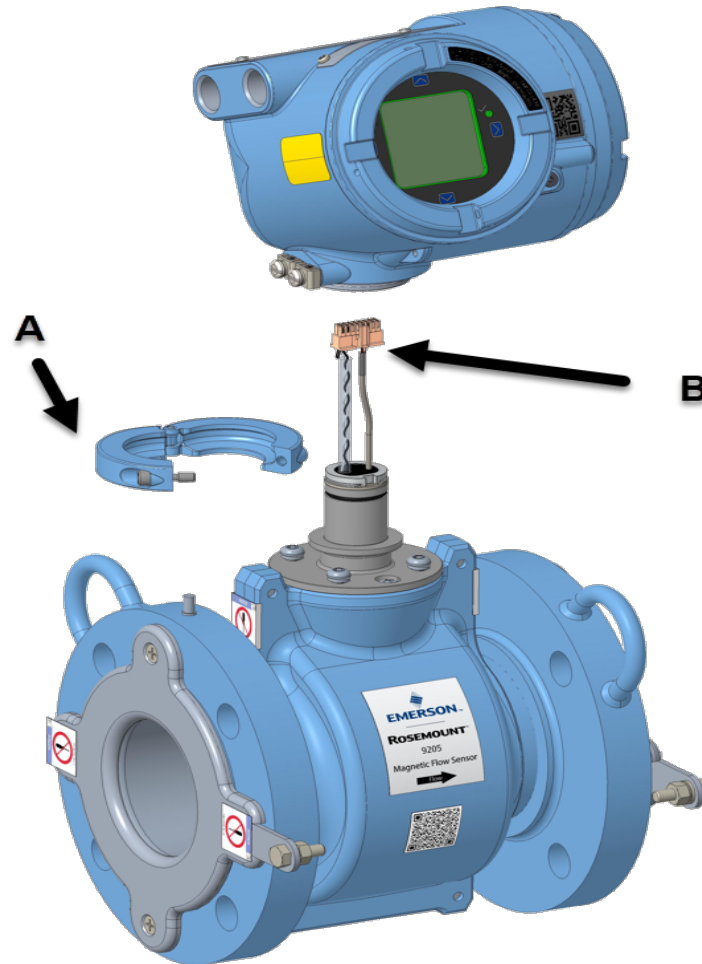
Figure 15-9: Disconnect Connector (Integral Mount)

A. Cable Assembly Connector

7. Using a 4 mm (5/32") hex key, loosen and remove the clamping ring securing the transmitter to the sensor.

8. Gently detach the transmitter housing from the sensor, ensuring that the cable assembly connector passes through the opening at the base of the transmitter.

Figure 15-10: Integral Mount Cable Assembly

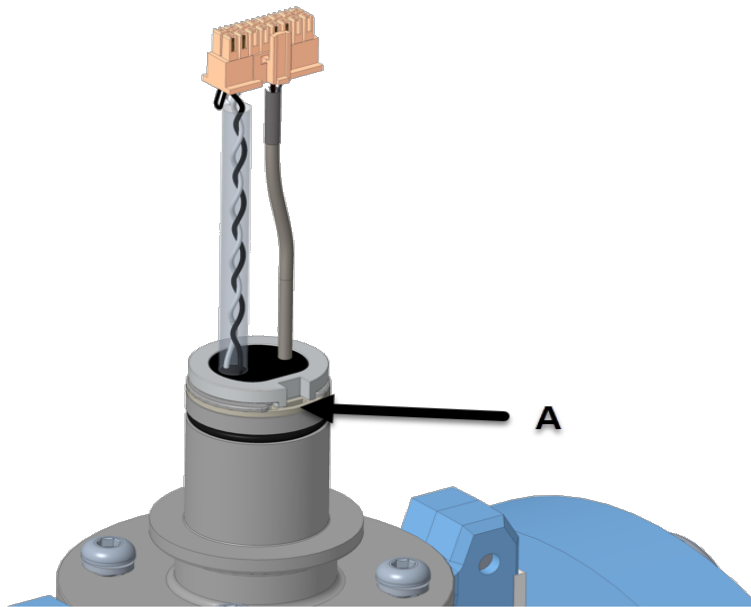


- A. Clamping Ring
B. Cable Assembly Connector

9. Use a flathead screwdriver to take the spring clip off the integral mount connector assembly.

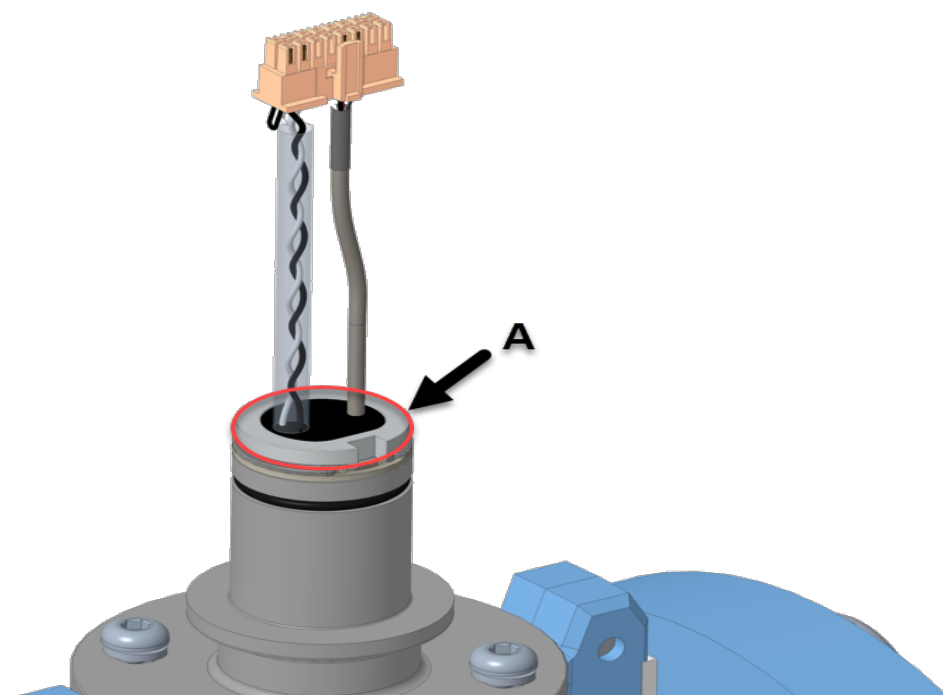
NOTICE

Do not pull the wires of the integral mount cable assembly.

Figure 15-11: Integral Mount Cable Assembly Sprint Clip Location

A. Integral Mount Cable Assembly Spring Clip

-
10. Remove the integral mount cable assembly from the sensor by pulling from the base of integral mount cable assembly.
-

Figure 15-12: Integral Mount Cable Assembly Base Location

A. Base of Integral Mount Cable Assembly

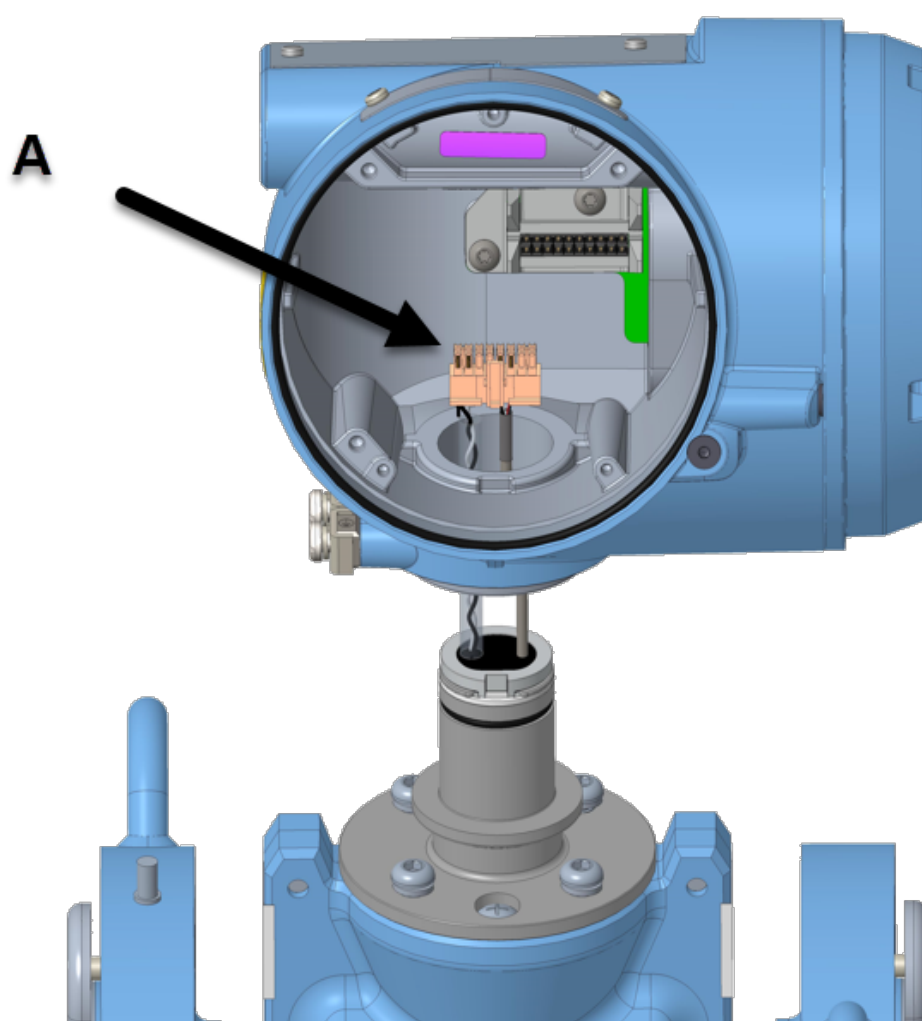
11. Install the new integral mount cable assembly onto the sensor so that the assembly is seated in the sensor.

NOTICE

The integral mount cable assembly is keyed and can only be inserted in one orientation.

12. Install the new spring clip onto the new integral mount cable assembly.
13. Carefully reinstall the transmitter housing, verifying that the integral mount cable assembly is properly aligned through the specified opening at the transmitter base and positioned for connection to the electronics board stack.

Figure 15-13: Reinstall the Transmitter Housing



A. Cable Assembly Connector

14. Rotate the transmitter to the desired position.
15. Fasten the transmitter and sensor together by reattaching and firmly tightening the clamping ring. Tighten the screw to 30 in-lb. (3.4 N-m) to 32 in-lb. (3.62 N-m).
16. Connect the integral mount cable assembly connector to the electronics board stack.
17. If necessary, utilize a Phillips screwdriver to fasten the two screws attaching the sub bezel to the electronics board.

18. If necessary, mount the display on the electronics board and secure it with three captive screws with a Philips screwdriver.
19. Reinstall the cover on the electronics compartment of the transmitter housing.
20. Reinstall power to the transmitter.
21. If installed in a control loop, return the loop to automatic control.

15.12 Replacing the integral mount on the 8795 sensor

For replacement options, contact Flow Support.

15.13 Replacing the clamping ring

Table 15-1: Clamping Ring Selection Guide

Assembly to be attached		Materials of construction		Clamp part number
Component A	Component B	Component A	Component B	
9205 Sensor (integral)	Transmitter (integral)	Aluminum	Aluminum	MMI-20029111
		SST	SST	MMI-20056067
		SST	Aluminum	MMI-20029111
9205 Sensor (remote)	Remote junction box	Aluminum	Aluminum	MMI-20029111
		Aluminum	SST	MMI-20014677
		SST	Aluminum	MMI-20029111
		SST	SST	MMI-20014677
Transmitter		Aluminum	Aluminum	MMI-20026189
		SST	SST	MMI-20028431
8795 Sensor (integral)	Transmitter (integral)	Aluminum	Aluminum	MMI-20029111

Table 15-2: Mounting Configurations

Configuration	Aluminum Assembly ⁽¹⁾	SST Assembly ⁽²⁾
Integrally mounted 9732 transmitter on 9205 sensor		

Configuration	Aluminum Assembly ⁽¹⁾	SST Assembly ⁽²⁾
Remote mounted 9205 sensor and remote junction box		
Remote mounted 9732 transmitter and remote junction box		
Integrally mounted 9732 transmitter on 8795 sensor		N/A

(1) Painted Emerson blue color indicates aluminum construction.

(2) Unpainted metallic finish indicates stainless steel construction.

Procedure

1. If the transmitter is installed in a control loop, secure the loop.
2. Remove power from the transmitter.
3. Using a 4 mm (5/32") hex key, loosen and remove the clamping ring holding the two components together.
4. Using a 4 mm (5/32") hex key, install and tighten the new clamping ring securing the two components together. Tighten the screw to 30 in-lb. (3.4 N-m) to 32 in-lb. (3.62 N-m).
5. Reinstall power to the transmitter.
6. If installed in a control loop, return the loop to automatic control.

16 Historical files and service files

16.1 Generate historical log files

The transmitter can save historical data of several types, including process variables, diagnostics parameters, Smart Meter Verification (SMV) test results, and totalizer values. Generating a historical file allows access to past data, which can then be viewed on a PC. Here are the historical files that can be accessed:

Display	Menu → Main Menu → USB Options → Transmitter → USB Drive → Download Historical Files
ProLink III	Device Tools → File Transfer → Download Historical Files
Field communicator	Not available

Historical file	Description	File name
Historian Data (Fast) ⁽¹⁾	Values of selected process and diagnostic variables for the previous day, recorded at 1-second intervals.	File name based on transmitter tag, the starting date of the log contents, and the record type (F = Fast, 1-second raw data). For example: <i>FTx9732x_2025JUN04a_F.csv</i>
Historian Data (Slow) ⁽¹⁾	Values of selected process and diagnostic variables for the previous 30 days, recorded at 10-minute intervals.	File name based on transmitter tag, the starting date of the log contents, and the record type (S=Slow, 10-minute average data). For example: <i>FTx9732x_2025JUN04a_S.csv</i>
SMV Lifetime ⁽²⁾	All SMV results from every 7-day cycle.	<i>SmvLongTermData.csv</i> .
SMV: 20 runs ⁽²⁾	Reports of previous 20 SMV results.	<i>SmvLast20Data.csv</i>
Totalizer Log ⁽³⁾	Values of the Log Total 1, 2, 3, and 4 from <i>TotLog.txt</i> .	<i>TotLog.txt</i>

⁽¹⁾ Requires HS option code or Data Historian field licensing.

⁽²⁾ Requires MV option code or SMV Pro field licensing.

⁽³⁾ To generate the appropriate totalizer log, configuration of the totalizer log must be performed. To configure the totalizer log, please refer to [Totalizer log](#).

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

Procedure

1. Remove wiring access cover.
2. Open Service Port cover, and insert either a USB-A cable or a USB drive into Universal Service Port.



3. Choose one of the following:
 - a. If using the display, access **Menu** → **Main Menu** → **USB Option** → **Transmitter** → **USB Drive** → **Download Historical Files** → .
 - b. If using ProLink, access **Device Tools** → **File transfer** → **Download Historical Files**
4. Select the type of log file to generate. Please refer to Table X.X for the list of log files to generate.
5. If Historian Data (process and diagnostic variables) is selected:
 - a. Set the date and time for the first entry in the historian log file.
 - b. Set the number of days that the log file will include.

Note

For best performance, please limit downloads to 7 days at a time .

- c. Select type of data:

Option	Description
1 Second Raw Data	The current values of process and diagnostic variables, recorded at 1-second intervals.
10 Min Average Data	The minimum and maximum values of the 1-second raw data over the last 10 minutes, plus the average and the standard deviation, recorded at 10-minute intervals.

Note

The transmitter provides an estimated file size or transfer time.

6. If using the display:
 - a. Enter the USB folder name.
7. If using ProLink III:

- a. Select **Save**.
- b. Specify a location to save the historical log file on a PC and select **OK**.

16.1.1 Historian data (fast)

The Historian Data (Fast) file provides values of selected process and diagnostic variables for the previous day, recorded at 1- second intervals.

The Historian Data (Fast) log is a CSV file.

16.1.2 Historian data (slow)

The Historian Data (Slow) file provides values of selected process and diagnostic variables for the previous 30 days, recorded at 10-minute intervals.

The Historian data (slow) log is a CSV file.

16.1.3 SMV lifetime

The SMV Lifetime file provides all SMV results from every 7-day cycle.

The SMV Lifetime log is a CSV file.

16.1.4 SMV: 20 runs log

The SMV Log stores the last 20 Commanded Smart Meter Verification result data. This includes the overall SMV result, the test limit, the test scope that was observed during the Commanded Smart Meter Verification, as well as the measured values and baselines for SMV.

The SMV:20 Runs logs are CSV files.

16.1.5 SMV 20 Runs

The SMV 20 Runs log provides reports of previous 20 SMV results.

The SMV 20 Runs log is a CSV file.

16.1.6 Totalizer log

The totalizer log can track four configurable totals. The period is configurable; configure the transmitter to save totalizer and inventory values at a user-specified interval and then generate a totalizer log.

The totalizer log is an ASCII file.

Contents of totalizer log

The totalizer log contains one record for each logged totalizer or inventory value. Each record contains the following information:

- Default totalizer or inventory name (user-specified names are not used)
- Value and measurement unit
- Timestamp
 - Format: Military time
 - Time and time zone: Transmitter clock

The totalizer log also contains a line item for each totalizer or inventory reset.

Note

- The historian totalizer log is configurable, but defaults to mass and volume totalizers logged at one hour intervals.
 - The entire log saves 240 lines before rolling the last lines out, so 5 days of totalizer data are saved by default.
-

Totalizer logs and power cycles

If the transmitter is rebooted or power-cycled, the totalizer log is not affected.

Totalizer logs and configuration files

If the factory configuration is restored or a configuration file is uploaded, the totalizer log is not affected.

Example: Totalizer log

If the factory configuration is restored or a configuration file is uploaded, the totalizer log is not affected.

UID: 1F40CCC5 Tag: FT-0000 Drev: 033 Crev: 050 DType: 62 CType: 4				
TimeNow: 26/SEP/2025 13:58:25 Zone: GMT 0.00 DST OFF SensType:				
Name	Reset/Host	Value	Units	Time
=====				
Vol Fwd Total		7304591.749429	gal	21/MAY/2025 18:23:17
Vol Fwd Inv		7304591.749429	gal	21/MAY/2025 18:23:17
Vol Fwd Total		7306421.915060	gal	21/MAY/2025 19:00:00
Vol Fwd Inv		7306421.915060	gal	21/MAY/2025 19:00:00
Vol Fwd Total		7309730.890190	gal	21/MAY/2025 20:00:00
Vol Fwd Inv		7309730.890190	gal	21/MAY/2025 20:00:00
Vol Fwd Total		7313039.906830	gal	21/MAY/2025 21:00:00
Vol Fwd Inv		7313039.906830	gal	21/MAY/2025 21:00:00
Vol Fwd Total		7316348.800410	gal	21/MAY/2025 22:00:00
Vol Fwd Inv		7316348.800410	gal	21/MAY/2025 22:00:00
Vol Fwd Total		7319657.694695	gal	21/MAY/2025 23:00:00
Vol Fwd Inv		7319657.694695	gal	21/MAY/2025 23:00:00
Vol Fwd Total		7322966.657615	gal	22/MAY/2025 00:00:00
Vol Fwd Inv		7322966.657615	gal	22/MAY/2025 00:00:00
Vol Fwd Total		7326275.671888	gal	22/MAY/2025 01:00:00
Vol Fwd Inv		7326275.671888	gal	22/MAY/2025 01:00:00
Vol Fwd Total		7329584.591371	gal	22/MAY/2025 02:00:00
Vol Fwd Inv		7329584.591371	gal	22/MAY/2025 02:00:00

Note

The totalizer history displays only in English.

16.2 Generate service files

The transmitter automatically saves several types of service data that is useful in troubleshooting, device maintenance, and administration. View the data by generating a service file, using ProLink III to download it to the PC, and using the PC to open the file.

Display	Menu → USB Options → Transmitter → USB Drive → Download Service Files
ProLink III	Not available
Field communicator	Not available

Prerequisites

Use either a USB memory stick to download files directly through the USB-A service port, using either Display prompts or ProLink III.

Procedure

1.

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

Open the wiring compartment on the transmitter and connect the RS-485 adapter to the Factory Use Only port.

2. From ProLink III, choose **Device Tools** → **File Transfer** → **Download Service Files**.
3. Select the desired service file to generate.

Service file	Description	File name
Audit Trail	All changes to configuration.	<i>ConfigAuditLog.txt</i>
Alert List	All occurrences of alerts and conditions, independent of alert severity..	<i>AlertLog.txt</i>
Historian: 1 month ⁽¹⁾	Values of selected process and diagnostic variables for the previous day, recorded at 1-second intervals.	File name based on transmitter tag, the starting date of the log contents, and the record type (S=Slow, 5-minute average data). <i>FTx9732x_2025JUN04a_F.csv</i>
Historian: 1 day ⁽²⁾	File name based on transmitter tag, the starting date of the log contents, and the record type (F = Fast, 1-second raw data) <i>FTx9732x_2025JUN04a_F.csv</i>	File name based on transmitter tag, the starting date of the log contents, and the record type (F = Fast, 1-second raw data). <i>FTx9732x_2025JUN04a_F.csv</i>
SMV: 20 runs ⁽³⁾	Reports of previous 20 SMV results.	<i>SmvLast20Data.csv</i>
Service snapshot	An ASCII file containing a snapshot of the transmitter's internal database. This file is used by customer service.	<i>Service.dump</i>
Assert log	A troubleshooting file used by customer service.	<i>AssertLog.Txt</i>
Security log	Tracks the number of failures on failed password attempts, software upgrade failures, or the number of database write failures.	<i>SecurityLog.txt</i>
Factory config	A saved snapshot of the configuration in the transmitter as it leaves the factory.	<i>FactoryConfig.cfg</i>

⁽¹⁾ Requires HS option code or Data Historian field licensing.

