Reference Manual
00809-0100-4690, Rev FC
June 2011

Rosemount 2088, 2090P, and 2090F Pressure Transmitters

with 4-20 mA HART and 1-5 Vdc Low Power Protocol

HART COMMUNICATION PROTOCOL

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Reference Manual
00809-0100-4690, Rev FC
June 2011

Rosemount 2088, 2090F, and 2090P Pressure Transmitters

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

For technical assistance, contacts are listed below:

Customer Central
Technical support, quoting, and order-related questions.

United States - 1-800-999-9307 (7:00 am to 7:00 pm CST)

Asia Pacific- 65 777 8211

Europe/ Middle East/ Africa - 49 (8153) 9390

North American Response Center
Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of these areas, contact your local Emerson Process Management representative.

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Emerson Process Management Sales Representative.

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Section 1 Introduction

USING THIS MANUAL

The sections in this manual provide information on installing, operating, and maintaining Rosemount 2088, 2090F, and 2090P pressure transmitters with HART® protocol. The sections are organized as follows:

- **Section 2: Installation** contains mechanical and electrical installation instructions.
- **Section 3: Configuration** provides instruction on commissioning and operating Rosemount 2088, 2090F, and 2090P transmitters. Information on software functions, configuration parameters, and online variables is also included.
- **Section 4: Operation and Maintenance** contains operation and maintenance techniques.
- **Section 5: Troubleshooting** provides troubleshooting techniques for the most common operating information.
- **Appendix A: Reference Data** supplies reference and specification data, as well as ordering information.
- **Appendix B: Approval Information** contains intrinsic safety approval information, European ATEX directive information, and approval drawings.
- **Appendix C: Glossary**

SERVICE SUPPORT

To expedite the return process outside of the United States, contact the nearest Emerson Process Management representative.

Within the United States, call the Emerson Process Management Instrument and Valves Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

⚠CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

Emerson Process Management Instrument and Valves Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

MODELS COVERED

The following Rosemount Pressure Transmitters are covered by this manual:

Rosemount 2088 Pressure Transmitter

2088G - Gage Pressure Transmitter
Measures gage pressure up to 4000 psi (275,8 bar)

2088A - Absolute Pressure Transmitter
Measures absolute pressure up to 4000 psi (275,8 bar)

Rosemount 2090F Hygienic Pressure Transmitter

2090FG - Gage Pressure Transmitter
Measures gage pressure up to 300 psi (20,7 bar)

2090FA - Absolute Pressure Transmitter
Measures absolute pressure up to 300 psi (20,7 bar)

Rosemount 2090P Pulp & Paper Pressure Transmitter

2090PG - Gage Pressure Transmitter
Measures gage pressure up to 300 psi (20,7 bar)

2090PA - Absolute Pressure Transmitter
Measures absolute pressure up to 300 psi (20,7 bar)

PRODUCT RECYCLING/DISPOSAL

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

Section 2 Installation

OVERVIEW

The information in this section covers installation considerations for the Rosemount 2088, 2090F, and 2090P transmitters with HART protocols. A Quick Installation Guide (document number 00825-0100-4690) is shipped with every transmitter to describe basic pipe-fitting and wiring procedures for initial installation.

Field Communicator and AMS Device Manager instructions are given to perform configuration functions. For convenience, Field Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Conduit/Cable Entries.

- Unless marked, the conduit/cable entries in the transmitter housing use a $^1/_2$-14 NPT thread form. Only use plugs, adapters, glands, or conduit with a compatible thread form when closing these entries.

⚠WARNING

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals.

Process leaks could result in death or serious injury.

- Install and tighten all four flange bolts before applying pressure.
- Do not attempt to loosen or remove flange bolts while the transmitter is in service.

Replacement equipment or spare parts not approved by Emerson Process Management for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.

- Use only bolts supplied or sold by Emerson Process Management as spare parts.
- Refer to page A-7 for a complete list of spare parts.

⚠WARNING

Use appropriately rated sanitary clamps and gaskets during installation of the 2090F. The maximum working pressure of the clamp and gasket must be greater than or equal to the working pressure range of the transmitter. Failure to use proper clamps and gaskets can cause process leaks and can result in death or serious injury.

GENERAL CONSIDERATIONS

Measurement accuracy depends on proper installation of the transmitter and impulse piping. Mount the transmitter close to the process and use a minimum of impulse piping to achieve the best accuracy. Also, consider the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the transmitter to minimize vibration, shock, and temperature fluctuation.

IMPORTANT
Install the enclosed pipe plug (found in the box) in unused conduit opening with a minimum of five threads engaged to comply with explosion-proof requirements.

For material compatibility considerations, see document number 00816-0100-3045 on www.emersonprocess.com/rosemount.

MECHANICAL CONSIDERATIONS

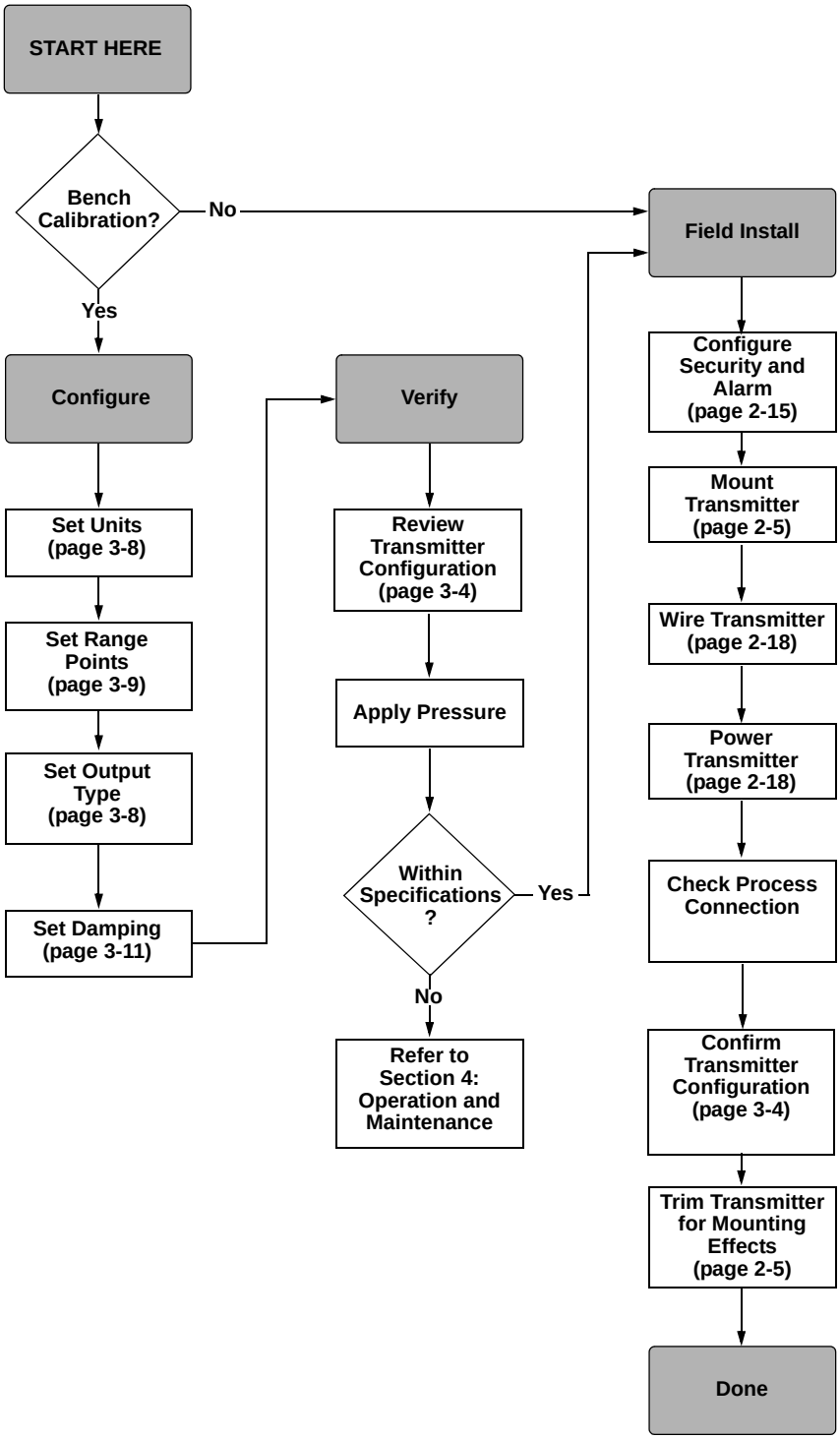
NOTE
For steam service or for applications with process temperatures greater than the limits of the transmitter, do not blow down impulse piping through the transmitter. Flush lines with the blocking valves closed and refill lines with water before resuming measurement.