⁽²⁾ Requires HS option code or Data Historian field licensing.

⁽³⁾ Requires MV option code or SMV Pro field licensing.

4. Specify the folder on the PC where the log file will be saved.

16.2.1 Configuration audit trail

The Audit Trail stores configuration changes that occur in the transmitter. This may include data that has changed when connecting a new core processor assembly, or when a user makes a change through Modbus, HART, or display.

The Audit Trail is an ASCII file.

Contents of configuration audit log

Each configuration change includes the address of the parameter, its name, the old and new value, an associated unit, the timestamp, and how the change was performed.

Each record contains:

- Modbus location in transmitter memory
 - Cnnn = Coil
 - Rnnn = Register
 - Rnnn xxx = Array, indexed by register xxx
- Name of Modbus location
- Original value
- New value
- Measurement unit, if applicable
- Timestamp
 - Format: Military time
 - Time and time zone: Transmitter clock
- Host or protocol from which the change was made

Configuration audit history and power-cycles

If the transmitter is power-cycled or rebooted, the event is logged in the configuration audit history. Earlier records are not affected.

Configuration audit history and configuration files

If a user restores the factory configuration or upload a configuration file, the event is logged in the configuration audit history. Earlier records are not affected.

UID: DD606F44 Tag: DEMO Drev: 035 Crev: 052 DType: 62 CType: 4

TimeNow: 16/DEC/2025 21:20:00 Zone: GMT 0.00 DST OFF

Addr	Name	Old Value	New Value	Unit	Time	Host
=====						
C51	BL_StartSensor	0	1		16/DEC/2025 16:16:55	Display
C51	BL_StartSensor	1	0		16/DEC/2025 16:16:55	System
401	BL_CoilInduct	nan	31.030775	mH	16/DEC/2025 16:20:56	System
403	BL_CoilResist	nan	15.312373	ohm	16/DEC/2025 16:20:56	System
405	BL_ElectResist	nan	3.372046	kohm	16/DEC/2025 16:20:56	System
2001	BL_ElectCMResi	nan	5.137955	kohm	16/DEC/2025 16:20:57	System
2003	BL_ElectPosRes	nan	3.464452	kohm	16/DEC/2025 16:20:57	System
2005	BL_ElectNegRes	nan	3.502155	kohm	16/DEC/2025 16:20:57	System
2007	BL_ElectHFDiff	nan	3.370475	kohm	16/DEC/2025 16:20:58	System
2009	BL_ElectHFCMRe	nan	5.134248	kohm	16/DEC/2025 16:20:58	System
C167	SYS_CfgFile_Re	0	1		16/DEC/2025 18:00:17	Display

Note

The configuration audit log displays only in English.

16.2.2 Alert list

The Alert List tracks the setting and clearing of the Conditions that denote the various issues found within the transmitter.

The data includes the name of the condition, its NE-107 Category (**Fault**, **Function Check**, **Out of Specification**, or **Maintenance Required**), its current state (Active, Inactive, or Toggling), and the timestamp.

This provides a detailed look at when errors occurred in the device, allowing correlation to other logged files to see how the transmitter behaved over time.

The Alert List log is an ASCII file.

Contents of alert list

The alert list contains the 1000 most recent alert records. Each alert record contains the following information:

- Name of alert or condition
- Category:
 - F = Failure
 - FC = Function Check
 - M = Maintenance Required
 - OOS = Out of Specification
 - I = Ignore
- Action:
 - Active = Transition from inactive to active
 - Inactive = Transition from active to inactive
 - Toggling = More than 2 transitions in the last 60 seconds
- Timestamp
 - Format: Military time
 - Time and time zone: Transmitter clock
 - Not displayed if Action = Toggling

16.2.3 Alert history and log

Alert history and power-cycles

If the transmitter is rebooted or power-cycled, the 20 most recent records in alert history are retained in the transmitter internal memory. All earlier records are cleared from internal memory.

Alert history and configuration files

If a user restores the factory configuration or upload a configuration file, alert history is not affected.

Example: alert history log

UID: DD606F44 Tag: DEMO Drev: 035 Crev: 052 DType: 62 CType: 4
TimeNow: 16/DEC/2025 21:20:00 Zone: GMT0.00 DST OFF

Addr	Name	Old Value	New Value	Unit	Time	Host
C51	BL_StartSensor 0	1			16/DEC/2025 16:16:55	Display
C51	BL_StartSensor 1	0			16/DEC/2025 16:16:55	System
401	BL_CoilInduct	nan	31.030775	mH	16/DEC/2025 16:20:56	System
403	BL_CoilResist	nan	15.312373	ohm	16/DEC/2025 16:20:56	System
405	BL_ElectResist	nan	3.372046	kohm	16/DEC/2025 16:20:56	System
2001	BL_ElectCMResi	nan	5.137955	kohm	16/DEC/2025 16:20:57	System
2003	BL_ElectPosRes	nan	3.464452	kohm	16/DEC/2025 16:20:57	System
2005	BL_ElectNegRes	nan	3.502155	kohm	16/DEC/2025 16:20:57	System
2007	BL_ElectHFDiff	nan	3.370475	kohm	16/DEC/2025 16:20:58	System
2009	BL_ElectHFCMRe	nan	5.134248	kohm	16/DEC/2025 16:20:58	System
C167	SYS_CfgFile_Re	0	1		16/DEC/2025 18:00:17	Display

Note

The alert history log displays only in English.

16.2.4 Historian: 1 month log

The Historian: 1 Month Log provides values of selected process and diagnostic variables for the previous 30 days, providing the Minimum, Maximum, Average and Standard Deviation of the tracked unconfigurable parameters at 10-minute intervals.

The Historian: 1 Month log is a CSV file.

16.2.5 Historian: 1 Day log

The Historian: 1 Day Log provides provides values of specific process and diagnostic variables for the previous day, recorded at 1-second intervals.

The Historian: 1 Day log is a CSV file.

16.2.6 SMV: 20 runs log

The SMV Log stores the last 20 Commanded Smart Meter Verification result data. This includes the overall SMV result, the test limit, the test scope that was observed during the Commanded Smart Meter Verification, as well as the measured values and baselines for SMV.

The SMV:20 Runs logs are CSV files.

16.2.7 Service snapshot log

The Service Snapshot is a copy of the Modbus registers and coils when the file is saved. This will provide the address, name, value, and any units associated with that parameter. This will provide a dump of all the public register data in the transmitter.

The Service Snapshot is an ASCII file.

16.2.8 Assert log

An assert log captures unusual event in the transmitter firmware that may indicate an error or malfunction. A list of asserts can be useful for troubleshooting by customer service. The assert log is not designed for customer use.

The assert log is an ASCII file.

Contents of assert log

The assert history contains the 25 most recent asserts.

Assert history and power-cycles

Assert history is not affected by reboots or power-cycles.

Assert history and configuration files

If a user restores the factory configuration or upload a configuration file, assert history is not affected.

16.2.9 Security log

The security log tracks the number of failures for certain security items. Specifically, this is number of failed Password Attempts, Software Upgrade Failures, or the number of Database Write Failures.

The Security Log is an ASCII file.

Figure 16-1: Sample Security Log Content

TAG:DEMO UID:DD606F44 SW:0035 DATE:16/DEC/2025 21:20:00
Device:Config I/O GMT+0.00 DST: Zone:(UTC) Greenwich

Addr	Name	Value
5851	Password Failures	0
5852	SWUpgrade Failures	0
5853	Database Write Failures	187

16.2.10 Factory Config log

The Factory Configuration File is a saved snapshot of the configuration in the transmitter as it leaves the factory. This is similar to the Spare and Transfer configuration files but is stored in the Non-Volatile Memory of the transmitter. The format is also similar to the Service. Dump file type. To save this data, Coil 504 can be sent to save the data, and Coil 247 performs the restore action.

The Factory Config Log is a cfg file.

17 Troubleshooting

17.1 Overview

This section covers basic transmitter and sensor troubleshooting. Problems in the magnetic flow meter 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 an Emerson Flow 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 flow meter system: the transmitter, the sensor, and the interconnecting wiring. By sequentially troubleshooting each individual piece of the system, it becomes easier to identify the problem and make the appropriate adjustments.

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

Note

All ProLink III procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink III procedures also assume that you are complying with all applicable safety requirements. For more information, see [Basic information about ProLink III](#).

Note

All Communicator key sequences in this section assume that you are starting from the *Online* menu. For more information, see [Using a field communicator with the transmitter](#).

17.2 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 Occupational Safety and Health Administration (OSHA), a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

17.3 Installation check and guide

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

17.3.1 Transmitter

Checking the transmitter before applying power

Prerequisites

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

Procedure

1. Record the transmitter model number and serial number.
2. Visually inspect the transmitter for any damage including the terminal block.
3. Verify that the clamp securing the transmitter to the sensor or transmitter to the remote transmitter junction box is tightened to 30 in lbf (3.4 N m)– 32 in lbf (3.62 N m).
4. If applicable, visually inspect the core processor assembly for remote mount configurations.

Checking the transmitter after applying power

Prerequisites

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

Procedure

1. Check for an active error message or status alert.
2. Verify the correct sensor calibration data is entered in the transmitter.
The calibration data is listed on the sensor approvals tag.
3. Verify the correct sensor line size is entered in the transmitter.
The line size value is listed on the sensor approvals tag.
4. Verify the analog range of the transmitter matches the analog range in the control system.
5. Verify the forced analog output and forced frequency output of the transmitter produces the correct output at the control system.
6. If desired, use a Rosemount Calibration Standard to verify the transmitter calibration.

17.3.2 Sensor

Prerequisites

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

Procedure

1. Record the sensor model number and serial number.
The calibration data is listed on the sensor approvals tag.
2. Visually inspect the sensor for any damage, including the core processor assembly and inside the remote junction box, if applicable.
3. Verify that the clamp securing the sensor to the transmitter, or the sensor to the remote sensor junction box, is tightened to 28 in-lb. (3.16 N-m) – 32 in-lb. (3.62 N-m).
4. 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.
5. Verify the flow arrow is pointing in the same direction as forward flow.
The flow arrow is found on the sensor brand label.
6. Ensure the grounding straps on the sensor are connected to grounding rings, lining protectors, or the adjacent pipe flanges. Improper process reference grounding will cause erratic operation of the system.
Sensors with a third reference electrode will not require the grounding straps to be connected.
7. Run Smart Meter Verification and review the Sensor Health Test results (refer to [Run commanded Smart Meter Verification](#)).

17.3.3 Remote wiring (if applicable)

Procedure

1. Verify the correct Emerson remote cable is being used. The cable supplied by Emerson consists of one pair of red and black 18 AWG (0.823 mm²) wires for the Vdc connection, and one pair of white and green 22 AWG (0.326 mm²) wires for the RS-485 connection. For more information, see the *Rosemount 9732 Magnetic Flow Meter Transmitter Quick Start Guide* (MS-00825-0100-9732).
2. See [Product certifications](#) regarding wiring installation requirements.
3. Verify there is minimal exposed wiring and shielding per the *Rosemount 9000 Series Magnetic Flow Sensor Product Data Sheet* (MS-00813-0100-9000).
4. Verify that the single conduit that houses the remote cable does not contain any other wires, including wires from other magmeters.

17.3.4 Process fluid

Procedure

1. The process fluid should have a minimum conductivity of 2 microSiemens/cm (2 micro mhos/cm) for 9205 sensors, and 5 microSiemens/cm (5 micro mhos/cm) for 8795 sensor.
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 Flow Meter Material Selection Guide Technical Data Sheet](#) (00816-0100-3033) for details.

17.3.5 Troubleshooting high process noise

Note

For more information about process noise, see [Process noise profiles](#).

1/f noise

This type of noise can be mitigated by switching to the High frequency coil drive setting.

Spike noise

The type of noise can be mitigated by switching to the High frequency coil drive setting and potentially adjusting the digital signal process settings.

White noise

This type of noise can be mitigated by switching to the High frequency coil drive setting and potentially adjusting the digital signal process settings.

17.4 Basic troubleshooting

When troubleshooting a magnetic flow meter, it is important to identify the issue. [Table 17-1](#) provides common symptoms displayed by a magnetic flow meter that is not functioning properly. This table provides potential causes and suggested corrective actions for each symptom.

Table 17-1: Common Magnetic Flow Meter Issues

Symptom	Potential cause	Corrective action
Output at 0 mA	No power to transmitter	Check power source and connections to the transmitter.
	Analog output improperly configured	Check the analog power switch position.
		Verify wiring and analog power.
	Electronics failure	Verify transmitter operation with an 8714D Calibration Standard. If it fails, replace the electronics stack.
	Blown fuse	Check the fuse and replace with an appropriately rated fuse, if necessary.
Output at 4 mA	Transmitter in multidrop mode	Configure Poll Address to 0 to take transmitter out of multidrop mode.
	Low Flow Cutoff set too high	Configure Low Flow Cutoff to a lower setting or increase flow to a value above the low flow cutoff.
	Flow is in reverse direction.	Enable Reverse Flow function.
	Shorted coil	Coil check—perform Sensor Health Test
	Empty pipe	Fill pipe.
	Electronics failure	Verify transmitter operation with an 8714D Calibration Standard. If it fails, replace the electronics stack.
	Transmitter in multidrop mode and Analog Output Action is disabled	Set HART Address to 0 or configure Analog Output Action to Enabled.
Output will not reach 20 mA	Loop resistance is greater than 600 ohms.	Reduce loop resistance to less than 600 ohms.
		Perform analog loop test.
	Insufficient supply voltage to analog output	Verify analog output supply voltage.
		Perform analog loop test.
Output at saturation level	Transmitter not ranged properly	Reset the transmitter range values. See Configure the Analog Outputs .
		Check tube size setting in transmitter and ensure it matches the actual tube size. See Characterize the meter (if required) .
Output at alarm level	Electronics failure	Cycle power. If alarm is still present, verify transmitter operation with an 8714D Calibration Standard. If it fails, replace the electronics stack.
	Device status alert severity set to Failure.	Change alert severity. See Configure the transmitter's response to alerts .

Symptom	Potential cause	Corrective action
Frequency output at zero, regardless of flow	Wiring error	Check frequency output wiring. Refer to wiring diagram for pulse counter and pulse output. See frequency output wiring in the <i>9732 Quick Start Guide</i> (00825-0100-9732) for more information.
	No power to frequency output channel	Check frequency output wiring, frequency output wiring in the <i>9732 Quick Start Guide</i> (00825-0100-9732) for more information.
		1. If set to passive, supply power to the frequency channel. 2. Set to active if no power is being supplied to the channel. 3. Apply power to the transmitter.
	Reverse flow	Enable Reverse Flow function.
	Electronics failure	Verify transmitter operation with an 8714D Calibration Standard. If it fails, replace the electronics stack.
	Frequency output incorrectly configured	Review configuration and correct as necessary.
Error Messages on LOI or Handheld Communicator	Many possible causes depending upon the message	See table Status alerts, causes, and recommendations
Discrete input does not register.	Input signal does not provide enough counts.	Verify that the discrete input provided meets the requirements in the Wire Frequency Output/Discrete Output/Discrete Input .
		Configure the discrete event. See Configure the Discrete Output for more information.

Symptom	Potential cause	Corrective action
Reading does not appear to be within rated accuracy.	Transmitter, control system, or other receiving device not configured properly.	Check all configuration variables for the transmitter, sensor, communicator, and/or control system.
		Check these other transmitter settings: • Sensor calibration number • Units • Line size
		Perform a loop test to check the integrity of the circuit
	Electrode coating	Enable Coated Electrode Detection diagnostic.
		Use bullet-nose electrodes.
		Downsize sensor to increase flow rate above 3 ft/s (1 m/s).
		Periodically clean sensor.
	Gas/air in line	Move the sensor to another location in the process line to ensure it is full under all conditions.
	Moisture problem	Perform the sensor tests. See Run commanded Smart Meter Verification .
	Insufficient upstream/downstream pipe diameter	Move sensor to a new location with five pipe diameters upstream and two pipe diameters downstream, if possible.
	Cables for multiple magmeters run through same conduit.	Use dedicated conduit run for each sensor and transmitter.
	Improper wiring	If electrode shield and electrode signal wires are switched, flow indication will be about half of what is expected. Check wiring diagrams.
	Flow rate is below 1 ft/s (specification issue).	See accuracy specification for specific transmitter and sensor.
	Auto zero was not performed.	Verify the sensor is full, verify there is no flow, and perform the auto zero function.
	Sensor failure—shorted electrode	Perform the sensor tests. See Run commanded Smart Meter Verification .
	Sensor failure—shorted or open coil	Perform the sensor tests. See Run commanded Smart Meter Verification .
	Transmitter failure	Verify transmitter operation with an 8714D Calibration Standard. If it fails, replace the electronics stack.

Symptom	Potential cause	Corrective action
Noisy Process	Chemical additives upstream of magnetic flow meter	See Troubleshooting high process noise .
		Move injection point downstream of magnetic flow meter or move magnetic flow meter.
		Set Coil Drive Frequency to High .
	Sludge flows—mining/coal/sand/slurries (other slurries with hard particles)	Decrease flow rate below 10 ft/s (3 m/s).
		Set Coil Drive Frequency to High .
	Styrofoam or other insulating particles in process	See Troubleshooting high process noise .
		Consult factory.
		Set Coil Drive Frequency to High .
	Electrode coating	Enable Coated Electrode Detection diagnostic.
		Use a smaller sensor to increase flow rate above 3 ft/s (1 m/s).
		Periodically clean sensor.
	Gas/air in line	Move the sensor to another location in the process line to ensure it is full under all conditions.
	Low conductivity fluids (below 2 microsiemens/cm)	Set Coil Drive Frequency to High and adjust digital signal processing as needed.
		Keep flow rate below 3 ft/s (1 m/s).
Meter output is unstable.	Low conductivity fluids (below 2 microsiemens/cm) combined with cable vibration or 60 Hz interference	Eliminate cable vibration.
		Move cable to lower vibration run.
		Tie down cable mechanically.
		Set Coil Drive Frequency to High and adjust digital signal processing as needed.
		Route cable line away from other equipment powered by 60 Hz.
	Electrode incompatibility	Check the Rosemount Magnetic Flow Meter Material Selection Guide Technical Data Sheet for chemical compatibility with electrode material.
	Improper grounding	Check ground wiring. Refer to either the 9205 or 8795 QSG for grounding procedures.
	High local magnetic or electric fields	Move magnetic flow meter (20 to 25 feet away is usually acceptable).
	Control loop improperly tuned	Check control loop tuning.
	Sticky valve (look for periodic oscillation of meter output)	Service valve.
	Sensor failure	Perform the Sensor Health Test . (refer to Smart Meter Verification test results).
	Analog output loop problem	Check that the 4–20 mA loop matches the digital value. Perform analog output test.

The following table lists all of the alerts, conditions, and configuration options in tables sorted by NE 107 default severity.