ENVIRONMENTAL CONSIDERATIONS

Best practice is to mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are -40 to 185 °F (-40 to 85 °C). Refer to Appendix A: Reference Data which lists the sensing element operating limits. Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

HART INSTALLATION FLOWCHART

Figure 2-1. HART Installation Flowchart



INSTALLATION PROCEDURES

Mount the Transmitter

Rosemount 2088

The Rosemount 2088 Transmitter weighs approximately 2.44 lb. (1,11 kg). In many cases, its compact size and light weight makes it possible to mount the 2088 directly to the impulse line without using an additional mounting bracket. When this is not desirable, mount directly to a wall, panel, or two-inch pipe using the optional mounting bracket (see Figure 2-3).

The 2088 offers several process connections. Use your plant-approved thread sealant to ensure a leak-proof connection.

Rosemount 2090P

The Rosemount 2090P is designed to be mounted directly to the process pipe using a weld spud (see Figure 2-7). Mount the transmitter using an existing weld spud or install a new one using the instructions on page 2-11.

Rosemount 2090F

The Rosemount 2090F is designed to be mounted directly to the process pipe using a standard sanitary fitting (see Figure 2-8). The transmitter is available with either a 1½- or 2-inch Tri-Clamp® connection.

NOTE
Most transmitters are calibrated in the horizontal position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head pressure caused by the varied mounting position. To reset zero point, refer to “Sensor Trim” on page 4-8.

Terminal Side of Electronics Housing

Mount the transmitter so the terminal side is accessible. Clearance of 0.75-in. (19 mm) is required for cover removal. Use a conduit plug on the unused side of the conduit opening.

Circuit Side of Electronics Housing

Provide 0.75 in. (19 mm) of clearance for units without an LCD display. Provide 3 in. (76 mm) of clearance for units installed with an LCD display.

Cover Installation

Always ensure a proper seal by installing the electronics housing covers so that metal contacts metal. Use Rosemount supplied o-rings.

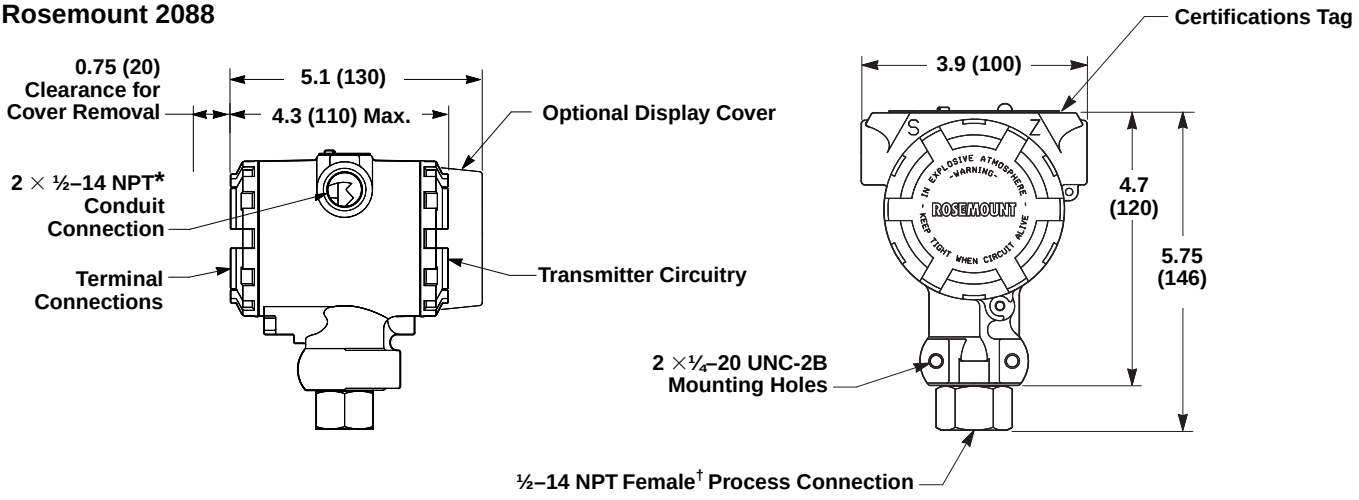
Mounting Brackets

Rosemount 2088/2090 Transmitters may be panel-mounted or pipe-mounted through an optional mounting bracket. See Figure 2-3 on page 2-8 for dimensional and mounting configurations.

Dimensional Drawings

Figure 2-2. Transmitter Dimensional Drawings

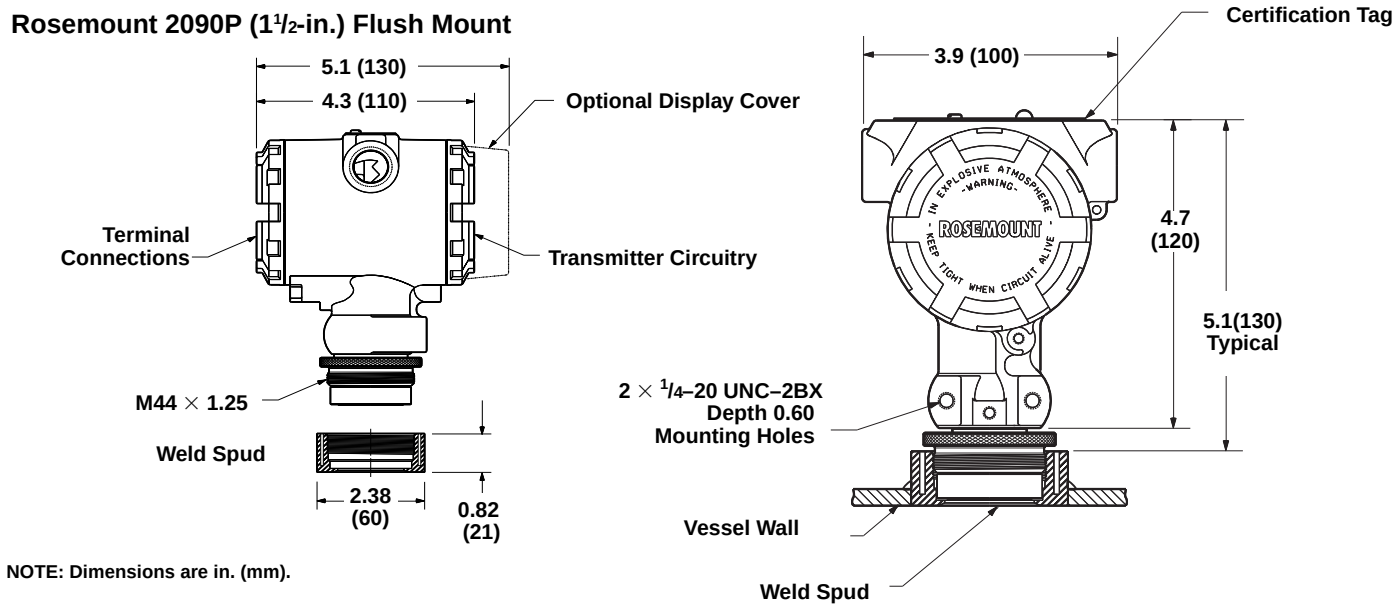
Rosemount 2088



* *M20 × 1.5 Female and G 1/2 Female (PF 1/2) also available as options.*

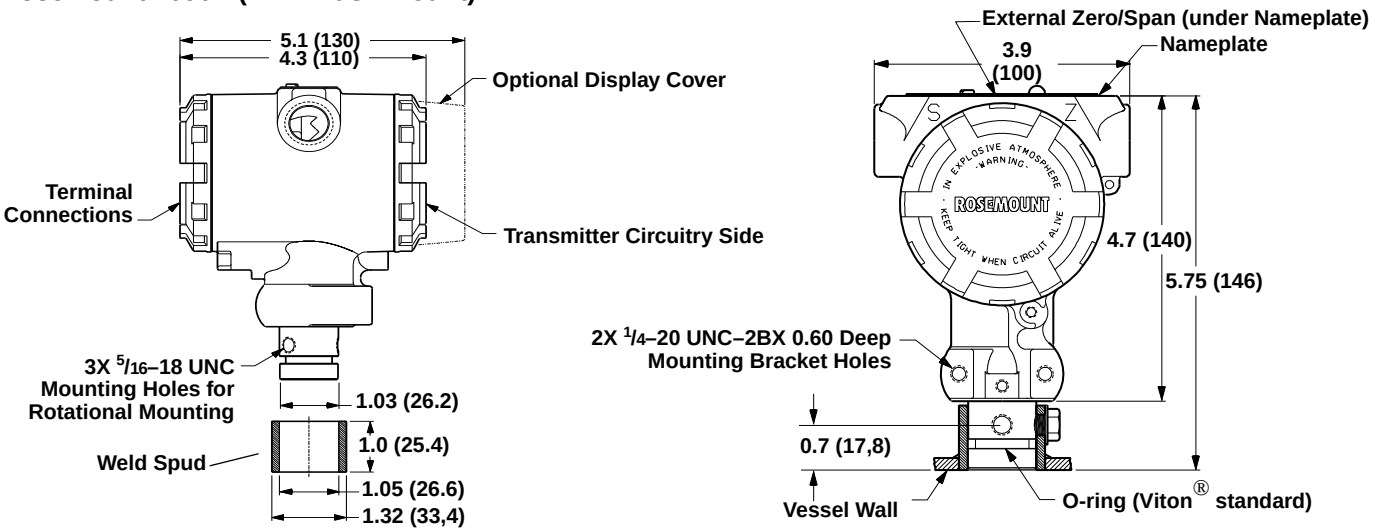
† *DIN 16288 G 1/2 Male, RC 1/2 Female (PT 1/2), and M20 × 1.5 Male also available.*