17.5 Alerts, conditions, and configuration options

Table 17-2: Options for alerts and conditions

Alert	Conditions		
	Name	Description	Ignorable
Electronics Failure • Default severity: Failure • Severity configurable: No • Fault Timeout applicable: No	Core ROM/RAM Failure	There is a ROM checksum error, RAM write failure, or NVM failure occurred in the core processor assembly.	No
	Transmitter NVM Failure	There is an issue with the transmitter's non-volatile memory.	No
	Transmitter ROM/RAM Failure	There is a ROM checksum error, RAM write failure, or NVM failure occurred in the transmitter.	No
	Core NVM Failure	There is an issue with the core processor assembly's non-volatile memory.	No
	Transmitter Watchdog Error	A Watchdog Error has occurred in the transmitter.	No
	Core Watchdog Error	A Watchdog Error has occurred in the core processor assembly.	No
	LPC Watchdog Error	A Watchdog Error has occurred in the core processor assembly.	No
	Verification of AO1 Failed	The AO1 and internal verification readings do not match. Process data from AO1 is not valid for SIL applications.	No
	Update Missed Error	The internal communications have missed an update.	No
	ADC Out of Specification	An issue occurred with an analog-to-digital converter (ADC).	No
	Flow Missed Error	Flow has missed an update.	No
Sensor Failed • Default severity: Failure • Severity configurable: No • Fault Timeout applicable: No	Rail Failure	An internal power supply has failed.	No
	Boost Supply Failure	An internal power supply has failed.	No
	Coil Short Detected	The transmitter has detected a shorted coil circuit condition.	No
	Coil Open Circuit	The transmitter has detected an open coil circuit condition.	No

Alert	Conditions		
	Name	Description	Ignorable
	Coil Over Current Detected	The coil current has exceeded the maximum allowable current for the sensor.	No
	Sensor Electrode Saturated	The sensor signal has exceeded the limits of the transmitter.	No
	Coil Power Limit	The power supplied to the coils has exceeded the maximum allowable for the sensor.	No
	Coil Fault	There is an issue with the coil measurement.	No
Configuration Error • Default severity: Failure • Severity configurable: No • Fault Timeout applicable: No	Board Type Incorrect	The firmware or configuration loaded in the transmitter is incompatible with the board type.	No
	Core Software Update Failed	Core processor assembly software could not be updated.	Yes
	No Password	Security is enabled but the password has not been set.	No
	Time Not Entered	The system time has not been set.	Yes
	Core has ETO	Core processor has an ETO installed and is not compatible.	No
	Sensor Calibration Number Not Entered	The Sensor Calibration Information have not been entered completely. Flow performance may be impacted.	No
Security Breach • Default severity: Failure • Severity configurable: No • Fault Timeout applicable: No	Security Breach	The transmitter has been switched from secure mode to insecure mode.	No
Sensor-Xmtr Comm Error • Default severity: Failure • Severity configurable: No • Fault Timeout applicable: No	Core/Transmitter Communication Failure	The transmitter has lost communication with the core processor assembly	Yes As per SRS this condition is not allowed to ignore from UI.
	Core Processor Write Failure	The transmitter detected a write error to the core processor assembly.	No
Sensor Out of Range	Sensor Out of Range	The transmitter has detected a flow rate outside the sensor limits of the device.	No

Alert	Conditions		
	Name	Description	Ignorable
- Default severity: Failure - Severity configurable: No - Fault Timeout applicable: No			
Warming up - Default severity: Failure - Severity configurable: No - Fault Timeout applicable: No	Transmitter Initializing	The transmitter is completing its normal start up sequence. This is expected during power-up and will clear automatically once initialization is finished.	Yes
Output Fixed - Default severity: Out of specification - Severity configurable: Yes - Fault Timeout applicable: No	AO1 Fixed	AO1 is currently set to a fixed value. This can be caused when the HART address is set to a non-zero value, output simulation (loop testing) is enabled, or mA output trim is in progress.	Yes
	AO2 Fixed	AO2 is currently set to a fixed value. This can be caused when output simulation (loop testing) is enabled or mA output trim is in progress.	No
	FO1 Fixed	FO1 has been set to a fixed value. This is caused when output simulation (loop testing) is enabled.	No
	FO2 Fixed	FO2 has been set to a fixed value. This is caused when output simulation (loop testing) is enabled.	No
	DO1 Fixed	DO1 has been set to a fixed value. This is caused when output simulation (loop testing) is enabled.	No
	DO2 Fixed	DO2 has been set to a fixed value. This is caused when output simulation (loop testing) is enabled.	No
Simulation Mode Active - Default severity: Function Check - Severity configurable: No - Fault Timeout applicable: No	Simulation Mode Active	Sensor Simulation is currently active.	No
Core Processor Write Failure	The transmitter detected a write error to the core processor assembly.	Yes	No

Alert	Conditions		
	Name	Description	Ignorable
Output Saturated • Default severity: Out of specification • Severity configurable: Yes • Fault Timeout applicable: No	AO1 Saturated	The calculated AO1 output value is outside the configured range.	Yes
	AO2 Saturated	The calculated AO2 output value is outside the configured range.	Yes
	FO1 Saturated	The calculated FO1 output value is outside the configured range.	Yes
	FO2 Saturated	The calculated FO2 output value is outside the configured range.	Yes
Discrete Event Active • Default severity: Out of specification • Severity configurable: Yes • Fault Timeout applicable: Yes	Discrete Event 1 Active	Discrete Event 1 is ON (active).	Yes
	Discrete Event 2 Active	Discrete Event 2 is ON (active).	Yes
	Discrete Event 3 Active	Discrete Event 3 is ON (active).	Yes
	Discrete Event 4 Active	Discrete Event 4 is ON (active).	Yes
	Discrete Event 5 Active	Discrete Event 5 is ON (active).	Yes
High Process Noise Detected • Default severity: Out of specification • Severity configurable: Yes • Fault Timeout applicable: No	High Process Noise Detected	The transmitter has detected a low Signal-to-Noise ratio.	Yes
Grounding/Wiring Fault • Default severity: Out of specification • Severity configurable: Yes • Fault Timeout applicable: No	Grounding/Wiring Fault	The transmitter detected high levels of 50/60 Hz noise caused by improper wiring or poor grounding.	Yes
Smart Fluid Diagnostic Fault • Default severity: Out of Specification • Severity configurable: Yes • Fault Timeout applicable: Yes	Smart Fluid Diagnostic Fault	The transmitter detected high levels of multi-spectrum noise.	Yes
Electronics Temp out of Range • Default severity: Out of specification • Severity configurable: Yes • Fault Timeout applicable: No	IO Board Temperature Out of Range	The IO board temperature is out of range. Flow performance may be impacted.	Yes
	Core Board temperature Out of Range	The core board temperature is out of range. Flow performance may be impacted.	Yes

Alert	Conditions		
	Name	Description	Ignorable
Digital Trim Required • Default severity: Maintenance required • Severity configurable: Yes • Fault Timeout applicable: No	Digital Trim Required	The transmitter has detected an abnormality that can be resolved by a Digital Trim.	Yes

Alert	Conditions		
	Name	Description	Ignorable
Continuous MV Error • Default severity: Maintenance Required • Severity configurable: Yes • Fault Timeout applicable: No	Internal Flow Simulation Test Failed	During the transmitter verification test, the deviation between the reference and simulated velocity has exceeded the specified verification limit. The transmitter may no longer be within accuracy specifications. The test may be invalid if the flow value is noisy and/or fluctuating	Yes
	Coil Resistance Error	During the coil resistance verification test, the deviation between the coil resistance baseline and measured coil resistance value has exceeded the specified verification limit. The sensor may no longer be within accuracy specifications.	Yes
	Coil Inductance Error	During the coil inductance verification test, the deviation between the coil inductance and measured coil inductance value has exceeded the specified verification limit. The sensor may no longer be within accuracy specifications.	Yes
	Electrode Resistance Error	During the electrode resistance verification test, the deviation between the electrode resistance baseline and measured electrode resistance value has exceeded the specified verification limit. There may be moisture in the terminal block, coating, or shorted electrodes.	Yes
	AO Feedback Error	During the analog output verification test, the deviation between the expected and actual mA output has exceeded the specified verification limit. The analog output may no longer be within accuracy specifications. The test may be invalid if the flow value is noisy and/or fluctuating.	Yes
Empty Pipe Detected	Empty Pipe Detected	The sensor is not full of fluid. The flow rate is set to zero.	Yes

Alert	Conditions		
	Name	Description	Ignorable
• Default severity: Maintenance required • Severity configurable: Yes • Fault Timeout applicable: No			
Electrode Coated Limit 1 • Default severity: Maintenance required • Severity configurable: Yes • Fault Timeout applicable: No	Electrode Coated Limit 1	The electrode coating value has exceeded the 'Electrode Coating Level 1 Limit'. Electrode coating can result in an erratic, inaccurate output or complete loss of flow measurement.	Yes
Electrode Coated Limit 2 • Default severity: Maintenance required • Severity configurable: Yes • Fault Timeout applicable: No	Electrode Coated Limit 2	The electrode coating value has exceeded the 'Electrode Coating Level 2 Limit'. Electrode coating can result in an erratic, inaccurate output or complete loss of flow measurement.	Yes
Reverse Flow Detected • Default severity: Maintenance Required • Severity configurable: Yes • Fault Timeout applicable: No	Reverse Flow Detected	The transmitter is measuring flow in the reverse direction.	Yes
Configuration Warning • Default severity: Maintenance Required • Severity configurable: Yes • Fault Timeout applicable: No	Internal Memory Failure	An internal memory failure has occurred.	No
	Clock Constant	The real-time clock is not incrementing. Measurement is not affected but log timestamps will not be accurate.	No
	Internal Memory Full	The transmitter's internal memory is nearly full.	No
	Transmitter Software Update Failed	Security is enabled but the password has not been set.	Yes

Alert	Conditions		
	Name	Description	Ignorable
Electronics Warning • Default severity: Maintenance Required • Severity configurable: Yes • Fault Timeout applicable: No	Bluetooth [®] Functionality Limited	Unable to send device data over Bluetooth due to an internal error. Device will continue to function independent of this Bluetooth alert.	Yes
	Bluetooth Electronics Error	Electronics error was detected on the Bluetooth board. Device will continue to function independent of this Bluetooth alert.	Yes
	Bluetooth Security Error	The security keys have not been properly installed on the Bluetooth board.	No
	Bluetooth Firmware Out of Date	Unable to send device data over Bluetooth because the Bluetooth firmware is out of date.	Yes

17.6 Status alerts, causes, and recommendations

The following table lists all of the alerts, conditions, and configuration options in tables based on NE 107 default severity.

Table 17-3: NE 107 Fault Conditions

Fault		
Alert name/ conditions	Potential cause	Action
Electronics Failure: - Core ROM/RAM failure - Transmitter NVM failure - Transmitter ROM/RAM failure - Core NVM failure - Transmitter Watchdog error - Core Watchdog error - LPC Watchdog error - Verification of AO1 failed - Update missed error - ADC out of specification - Flow missed error - Rail failure - Boost supply failure	- High EMI interference - Hardware failure	- Evaluate the environment for sources of high electromagnetic interference (EMI). - Cycle power to the meter. - If the alert persists, replace the core processor assembly, if applicable. - Otherwise, replace the transmitter electronics.
Electronics failure: Boost supply failure	- High EMI interference - Incorrect sensor calibration data entered - Hardware failure	- Evaluate the environment for sources of high electromagnetic interference (EMI). - Verify the sensor calibration numbers match what is entered in the transmitter. - Cycle power to the meter. - If the alert persists, replace the core processor assembly, if applicable. - Otherwise, replace the transmitter electronics.
Sensor failure: - Coil Short Detected - Coil Open Circuit - Coil Over Current Detected - Coil Fault	- Incorrect sensor calibration data entered - Loose core processor assembly - Loose sensor connection - Sensor failure - Electronics failure	- Verify that the correct sensor calibration information is entered in the transmitter. - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Cycle power to the meter.

Fault		
Alert name/ conditions	Potential cause	Action
		5. If the alert persists, replace the sensor and attached electronics.
Sensor failure: Sensor electrode saturated	- Loose core processor assembly - Loose sensor connection - Improper process reference grounding - Improper earth ground - Sensor failure - Electronics failure	- Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Otherwise, validate the sensor connector is seated correctly on the transmitter.. - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Cycle power to the meter. - If the alert persists, replace the core processor assembly electronics, if applicable. - Otherwise, replace the sensor electronics.
Sensor failure: Coil power limit	- Incorrect sensor calibration data entered - Sensor temperature exceeding operating limits - Loose sensor connection - Poor remote cable connection - Sensor not compatible with high frequency operation - Sensor failure - Electronics failure	- Verify that the correct sensor calibration information is entered in the transmitter. - Check the core board temperature for elevated value. - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - If the Coil Drive Frequency is set to <i>High Frequency</i>, change it to <i>Low Frequency</i>. The diagnostic will trigger after 1 minute if there is still a power issue. If the diagnostic does not trigger, then the sensor may not be suitable for high frequency operation. - If the alert persists, replace the sensor and attached electronics.
Configuration error: Board type incorrect	- Incorrect firmware - Outdated/obsolete boardstack	- If this alarm occurred in conjunction with an effort to load a configuration into the transmitter, confirm that the transmitter is of the same model as the one the configuration came from. - Cycle power to the meter. - If the alert persists, contact Emerson.

Fault		
Alert name/ conditions	Potential cause	Action
Configuration error: Core software update failed	Core processor assembly failure	- Cycle power to the meter. - Attempt to update the core processor software again. - If the alert persists, contact Emerson.
Configuration error: No password	Password not set	Set the password.
Configuration error: Time not Entered	System time not set.	Set the time and time zone.
Configuration error: Core has ETO	Core assembly has an Engineered-to-Order (ETO) solution.	- The core can be updated but the ETO will be overwritten. - Contact Emerson to discuss options for preserving the ETO.
Configuration error: Sensor Calibration Number not Entered	Sensor calibration data not entered completely	- Re-enter all the characterization and calibration parameters even if the calibration data is set to the correct values. See the sensor tag or the calibration sheet for the meter. - If alert persists, contact Emerson.
Security breach	Transmitter switched from secure to unsecure mode.	Set the transmitter to secure to clear the alert. Note Additional procedures may be required to return the device to secured mode.
Sensor-Xmtr communication error Core/Transmitter Communication Failure	- Loose wiring connection - Electronics failure	- Evaluate the wiring of the core processor assembly to the transmitter, if applicable. - Check the core processor LEDs are lit. See manual for LED locations. - Cycle power to the meter. - If the alert persists, replace the transmitter electronics. - If the alert still persists, replace the core processor assembly.
Sensor-Xmtr communication error Core Processor Write Failure	Electronics failure	- Cycle power to the meter. - If the alert persists, replace the core processor assembly, if applicable. - Otherwise, replace the transmitter electronics.

Fault		
Alert name/ conditions	Potential cause	Action
Sensor out of range	- Excessively high flow rate - Incorrect sensor calibration data entered - Incorrect sensor line size entered. - Empty pipe detection is disabled. - Flow rate above 43 ft/sec (13.2 m/s)	- Check for excessively high flow rate. - Verify sensor calibration information. - Verify sensor line size. - Verify that empty pipe detection is enabled. - Perform Sensor Health Test - Reduce the flow rate. - Reset the transmitter. - If the alert persists, contact Emerson.
Transmitter initializing	- Transmitter still in power-up mode - Other alerts are present - Insufficient power - Electronics failure	- If other alerts are present, resolve those alert conditions. - Verify the transmitter is receiving sufficient voltage. - If the alert persists, replace the transmitter electronics.
Digital trim required	Coil circuit out of calibration	Perform a digital trim.
Simulation mode active	Simulation mode active	Disable sensor simulation.
Output fixed: AO1 Fixed	- Output simulation enabled - Analog output trim in progress - HART® address non-zero and analog output action disabled	- Disable output simulation, if applicable. - Exit mA output trim, if applicable. - Check the HART address. If the HART address is non-zero, change the setting of Analog Output Action (Loop Current Mode) to Enabled
Output fixed: AO2 Fixed	- Output simulation enabled - mA output trim in progress	- Disable output simulation, if applicable. - Exit analog output trim, if applicable.
Output Fixed: - FO1 Fixed - FO2 Fixed - DO1 Fixed - DO2 Fixed	Output simulation enabled	Disable output simulation.

Fault		
Alert name/ conditions	Potential cause	Action
Output Saturated: • AO1 Saturated • AO2 Saturated	• URV/LRV set incorrectly • Incorrect sensor calibration data • Flow rate outside of configured range • Incorrect measurement units	1. Verify that Upper Range Value and Lower Range Value are set correctly for the process variable and the process. 2. Check your process conditions against the values reported by the meter. 3. Verify sensor line size, sensor calibration data, and meter factor. 4. Verify that the measurement units are configured correctly for the application. 5. If the alert persists, contact Emerson.
Output saturated: • FO1 Saturated • FO2 Saturated	• Frequency Output Scaling Method set incorrectly • Incorrect scaling factors • Flow rate outside of configured range • Incorrect measurement units	1. Check the Frequency Output Scaling Method parameter. 2. Check frequency or scaling factors. 3. Check your process conditions against the values reported by the meter. 4. Verify that the measurement units are configured correctly for the application. 5. If the alert persists, contact Emerson.
Discrete event active: • Discrete Event 1 Active • Discrete Event 2 Active • Discrete Event 3 Active • Discrete Event 4 Active • Discrete Event 5 Active	• Incorrect discrete event configuration • Discrete Event 1 Active • Discrete Event 2 Active • Discrete Event 3 Active • Discrete Event 4 Active • Discrete Event 5 Active	1. Check discrete event configuration. 2. If not desired, disable the discrete event.

Fault		
Alert name/ conditions	Potential cause	Action
High process noise detected:	- Loose core processor assembly - Loose sensor connection - Improper process reference grounding - Improper earth ground - Fluid conductivity too low - Process related issues including solids, entrained gas, or chemical reactions	- Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Otherwise, validate the sensor connector is seated correctly on the transmitter. - Verify that the grounding strap connections to mating flanges, grounding rings, or lining protectors are clean and secure. - Increase transmitter 'Coil Drive Frequency' to 'High Frequency'. - Increase the Signal Processing Mode to stabilize the flow reading. Note This action does not clear the alert message. - Decrease the Process Noise Sensitivity level to change the trigger level of the alert. - If possible, redirect chemical additions downstream of the magmeter. - Verify process fluid conductivity is above 10 microsiemens/cm. If desired, transmitter can be configured to ignore this condition.

Fault		
Alert name/ conditions	Potential cause	Action
Grounding/wiring fault:	- High level of AC line noise - Loose core processor assembly - Loose sensor connection - Improper process reference grounding - Improper earth ground - Empty Pipe is disabled	- Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Otherwise, validate the sensor connector is seated correctly on the transmitter. - Verify that the transmitter is grounded correctly. - Connect grounding rings, grounding electrode, lining protectors, or grounding straps. Grounding diagrams are included in the product manual. - Verify Empty Pipe Detection is enabled. - Match the AC Line Filter setting to AC power frequency. Note This action does not clear the alert message. - Increase the Line Noise Sensitivity level to change the trigger level of the alert. If desired, the transmitter can be configured to ignore this condition.
Smart fluid diagnostics fault:	- Process related changes including solids, entrained gas, or chemical reactions - High electromagnetic interference (EMI) - Loose core processor assembly - Loose sensor connection - Improper process reference grounding - Improper earth ground - Empty Pipe Detection disabled	- Evaluate the process conditions for changes (increased solids, oil, gas/ air, chemicals, etc.). - Evaluate the environment for sources of high electromagnetic interference (EMI). - Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Otherwise, validate the sensor connector is seated correctly on the transmitter. - Verify that the transmitter is grounded correctly. - Verify that the grounding strap connections to mating flanges, grounding rings, or lining protectors are clean and secure. - Verify Empty Pipe Detection is enabled. - Increase the Smart Fluid Diagnostic trigger level to change the trigger level of the alert.

Fault		
Alert name/ conditions	Potential cause	Action
		If desired, the transmitter can be configured to ignore this condition.
Electronics temperature out of range: IO Board Temperature Out of Range	- Ambient temperature is too hot - Process temperature is too hot	- Turn off transmitter. - Evaluate environmental conditions around transmitter. - If transmitter is integrally mounted to the sensor, convert to a remote mount configuration.
Electronics temperature out of range: Core Board Temperature Out of Range	- Process temperature is too hot - Ambient temperature is too hot	- Turn off transmitter. - Ensure the transmitter is neither heat-traced nor insulated. - Evaluate environmental conditions around the core processor assembly, if applicable. - Otherwise, evaluate the environmental conditions around the transmitter. - Rotate the sensor to position the transmitter or remote junction box below the pipe.
Continuous meter verification error: Internal Flow Simulation Test Failed	- Empty Pipe Detection is disabled - Electronics drift - Electronics failure	- Verify Empty Pipe Detection is enabled. - Rerun the transmitter verification test with a steady flow rate or no flow and a full pipe. - Verify transmitter electronics with Model 8714D reference standard. The dial on the 8714 should be set at 30 ft/s (9.14 m/s). Perform Digital Trim validation. - Perform an 'Digital Trim' using the 'Model 8714' reference standard. - If the digital trim doesn't correct the issue, replace the electronics. If desired, the transmitter can be configured to ignore this condition.

Fault		
Alert name/ conditions	Potential cause	Action
Continuous meter verification error: - Coil Resistance Error - Coil Inductance Error	- Loose core processor assembly - Loose sensor connection - Coil short - Coil open - Electronics failure	- Verify the core processor assembly is pressed in and screwed down correctly, if applicable. - Otherwise, validate the sensor connector is seated correctly on the transmitter. - Run a commanded meter verification test retrieve a full report and review report with Emerson support. - If the alert persists, send the sensor back for recalibration. If desired, the transmitter can be configured to ignore this condition.
Continuous meter verification error: Electrode Resistance Error	- Loose wiring connection - Major change in process fluid conductivity - Electrode short - Electrode open - Coated electrode - Electronics failure	- Evaluate the wiring of the core processor assembly to the transmitter, if applicable. - For major process fluid changes, perform a new SMV electrode resistance baseline. - Run a commanded meter verification test retrieve a full report and review report with Emerson support. - Perform visual inspection of the sensor. Remove the coating buildup inside the sensor if necessary. - If the alert persists, replace the sensor. If desired, the transmitter can be configured to ignore this condition.
Continuous meter verification error: AO Feedback Error	- Poor analog loop wiring - D/A drift - Electronics failure	- Rerun the analog output verification test with a steady flow rate or no flow and a full pipe. - Check the analog loop wiring. Excessive loop resistance can cause an invalid test. - Perform a loop test to validate the analog control loop. - Perform an analog output trim. This allows the calibration of the analog output with an external reference at operating endpoints of the analog output. - If the digital to analog trim doesn't correct the issue, replace the electronics. If desired, the transmitter can be configured to ignore this condition.