Rosemount 2090P (1 1/2-in.) Flush Mount

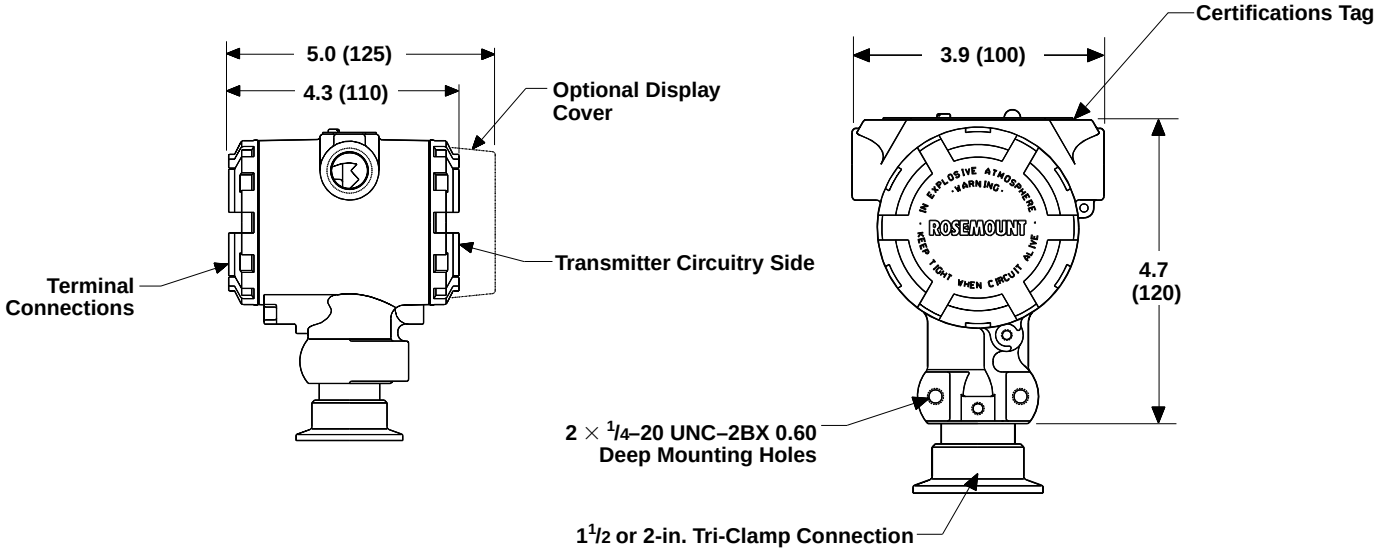


NOTE: Dimensions are in. (mm).

Rosemount 2090P (1-in. Flush Mount)



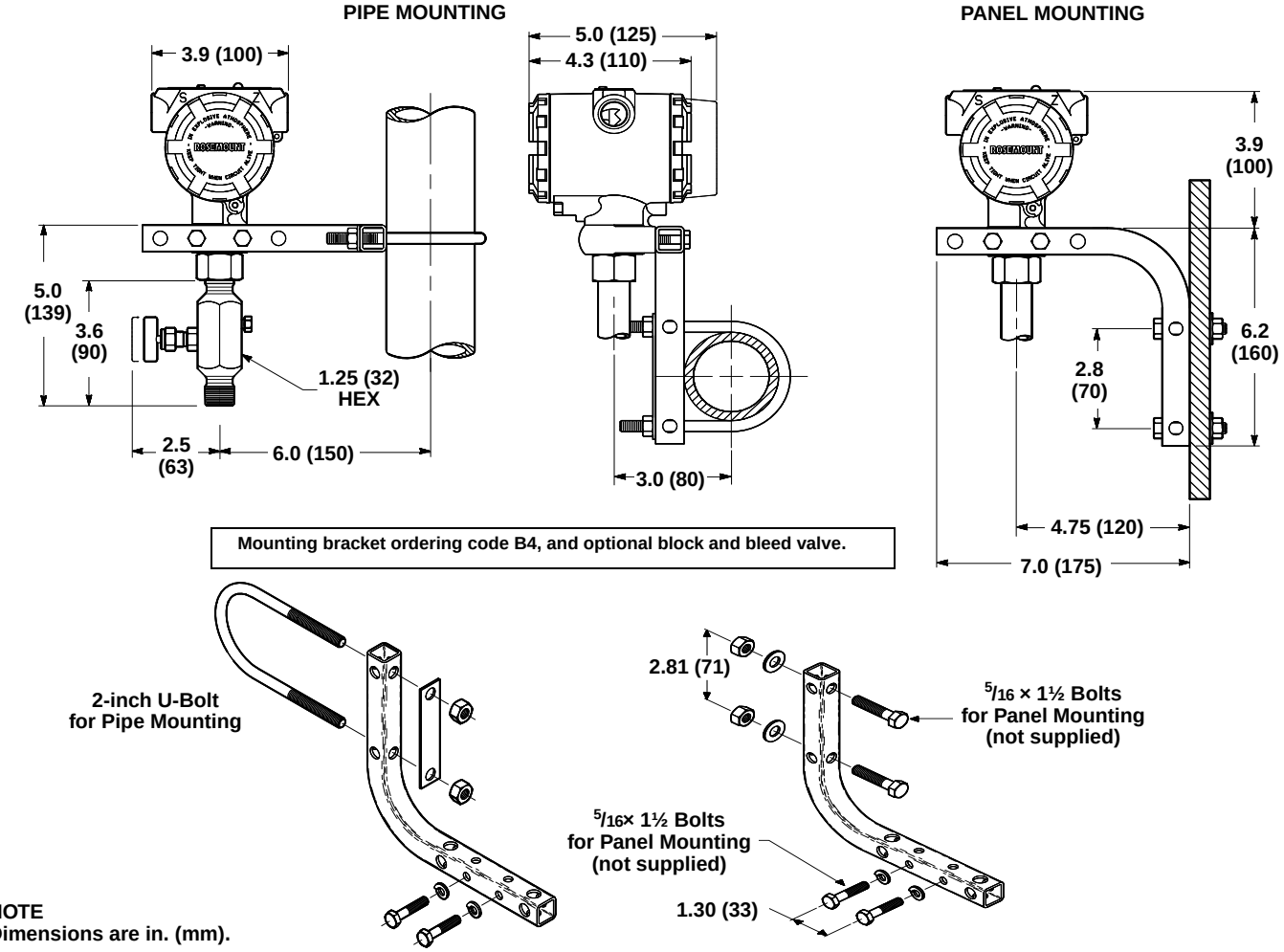
Rosemount 2090F



* *M20 × 1.5 Female also available.*

NOTE: Dimensions are in inches (millimeters).

Figure 2-3. Transmitter Mounting Configurations with Optional Bracket.



Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are six possible sources of impulse piping error: pressure transfer, leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and density variations between the legs.

The best location for the transmitter in relation to the process pipe is dependent on the process. Use the following guidelines to determine transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 in./foot (8 cm/m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 in./foot (8 cm/m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Maintain equal leg of head pressure on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

Mounting Requirements

Impulse piping configurations depend on specific measurement conditions. Refer to Figure 2-4 for examples of the following mounting configurations:

Liquid Flow Measurement

- Place taps to the side of the line to prevent sediment deposits on the process isolators.
- Mount the transmitter beside or below the taps so gases vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