Fault		
Alert name/ conditions	Potential cause	Action
Empty pipe	- Loose core processor assembly - Loose sensor connection - Pipe is not full - Improper process reference grounding - Improper earth ground - Empty Pipe Trigger Level set too low - Process conductivity below the minimum conductivity requirement	1. Verify the core processor assembly is pressed in and screwed down correctly, if applicable 2. Otherwise, validate the sensor connector is seated correctly on the transmitter. 3. Verify sensor is full. 4. Set the 'Empty Pipe Trigger Level' to a value above the 'Empty Pipe Value' seen with a full pipe. 5. Increase the 'Empty Pipe Counts' on the diagnostic tab of the configuration screen to compensate for process noise. The 'Empty Pipe Time' is the number of seconds 'Empty Pipe Value' readings above the 'Empty Pipe Trigger Level' required to activate the Empty Pipe diagnostic. 6. Verify process fluid conductivity is above the minimum conductivity requirement.
Electrode coated limit 1 Electrode coated limit 2	- Empty pipe detection is disabled - Loose wiring connection - Coated electrode(s) - Electrode coating level limit set too low	1. Verify empty pipe detection is enabled. 2. Evaluate the wiring of the core processor assembly to the transmitter, if applicable. 3. If alert persists, clean the inside surface of the sensor to remove any coating build-up. If desired, the transmitter can be configured to ignore this condition.
Reverse flow detected	- Sensor Flow Direction is not properly set - Sensor installed backwards - Reverse flow - Empty pipe condition with empty pipe detection disabled	1. Set Sensor Flow Direction to match flow direction. 2. If flow is not in the reverse direction, verify the sensor is installed in the correct direction according to the flow arrow on the sensor. 3. If the sensor is installed incorrectly, either correct the installation or enable the Flow Direction feature to reverse the flow value within the transmitter. 4. Ensure full pipe or Empty Pipe Detection is turned on. 5. If the sensor is installed correctly and configuration is set properly, contact Emerson.

Fault		
Alert name/ conditions	Potential cause	Action
Configuration warning: • Internal Memory Failure	Electronics failure	1. Cycle power to the meter. 2. If alert persists, replace the transmitter electronics.
Configuration warning: • SMV Baseline Missing	No SMV baseline	1. Perform a Smart Meter Verification baseline to remove this alert. 2. If the alert persists, contact Emerson.
Configuration warning: • Clock constant	Electronics failure	Replace the transmitter electronics.
Configuration warning: • Internal Memory Full	Internal Memory Full	Contact Emerson.
Configuration warning: • Transmitter Software Update Failed	Update failure	1. Verify that the correct hex file is loaded onto the device. 2. Cycle power to the meter. 3. Contact Emerson.
Electronics warning: • Bluetooth® Functionality Limited	- Loose Bluetooth display - Bluetooth display failure - Electronics failure	1. Verify the local display is pressed in and screwed down correctly. 2. If the alert persists, contact Emerson.
Electronics warning: • Bluetooth Electronics Error	Bluetooth display error	1. Cycle power to the meter. 2. If the alert persists, replace the local display.
Electronics warning: • Bluetooth Security Error	Bluetooth display failure	Contact Emerson.
Electronics warning: • Bluetooth Firmware Out of Date	Bluetooth firmware out of date.	Update the Bluetooth firmware.

17.7 Transmitter does not communicate

If the transmitter does not appear to be communicating, the wiring may be faulty or the communications device may be incompatible.

- For HART network communications, refer to [Configure HART parameters](#)
- For communication using a communication device, check the wiring and the communication device. Refer to either [Basic information about ProLink III](#) or [Using a field communicator with the transmitter](#).

Important

If you can read data from the transmitter but cannot write data (that is, you cannot start, stop or reset totalizers or change transmitter configuration), check to see if the transmitter is write protected, and disable write protection if required.

17.8 Locate a device using the HART 7 Squawk feature

The Squawk feature causes the device to show a specific pattern on its display and can be used to locate or identify a device.

Restriction: The Squawk feature is available only with HART 7 connections from a field communicator. It is not available with ProLink III.

Procedure

1. Choose **Device Settings** → **Device Information** → **Blink Device**.
2. Choose **Blink Device**.

A 0-0-0-0 pattern is shown on the display.

To return to the normal display, activate any button on the device display, or wait 60 seconds.

Appendix A Using the transmitter display

This section explains how to operate the display. The display allows navigation through menus, configuration of the application, monitoring and control of processes, and execution of maintenance and diagnostic tasks.

A.1 Components of the transmitter display

The transmitter display includes a multi-line LCD panel.

Figure A-1: 9732 transmitter display with Capacitive Buttons

A.1.1 LCD panel

In normal operation, the LCD panel shows the current value of the display variables, and their measurement units.

The LCD panel also provides access to the display menus and alert information.

- View the current configuration and make configuration changes.
- Perform procedures such as loop testing and Smart Meter Verification.

The alert information allows an indication of which alerts are active, acknowledge the alerts individually or as a group, and to see more detailed information for individual alerts.

A.2 Access and use the display menu

The display menus enable most configuration, administration, and maintenance tasks.

The four capacitive buttons, $\leftarrow$ $\uparrow$ $\downarrow$ $\rightarrow$, are used to navigate the menus, make selections, and enter data.

Figure A-2: Capacitive buttons**Procedure**

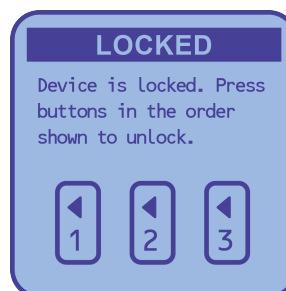
1. Observe the action bar at the bottom of the LCD panel.
The action bar displays **Menu⇒**.
2. Navigate the menus using the four capacitive buttons:
 - Activate ↑ or ↓ to scroll to the previous or next item in the menu.
 - Activate and hold ↑ or ↓ (approximately 1 second to scroll rapidly through numbers or menu options, or to move to the previous screen or next screen in a multi-screen display.
 - Activate ⇒ to drill down to a lower menu or to select an option.
 - Activate and hold ⇒ to save and apply an action.
 - Activate ⇐ to return to the previous menu.
 - Activate and hold ⇐ to cancel an action.

The action bar is updated with context-sensitive information.

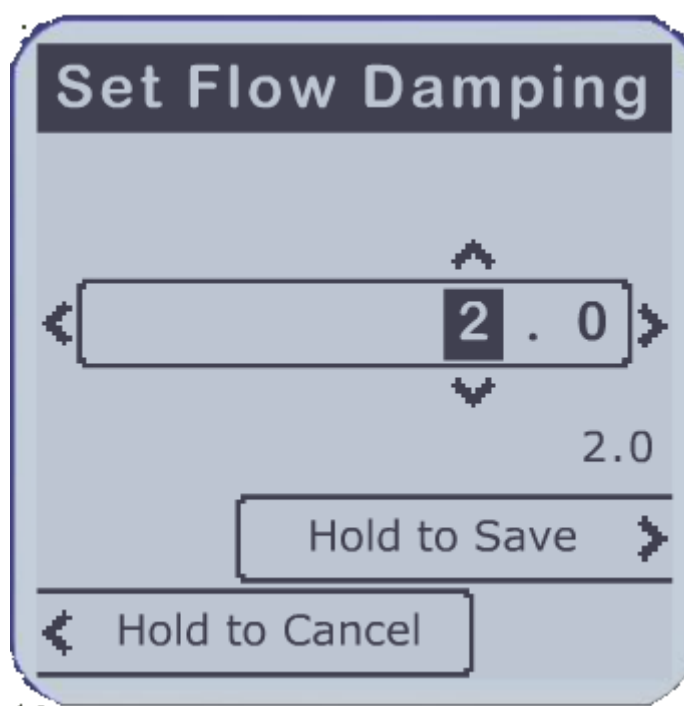
If the menu or the topic is too large for a single display screen, the ↓ and ↑ symbols at the bottom and top of the LCD panel are used to indicate that scrolling down or up is required to see more information.

Figure A-3: Navigation arrows

3. If a user makes a menu choice that leads to a possible configuration change, or to certain procedures such as Smart Meter Verification
 - If display security is not enabled, the display prompts a user to activate ⇐⇓⇑⇒, in that order. This feature protects against accidental changes to configuration, but does not provide any security.

Figure A-4: Security prompts

- If display security is enabled, the display prompts a user to enter the display passcode.
4. If a user makes a menu choice that requires entering a numeric value or character string, the display provides a screen similar to the following:

Figure A-5: Numeric values and character strings

- Activate ⇐ or ⇒ to position the cursor.
 - Activate ↑ and ↓ to scroll through the values that are valid for that position.
 - Repeat until all characters are set.
 - Activate and hold ⇒ to save the value.
5. To exit the display menu system, use either of the following methods:
- Wait until the menu times out and returns to the display variables.
 - Exit each menu separately, working back to the top of the menu system.

A.3 Access and use Quick Menu

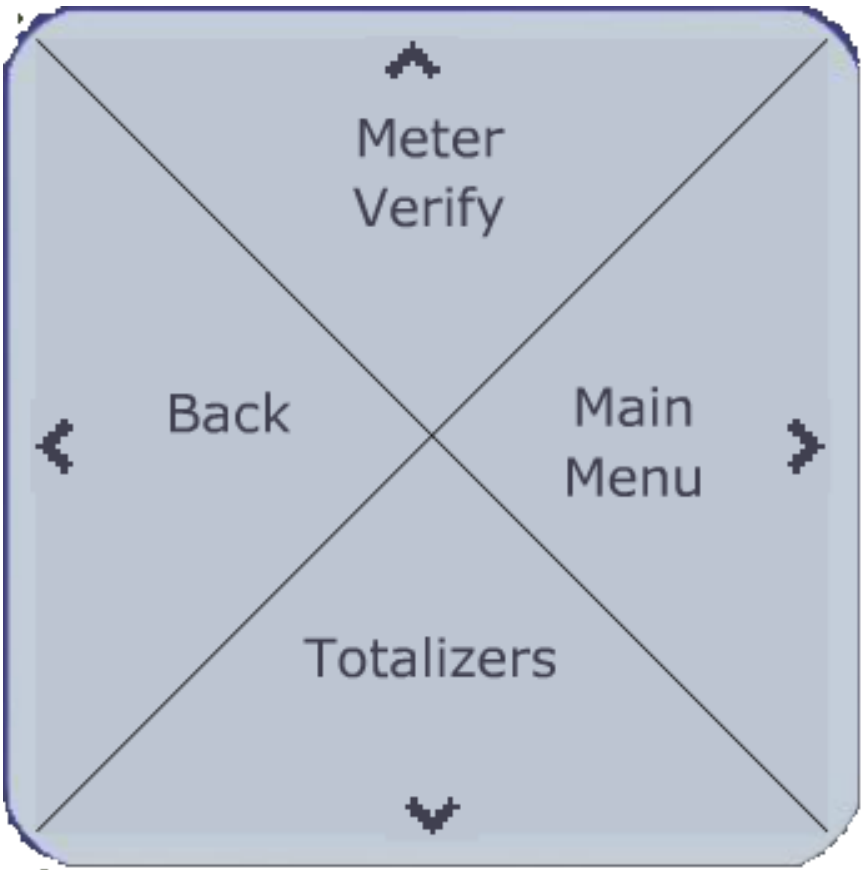
The Quick Menu provides fast access to most commonly accessed parameters or features such as:

- Smart Meter Verification (default)
- Totalizers (default)
- Service Tools
- Diagnostics

A.3.1 Turning Quick Menu on/off

The Quick Menu is enabled from the factory and can be disabled.

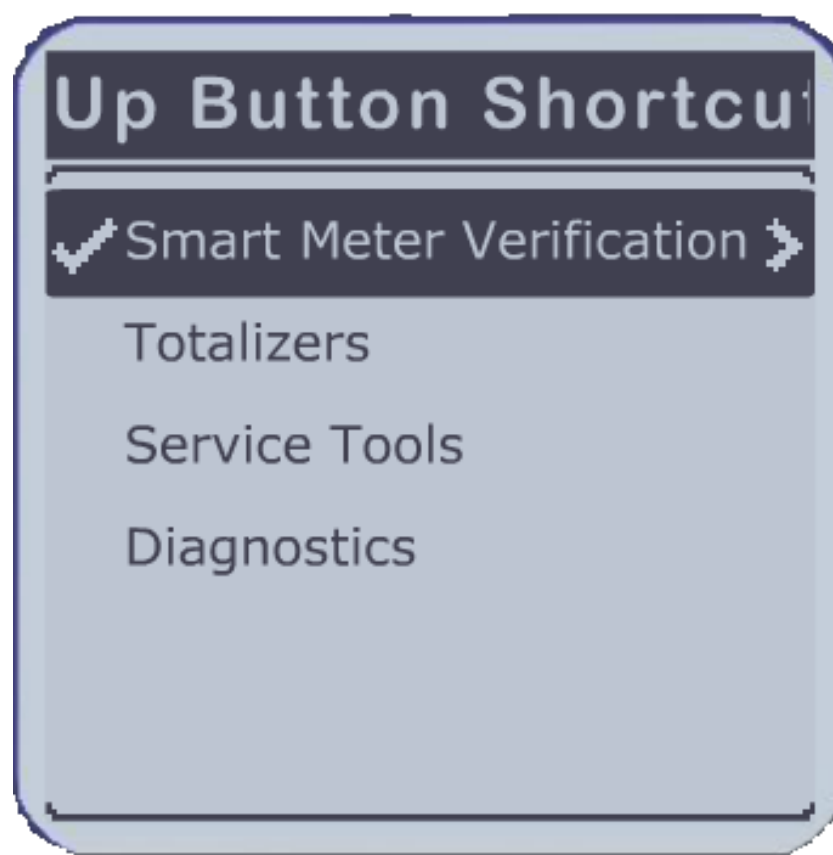
Figure A-6: 9732 Default Quick Menu Layout



Display	Menu → Quick Menu → Configuration → Detailed Setup → Display Settings → Quick Menu → Quick Menu Available
ProLink III	Device Tools → Configuration → Transmitter Display → General → Quick Menu → Quick Menu Available
Field Communicator	Device Settings → Display → General Settings → Quick Menu → Display Quick Menu

A.3.2 Configure the Quick Menu

The ↑ and ↓ arrows of the Quick Menu can be configured to quickly access Smart Meter Verification, Totalizers, Service Tools, and Diagnostics parameters. The table below provides the menu path to configure the Quick Menu.

Figure A-7: Configuring Quick Menu Button Shortcut**Note**

The Up or Down button shortcut configuration can quickly be accessed through the Quick Menu by pressing and holding the appropriate arrow button (↑ or ↓) for the desired shortcut for 5 seconds, then releasing the button.

Appendix B Using ProLink III with the transmitter

B.1 Basic information about ProLink III

ProLink III is a configuration and service tool available from Emerson. ProLink III runs on a Windows platform and provides complete access to transmitter functions and data.

B.1.1 Version requirements

Use the latest version of ProLink III and the device firmware to support all features. For details about ProLink III device support, refer to the *ProLink III ChangeLog.txt* file.

B.1.2 ProLink III requirements

To install ProLink III, a user must have:

- The ProLink III installation media
- The ProLink III installation kit for the connection type:
 - USB A-type to A-type cable or USB converter: Service port connection
 - HART modem: HART connection

To obtain ProLink III and the appropriate installation kit, visit [Emerson.com/global](https://emerson.com/global).

B.1.3 ProLink III documentation

Most instructions in this manual assume prior familiarity with ProLink III or a general understanding of Windows programs. For additional information beyond what is provided here, see the [ProLink III with ProcessViz Software User Manual](#).

B.1.4 ProLink III features and functions

ProLink III offers complete transmitter configuration and operation functions. ProLink III also offers a number of additional features and functions, including:

- A Professional version with expanded features not available on the Basic version
- The ability to save the transmitter configuration set to a file on the PC, and reload it or propagate it to other transmitters
- The ability to log specific types of data to a file on the PC
- The ability to view performance trends for various types of data on the PC
- The ability to connect to and view information for more than one device
- A guided connection wizard

These features are documented in the [ProLink III with ProcessViz Software User Manual](#). ProLink III features are not documented in this manual.

B.1.5 ProLink III messages

When using ProLink III with a Rosemount transmitter, there will be a number of messages and notes. The manual does not document all of these messages and notes.

Important

The user is responsible for responding to messages and notes and complying with all safety messages.

B.2 Connect with ProLink III

A connection from ProLink III to the transmitter allows a user to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

B.2.1 Connection types supported by ProLink III

Depending on the channels that are licensed on the transmitter, there may be several connection types available to connect from ProLink III to the transmitter. Choose the connection type appropriate to the network and the tasks to be performed.

Table B-1: Connection types supported by ProLink III

Connection type	Port or channel	Terminals
Service port	USB A-type	N/A
HART®/Bell 202	Channel A (mA Output 1)	1 and 2
Modbus/RS-485 8-bit (Modbus RTU)	Channel C (RS-485)	5 and 6

When selecting a connection type, consider the following:

- Some connections require opening the wiring compartment. These connection types should be used only for temporary connections, and may require extra safety precautions.
- Service port connections use standard connection parameters and a standard address already defined in ProLink III.
- Channel C auto-detects incoming connection requests, and automatically responds to Modbus.
- HART/Bell 202 connections use standard HART connection parameters that are already defined in ProLink III.
- RS-485 connections and service port connections are typically faster than HART/Bell 202 connections.

B.2.2 Make a service port connection from ProLink III to the transmitter

⚠ WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

Prerequisites

- Ensure the transmitter service port is enabled.
- Obtain a USB type A to type A cable.

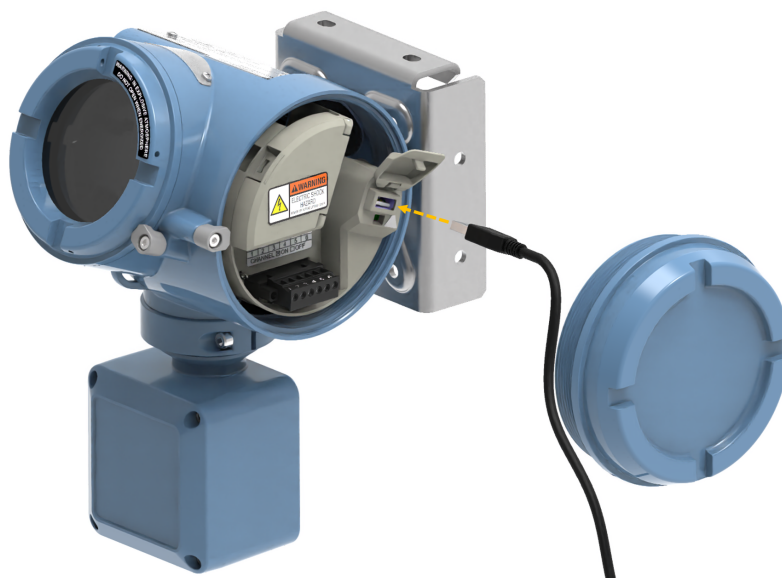
Important

The USB cable should be no greater than 1 meter in length.



Procedure

1. Insert one end of the USB cable into the USB port on the PC.
2. Open the wiring compartment on the transmitter, and insert the other end of the USB cable into the service port on the transmitter.

Figure B-1: Service port inside transmitter wiring compartment

3. Start ProLink III.
4. Choose **Connect to Physical Device**.
5. Set parameters as shown here.

Parameter	Setting
Protocol	Service Port
PC Port	The number assigned to the USB port on the PC

6. Click **Connect**.
If an error message appears:
 - Ensure that the correct port on the PC has been specified.
 - Ensure the transmitter service port is enabled at
Menu → Configuration → Security → Service Port.

B.2.3 Make a Modbus/RS-485 connection from ProLink III to the transmitter

This connection type uses Modbus protocol and commands to communicate with the transmitter over an RS-485 network. A user can make a Modbus/RS-485 connection to the transmitter RS-485 terminals (Channel C) or to any point on the network.

Prerequisites

- Channel C activated on the transmitter
- An available serial port or USB port
- Adapters as required (for example, 9-pin to 25-pin)

Procedure

1. Attach the signal converter to the serial port or USB port on the PC.
2. To connect directly to the transmitter terminals:

- a. Open the transmitter wiring compartment.

⚠ WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

Opening the wiring compartment while the transmitter is powered up could cause an explosion.

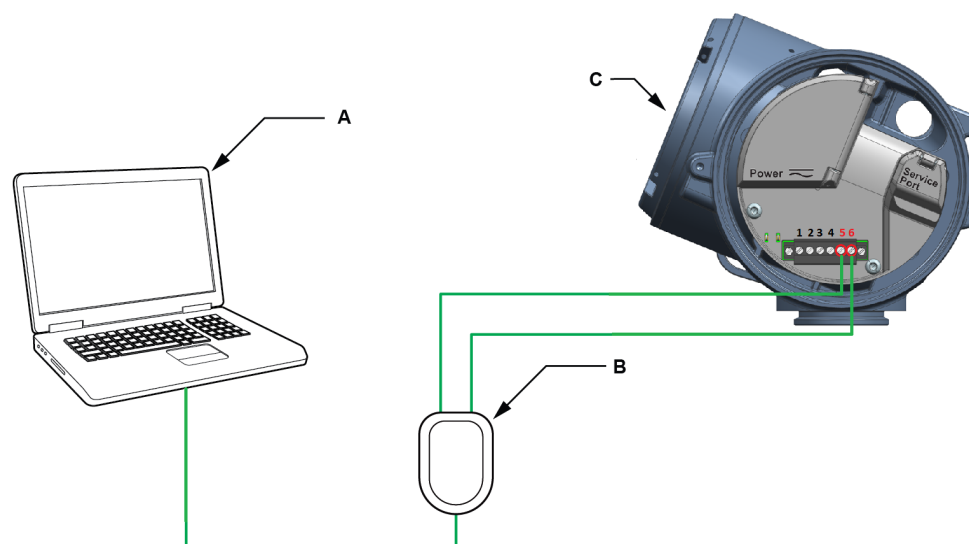
To connect to the transmitter in a hazardous environment, use a connection method that does not require opening the wiring compartment.

- b. Connect the leads from the signal converter to terminals 5 (RS-485/A) and 6 (RS-485/B).

Tip

Usually, but not always, the black lead is RS-485/A and the red lead is RS-485/B.

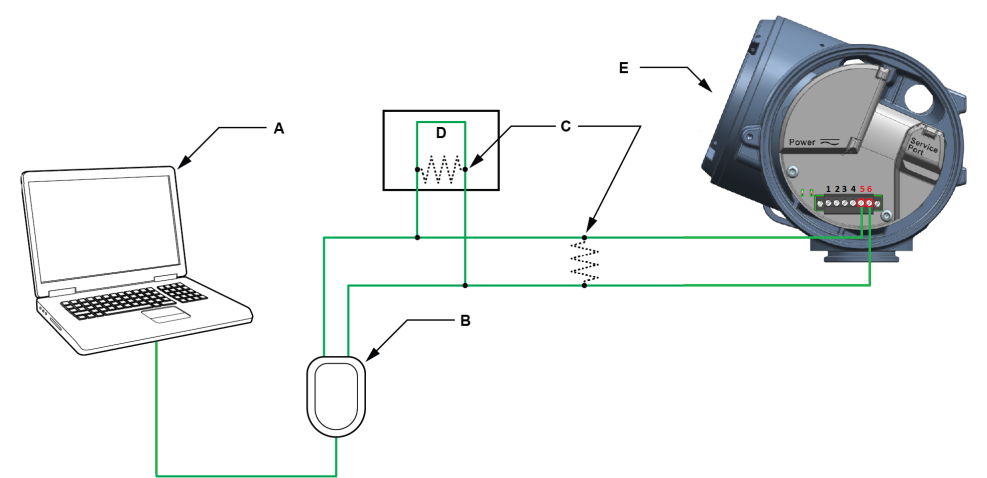
Figure B-2: Connection to RS-485 terminals



- A. PC
B. USB port to RS-485 converter
C. Transmitter with end-cap removed

3. To connect over the RS-485 network:
 - a. Attach the leads from the signal converter to any point on the network.
 - b. Add resistance as necessary to achieve at least one volt across the connection points.
 - c. Ensure that the PLC or DCS is not trying to communicate to this meter at this time.
Restriction:
The meter does not support concurrent connections from ProLink III and a PLC or DCS. If another host is already communicating with the meter, ProLink III will not be able to connect, but its connection attempts will corrupt messages from the other host. To make a ProLink III connection, a user can temporarily stop host communications, disconnect the cable from the host, or connect through the service port.

Figure B-3: Connection over network



- A. PC
- B. USB port to RS-485 converter
- C. 120-Ω, ½-watt resistors at both ends of the segment, if necessary
- D. DCS or PLC
- E. Transmitter with end-cap removed

- 4. Start ProLink III.
- 5. Choose **Connect to Physical Device**.
- 6. Set parameters as shown here.

Parameter	Setting
PC Port	The number assigned to the COM port or USB port on the PC
Address	The Modbus address configured for this transmitter. The default is 1.

The transmitter automatically detects all other communications settings.

- 7. Click **Connect**.
If an error message appears:
 - Switch the leads and try again.
 - Verify the Modbus address of the transmitter.
 - Ensure the correct port has been specified on the PC.
 - Check the wiring between the PC and the transmitter.
 - For long-distance communication, or if noise from an external source interferes with the signal, install 120-Ω ½-W terminating resistors in parallel with the output at both ends of the communication segment.
 - Ensure that there is no concurrent Modbus communication to the transmitter.

B.2.4 Make a HART/Bell 202 connection from ProLink III to the transmitter

This connection type uses HART protocol and commands to communicate with the transmitter over a Bell 202 physical layer. A user can connect directly to the Channel A terminals on the transmitter, to any point in a local HART loop, or to any point in a HART multidrop network.

Prerequisites

- Channel A activated on the transmitter

Procedure

1. Attach the signal converter to the serial port or USB port on the PC.
2. To connect directly to the transmitter terminals:

⚠ WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

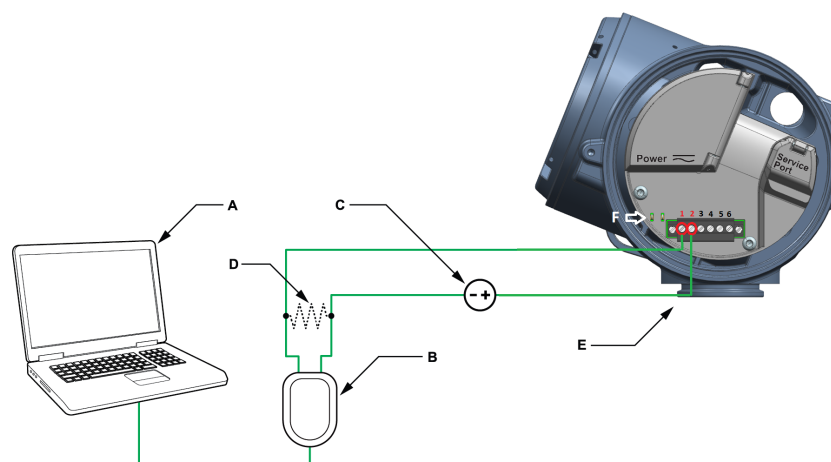
- a. Open the transmitter wiring compartment.
- b. Connect the leads from the signal converter to terminals 1 and 2 on the transmitter, or to the HART connection posts.

Tip

HART connections are not polarity-sensitive. It does not matter which lead a user attaches to which terminal.

- c. Add resistance as necessary to achieve at least one volt across the connection points.

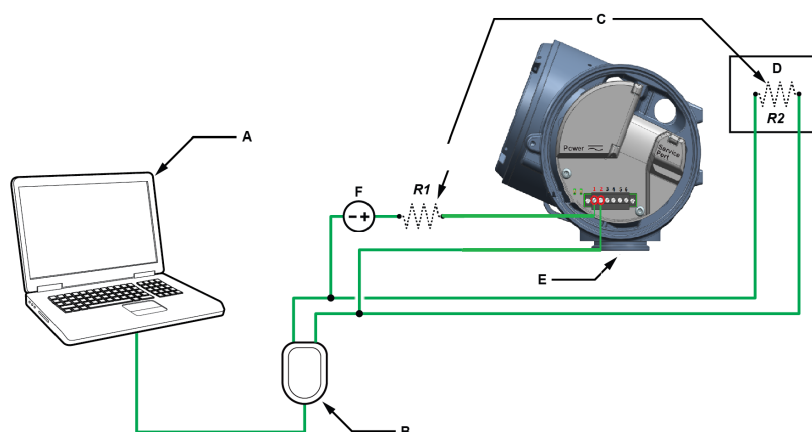
Figure B-4: Connection to mA Output terminals



- A. PC
- B. USB port to Bell 202 converter
- C. External power supply, if required
- D. 250–600 Ω resistance
- E. Transmitter with end-cap removed
- F. HART® connection posts

The signal converter must be connected across a resistance of 250–600 Ω . The mA output requires an external power supply with a minimum of 250 Ω and 17.5 V. Note that many PLCs have a built-in 250- Ω resistor. If the PLC is powering the circuit, be sure to take this into consideration.

3. To connect to a point in the local HART loop:
 - a. Attach the leads from the signal converter to any point in the loop, ensuring that the leads are across the resistor.
 - b. Add resistance as necessary to achieve at least one volt across the connection points.

Figure B-5: Connection over local loop

- A. PC
- B. USB port to Bell 202 converter
- C. Any combination of resistors R1 and R2 as necessary to meet HART® communication resistance requirements
- D. DCS or PLC
- E. Transmitter with end-cap removed
- F. External power supply, if required

The signal converter must be connected across a resistance of 250–600 Ω . The mA output requires an external power supply with a minimum of 250 Ω and 11 V. To meet the resistance requirements, a user may use any combination of resistors R1 and R2. Note that many PLCs have a built-in 250- Ω resistor. If the PLC is powering the circuit, be sure to take this into consideration.

4. To connect over a HART® multidrop network:
 - a. Attach the leads from the signal converter to any point on the network.
 - b. Add resistance as necessary to achieve at least one volt across the connection points.
5. Start ProLink III.
6. Choose **Connect to Physical Device**.
7. Set **Protocol** to **HART Bell 202**.
8. When using a USB signal converter, enable **Toggle RTS**.
9. Set **Address/Tag** to the HART polling address configured in the transmitter.

Tip

- If this is the first time connecting to the transmitter, use the default address: 0.
- When not in a HART multidrop environment, the HART polling address is typically left at the default value.
- If unsure of the transmitter address, click **Poll**. The program will search the network and return a list of the transmitters that it detects.

10. Set the **PC Port** value to the PC COM port used for this connection.
11. Select **Connect**.

If an error message appears:

- Verify the HART® address of the transmitter, or poll HART addresses 1–15.
- Ensure that the correct port on the PC has been specified.
- Check the wiring between the PC and the transmitter.
- If the channel is configured for external power, ensure that the mA output is powered.
- Increase or decrease resistance.
- Disable burst mode.
- Ensure that the resistor is installed correctly. If the mA output is internally powered (active), the resistor must be installed in parallel. If the mA output is externally powered (passive), the resistor must be installed in series.
- Ensure that there is no conflict with another HART master. If any other host (DCS or PLC) is connected to the mA output, temporarily disconnect the DCS or PLC wiring.

Appendix C Using a field communicator with the transmitter

C.1 Basic information about field communicators

A field communicator is a handheld configuration and management tool that can be used with a variety of devices, including Rosemount transmitters. It provides complete access to transmitter functions and data.

C.1.1 Field communicator documentation

Most of the instructions in this manual assume familiarity with field communicators and can perform the following tasks:

- Turn on the field communicator
- Navigate the field communicator menus
- Establish communication with HART®-compatible devices
- Send configuration data to the device
- Use the alpha keys to enter information

C.1.2 Device descriptions (DDs)

In order for the field communicator to work with the device, the appropriate device description (DD) must be installed. Make sure that the DD version matches the transmitter version.

To view the device descriptions that are installed on your field communicator:

Type of field communicator	Procedure
AMS TREX	1. In the field communicator, tap either HART or Fieldbus Offline on the Connect → Select screen. 2. Tap Simulate → Device manufacturer → Device type. 3. Select the device revision and the device description revision.

If the required description is not listed, use the field communicator's upgrade utility to install the device description or contact customer support.

C.1.3 Field communicator menus and messages

This manual does not document all messages and notes from the field communicator.

Important

The user is responsible for responding to messages and notes and complying with all safety messages.

C.2 Connect with a field communicator

A connection from a field communicator to your transmitter allows access to process data, transmitter configuration, performing maintenance and troubleshooting tasks.

Prerequisites

The following HART® device description (DD) must be installed on the field communicator : 9732 Dev v1 DD V1 or later.

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up.

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

Important

If the HART security switch is set to **ON**, HART protocol cannot be used to perform any action that requires writing to the transmitter. For example, a user cannot change the configuration, reset totalizers, or perform calibration changes using a field communicator with a HART connection. When the security switch is set to **OFF**, no functions are disabled.

Procedure

1. To connect to a point in the local HART loop, attach the leads from the field communicator to any point in the loop and add resistance as necessary.
The field communicator must be connected across a resistance of 250–600 Ω.
2. To connect to a point in the HART multidrop network, attach the leads from the field communicator to any point on the network.
3. Turn on the field communicator and wait until the main menu is displayed.
4. If connecting across a multidrop network:
 - Set the field communicator to poll. The device returns all valid addresses.
 - Enter the HART address of the transmitter. The default HART address is 0. However, in a multidrop network, the HART address has probably been set to a different, unique value.

After completing the task:

To navigate to the **Online** menu, choose **HART Application → Online**. Most configuration, maintenance, and troubleshooting tasks are performed from the **Online** menu.

Tip

A user may see messages related to the DD or active alerts. Carefully read any messages and proceed as directed.

Other:

A field communicator requires a minimum of 1 Vdc across the connection leads to communicate. If necessary, increase the resistance at the connection point until 1 Vdc is achieved.

Appendix D View Spectrum approvals

Spectrum management promotes and regulates the efficient use of radio frequencies. Use this section to view the spectrum approvals for this device.

Display	Menu → About → Spectrum Approvals
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Note

Spectrum approvals can only be viewed using the display. Spectrum approvals are listed in the *Rosemount 9732 Magnetic Flow Meter Transmitter Product Data Sheet*.

Appendix E Modbus® coil and register map

Here is a complete listing of the registers and coils available in the transmitter.

Table E-1: Modbus Registers

Register	Description	Parameter type	Work level access	Write protect?
5574	Alert current status - latched until acknowledged. Shared with Local Display. 1 bit per alert as below Bit 0: Electronics Failure Bit 1: Sensor Failure Bit 2: Configuration Error Bit 3: Reserved Bit 4: Security Breach Bit 5: Sensor/Xmtr Comm Error Bit 6: Sensor Out of Range Bit 7: Flowmeter Initializing Bit 8: Calibration Required Bit 9: Simulation Mode Bit 10: Fixed Output Bit 11: Saturated Output Bit 12: Process Aberration Bit 13: Event Active Bit 14: Process Noise Detected Bit 15: Ground Wiring Fault Bit 16: Smart Fluid Diagnostic Failure Bit 17: Electronics Temp Out of Range Bit 18: Continuous SMV Failure Bit 19: Empty pipe Detected Bit 20: Electrode Coating 1 Bit 21: Electrode Coating 2 Bit 22: Reverse Flow Bit 23: Configuration Warning Bit 24: Electronics Warning Note Writable when Alert Simulation is enabled (coil 521).	U32	RW	N
3021	Volume flow rate	F32	R	N
3023	Mass flow rate	F32	R	N
3025	Velocity Flow Rate	F32	R	N
12	Analog Output 1 Source	U16	RW	Y
13	Analog Output 2 Source	U16	RW	Y
14	Frequency Output 1 Source	U16	RW	Y
15	Quaternary variable (QV)	U16	RW	Y
16	Transmitter software revision – (xxxx.x format, e.g., 14.1 means rev 14.1)	U16	R	N
39	Mass flow rate unit	U16	RW	Y
40	Density unit	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
41	Temperature unit	U16	RW	Y
42	Volume flow rate unit	U16	RW	Y
45	Mass total/inv unit	U16	RW	Y
46	Volume total/inv unit	U16	RW	Y
47	HART Address	U16	RW	Y
48	Final assembly number	U32	RW	Y
50	Date: Day (low order byte)	U8	RW	Y
51	Date: Month/Year Month = High byte order Year = Low byte order	U16	RW	Y
52	Special mass flow unit string	A8	RW	Y
56	Special volume flow unit string	A8	RW	Y
60	Primary Analog Output variable	A8	RW	Y
64	Special volume total (or inventory) unit string	A8	RW	Y
68	Tag	A8	RW	Y
96	Description	A16	RW	Y
104	Message	A32	RW	Y
120	Device type code	U16	R	N
121	Manufacturer ID	U16	R	N
122	HART Device ID	U24	RW	Y
124	Digital Communication Fault Action code	U16	RW	Y
127	Sensor serial number	U32	RW	Y
129	Flange type	U16	RW	Y
130	Sensor material	U16	RW	Y
131	Liner material	U16	RW	Y
132	Base mass unit for special mass unit	U16	RW	Y
133	Base time unit for special mass unit	U16	RW	Y
134	Base volume unit for special volume unit	U16	RW	Y
135	Base time unit for special volume unit	U16	RW	Y
143	Analog Output 1 Fixed Current (mA)	F32	RW	Y
145	Analog Output 2 Fixed Current (mA)	F32	RW	Y
147	Fixed frequency (Hertz)	F32	RW	Y
165	Upper Sensor Limit - Mass Flow	F32	R	N
167	High temperature limit of sensor	F32	R	N
171	Upper Sensor Limit - Volume Flow	F32	R	N
173	Lower Sensor Limit - Mass Flow	F32	R	N

Register	Description	Parameter type	Work level access	Write protect?
175	Low temperature limit of sensor	F32	R	N
179	Lower Sensor Limit - Volume	F32	R	N
181	Minimum Span - Mass Flow	F32	R	N
183	Temperature minimum range	F32	R	N
187	Minimum Span - Volume Flow	F32	R	N
189	Flow Damping	F32	R	Y
195	Low Flow Cutoff - Mass Flow	F32	R	Y
197	Low Flow Cutoff - Volume Flow	F32	R	Y
203	Analog Output 1 mA	F32	R	N
205	Analog Output 1 Damping	F32	RW	Y
207	Analog Output 1 Low Flow Cutoff	F32	RW	Y
209	Analog Output 1 Upper Range Value (URV)	F32	RW	Y
211	Analog Output 1 Lower Range Value (LRV)	F32	RW	Y
213	Analog Output 2 mA	F32	R	N
215	Analog Output 2 Damping	F32	RW	Y
217	Analog Output 2 Low Flow Cutoff	F32	RW	Y
219	Analog Output 2 Upper Range Value (URV)	F32	RW	Y
221	Analog Output 2 Lower Range Value (LRV)	F32	RW	Y
223	Frequency Output 1 Frequency Factor	F32	RW	Y
225	Frequency Output 1 Rate Factor	F32	RW	Y
229	Frequency Output 1 Hz	F32	R	Y
237	Special mass unit conversion factor	F32	RW	Y
239	Special volume unit conversion factor	F32	RW	Y
249	Density	F32	RW	Y
285	Meter Factor	F32	RW	Y
287	Combined Low Frequency AutoZero Value (Cal Number AutoZero + AutoZero Service)	F32	R	N
289	Combined High Frequency AutoZero Value (Cal Number AutoZero + AutoZero Service)	F32	R	N
291	Digital Trim and AutoZero Calibration Status	U32	R	N
293	Low Frequency AutoZero Value (AutoZero Service)	F32	RW	Y
295	High Frequency AutoZero Value (AutoZero Service)	F32	RW	Y
297	AC Line Noise Filter	U8	RW	Y
313	Modbus Address	U16	RW	Y
314	Fault Timeout (seconds)	U16	RW	Y
315	Core Board Processor Firmware Checksum	U32	R	N

Register	Description	Parameter type	Work level access	Write protect?
352	Configuration Change Counter incremented for all config writes through any interface (i.e. HART, Modbus, Local Display, etc). Only 0 can be written (to clear it)	U16	RW	N
353	Host Locked Status - 1 indicates that host cannot write to configuration data Bit #0 - Write Protect Switch (reads state of write protect switch - not writable) Bit #1 - HART Primary Master (NOTE: reserved but not currently used. it is handled internally by HART stack) Bit #2 - HART Secondary Master (NOTE: reserved but not currently used. it is handled internally by HART stack) Bit #3 - Modbus User Port Bit #4 - Reserved Bit #5 - Modbus Service Port Bit #6 - Local Display Bit #7 - Reserved Bit #8 - Reserved Bit #9 - Reserved Bit #10 - Reserved Bit #11 - Modbus TCP Bit #12 - Reserved Bit #13 - BLE Bit #14 - unused Bit #15 - unused	U16	RW	N
355	mAI Actual current being measured	F32	R	N
363	Empty Pipe Value Units	U8	R	N
364	Empty Pipe Trigger Time	F32	RW	Y
366	Empty Pipe Trigger Level	F32	RW	Y
383	Core Board Temperature	F32	R	N
385	Core Board Input Voltage (Volts)	F32	R	N
387	Lower Sensor Limit - Primary Variable	F32	R	N
389	Upper Sensor Limit - Primary Variable	F32	R	N
391	Minimum Span - Primary Variable	F32	R	N
397	IO Board Temperature (Processor Chip Die Temperature)	F32	R	N
401	Coil Inductance Baseline	F32	RW	Y
403	Coil Resistance Baseline	F32	RW	Y
405	Electrode Resistance Baseline	F32	RW	Y
443	IO Board Maximum Recorded Temperature	F32	R	N
445	IO Board Minimum Recorded Temperature	F32	R	N
447	IO Board Average Recorded Temperature	F32	R	N
463	Core Board Maximum Recorded Temperature	F32	R	N