Gas Flow Measurement

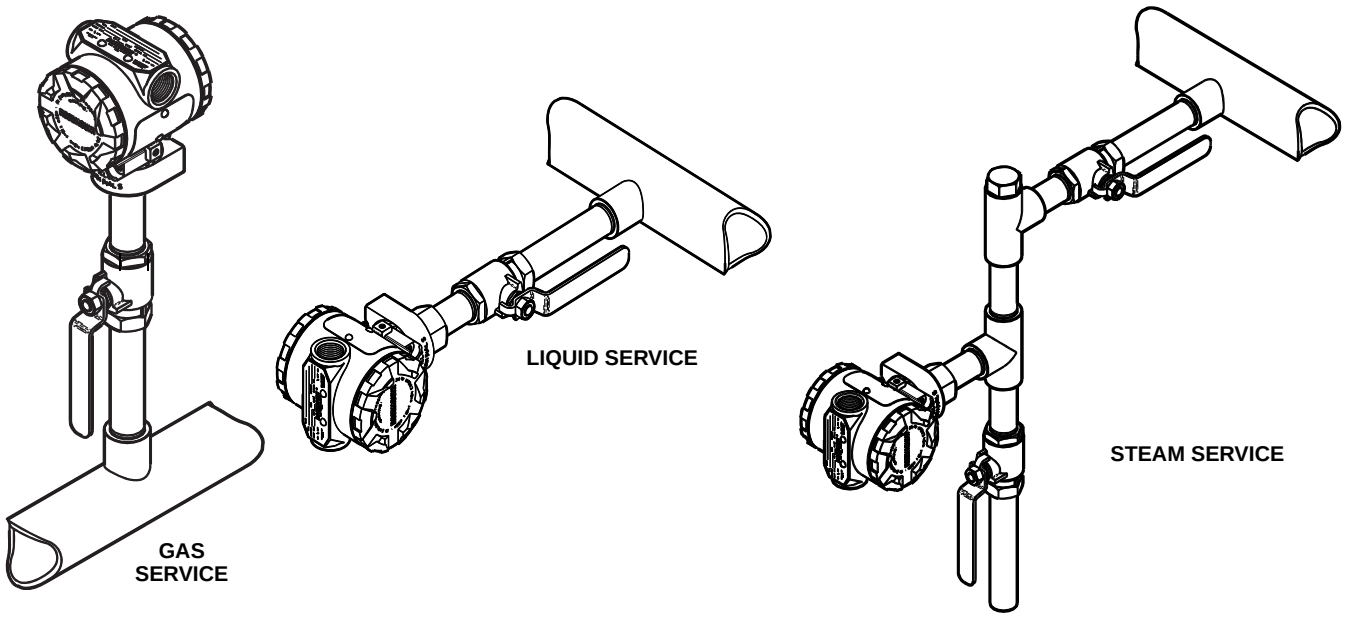
- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so to drain liquid into the process line.

Steam Flow Measurement

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that impulse piping will remain filled with condensate.
- In steam service above 250 °F (121 °C), fill impulse lines with water to prevent steam from contacting the transmitter directly and to ensure accurate measurement start-up.

NOTE
For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limit, which is 250 °F (121 °C).

Figure 2-4. Installation Examples



Process Connections

Rosemount 2090P

Installing the Rosemount 2090P transmitter involves attaching a weld spud to the tapped process vessel, attaching the transmitter to the weld spud, and making electrical connections. If you intend to use an existing weld spud, proceed to the transmitter section of this installation procedure (page 2-12).

NOTE
The Rosemount 2090P isolating diaphragm can be mounted flush with the inside diameter of any vessel larger than three inches in diameter.

⚠CAUTION

Installation of the weld spud should be performed by a skilled welder using a TIG welder. Improper installation may result in weld spud distortion.

Weld Spud

1. Using the appropriate size hole saw, cut a hole in the process vessel to accept the weld spud. The diameter for a weld spud with heat isolator groove is 2.37 in. (60 mm); when compatible with 1-in. PMC® process connection style spud, diameter is 1.32 in. (33,4 mm). The hole should produce a tight, uniform fit when coupled with the weld spud.
2. Bevel the edge of the vessel hole to accept filler material (see Figure 2-5).
3. Remove the weld spud from the transmitter and remove the PTFE gasket from the weld spud.

⚠CAUTION

Excessive heat will distort the weld spud. Weld in sections, as shown in Figure 2-5, cooling each section with a wet cloth. Allow adequate cooling between passes.

To reduce the chances of distorting the weld spud (for 1.5-in. connection), use a heat sink—Rosemount Part Number 02088-0196-0005.

4. Position the weld spud in the vessel hole, place heat sink and tack spud in place using the welding sequence shown in Figure 2-5. Cool each section with a wet cloth before proceeding to the next section.
5. Weld the spud in place using 0.030 to 0.045 in. (0,762 to 1,143 mm) stainless steel rod as filler in the bevelled area. Using between 100 and 125 amps., adjust the amperage for 0.080 in. (2,032 mm) penetration.

Transmitter

1. After the weld spud has cooled, remove the heat sink and install the PTFE gasket into the weld spud. Ensure that the gasket is properly positioned within the weld spud; improper placement could cause a process leak (see Figure 2-6).
2. Position the transmitter into the spud and begin to engage the threads. Rotate the transmitter prior to seating the threads completely to enable access to the housing compartments, the conduit entry, and the LCD Display.
3. Hand tighten the transmitter using the knurled retaining ring, then snug an additional 1/8 turn with adjustable pliers.

IMPORTANT
Do not over-tighten the retaining ring. A spanner wrench hole is located on the knurled portion of the retaining ring to assist in transmitter removal if it is over-tightened.

Figure 2-5. PTFE Installing the Weld Spud.

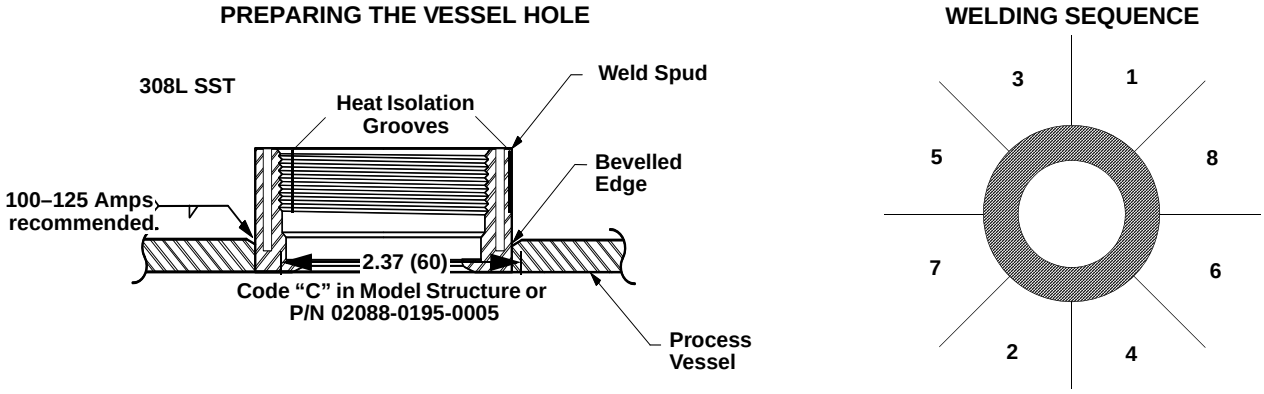


Figure 2-6. PTFE Gasket Placement.

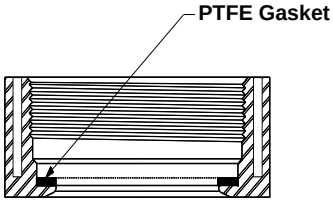
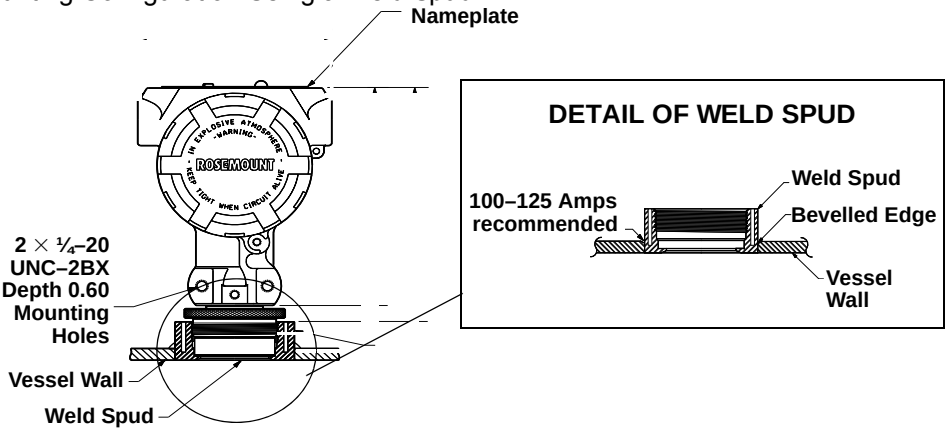


Figure 2-7. Rosemount 2090P Mounting Configuration Using a Weld Spud.

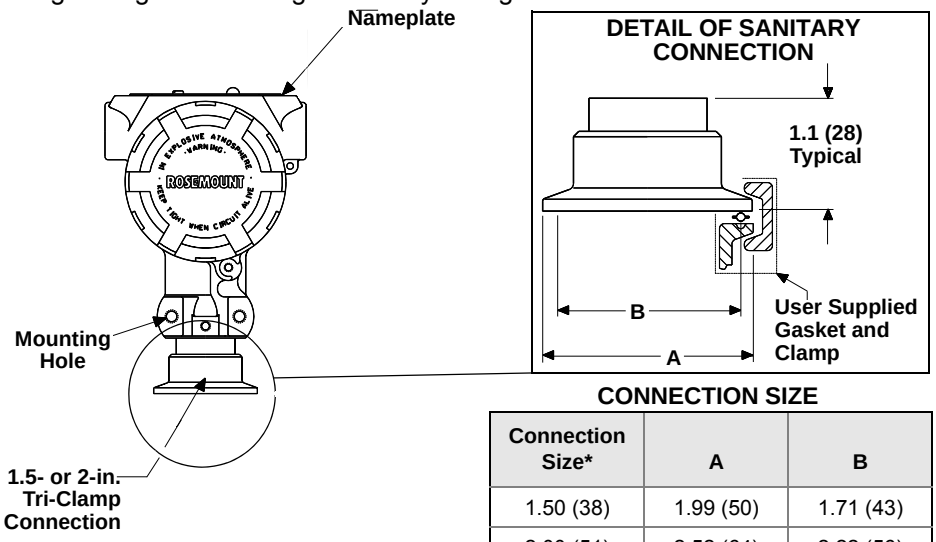


Rosemount 2090F

⚠ The Rosemount 2090F hygienic pressure transmitter is designed to be installed directly to a sanitary fitting. The transmitter is available with either a 1½- or 2-in. clamp connection.

When installing the transmitter to the sanitary fitting, it is important to use the proper sanitary clamp and gasket (user-supplied). Check the clamp and gasket specifications before installing. Refer to *Standard Sanitary Clamp Models* in Figure 2-8 for a list of standard sanitary clamps, their respective maximum pressure ranges, and the recommended torque to be applied when mounting.

Figure 2-8. Rosemount 2090F Mounting Configuration Using a Sanitary Fitting.



CONNECTION SIZE

Connection Size*	A	B
1.50 (38)	1.99 (50)	1.71 (43)
2.00 (51)	2.52 (64)	2.22 (56)

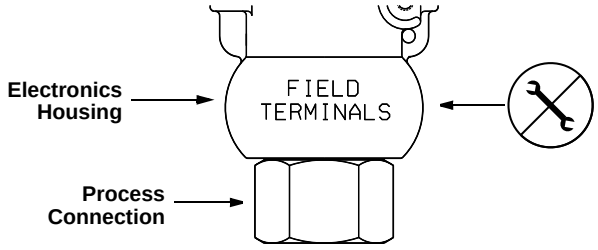
** Dimensions are in inches (millimeters)*

Standard Sanitary Clamp Models

Clamp Model	psi @ 70 °F (kPa @ 21 °C)	psi @ 250 °F (kPa @ 121 °C)	Recommended Torque
13 MHHM 1.5-inch 13 MHHM 2-inch	450 (3 103) 500 (3 448)	250 (1 724) 250 (1 724)	25 in-lb. (2.8 N•m)
13 MHHS 1.5-inch 13 MHHS 2-inch	600 (4 138) 550 (3 793)	300 (2 069) 275 (1 896)	25 in-lb. (2.8 N•m)
13 MHP 1.5-inch 13 MHP 2-inch	1500 (10 345) 1000 (6 896)	1200 (8 276) 800 (5 517)	20 ft-lb (27 N•m)

⚠CAUTION

Do not apply torque directly to the electronics housing. Rotation between the electronics housing and the process connection can damage the electronics. To avoid damage, apply torque only to the hex-shaped process connection. Use a backup wrench on Process Connection when installing an adapter.



CONFIGURE SECURITY AND ALARM

Write Protect

There are three security methods in the Rosemount 2088/2090 transmitter:

1. Security Jumper: prevents all writes to transmitter configuration.
2. Local Keys (Local Zero and Span) Software Lock Out: prevents changes to transmitter range points via local zero and span adjustment keys. With local keys security enabled, changes to configuration are possible via HART.
3. Physical removal of Local Keys (Local Zero and Span) Magnetic Buttons: removes ability to use local keys to make transmitter range point adjustments. With removing local keys, changes to configuration are possible via HART.

You can prevent changes to the transmitter configuration data with the write protect jumper. Security is controlled by the security (write protect) jumper located on the electronics board or LCD display. Position the jumper on the transmitter circuit board in the “ON” position to prevent accidental or deliberate change of configuration data.

If the transmitter write protection is in the “ON” position, the transmitter will not accept any “writes” to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the transmitter security is on.

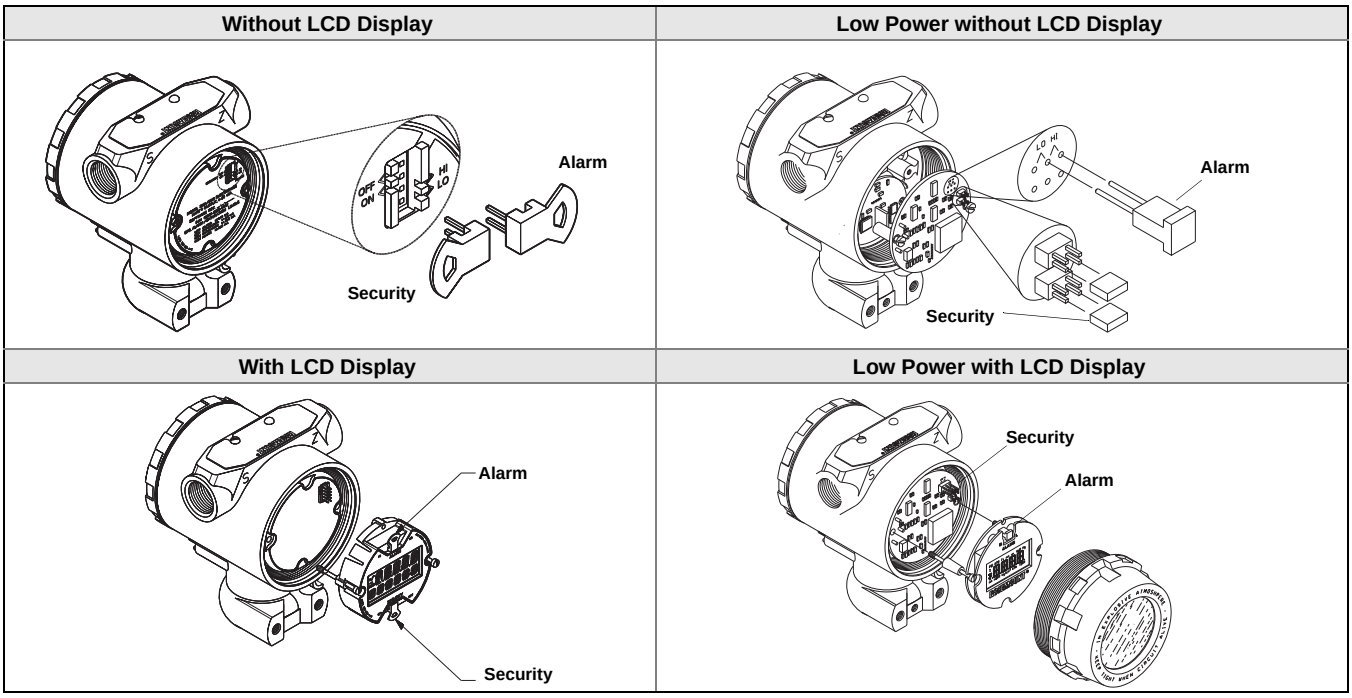
NOTE
If either the alarm or security jumper is dislodged or removed from its position, the transmitter reverts to default alarm or security settings of: Alarm: Output high; Security: Off

Configuring Transmitter Security and Alarm Jumper Procedure

To reposition the jumpers, follow the procedure described below.

1. Do not remove the transmitter covers in explosive atmospheres when the circuit is live. If the transmitter is live, set the loop to manual and remove power.
2. ⚠ Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is live.
3. Reposition the jumpers as desired.
   - Figure 2-9 shows the jumper positions for the 4-20 mA HART Transmitter and 1-5 Vdc Low Power Transmitter.
4. ⚠ Reattach the transmitter cover. Always ensure a proper seal by installing the electronics housing covers so that metal contacts metal to meet explosion-proof requirements.

Figure 2-9. Transmitter Alarm and Security Jumper Locations



Without a display installed

⚠ The failure mode alarm jumper is located on the front side of the electronics module just inside the electronics housing cover and is labeled ALARM (See Figure 2-9). Do not remove the transmitter cover in explosive atmospheres when the circuit is alive. Both covers must be fully engaged to meet explosion-proof requirements.

With a display installed

⚠ The failure mode alarm jumper is located on the LCD faceplate in the electronics module side of the transmitter housing and is labeled ALARM (See Figure 2-9). Do not remove the transmitter cover in explosive atmospheres when the circuit is alive. Both covers must be fully engaged to meet explosion proof requirements.

ELECTRICAL CONSIDERATIONS

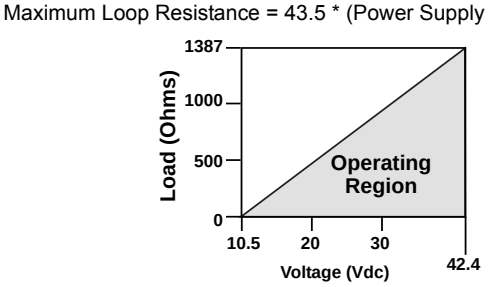
The wiring terminations on the Rosemount 2088/2090 are located in the side of the transmitter housing marked “FIELD TERMINALS.” Access to these terminations is required during installation and may be necessary during periodic calibration of the transmitter.

NOTE
Make sure all electrical installation is in accordance with national and local code requirements.