Register	Description	Parameter type	Work level access	Write protect?
465	Core Board Minimum Recorded Temperature	F32	R	N
467	Core Board Average Recorded Temperature	F32	R	N
479	Signal Processing Mode	U8	RW	Y
480	Signal Processing Averaging Time	F32	RW	Y
482	Signal Processing Mode	F32	RW	Y
484	Signal Processing Noise Level	F32	R	N
486	Signal Processing Scan Time	U8	RW	Y
488	Signal Processing Time Limit	F32	RW	Y
497	Core Board Power Cycle Count	U16	R	N
498	Core Board EEPROM Configuration "A" Copy Bad on power-up (Count)	U16	R	N
499	Core Board EEPROM Power-Down "B" Copy Bad on power-up (Count)	U16	R	N
502	Transmitter Power Cycle Count	U16	R	N
503	Electrode Coating Resistance Unit	U8	R	N
504	Electrode Coating Resistance Unit	F32	R	N
506	Electrode Coating Level 1 Limit	F32	RW	Y
508	Electrode Coating Level 2 Limit	F32	RW	Y
521	(Enumerated) Floating Point Byte Ordering Type for Modbus	U16	RW	Y
522	Additional Delay to Modbus Response (0-255). Units: 200uS for 38,400 baud; 400uS/19.2; 800uS/9600; 1.6mS/4800; 3.2mS/2400; 6.4mS/1200	U16	RW	Y
593	Velocity (in Feet per Second)	F32	R	N
596	Base Velocity Unit	U8	RW	Y
597	Base time unit for special Velocity Unit	U8	RW	Y
598	Special Velocity unit conversion factor	F32	RW	Y
600	Special Velocity flow unit string	A8	RW	Y
604	Special Velocity total (or inventory) unit string	A8	RW	Y
609	Discrete Event Index (x = 0, 1, 2, 3, 4)	U16	RW	N
610	Discrete Event x Action 0 = Greater than set-point A (process value > A) 1 = Less than set-point A (process value < A) 2 = In Range (A < process value < B)	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
	3 = Out of Range (process value < A or proc value > B)			
611	Discrete Event x Set-point A	F32	RW	Y
613	Discrete Event x Set-point B	F32	RW	Y
615	Discrete Event x Process Variable Code	U16	RW	Y
616	Bit 0 = Discrete Event 1 Status (1=on, 0=off) Bit 1 = Discrete Event 2 Status Bit 2 = Discrete Event 3 Status Bit 3 = Discrete Event 4 Status Bit 4 = Discrete Event 5 Status Bits 5 – 15 = Undefined	U16	R	N
625	Sensor Size	U8	RW	Y
626	Electrode Material Code	U8	RW	Y
627	Electrode Type Code	U8	RW	Y
628	Coil Drive Frequency	U8	RW	Y
629	Sensor Tag	A8	RW	Y
655	Slot 0 Configuration Index	U16	RW	Y
656	Slot 1 Configuration Index	U16	RW	Y
657	Slot 2 Configuration Index	U16	RW	Y
658	Slot 3 Configuration Index	U16	RW	Y
659	Slot 4 Configuration Index	U16	RW	Y
660	Slot 5 Configuration Index	U16	RW	Y
661	Slot 6 Configuration Index	U16	RW	Y
662	Slot 7 Configuration Index	U16	RW	Y
663	Slot 8 Configuration Index	U16	RW	Y
664	Slot 9 Configuration Index	U16	RW	Y
665	Slot 10 Configuration Index	U16	RW	Y
666	Slot 11 Configuration Index	U16	RW	Y
667	Slot 12 Configuration Index	U16	RW	Y
668	Slot 13 Configuration Index	U16	RW	Y
669	Slot 14 Configuration Index	U16	RW	Y
670	Slot 15 Configuration Index	U16	RW	Y
671	Slot 16 Configuration Index	U16	RW	Y
672	Slot 17 Configuration Index	U16	RW	Y
673	Slot 18 Configuration Index	U16	RW	Y
674	Slot 19 Configuration Index	U16	RW	Y
675	Slot 20 Configuration Index	U16	RW	Y
676	Slot 21 Configuration Index	U16	RW	Y
677	Slot 22 Configuration Index	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
678	Slot 23 Configuration Index	U16	RW	Y
679	Slot 24 Configuration Index	U16	RW	Y
680	Slot 25 Configuration Index	U16	RW	Y
681	Slot 26 Configuration Index	U16	RW	Y
682	Slot 27 Configuration Index	U16	RW	Y
683	Slot 28 Configuration Index	U16	RW	Y
684	Slot 29 Configuration Index	U16	RW	Y
685	Slot 30 Configuration Index	U16	RW	Y
686	Slot 31 Configuration Index	U16	RW	Y
687	Slot 0 Configuration	A4	RW	N
689	Slot 1 Configuration	A4	RW	N
691	Slot 2 Configuration	A4	RW	N
693	Slot 3 Configuration	A4	RW	N
695	Slot 4 Configuration	A4	RW	N
697	Slot 5 Configuration	A4	RW	N
699	Slot 6 Configuration	A4	RW	N
701	Slot 7 Configuration	A4	RW	N
703	Slot 8 Configuration	A4	RW	N
705	Slot 9 Configuration	A4	RW	N
707	Slot 10 Configuration	A4	RW	N
709	Slot 11 Configuration	A4	RW	N
711	Slot 12 Configuration	A4	RW	N
713	Slot 13 Configuration	A4	RW	N
715	Slot 14 Configuration	A4	RW	N
717	Slot 15 Configuration	A4	RW	N
719	Slot 16 Configuration	A4	RW	N
721	Slot 17 Configuration	A4	RW	N
723	Slot 18 Configuration	A4	RW	N
725	Slot 19 Configuration	A4	RW	N
727	Slot 20 Configuration	A4	RW	N
729	Slot 21 Configuration	A4	RW	N
731	Slot 22 Configuration	A4	RW	N
733	Slot 23 Configuration	A4	RW	N
735	Slot 24 Configuration	A4	RW	N
737	Slot 25 Configuration	A4	RW	N
739	Slot 26 Configuration	A4	RW	N

Register	Description	Parameter type	Work level access	Write protect?
741	Slot 27 Configuration	A4	RW	N
743	Slot 28 Configuration	A4	RW	N
745	Slot 29 Configuration	A4	RW	N
747	Slot 30 Configuration	A4	RW	N
749	Slot 31 Configuration	A4	RW	N
751	Slot 0 Transmitter Variable Index	U16	RW	Y
752	Slot 1 Transmitter Variable Index	U16	RW	Y
753	Slot 2 Transmitter Variable Index	U16	RW	Y
754	Slot 3 Transmitter Variable Index	U16	RW	Y
755	Slot 4 Transmitter Variable Index	U16	RW	Y
756	Slot 5 Transmitter Variable Index	U16	RW	Y
757	Slot 6 Transmitter Variable Index	U16	RW	Y
758	Slot 7 Transmitter Variable Index	U16	RW	Y
759	Slot 8 Transmitter Variable Index	U16	RW	Y
760	Slot 9 Transmitter Variable Index	U16	RW	Y
761	Slot 10 Transmitter Variable Index	U16	RW	Y
762	Slot 11 Transmitter Variable Index	U16	RW	Y
763	Slot 12 Transmitter Variable Index	U16	RW	Y
764	Slot 13 Transmitter Variable Index	U16	RW	Y
765	Slot 14 Transmitter Variable Index	U16	RW	Y
766	Slot 15 Transmitter Variable Index	U16	RW	Y
767	Slot 16 Transmitter Variable Index	U16	RW	Y
768	Slot 17 Transmitter Variable Index	U16	RW	Y
769	Slot 18 Transmitter Variable Index	U16	RW	Y
770	Slot 19 Transmitter Variable Index	U16	RW	Y
771	Slot 20 Transmitter Variable Index	U16	RW	Y
772	Slot 21 Transmitter Variable Index	U16	RW	Y
773	Slot 22 Transmitter Variable Index	U16	RW	Y
774	Slot 23 Transmitter Variable Index	U16	RW	Y
775	Slot 24 Transmitter Variable Index	U16	RW	Y
776	Slot 25 Transmitter Variable Index	U16	RW	Y
777	Slot 26 Transmitter Variable Index	U16	RW	Y
778	Slot 27 Transmitter Variable Index	U16	RW	Y
779	Slot 28 Transmitter Variable Index	U16	RW	Y
780	Slot 29 Transmitter Variable Index	U16	RW	Y
781	Slot 30 Transmitter Variable Index	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
782	Slot 31 Transmitter Variable Index	U16	RW	Y
783	Slot 0 Transmitter Variable	A4	R	N
785	Slot 1 Transmitter Variable	A4	R	N
787	Slot 2 Transmitter Variable	A4	R	N
789	Slot 3 Transmitter Variable	A4	R	N
791	Slot 4 Transmitter Variable	A4	R	N
793	Slot 5 Transmitter Variable	A4	R	N
795	Slot 6 Transmitter Variable	A4	R	N
797	Slot 7 Transmitter Variable	A4	R	N
799	Slot 8 Transmitter Variable	A4	R	N
801	Slot 9 Transmitter Variable	A4	R	N
803	Slot 10 Transmitter Variable	A4	R	N
805	Slot 11 Transmitter Variable	A4	R	N
807	Slot 12 Transmitter Variable	A4	R	N
809	Slot 13 Transmitter Variable	A4	R	N
811	Slot 14 Transmitter Variable	A4	R	N
813	Slot 15 Transmitter Variable	A4	R	N
815	Slot 16 Transmitter Variable	A4	R	N
817	Slot 17 Transmitter Variable	A4	R	N
819	Slot 18 Transmitter Variable	A4	R	N
821	Slot 19 Transmitter Variable	A4	R	N
823	Slot 20 Transmitter Variable	A4	R	N
825	Slot 21 Transmitter Variable	A4	R	N
827	Slot 22 Transmitter Variable	A4	R	N
829	Slot 23 Transmitter Variable	A4	R	N
831	Slot 24 Transmitter Variable	A4	R	N
833	Slot 25 Transmitter Variable	A4	R	N
835	Slot 26 Transmitter Variable	A4	R	N
837	Slot 27 Transmitter Variable	A4	R	N
839	Slot 28 Transmitter Variable	A4	R	N
841	Slot 29 Transmitter Variable	A4	R	N
843	Slot 30 Transmitter Variable	A4	R	N
845	Slot 31 Transmitter Variable	A4	R	N
936	ON time since last reset/power cycle	U32	R	N
938	Core Board ON time since last reset/power cycle	U32	R	N
940	Core Board Power-ON time	U32	R	N

Register	Description	Parameter type	Work level access	Write protect?
942	Core Board Watch Dog Time timeout counter (increments for each Kinetis core WDT reset)	U32	R	N
995	Base Model Number	A22	RW	N
1055	Core Board processor final assembly number	U32	RW	Y
1060	IO Board ROM checksum	U32	R	N
1062	Core Board ROM Checksum	U32	R	N
1064	Core Firmware ROM Checksum	U32	R	N
1101	Frequency Output Pulses per Unit	F32	RW	Y
1103	Frequency Output Units per Pulse	F32	RW	Y
1105	Frequency Output fault setting for upscale (Hz)	F32	RW	Y
1107	Frequency Output Fault Code	U16	RW	Y
1108	Frequency Output Scaling Method	U16	RW	Y
1109	Analog Output 1 Fault Level (mA)	F32	RW	Y
1111	Analog Output 2 Fault Level (mA)	F32	RW	Y
1113	Analog Output 1 Fault Action	U16	RW	Y
1114	Analog Output 2 Fault Action	U16	RW	Y
1116	Display Auto Scroll Rate (1 to 30 seconds)	U16	RW	Y
1117	Display Process Variable #1	U16	RW	Y
1118	Display Process Variable #2	U16	RW	Y
1119	Display Process Variable #3	U16	RW	Y
1120	Display Process Variable #4	U16	RW	Y
1121	Display Process Variable #5	U16	RW	Y
1122	Display Process Variable #6	U16	RW	Y
1123	Display Process Variable #7	U16	RW	Y
1124	Display Process Variable #8	U16	RW	Y
1125	Display Process Variable #9	U16	RW	Y
1126	Display Process Variable #10	U16	RW	Y
1127	Display Process Variable #11	U16	RW	Y
1128	Display Process Variable #12	U16	RW	Y
1129	Display Process Variable #13	U16	RW	Y
1130	Display Process Variable #14	U16	RW	Y
1131	Display Process Variable #15	U16	RW	Y
1137	Attached Core Board Software revision	U16	RW	N
1151	Discrete Output 1 Assignment	U16	RW	Y
1152	Discrete Output 1 Polarity (0 = active low, 1 = active high)	U16	RW	Y
1153	Discrete Output 2 Assignment	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
1154	Discrete Output 2 Polarity (0 = active low, 1 = active high)	U16	RW	Y
1162	Device Type Code for attached Core Board	U16	R	N
1166	Channel A Type	U16	RW	Y
1167	Channel B Type	U16	RW	Y
1168	Channel C Type	U16	R	N
1173	Channel A Power	U16	RW	Y
1174	Channel B Power	U16	RW	Y
1178	Discrete Input 1 Polarity (0 = active low, 1 = active high)	U16	RW	Y
1181	Frequency Output Mode	U16	RW	Y
1182	Discrete Output 1 Fixed Value	U16	RW	Y
1183	Discrete Output 2 Fixed Value	U16	RW	Y
1187	Attached Core Board HART device I.D. number	U24	RW	Y
1189	Analog Output 1 4 mA Trim Constant	F32	RW	Y
1191	Analog Output 1 20 mA Trim Constant	F32	RW	Y
1193	Analog Output 2 4 mA Trim Constant	F32	RW	Y
1195	Analog Output 2 4 mA Trim Constant	F32	RW	Y
1200	IO Board Software Version Number (xxx.xx format – 612 means rev 6.12)	U16	R	N
1215	Real-time clock: seconds (0-59)	U16	R	N
1216	Real-time clock: minutes (0-59)	U16	R	N
1217	Real-time clock: hours (0-23)	U16	R	N
1218	Real-time clock: day (1-31)	U16	R	N
1219	Real-time clock: month (1-12)	U16	R	N
1220	Real-time clock: year	U16	R	N
1316	Reset Config Total #1 (For DI and Discrete Event)	U16	RW	Y
1317	Reset Config Total #2(For DI and Discrete Event)	U16	RW	Y
1318	Reset Config Total #3 (For DI and Discrete Event)	U16	RW	Y
1319	Reset Config Total #5 (For DI and Discrete Event)	U16	RW	Y
1320	Reset Config Total #6 (For DI and Discrete Event)	U16	RW	Y
1321	Reset Config Total #7 (For DI and Discrete Event)	U16	RW	Y
1322	Reset All Totals (For DI and Discrete Event)	U16	RW	Y
1323	Start/Stop All Totals (For DI and Discrete Event)	U16	RW	Y
1335	Reset Config Total #4 (For DI and Discrete Event)	U16	RW	Y
1341	Start meter verification (For DI and Discrete Event)	U16	RW	Y
1344	Modbus Double Precision Floating Point Byte Order	U16	RW	Y
1359	Display language	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
1360	Display Type	U8	R	N
1367	Process Variable Code	U16	RW	N
1368	Process Variablen – number of digits displayed to right of decimal point (0 to 5)	U16	RW	Y
1487	Core Board Bootloader Software revision	U16	R	N
1488	IO Board Bootloader revision (x.xx format)	U16	R	N
1489	Long Tag	A32	RW	Y
1517	Transmitter Firmware Checksum	U32	R	N
2001	Baseline Electrode Impedance Common Mode Resistance	F32	RW	Y
2003	Baseline Electrode Impedance Positive Resistance	F32	RW	Y
2005	Baseline Electrode Impedance Negative Resistance	F32	RW	Y
2007	Baseline Electrode Impedance High Frequency Differential Resistance	F32	RW	Y
2009	Baseline Electrode Impedance High Frequency Common Mode Resistance	F32	RW	Y
2556	Lock Device Status	U8	R	N
2557	Burst Message Index (0-2)	U8	RW	N
2558	Burst Message Control (indexed)	U8	RW	Y
2559	Burst Message Command (indexed)	U16	RW	Y
2560	Burst Message Trigger Mode (indexed)	U8	RW	Y
2561	Burst Message Trigger Value (indexed)	F32	RW	Y
2563	Burst Message Update Time (indexed)	U32	RW	Y
2565	Burst Message Max Update Time (indexed)	U32	RW	Y
2567	Burst Message Variable 0 (indexed)	U8	RW	Y
2568	Burst Message Variable 1 (indexed)	U8	RW	Y
2569	Burst Message Variable 2 (indexed)	U8	RW	Y
2570	Burst Message Variable 3 (indexed)	U8	RW	Y
2571	Burst Message Variable 4 (indexed)	U8	RW	Y
2572	Burst Message Variable 5 (indexed)	U8	RW	Y
2573	Burst Message Variable 6 (indexed)	U8	RW	Y
2574	Burst Message Variable 7 (indexed)	U8	RW	Y
2598	Unique Hart ID of last connected Core Board	U32	RW	N
2615	Discrete Output 1 Fault Indication (refer to discrete output fault codes)	U16	RW	Y
2616	Discrete Output 2 Fault Indication (refer to discrete output fault codes)	U16	RW	Y
2619	Totalizer Reset Option for Custody Transfer		RW	Y

Register	Description	Parameter type	Work level access	Write protect?
2620	Bell-202 HART Loop Current Mode (0=Disabled, 1=Enabled)	U16	RW	Y
2621	Display update period (milliseconds) - The range is (100 - 10,000 ms)	U16	RW	Y
2622	Backlight intensity (0=off to 100=full on)	U16	RW	Y
2625	Xmtr Power-ON time	U32	R	N
2907	Config Total #1 Direction Config Register	U16	RW	Y
2908	Config Total #2 Direction Config Register	U16	RW	Y
2909	Config Total #3 Direction Config Register	U16	RW	Y
2910	Config Total #4 Direction Config Register	U16	RW	Y
2911	Config Total #5 Direction Config Register	U16	RW	Y
2912	Config Total #6 Direction Config Register	U16	RW	Y
2913	Config Total #7 Direction Config Register	U16	RW	Y
2914	Config Inv #1 Direction Config Register	U16	RW	Y
2915	Config Inv #2 Direction Config Register	U16	RW	Y
2916	Config Inv #3 Direction Config Register	U16	RW	Y
2917	Config Inv #4 Direction Config Register	U16	RW	Y
2918	Config Inv #5 Direction Config Register	U16	RW	Y
2919	Config Inv #6 Direction Config Register	U16	RW	Y
2920	Config Inv #7 Direction Config Register	U16	RW	Y
2921	Config Total #1 Source Config Register	U16	RW	Y
2922	Config Total #2 Source Config Register	U16	RW	Y
2923	Config Total #3 Source Config Register	U16	RW	Y
2924	Config Total #4 Source Config Register	U16	RW	Y
2925	Config Total #5 Source Config Register	U16	RW	Y
2926	Config Total #6 Source Config Register	U16	RW	Y
2927	Config Total #7 Source Config Register	U16	RW	Y
2928	Config Inv #1 Source Config Register	U16	RW	Y
2929	Config Inv #2 Source Config Register	U16	RW	Y
2930	Config Inv #3 Source Config Register	U16	RW	Y
2931	Config Inv #4 Source Config Register	U16	RW	Y
2932	Config Inv #5 Source Config Register	U16	RW	Y
2933	Config Inv #6 Source Config Register	U16	RW	Y
2934	Config Inv #7 Source Config Register	U16	RW	Y
2935	Config Total #1 Units Code Register	U16	RW	Y
2936	Config Total #2 Units Code Register	U16	RW	Y
2937	Config Total #3 Units Code Register	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
2938	Config Total #4 Units Code Register	U16	RW	Y
2939	Config Total #5 Units Code Register	U16	RW	Y
2940	Config Total #6 Units Code Register	U16	RW	Y
2941	Config Total #7 Units Code Register	U16	RW	Y
2942	Config Inv #1 Units Code Register	U16	RW	Y
2943	Config Inv #2 Units Code Register	U16	RW	Y
2944	Config Inv #3 Units Code Register	U16	RW	Y
2945	Config Inv #4 Units Code Register	U16	RW	Y
2946	Config Inv #5Units Code Register	U16	RW	Y
2947	Config Inv #6 Units Code Register	U16	RW	Y
2948	Config Inv #7 Units Code Register	U16	RW	Y
2960	Type of Sensor	U8	RW	Y
2961	Sensor Calibration Mode Configuration 1 0xABCD A = Future B = Future C = Future D = Max Drive Voltage	U16	RW	Y
2962	Sensor Calibration Mode Configuration 2 0xEFGH E = Low Current F = Low Freq G = High Current H = High Freq	U16	RW	Y
2963	Low Frequency Sensor Gain	U32	RW	Y
2965	High Frequency Sensor Gain	U32	RW	Y
2967	Zero Offset	U16	RW	Y
2968	Sensor AutoZero value for Frequency Low (Cal Number AutoZero)	U16	RW	Y
2969	Sensor AutoZero value for Frequency High (Cal Number AutoZero)	U16	RW	Y
2970	Gain shift per mA	U16	RW	Y
3027	Total 1	F32	R	N
3029	Inventory 1	F32	R	N
3031	Total 2	F32	R	N
3033	Inventory 2	F32	R	N
3035	Total 3	F32	R	N
3037	Inventory 3	F32	R	N
3039	Total 4	F32	R	N
3041	Inventory 4	F32	R	N
3043	Total 5	F32	R	N
3045	Inventory 5	F32	R	N
3047	Total 6	F32	R	N
3049	Inventory 6	F32	R	N
3051	Total 7	F32	R	N