Power Supply

The dc power supply should provide power to the transmitter with less than one percent ripple. The total loop resistance load is the sum of the resistance of the signal wires and the resistance load of the controller, indicator, and other pieces of equipment in the loop. Note that the resistance of intrinsic safety barriers, if used, must be included. Figure 2-10 shows the transmitter power supply load limitations.

Figure 2-10. Load Limitation



The Field communicator requires a minimum loop resistance of 250Ω for communication.

Power Supply for 1-5 Vdc HART Low Power

Low power transmitters operates on 6-14 Vdc. The dc power supply should provide power with less than two percent ripple. The V_{out} load should be 100 kΩ or greater.

Wiring

⚠CAUTION

Do not connect the power signal wiring to the test terminals. Voltage may burn out the reverse-polarity protection diode in the test connection.

NOTE
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire, and do not exceed 5000 feet (1500 meters).

⚠ All power to the transmitter is supplied over the signal wiring. Signal wiring need not be shielded, but use twisted pairs for best results. Do not run unshielded signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. For high EMI/RFI environments, shielded twisted pair cable should be used. To power the transmitter, connect the positive power lead to the terminal marked “PWR/COMM+” and the negative power lead to the terminal marked “–” (see Figure 2-11). Tighten the terminal screws to ensure that proper contact is made. Avoid contact with the leads and the terminals. No additional power wiring is required for transmitters with “S” output. For “N” output code transmitters, connect positive signal lead to “test +” and negative signal lead to terminal marked “-.”

⚠ To connect test equipment for monitoring the output of the Rosemount 2088/2090 transmitter during maintenance procedures, connect one lead to the terminal labeled “TEST+” and the other lead to the terminal labeled “–” (see Figure 2-11). Avoid contact with the leads and the terminals.

Signal wiring may be grounded at any one point on the measurement loop, or it may be left ungrounded. The negative side of the power supply is a recommended grounding point. The transmitter case may be grounded or left ungrounded.

Conduit connections at the transmitter should be sealed to prevent moisture accumulating in the field terminal side of the transmitter housing. Also, install wiring with a drip loop with the bottom of the drip loop lower than the conduit connection of the transmitter housing.

Figure 2-11. Rosemount 2088/2090 Transmitter Signal Wiring Terminals

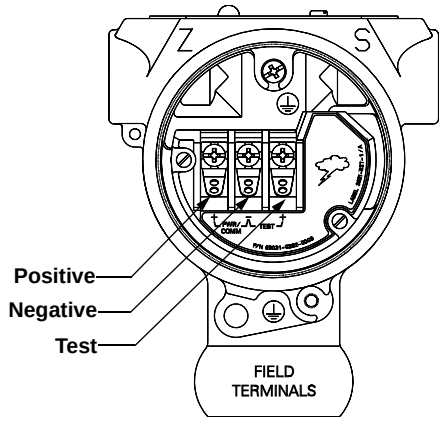


Figure 2-12. 4-20 mA HART Transmitter Wiring Diagram

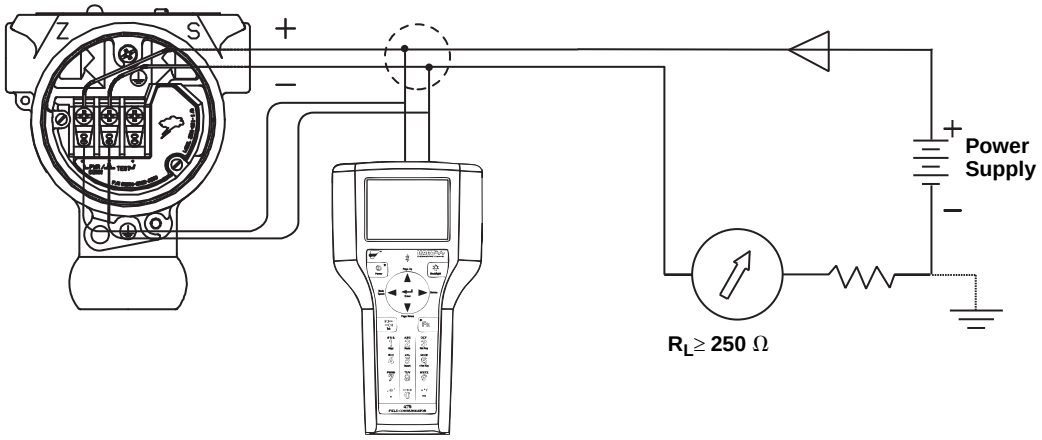
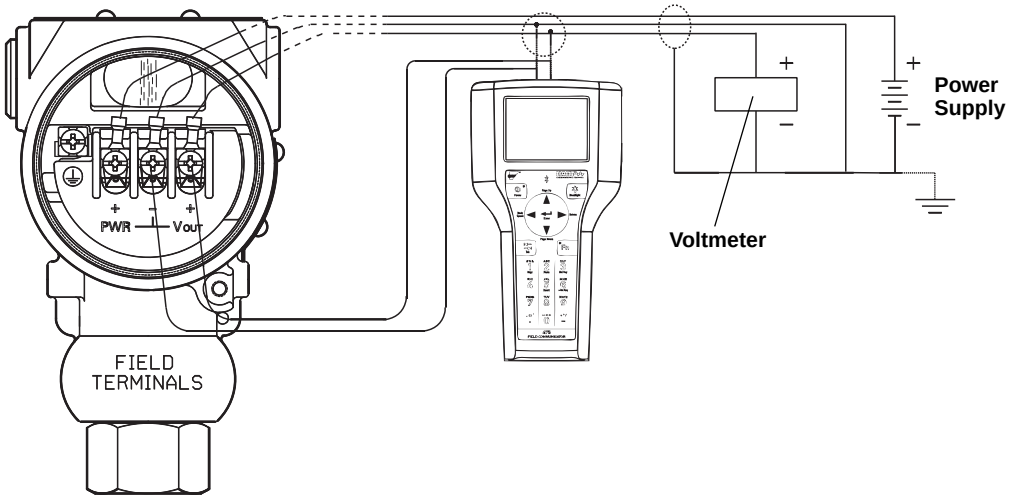


Figure 2-13. 1-5 mA Vdc HART Low Power Transmitter Wiring



Transient Protection Terminal Block

The transmitter will withstand electrical transients of the energy level usually encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, can damage the transmitter.

The transient protection terminal block can be ordered as an installed option (Option Code T1 in the transmitter model number) or as a spare part to retrofit existing 2088 transmitters in the field. See “Spare Parts” on page A-7 for spare part numbers.

NOTE
The transient protection terminal block does not provide transient protection unless the transmitter case is properly grounded. Use the guidelines to ground the transmitter case.

Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

Grounding

⚠ Use the following techniques to properly ground the transmitter signal wiring and case:

Signal Wiring

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment. It is important that the instrument cable shield be:

- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

For 4-20 mA HART output, the signal wiring may be grounded at any one point on the signal loop or may be left ungrounded. The negative terminal of the power supply is a recommended grounding point.

For 1-5 Vdc HART Low Power output, the power wires may be grounded at only one point or left ungrounded. The negative terminal of the power supply is a recommended grounding point.

Transmitter Case

Always ground the transmitter case in accordance with national and local electrical codes. The most effective transmitter case grounding method is a direct connection to earth ground with minimal impedance. Methods for grounding the transmitter case include:

- **Internal Ground Connection**: The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚). The ground connection screw is standard on all Rosemount 2088 transmitters.

HAZARDOUS LOCATIONS CERTIFICATIONS

⚠ Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to “Hazardous Locations Certifications” on page B-1 for information on these approvals.

Section 3 Configuration

OVERVIEW

This section contains information on commissioning and tasks that should be performed on the bench prior to installation.

Field Communicator and AMS Device Manager instructions are given to perform configuration functions. For convenience, Field Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 2051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

COMMISSIONING

Commissioning consists of testing the transmitter and verifying transmitter configuration data. The Rosemount 2088/2090 can be commissioned either before or after installation. Commissioning the transmitter on the bench before installation using a Field Communicator or AMS Device Manager ensures that all transmitter components are in working order.

⚠ To commission on the bench, required equipment includes a power supply, a milliamp meter, and a Field Communicator or AMS Device Manager. Wire equipment as shown in Figure 3-1 and Figure 3-2. To ensure successful communication, a resistance of at least 250 ohms must be present between the Field Communicator loop connection and the power supply. Connect the Field Communicator leads to the terminals labeled “COMM” on the terminal block. Set all transmitter hardware adjustments during commissioning to avoid exposing the transmitter electronics to the plant environment after installation.

When using a Field Communicator, any configuration changes made must be sent to the transmitter by using the “Send” key. AMS Device Manager configuration changes are implemented when the “Apply” button is clicked.

Setting the Loop to Manual

Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual. The Field Communicator or AMS Device Manager will prompt you to set the loop to manual when necessary. Acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; set the loop to manual as a separate operation.

Wiring Diagrams

Connect the equipment as shown in Figure 3-1 for 4-20 mA HART or Figure 3-2 for 1-5 Vdc HART Low Power. To ensure successful communication, a resistance of at least 250 ohms must be present between the Field Communicator loop connection and the power supply. The Field Communicator or AMS Device Manager may be connected at “COMM” on the transmitter terminal block or across the resistor. Connecting across the “TEST” terminals will prevent successful communication for the 4-20 mA HART output.

Turn on the Field Communicator by pressing the ON/OFF key or log into AMS Device Manager. The Field Communicator or AMS Device Manager will search for a HART-compatible device and indicate when the connection is made. If the Field Communicator or AMS Device Manager fail to connect, it indicates that no device was found. If this occurs, refer to Section 5: Troubleshooting.

Figure 3-1. 4-20 mA HART
Transmitter Wiring Diagram

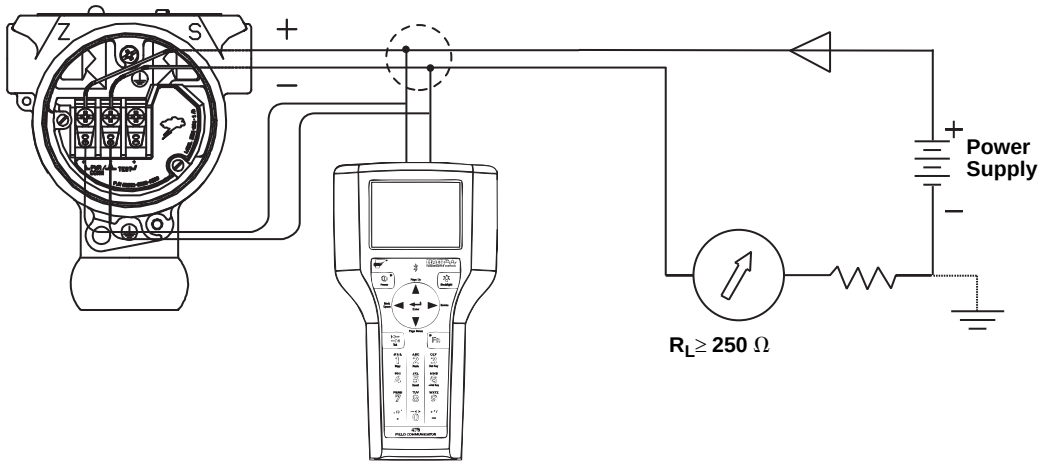
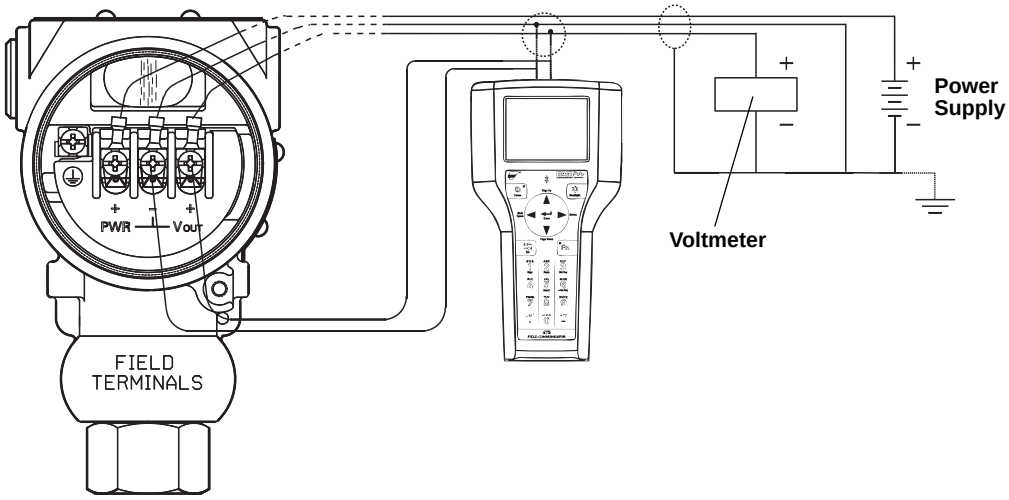


Figure 3-2. 1-5 Vdc HART Low
Power Transmitter Wiring



CONFIGURATION DATA REVIEW

NOTE
Information and procedures in this section that make use of Field Communicator fast key sequences and AMS Device Manager assume that the transmitter and communication equipment are connected, powered, and operating correctly.

The following is a list of factory default configurations. These can be reviewed by using the Field Communicator or AMS Device Manager

Field Communicator

4-20 mA Fast Keys	1, 5

Enter the fast key sequence to view the configuration data.

Tag	Range
Date	Descriptor
Message	Minimum and Maximum Sensor Limits
Minimum Span	Units
4 and 20 mA points	Output (linear or sq. root)
Damping	Alarm Setting (high, low)
Security Setting (on, off)	Local Zero/Span Keys (enabled, disabled)
Integral Display	Sensor Fill
Isolator Material	Flange (type, material)
O-Ring Material	Drain/Vent
Remote Seal (type, fill fluid, isolator material, number)	Transmitter S/N
Address	Sensor S/N

AMS Device Manager

Right click on the device and select “Configuration Properties” from the menu. Select the tabs to review the transmitter configuration data.