Register	Description	Parameter type	Work level access	Write protect?
3053	Inventory 7	F32	R	N
3057	Line Noise	F32	R	N
3059	Low Frequency Signal to Noise Ratio	F32	R	N
3061	High Frequency Signal to Noise Ratio	F32	R	N
3063	Signal Power	F32	R	N
3065	Empty Pipe Value	F32	R	N
3067	Continuous Flow Simulation Deviation	F32	R	N
3069	Electrode Coating Value	F32	R	N
3071	Continuous Electrode Resistance Value	F32	R	N
3073	Continuous Coil Resistance Value	F32	R	N
3075	Continuous Coil Inductance Value	F32	R	N
3077	Continuous Coil Inductance Deviation	F32	R	N
3079	Continuous Flow Simulation Value	F32	R	N
3081	Coil Current	F32	R	N
3083	Continuous Analog Feedback Deviation	F32	R	N
3085	Electrode Voltage Value	F32	R	N
3101	Smart Fluid Diagnostic Trigger Level	F32	RW	Y
3103	Smart Fluid Diagnostic Trigger Time	F32	RW	Y
3105	Smart Fluid Diagnostic Process Noise Value	F32	R	N
3107	Smart Fluid Diagnostic FFT Bin 0	F32	R	N
3109	Smart Fluid Diagnostic FFT Bin 1	F32	R	N
3111	Smart Fluid Diagnostic FFT Bin 2	F32	R	N
3113	Smart Fluid Diagnostic FFT Bin 3	F32	R	N
3115	Smart Fluid Diagnostic FFT Bin 4	F32	R	N
3117	Smart Fluid Diagnostic FFT Bin 5	F32	R	N
3119	Smart Fluid Diagnostic FFT Bin 6	F32	R	N
3121	Smart Fluid Diagnostic FFT Bin 7	F32	R	N
3123	Smart Fluid Diagnostic FFT Bin 8	F32	R	N
3125	Smart Fluid Diagnostic FFT Bin 9	F32	R	N
3127	Line Noise Mode	U16	RW	Y
3128	Process Noise Mode	U16	RW	Y
3129	Line Noise Trigger Level	F32	RW	Y
3131	Process Noise Trigger Level	F32	RW	Y
3133	Smart Fluid Diagnostic Mode	U16	RW	Y
3171	Velocity Flow waveform selection (1=fixed value, 2=sawtooth, 3=sine wave)	U16	RW	Y
3175	Value for a fixed Velocity flow in simulation mode	F32	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
3177	Min. amplitude of Sine / Sawtooth wave for Velocity flow	F32	RW	Y
3179	Max. amplitude of Sine / Sawtooth wave for Velocity flow	F32	RW	Y
3181	Period of Sine / Sawtooth wave for Velocity flow	F32	RW	Y
4075	Flow velocity units	U16	RW	Y
4077	Low Flow Cutoff - Velocity	F32	RW	Y
4079	Upper Sensor Limit - Velocity	F32	R	N
4081	Lower Sensor Limit - Velocity	F32	R	N
4083	Minimum Span - Velocity	F32	R	N
4200	Total 1 - Double - user units	F64	R	N
4204	Total 2 - Double - user units	F64	R	N
4208	Total 3 - Double - user units	F64	R	N
4212	Total 4- Double - user units	F64	R	N
4216	Total 5 - Double - user units	F64	R	N
4220	Total 6 - Double - user units	F64	R	N
4224	Total 7 - Double - user units	F64	R	N
4228	Inventory 1 - Double - user units	F64	R	N
4232	Inventory 2 - Double - user units	F64	R	N
4236	Inventory 3 - Double - user units	F64	R	N
4240	Inventory 4 - Double - user units	F64	R	N
4244	Inventory 5 - Double - user units	F64	R	N
4248	Inventory 6 - Double - user units	F64	R	N
4252	Inventory 7 - Double - user units	F64	R	N
4900	Gen5 Burst Mode Enable	U16	R	N
4961	Frequency Output 2 Source	U16	RW	Y
4962	Frequency Output 2 Fault Action	U16	RW	Y
4963	Frequency Output 2 Hz	F32	R	N
4965	Frequency Output 2 Fixed Value	F32	RW	Y
4967	Frequency Output 2 Fault Level	F32	RW	Y
4969	Frequency Output 2 Frequency Factor	F32	RW	Y
4971	Frequency Output 2 Rate Factor	F32	RW	Y
4973	Frequency Output 2 Pulses per Unit	F32	RW	Y
4975	Frequency Output 2 Units per Pulse	F32	RW	Y
4979	MAI 20mATrim Constant	F32	RW	Y
4981	MAI 4mATrim Constant	F32	RW	Y
4987	Analog Output 1 Direction	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
4988	Analog Output 2 Direction	U16	RW	Y
4990-	Frequency Output 1 Direction	U16	RW	Y
4991	Frequency Output 2 Direction	U16	RW	Y
5005	CEQ Number	U16	RW	N
5045	Board Type	U16	R	N
5046	Board Revision	U16	R	N
5142	Model Code Options	A64	RW	N
5175	Digital Trim Validate Result	F32	R	N
5177	Digital Trim Validate Progress(% Complete)	F32	R	N
5179	Digital Trim Progress(% Complete)	F32	R	N
5181	Auto Zero Progress (% Complete)	F32	R	N
5183	SMV Progress (% Complete)	U16	R	N
5184	SMV: Run Counter	U16	R	N
5185	Internal Flow Simulator Value units	U8	R	N
5186	Internal Flow Simulator Deviation units	U8	R	N
5187	Coil Inductance Deviation Units	U8	R	N
5188	Coil Inductance Units	U8	R	N
5189	Coil Resistance Units	U8	R	N
5190	Electrode Resistance Units	U8	R	N
5191	Meter Verification Result	U8	R	N
5192	Coil Inductance Test Result	U8	R	N
5193	Coil Resistance Test Result	U8	R	N
5194	Electrode Resistance Test Result	U8	R	N
5195	Internal Simulator Test Result	U8	R	N
5199	SMV Continuous Enable	U8	RW	Y
5200	Meter Verification Test Limit	U8	RW	Y
5201	Continuous Meter Verification Test Limit	U8	RW	Y
5202	Meter Verification Test Scope	U8	RW	N
5203	Meter Verification Test Condition	U8	R	N
5204	Flow Simulation Reference Value	F32	R	N
5206	Commanded Flow Simulation Value	F32	R	N
5208	Commanded Flow Simulation Deviation	F32	R	N
5210	Commanded Coil Inductance Value	F32	R	N
5212	Commanded Coil Inductance Deviation	F32	R	N
5214	Commanded Coil Resistance Value	F32	R	N
5216	Commanded Electrode Resistance Value	F32	R	N

Register	Description	Parameter type	Work level access	Write protect?
5218	Commanded Analog Feedback Value	F32	R	N
5220	Commanded Analog Feedback Deviation	F32	R	N
5222	Continuous Analog Feedback Value	F32	R	N
5224	Analog Feedback Units	U8	R	N
5225	Analog feedback Test Result	U8	R	N
5226	MV Timers: Time Until First Run in Hours	F32	RW	N
5228	MV Timers: Time between each run after the first run initiated in hours	F32	RW	N
5230	MV Timers: Time left until next run in hours	F32	R	N
5232	Analog Output Setpoint Value (Continuous)	F32	R	N
5250	Analog Output Setpoint Index	U8	RW	N
5251	Analog Output Deviation Units	U8	R	N
5252	Electrode Diff Capacitance Continuous Value	F32	R	N
5254	Electrode CM Resistance Continuous Value	F32	R	N
5256	Electrode CM Capacitance Continuous Value	F32	R	N
5258	Electrode Positive Resistance Continuous Value	F32	R	N
5260	Electrode Positive Capacitance Continuous Value	F32	R	N
5262	Electrode Negative Resistance Continuous Value	F32	R	N
5264	Electrode Negative Capacitance Continuous Value	F32	R	N
5266	Electrode Hi Freq Resistance Continuous Value	F32	R	N
5268	Electrode Hi Freq Capacitance Continuous Value	F32	R	N
5270	Electrode Hi Freq CM Resistance Continuous Value	F32	R	N
5272	Electrode Hi Freq CM Capacitance Continuous Value	F32	R	N
5274	Electrode Diff Capacitance Commanded Value	F32	R	N
5276	Electrode CM Resistance Commanded Value	F32	R	N
5278	Electrode CM Capacitance Commanded Value	F32	R	N
5280	Electrode Positive Resistance Commanded Value	F32	R	N
5282	Electrode Positive Capacitance Commanded Value	F32	R	N
5284	Electrode Negative Resistance Commanded Value	F32	R	N
5286	Electrode Negative Capacitance Commanded Value	F32	R	N
5288	Electrode Hi Freq Resistance Commanded Value	F32	R	N
5290	Electrode Hi Freq Capacitance Commanded Value	F32	R	N
5292	Electrode Hi Freq CM Resistance Commanded Value	F32	R	N
5294	Electrode Hi Freq CM Capacitance Commanded Value	F32	R	N
5296	Schedule Meter Verification Scope	U8	RW	Y
5300	Config Total #1 Name	A16	R	N
5308	Config Total #2 Name	A16	R	N

Register	Description	Parameter type	Work level access	Write protect?
5316	Config Total #3 Name	A16	R	N
5324	Config Total #4 Name	A16	R	N
5332	Config Total #5 Name	A16	R	N
5340	Config Total #6 Name	A16	R	N
5348	Config Total #7 Name	A16	R	N
5356	Config Inv #1 Name	A16	R	N
5364	Config Inv #2 Name	A16	R	N
5372	Config Inv #3Name	A16	R	N
5380	Config Inv #4 Name	A16	R	N
5388	Config Inv #5 Name	A16	R	N
5396	Config Inv #6 Name	A16	R	N
5404	Config Inv #7 Name	A16	R	N
5412	Config Total #1 User-Defined Name	A16	RW	Y
5420	Config Total #2 User-Defined Name	A16	RW	Y
5428	Config Total #3 User-Defined Name	A16	RW	Y
5436	Config Total #4 User-Defined Name	A16	RW	Y
5444	Config Total #5 User-Defined Name	A16	RW	Y
5452	Config Total #6 User-Defined Name	A16	RW	Y
5460	Config Total #7 User-Defined Name	A16	RW	Y
5468	Config Inv #2 User-Defined Name	A16	RW	Y
5476	Config Inv #1 User-Defined Name	A16	RW	Y
5484	Config Inv #3 User-Defined Name	A16	RW	Y
5492	Config Inv #4 User-Defined Name	A16	RW	Y
5500	Config Inv #5 User-Defined Name	A16	RW	Y
5508	Config Inv #6 User-Defined Name	A16	RW	Y
5516	Config Inv #7 User-Defined Name	A16	RW	Y
5524	LCD Contrast	U8	RW	Y
5525	LOI Status LED Setting - dynamic which means device will over write value	U8	RW	N
5526	LOI Network LED Setting - dynamic which means device will over write value	U8	RW	N
5527	LOI Link LED setting - dynamic which means device will over write value	U8	RW	N
5538	LOI Firmware Revision	U8	R	N
5542	LOI Status	U8	R	N
5543	LOI Raw button states bit7 = Left (0x80) bit6 = Up (0x40) bit5 = Down (0x20) bit4 = Right (0x10)	U16	R	N
5546	LCD Power setting	U16	RW	N

Register	Description	Parameter type	Work level access	Write protect?
5548	Password for configuration and alert access	A4	RW	Y
5556	Core Board Temperature Max Timestamp	U32	R	N
5558	Core Board Temperature Min Timestamp	U32	R	N
5560	IO Board Temperature Max Timestamp	U32	R	N
5562	IO Board Temperature Min Timestamp	U32	R	N
5576	Alert 1 - 4 severity condensed into nibbles with Alert 1 in least significant nibble and Alert 4 in most significant nibble	U16	RW	Y
5577	Alert 5 - 8 severity condensed into nibbles with Alert 5 in least significant nibble and Alert 8 in most significant nibble	U16	RW	Y
5578	Alert 9 - 12 severity condensed into nibbles with Alert 9 in least significant nibble and Alert 12 in most significant nibble	U16	RW	Y
5579	Alert 13 - 16 severity condensed into nibbles with Alert 13 in least significant nibble and Alert 16 in most significant nibble	U16	RW	Y
5580	Alert 17 - 20 severity condensed into nibbles with Alert 17 in least significant nibble and Alert 20 in most significant nibble	U16	RW	Y
5581	Alert 21 - 24 severity condensed into nibbles with Alert 21 in least significant nibble and Alert 24 in most significant nibble	U16	RW	Y
5582	Alert 25 - 28 severity condensed into nibbles with Alert 25 in least significant nibble and Alert 28 in most significant nibble	U16	RW	Y
5583	Alert 29 - 32 severity condensed into nibbles with Alert 29 in least significant nibble and Alert 32 in most significant nibble	U16	RW	Y
5584	Ignore Alerts - 1 bit per alert. 1=ignore, 0=don't ignore	U32	RW	Y
5586	Condition register 0 Bit #0: Core ROM/RAM Failure Bit #1: Core NVM failure Bit #2: Transmitter ROM/RAM Failure Bit #3: Transmitter NVM failure Bit #4: Transmitter Watchdog Error Bit #5: Core Watchdog Error Bit #6: LPC Watchdog Error Bit #7: Verification of AO1 Fail Bit #8: Update Missed Error Bit #9: Coil Short Detected Bit #10: Coil Open Circuit Bit #11: Coil Over Current Detect Bit #12: Sensor Electrode Sat Bit #13: Coil Power Limit Bit #14: Coil Fault Bit #15: Board Type Incorrect	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
5587	Condition register 1 Bit #0: Core Software Update Fail Bit #1: No Password Bit #2: Time not Entered Bit #3: Core has ETO Bit #4: Rail Failure Bit #5: Security Breach Bit #6: Core/XMTR Comm. Fail Bit #7: Core Processor Write Fail Bit #8: Sensor Out of Range Bit #9: Transmitter Initializing Bit #10: Digital Trim Required Bit #11: Simulation Mode Active Bit #12: AO1 Fixed Bit #13: AO2 Fixed Bit #14: FO1 Fixed Bit #15: FO2 Fixed	U16	RW	Y
5588	Condition register 2 Bit #0: DO1 Fixed Bit #1: DO2 Fixed Bit #2: AO1 Saturated Bit #3: AO2 Saturated Bit #4: FO1 Saturated Bit #5: FO2 Saturated Bit #6: External Input Error Bit #7: Discrete Event 1 Active Bit #8: Discrete Event 2 Active Bit #9: Discrete Event 3 Active Bit #10: Discrete Event 4 Active Bit #11: Discrete Event 5 Active Bit #12: High Process Noise Detect Bit #13: Grounding/Wiring Fault Bit #14: Smart Fluid Diagnostic Fault Bit #15: IO Board Temperature Out of Range	U16	RW	Y
5589	Condition register 3 Bit #0: Core Board Temperature Out of Range Bit #1: Internal Flow Sim Test Fail Bit #2: Coil Resistance Error Bit #3: Coil Inductance Error Bit #4: Electrode Resistance Error Bit #5: AO Feedback Error Bit #6: Empty Pipe Bit #7: Electrode Coated Limit 1 Bit #8: Electrode Coated Limit 2 Bit #9: Reverse Flow Detected Bit #10: Internal Memory Failure Bit #11: Sensor Calibration Number not Entered Bit #12: SMV Baseline Missing Bit #13: Clock constant Bit #14: Internal Memory Full Bit #15: XMTR Soft. Update Failed	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
5590	Condition register 4 Bit #0: BLE Functionality Limited Bit #1: BLE Electronics Error Bit #2: BLE Security Error Bit #3: BLE Firmware Out of Date Bit #4: Reserved Bit #5: Configuration Changed Bit #6: Burst Mode Enabled Bit #7: Programming Core Bit #8: Flow Accuracy Bit #9: Auto Zero Failed Bit #10: Reserved Bit #11: Digital Trim Failed Bit #12: Auto Zero in Progress Bit #13: Digital Trim in Progress Bit #14: D/A Trim Progress Bit #15: Meter Verif in Progress	U16	RW	Y
5591	Condition register 5 Bit #0: DO 1 Status Bit #1: DO 2 Status Bit #2: DI 1 Status Bit #3: Core Not Connected Bit #4: New Core Detected Bit #5: AO Feedback in Progress Bit #6: Digital Trim Validate In Progress Bit #7: Digital Trim Validate Failure Bit #8: Flow Missed Error Bit #9: ADC Out Of Spec Bit #10: Boost Supply Failure Bit #11: Not used Bit #12: Not used Bit #13: Not used Bit #14: Not used Bit #15: Not used	U16	RW	Y
5592	Condition register 6 Bit #0: Not used Bit #1: Not used Bit #2: Not used Bit #3: Not used Bit #4: Not used Bit #5: Not used Bit #6: Not used Bit #7: Not used Bit #8: Not used Bit #9: Not used Bit #10: Not used Bit #11: Not used Bit #12: Not used Bit #13: Not used Bit #14: Not used Bit #15: Not used	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
5593	Condition register 7 Bit #0: Not used Bit #1: Not used Bit #2: Not used Bit #3: Not used Bit #4: Not used Bit #5: Not used Bit #6: Not used Bit #7: Not used Bit #8: Not used Bit #9: Not used Bit #10: Not used Bit #11: Not used Bit #12: Not used Bit #13: Not used Bit #14: Not used Bit #15: Not used	U16	RW	Y
5594	Condition register 8 Bit #0: Not used Bit #1: Not used Bit #2: Not used Bit #3: Not used Bit #4: Not used Bit #5: Not used Bit #6: Not used Bit #7: Not used Bit #8: Not used Bit #9: Not used Bit #10: Not used Bit #11: Not used Bit #12: Not used Bit #13: Not used Bit #14: Not used Bit #15: Not used	U16	RW	Y
5595	Condition register 9 Bit #0: Not used Bit #1: Not used Bit #2: Not used Bit #3: Not used Bit #4: Not used Bit #5: Not used Bit #6: Not used Bit #7: Not used Bit #8: Not used Bit #9: Not used Bit #10: Not used Bit #11: Not used Bit #12: Not used Bit #13: Not used Bit #14: Not used Bit #15: Not used	U16	RW	Y

Register	Description	Parameter type	Work level access	Write protect?
5596	Ignore Conditions in Reg 5586 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5597	Ignore Conditions in Reg 5587- 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5598	Ignore Conditions in Reg 5588 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5599	Ignore Conditions in Reg 5589 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5600	Ignore Conditions in Reg 5590 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5601	Ignore Conditions in Reg 5591 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5602	Ignore Conditions in Reg 5592 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5603	Ignore Conditions in Reg 5593 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5604	Ignore Conditions in Reg 5594 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5605	Ignore Conditions in Reg 5595 - 1 bit per Conditions. 1=ignore 0=don't ignore	U16	RW	Y
5606	2 PV Screen Slot #1	U16	RW	Y
5607	2 PV Screen Slot #2	U16	RW	Y
5608	Temporary license Feature A Bit #0: Custody Transfer Bit #1: High Process Noise Bit #2: Short Run Install Bit #3 -5: Reserved Bit #6: SIL	U32	R	N

Register	Description	Parameter type	Work level access	Write protect?
	Bit #7: Reserved Bit #8: Reserved Bit #9: Data and Event Historian Download Bit #10: Reserved Bit #11: Smart Meter Verification Professional Bit #12: Reserved Bit #13: Smart Fluid Diagnostic Bit #14: Electrode Coating Bit #15: Reserved Bit #16: Channel A Bit #17: Channel B Bit #18: Channel C Bit #19 - 31: Reserved			
5610	Temporary license key number of expiration days	U16	R	N
5611	Permanent license key expiration days	U16	R	N
5612	Time Zone Units	F32	RW	Y
5614	Time Zone (Sets time zone units)	U16	RW	Y
5615	Time in Seconds (of time zone units) Number of seconds since January 1st, 1970, 00H:00M:00S	U32	RW	Y
5629	Secondary Variable	U16	RW	Y
5630	Tertiary Variable	U16	RW	Y
5631	Temporary license Feature B	U32	R	N
5633	LED Status Configuration 0 = Standard (default), 1 = NE107	U16	RW	Y
5634	Watch Dog Timeout counter	U32	R	N
5636	Unique ID	U32	R	N
5638	NE-107 Alert Summary Bit #0 - Failure Alert Active - immediate indication Bit #1 - Failure Alert Active - LMV timeout indication Bit #2 - Function Check Alert Active Bit #3 - Out of Specification Alert Active Bit #4 - Maintenance Alert Active	U16	R	N
5646	Permanent Licensed Feature A Bit #0: Custody Transfer Bit #1: High Process Noise Bit #2: Short Run Install Bit #3 -5: Reserved Bit #6: SIL Bit #7: Reserved Bit #8: Reserved Bit #9: Data and Event Historian Download Bit #10: Reserved Bit #11: Smart Meter Verification Professional Bit #12: Reserved Bit #13: Smart Fluid Diagnostic	U32	R	N

Register	Description	Parameter type	Work level access	Write protect?
	Bit #14: Electrode Coating Bit #15: Reserved Bit #16: Channel A Bit #17: Channel B Bit #18: Channel C Bit #19 - 31: Reserved			
5648	Totalizer Control Codes	U8	RW	N
5670	Totalizer Log StartTime(in seconds)	U32	RW	Y
5672	Totalizer Log Time Interval(in hours)	U8	RW	Y
5673	Totalizer Log PV1	U8	RW	Y
5674	Totalizer Log PV2	U8	RW	Y
5675	Totalizer Log PV3	U8	RW	Y
5676	Totalizer Log PV4	U8	RW	Y
5677	Permanent Licensed Feature B	U32	R	N
5698	NV Map Version	U16	R	N
5780	SMV Times	A20	R	N
5782	SMV Abort Reasons	A20	R	N
5783	SMV Results	A20	R	N
5784	SMV Test Criteria	A20	R	N
5785	SMV Test Scopes	A20	R	N
5786	SMV Test Conditions	A20	R	N
5787	SMV Flow Simulation Ref Values	A20	R	N
5789	SMV Flow Simulation Values	A20	R	N
5791	SMV Flow Simulation Deviations	A20	R	N
5793	SMV Inductance Values	A20	R	N
5795	SMV Inductance Deviations	A20	R	N
5797	SMV Coil Resistance Values	A20	R	N
5799	SMV Electrode Resistance Values	A20	R	N
5801	SMV Core Board Temperatures	A20	R	N
5803	SMV IO Board Temperatures	A20	R	N
5805	Baseline Coil Inductance Values	A20	R	N
5807	Baseline Coil Resistance Values	A20	R	N
5809	Baseline Electrode Resistance Values	A20	R	N
5811	SMV Coil Inductance Test Results	A20	R	N
5812	SMV Coil Resistance Test Results	A20	R	N
5813	SMV Electrode Resistance Test Results	A20	R	N
5814	SMV Flow Simulation Test Results	A20	R	N
5822	SMV Sensor Type	A20	R	N

Register	Description	Parameter type	Work level access	Write protect?
5823	SMV Sensor Serial Number	A20	R	N
5864	HART Field Alarm Severity 1 (NE107)	U16	RW	Y
5865	HART Field Alarm Severity 2 (NE107)	U16	RW	Y
6198	Password for totalizer inventory start/stop/reset context menu	A4	RW	Y
6200	Quick Menu configuration option for up button	U8	RW	Y
6201	Quick Menu configuration option for down button	U8	RW	Y
6859	IO Board Temperature Histogram 0 (Elect Temp below -57 degree C)	U32	R	N
6861	IO Board Temperature Histogram 1 (Elect Temp -57 to below -49 degree C)	U32	R	N
6863	IO Board Temperature Histogram 2 (Elect Temp -49 to below -39 degree C)	U32	R	N
6865	IO Board Temperature Histogram 3 (Elect Temp -39 to below -19 degree C)	U32	R	N
6867	IO Board Temperature Histogram 4 (Elect Temp -19 to below 1 degree C)	U32	R	N
6869	IO Board Temperature Histogram 5 (Elect Temp 1 to below 21 degree C)	U32	R	N
6871	IO Board Temperature Histogram 6 (Elect Temp 21 to below 41 degree C)	U32	R	N
6873	IO Board Temperature Histogram 7 (Elect Temp 41 to below 51 degree C)	U32	R	N
6875	IO Board Temperature Histogram 8 (Elect Temp 51 to below 55 degree C)	U32	R	N
6877	IO Board Temperature Histogram 9 (Elect Temp 55 to below 60 degree C)	U32	R	N
6879	IO Board Temperature Histogram 10 (Elect Temp 60 to below 65 degree C)	U32	R	N
6881	IO Board Temperature Histogram 11 (Elect Temp 65 to below 70 degree C)	U32	R	N
6883	IO Board Temperature Histogram 12 (Elect Temp 70 to below 75 degree C)	U32	R	N
6885	IO Board Temperature Histogram 13 (Elect Temp 75 to below 80 degree C)	U32	R	N
6887	IO Board Temperature Histogram 14 (Elect Temp 80 to below 85 degree C)	U32	R	N
6889	IO Board Temperature Histogram 15 (Elect Temp 85 to below 90 degree C)	U32	R	N
6891	IO Board Temperature Histogram 16 (Elect Temp 90 to 92 degree C)	U32	R	N
6893	IO Board Temperature Histogram 17 (Elect Temp above 92 degree C)	U32	R	N

Register	Description	Parameter type	Work level access	Write protect?
6895	Core Board Temperature Histogram 0 (Elect Temp below -57 degree C)	U32	R	N
6897	Core Board Temperature Histogram 1 (Elect Temp -57 to below -49 degree C)	U32	R	N
6899	Core Board Temperature Histogram 2 (Elect Temp -49 to below -39 degree C)	U32	R	N
6901	Core Board Temperature Histogram 3 (Elect Temp -39 to below -19 degree C)	U32	R	N
6903	Core Board Temperature Histogram 4 (Elect Temp -19 to below 1 degree C)	U32	R	N
6905	Core Board Temperature Histogram 5 (Elect Temp 1 to below 21 degree C)	U32	R	N
6907	Core Board Temperature Histogram 6 (Elect Temp 21 to below 41 degree C)	U32	R	N
6909	Core Board Temperature Histogram 7 (Elect Temp 41 to below 51 degree C)	U32	R	N
6911	Core Board Temperature Histogram 8 (Elect Temp 51 to below 55 degree C)	U32	R	N
6913	Core Board Temperature Histogram 9 (Elect Temp 55 to below 60 degree C)	U32	R	N
6915	Core Board Temperature Histogram 10 (Elect Temp 60 to below 65 degree C)	U32	R	N
6917	Core Board Temperature Histogram 11 (Elect Temp 65 to below 70 degree C)	U32	R	N
6919	Core Board Temperature Histogram 12 (Elect Temp 70 to below 75 degree C)	U32	R	N
6921	Core Board Temperature Histogram 13 (Elect Temp 75 to below 80 degree C)	U32	R	N
6923	Core Board Temperature Histogram 14 (Elect Temp 80 to below 85 degree C)	U32	R	N
6925	Core Board Temperature Histogram 15 (Elect Temp 85 to below 90 degree C)	U32	R	N
6927	Core Board Temperature Histogram 16 (Elect Temp 90 to 92 degree C)	U32	R	N
6929	Core Board Temperature Histogram 17 (Elect Temp above 92 degree C)	U32	R	N
7240	Display Security Options	U16	RW	N
7241	NE-53 Revision (Software)	A8	R	N
7286	BLE Number of Security Resets	U32	R	N
7288	BLE Subsystem Firmware Revision	U16	R	N
7289	BLE Wireless Host :	U8	R	N

Register	Description	Parameter type	Work level access	Write protect?
	1 if the incoming HART command is received over the Bluetooth interface 0 if the command is received over Analog Output or RS485 interface			
7296	NE-53 Revision (Hardware)	A8	R	N
7320	LCD software rotation [0=0°, 1=90°, 2=180°, 3=270°]	U8	RW	Y
7321	Fix Bluetooth LED	U16	RW	N
7322	BLE hardware detect	U16	RW	N
7351	Permanent License Key String	A20	RW	Y
7361	Temporary License Key String	A20	RW	Y
7371	Start/Stop Totalizer 1 (For DI and Discrete Event)	U16	RW	Y
7372	Start/Stop Totalizer 2 (For DI and Discrete Event)	U16	RW	Y
7373	Start/Stop Totalizer 3 (For DI and Discrete Event)	U16	RW	Y
7374	Start/Stop Totalizer 4 (For DI and Discrete Event)	U16	RW	Y
7375	Start/Stop Totalizer 5 (For DI and Discrete Event)	U16	RW	Y
7376	Start/Stop Totalizer 6 (For DI and Discrete Event)	U16	RW	Y
7377	Start/Stop Totalizer 7 (For DI and Discrete Event)	U16	RW	Y
7378	Start/Stop Inventory 1 (For DI and Discrete Event)	U16	RW	Y
7379	Start/Stop Inventory 2 (For DI and Discrete Event)	U16	RW	Y
7380	Start/Stop Inventory 3 (For DI and Discrete Event)	U16	RW	Y
7381	Start/Stop Inventory 4 (For DI and Discrete Event)	U16	RW	Y
7382	Start/Stop Inventory 5 (For DI and Discrete Event)	U16	RW	Y
7383	Start/Stop Inventory 6 (For DI and Discrete Event)	U16	RW	Y
7384	Start/Stop Inventory 7 (For DI and Discrete Event)	U16	RW	Y
7730	9732 12V Input Voltage Measurement	F32	R	N
8474	BLE Radio State	U16	RW	Y
8475	BLE Communication State	U16	R	N
8475	BLE Communication State	U16	R	N
8603	BLE radio Unique ID (UID) Set to the BLE Subsystem MAC address: "DD-FE-DC-BA-CA-FF" 18th char = null	A18	R	N
8612	My Assets URL	A76	RW	Y
8702	BLE software revision	U16	R	N
9001	Low Flow Cutoff - ft/sec	F32	RW	Y
10501	Sensor Test - Electrode Differential Resistance	F32	R	N
10503	Sensor Test - Internal Flow Simulator	F32	R	N

Register	Description	Parameter type	Work level access	Write protect?
10505	Sensor Test - Coil Inductance	F32	R	N
10507	Sensor Test - Internal Flow Simulator	F32	R	N
10509	Sensor Test - Electrode Differential Capacitance	F32	R	N
10511	Sensor Test - Electrode Common Mode Resistance	F32	R	N
10513	Sensor Test - Electrode Common Mode Capacitance	F32	R	N
10515	Sensor Test - Electrode Positive Resistance	F32	R	N
10517	Sensor Test - Electrode Positive Capacitance	F32	R	N
10519	Sensor Test - Electrode Negative Resistance	F32	R	N
10521	Sensor Test - Electrode Negative Capacitance	F32	R	N
10523	Sensor Test - Electrode High Frequency Differential Resistance	F32	R	N
10525	Sensor Test - Electrode High Frequency Differential Capacitance	F32	R	N
10527	Sensor Test - Electrode High Frequency Common Mode Resistance	F32	R	N
10529	Sensor Test - Electrode High Frequency Common Mode Capacitance	F32	R	N
10531	Sensor Test - Condition	U16	R	N
12003	PFS Number	A32	R	
12019	System Serial Number	U32	R	N
12021	Software Build Number	U16	R	N
12022	Core Board PFS Number	A32	R	
12038	Core Board System Serial Number	U32	R	N
12040	Core Board Software Build Number	U16	R	N
12061	Core Board firmware checksum	U32	R	N

Table E-2: Modbus Coils

Coil	Description	Work level access	Write protect?
2	Start/stop all totalization ("On" = Start, "Off" = Stop) [Overwrites ALL Start/Stop Coils]	RW	Y
3	Reset all totals ("On" = Reset, "Off" = N/A) [Affects ALL Config Totals]	RW	N
4	Reset all inventories ("On" = Reset, "Off" = N/A) [Affects ALL Config Invs]	RW	N
5	Perform AutoZero (Flow) ("On" = Start, "Off" = N/A)	RW	Y
6	Trim Analog Output 1 at 4 mA	RW	Y
7	Trim Analog Output 1 at 20 mA	RW	Y
8	Trim Analog Output 2 at 4 mA	RW	Y
9	Trim Analog Output 2 at 20 mA	RW	Y
10	Fix current level for Analog Output 1	RW	Y
11	Fix current level for Analog Output 2	RW	Y
12	Fix frequency output ("On" = Apply, "Off" = N/A)	RW	Y
13	Abort AutoZero ("On" = Abort, "Off" = N/A)	RW	Y
14	Abort Digital Trim ("On" = Abort, "Off" = N/A)	RW	Y
15	Abort Baseline ("On" = Abort, "Off" = N/A)	RW	Y
16	Abort Commanded SMV ("On" = Abort, "Off" = N/A)	RW	N
18	Abort Digital Trim Validate ("On" = Abort, "Off" = N/A)	RW	Y
19	Perform Digital Trim Validate ("On" = Start, "Off" = N/A)	RW	Y
20	Perform transmitter self-test ("On"=Start, "Off"=N/A)	RW	N
21	(E)EPROM checksum failure	R	N
22	RAM diagnostic failure	R	N
26	Auto Zero failure	R	N
31	Analog output(s) saturated	R	N
32	Analog output(s) fixed	R	N
33	Watchdog timer error	R	N

Coil	Description	Work level access	Write protect?
35	Transmitter configuration changed	RW	N
36	Transmitter electronics failure	R	N
37	Reverse Flow Enable	RW	Y
38	Perform Digital Trim ("On" = Start, "Off" = N/A)	RW	Y
41	Force Hard Reboot (no response) ("On"=Reboot, "Off"=N/A)	RW	Y
46	Fix Discrete Output 1 ("On" = Apply, "Off" = N/A)	RW	Y
47	Fix Discrete Output 2 ("On" = Apply, "Off" = N/A)	RW	Y
50	LOI Display Backlight Control ("On" = Backlight on, "Off" = Backlight off)	RW	Y
51	Perform Sensor Baseline	RW	Y
56	Reset: ("On" = Reset, "Off" = N/A); Config Total #1	RW	N
57	Reset: ("On" = Reset, "Off" = N/A); Config Total #2	RW	N
58	Reset: ("On" = Reset, "Off" = N/A) ; Config Total #3 ("On" = Reset, "Off" = N/A)	RW	N
59	Reset ("On" = Reset, "Off" = N/A); Config Total #4	RW	N
60	Reset: ("On" = Reset, "Off" = N/A); Config Total #5	RW	N
61	Reset: ("On" = Reset, "Off" = N/A); Config Total #6	RW	N
62	Reset: ("On" = Reset, "Off" = N/A); Config Total #7	RW	N
66	Flow Direction status ("On" = Active, "Off" = Inactive)	R	N
67	Clear Auto Zero	RW	Y
68	Auto Zero In Progress status ("On" = Active, "Off" = Inactive)	R	N
69	Fault status ("On" = Active, "Off" = Inactive)	R	N
70	Recall Sensor Baseline	RW	Y
71	Clear Sensor Baseline	RW	Y
72	Start Commanded SMV Test	RW	Y
73	Start Analog feedback commanded test	RW	Y
74	Recall Factory Fingerprint	RW	Y
78	Perform Clear Electrode Coating Max Value	RW	Y
91	Enable/Disable Display Start/Stop Totals	RW	Y
94	Enable/Disable Display Totals Reset	RW	Y
95	Enable/Disable Display Auto Scroll	RW	Y
96	Enable/Disable Display Offline Menu	RW	Y
97	Enable/Disable Display Offline Password	RW	Y

Coil	Description	Work level access	Write protect?
139	Enable/Disable Display Quick Menu	RW	Y
166	Configuration File Save	RW	N
167	Configuration File Restore	RW	Y
170	Enable/Disable Display Inventories Reset	RW	Y
171	Enable/Disable Display Inventories Start/Stop	RW	Y
172	Enable/Disable Display Offline Password when entering Menu (coil 97 = at time of write)	RW	Y
173	Enable/Disable Display Password for Totalizer Context Menus	RW	Y
174	Enable/Disable Smart Meter Verification Coil Test	RW	Y
175	Enable/Disable Smart Meter Verification Electrode Test	RW	Y
176	Enable/Disable Smart Meter Verification Transmitter Test	RW	Y
177	Empty Pipe Detection	RW	Y
178	High Process Noise Detection	RW	Y
179	Grounding/Wiring Fault Detection	RW	Y
181	Electrode Coating Detection	RW	Y
182	Enable/Disable Smart Meter Verification Analog Feedback Test	RW	Y
187	Save short term SMV history to Internal Memory	RW	N
188	Save long term SMV history to Internal Memory	RW	N
189	Save Alarm History	RW	N
190	Start meter verification	RW	N
192	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #1	RW	N
193	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #2	RW	N
194	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #3	RW	N
195	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #4	RW	N
196	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #5	RW	N
197	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #6	RW	N
198	Reset Inventory ("On" = Reset, "Off" = N/A) Config Inv #7	RW	N
236	Enable/Disable Alarm Screen Password	RW	Y
237	Enable/Disable Write Protection	R	N
241	Acknowledge All Alarms	RW	N
242	Reset power-on time	RW	Y
247	Restore Factory Configuration ("On"=restore, "Off"=N/A)	RW	Y

Coil	Description	Work level access	Write protect?
248	Factory Data Invalid ("On"=Data invalid, "Off"=Data valid)	R	N
255	Enable/Disable simulation mode	RW	Y
313	Reset Security Log Counters	RW	Y
355	Secondary Frequency Output (#2) Fixed Mode	RW	Y
356	Force Reboot of Attached Core Board	RW	Y
359	Meter Backwards	RW	Y
360	Config Total #1 Start/Stop	RW	Y
361	Config Total #2 Start/Stop	RW	Y
362	Config Total #3 Start/Stop	RW	Y
363	Config Total #4 Start/Stop	RW	Y
364	Config Total #5 Start/Stop	RW	Y
365	Config Total #6 Start/Stop	RW	Y
366	Config Total #7 Start/Stop	RW	Y
367	Config Inv #1 Start/Stop	RW	Y
368	Config Inv #2 Start/Stop	RW	Y
369	Config Inv #3 Start/Stop	RW	Y
370	Config Inv #4 Start/Stop	RW	Y
371	Config Inv #5 Start/Stop	RW	Y
372	Config Inv #6 Start/Stop	RW	Y
373	Config Inv #7 Start/Stop	RW	Y
424	Enable/Disable USB Port	RW	Y
461	Enable/Disable Daylight Savings time	RW	Y
462	Reset NE-107 Alert Severities to factory defaults. Also reset Alert and Condition ignore bits.	RW	Y
480	Diagnostic Status Alert - Electronics Failure	RW	Y
481	Diagnostic Status Alert - Sensor Failure	RW	Y
482	Diagnostic Status Alert - Empty Pipe	RW	Y
483	Write Protect Switch State	RW	Y
484	Diagnostic Status Alert - High Process Noise	RW	Y
485	Diagnostic Status Alert - Elect Temp Out of Range	RW	Y
486	Diagnostic Status Alert - Electrode Coating Limit 1	RW	Y
487	Diagnostic Status Alert - Electrode Coating Limit 2	RW	Y
488	Diagnostic Status Alert - Continuous Meter Verification	RW	Y
489	Diagnostic Status Alert - Smart Fluid Diagnostic	RW	Y
513	DO 1 Status	R	N
514	DO 2 Status	R	N
515	DI 1 Status	R	N

Coil	Description	Work level access	Write protect?
516	LOI LCD Reset	RW	N
518	LOI Dip Switch 1 Position	R	N
519	LOI Dip Switch 2 Position	R	N
521	Enable/Disable NE-107 Alert Simulation mode (allows writing to reg 5574/5575 and reg 5586-5595)	RW	Y
524	Enable/Disable showing prompt for guided setup at startup	RW	N
539	HART Enable Find Device (enables command 73 response)	RW	N
544	Memory Stick inserted ("On" = inserted; "Off" = not inserted)	R	N
567	Display Connected	R	N
573	Installation Check Performed	RW	N
577	Reset SMV Meter Factor	RW	Y
582	UI_RestoreButtonDefaults	RW	N
583	UI_ResetButtonController	RW	N
584	UI_ForceButtonRecal	RW	N
628	Perform Recall Last Saved Sensor Signature	RW	Y
631	BLE Security Reset	RW	Y
1001	Electronics Failure	R	N
1002	Sensor Failed	R	N
1003	Configuration Error	R	N
1005	Security Breach	R	N
1006	Sensor-Transmitter Communication Error	R	N
1007	Sensor Out of Range	R	N
1008	Warming Up (self clears and does not show up on PV screen but goes in logs)	R	N
1009	Digital Trim Required	R	N
1010	Simulation Mode Active	R	N
1011	Output Fixed	R	N
1012	Output Saturated	R	N
1013	Process Aberration(Future)	R	N
1014	Discrete Event X Active	R	N
1015	High Process Noise Detected	R	N
1016	Grounding/Wiring Fault	R	N
1017	Smart Fluid Diagnostic Fault	R	N
1018	Electronics Temperature Out of Range	R	N
1019	Continuous Meter Verification Error	R	N
1020	Empty Pipe Detected	R	N

Coil	Description	Work level access	Write protect?
1021	Electrode Coated Limit 1	R	N
1022	Electrode Coated Limit 2	R	N
1023	Reverse Flow Detected	R	N
1024	Configuration Warning	R	N
1025	Electronics Warning	R	N
1101	Digital Trim In Progress	R	N
1107	Clear Calibration Status Register and Digital Trim/Auto Zero failure Conditions	RW	Y

Appendix F Environmental compliance

F.1 RoHS and WEEE

In compliance with the RoHS directive (Restriction of Hazardous Substances) and the WEEE directive (Waste Electrical and Electronic Equipment), the battery in the Rosemount 9732 Transmitter cannot be serviced or replaced by users. If the transmitter requires disposal, follow all applicable local laws.



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