FIELD COMMUNICATOR MENU TREE

Figure 3-3. Rosemount 2088/2090 HART menu tree for 4-20 mA HART

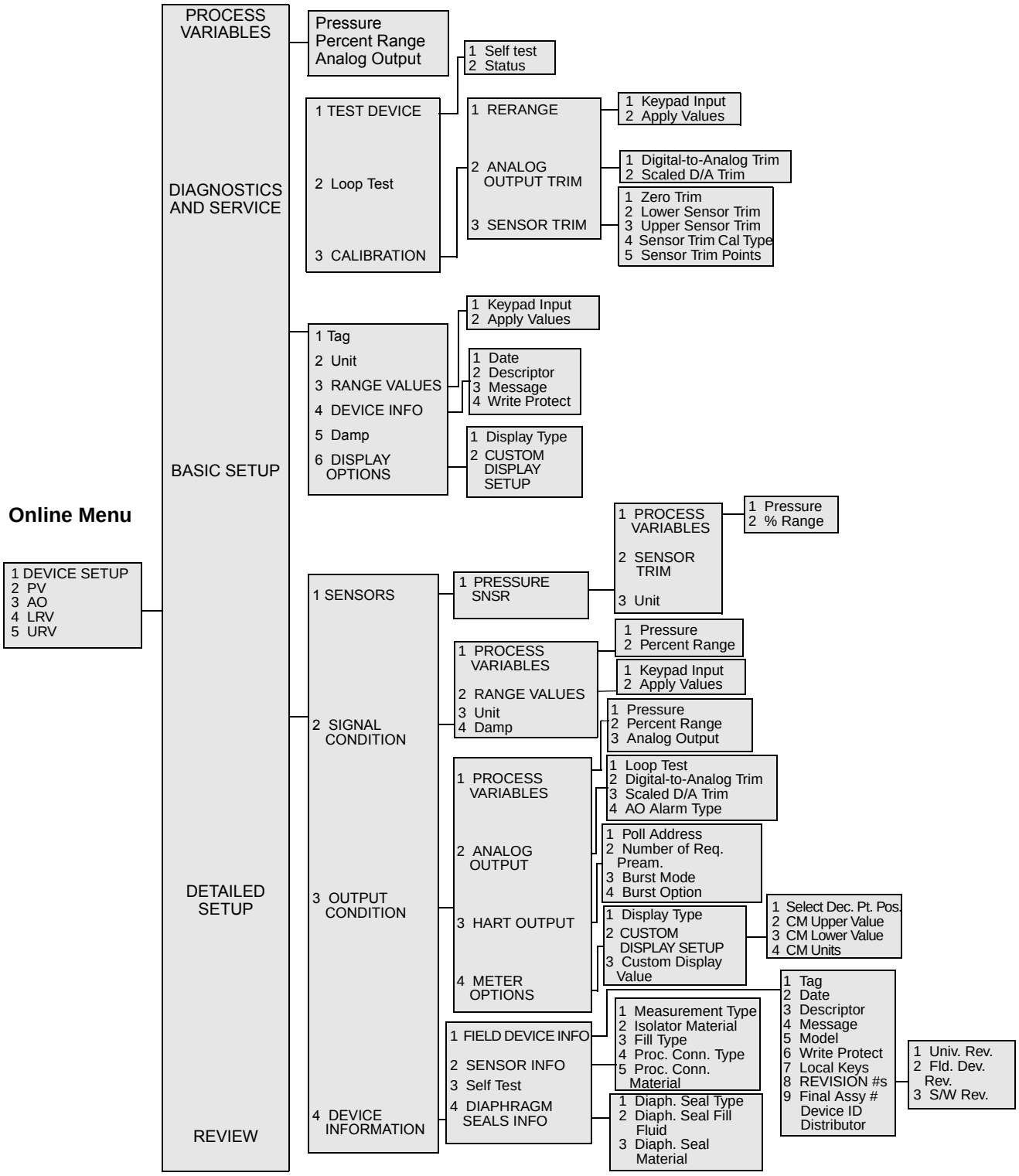
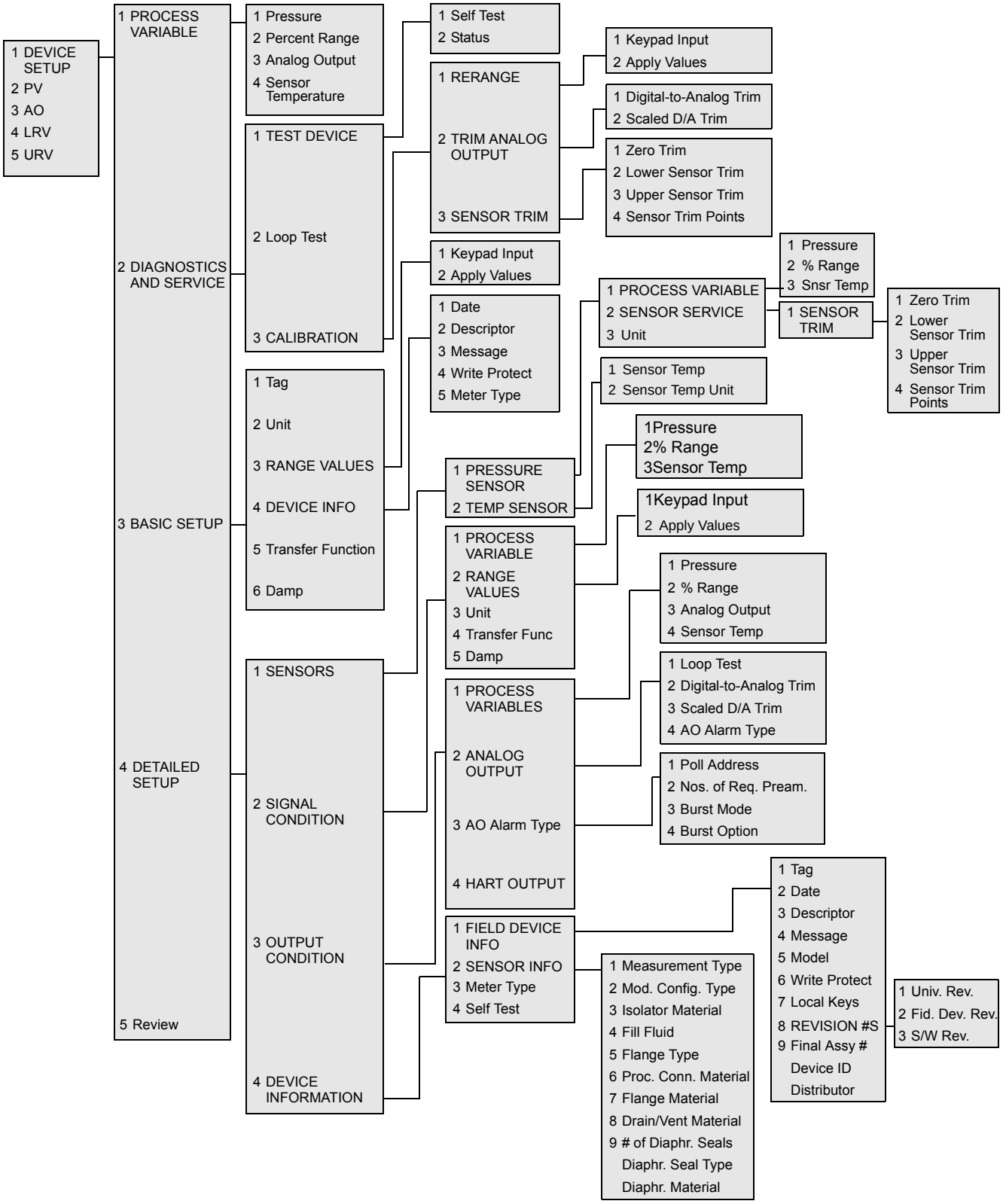


Figure 3-4. Rosemount 2088 HART Menu Tree for 1-5 Vdc Low Power



FAST KEY SEQUENCE

Table 3-1. HART Fast Key Sequences for the Rosemount 2088/2090.

A check (✓) indicates the basic configuration parameters. At minimum, these parameters should be verified as part of the configuration and startup procedure

	Function	HART Fast Key Sequence
	Analog Output Alarm	1, 4, 3, 2, 4
	Burst Mode Control	1, 4, 3, 3, 3
	Burst Option	1, 4, 3, 3, 4
	Calibration	1, 2, 3
✓	Damping	1, 3, 5
	Date	1, 3, 4, 1
	Descriptor	1, 3, 4, 2
	Digital To Analog Trim (4–20 mA Output)	1, 2, 3, 2, 1
	Disable Local Span/Zero Adjustment	1, 4, 4, 1, 7
	Field Device Info	1, 4, 4, 1
	Keypad Input	1, 2, 3, 1, 1
	Loop Test	1, 2, 2
	Lower Range Value	4, 1
	Lower Sensor Trim	1, 2, 3, 3, 2
	Message	1, 3, 4, 3
	Meter Type	1, 3, 6, 1
	Number of Requested Preambles	1, 4, 3, 3, 2
	Output Trim	1, 2, 3, 2
	Percent Range	1, 1, 2
	Poll Address	1, 4, 3, 3, 1
✓	Range Values	1, 3, 3
	Rerange	1, 2, 3, 1
	Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2
	Self Test (Transmitter)	1, 2, 1, 1
	Sensor Info	1, 4, 4, 2
	Sensor Trim (Full Trim)	1, 2, 3, 3
	Sensor Trim Points	1, 2, 3, 3, 5
	Status	1, 2, 1, 2
✓	Tag	1, 3, 1
	Transmitter Security (Write Protect)	1, 3, 4, 4
✓	Units (Process Variable)	1, 3, 2
	Upper Range Value	5, 2
	Upper Sensor Trim	1, 2, 3, 3, 3
	Zero Trim	1, 2, 3, 3, 1

CHECK OUTPUT

Before performing other transmitter on-line operations, review the digital output parameters to ensure that the transmitter is operating properly and is configured to the appropriate process variables.

Process Variables

The process variables for the Rosemount 2088/2090 provide the transmitter output, and are continuously updated. The *Process Variables* menu displays the following process variables:

- Pressure
- Percent Range
- Analog Output

Field Communicator

4-20 mA Fast Keys	1, 1

BASIC SETUP

From the *Basic Setup* menu you can configure the transmitter for certain basic variables. In many cases, all of these variables are pre-configured at the factory. Configuration may be required if your transmitter is not configured or if the configuration variables need revision.

Tag

The *Tag* variable is the easiest way to identify and distinguish between transmitters in multi-transmitter environments. Use this variable to label transmitters electronically according to the requirements of your application. The tag you define is automatically displayed when a Field Communicator establishes contact with the transmitter at power-up. The tag may be up to eight characters long and has no impact on the primary variable readings of the transmitter.

Field Communicator

4-20 mA Fast Keys	1, 3, 1

Set Units

The *Unit* command sets the desired primary variable units. Set the transmitter output to one of the following engineering units:

inH_20	g/cm^2
inHg	kg/cm^2
ftH_20	Pa
mmH_20	kPa
psi	torr
bar	atm
mbar	mmH20 @ 4 °C
nH2O @ 4 °C	

Field Communicator

4-20 mA Fast Keys	1, 3, 2

NOTE
After changing units, press SEND so the microprocessor will recalculate the associated variables (4–20 mA points, for example). The Rosemount 2088/2090 recalculates all variables that depend on units. After the transmitter recalculates the variables, you may change any of the remaining parameters.

Rerange

⚠ The *Range Values* command sets each of the lower and upper range analog values (4 and 20 mA points and 1 and 5 Vdc points) to a pressure. The lower range point represents 0% of range and the upper range limit represents 100% of range. Setting the range values to the limits of expected readings maximizes transmitter performance; the transmitter is most accurate when operated within the expected pressure ranges for your application. In practice, you may reset the transmitter range values as often as necessary to reflect changing process conditions.

NOTE
Transmitters are shipped from Emerson Process Management fully calibrated per request or by the factory default of full scale (zero to upper range limit).

NOTE
Regardless of the range points, the Rosemount 2088/2090 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH_20, and the transmitter detects a pressure of 25 inH_20, it digitally outputs the 25 inH_20 reading and a 250 percent of span reading.

You may use one of three methods to rerange the transmitter. Each method is unique; examine all three closely before deciding which method to use.

Method 1: Rerange with a Field Communicator or AMS Device Manager

This is the easiest and most popular way to rerange the transmitter. This method changes the values of the analog 4 and 20 mA points (1 and 5 Vdc points) independently without a pressure input. This means that when you change either the 4 or 20 mA setting, you also change the span.

To rerange using only the communicator enter the fast-key sequence above, select *1 Keypad input*, and follow the on-line instructions or enter the values directly from the HOME screen.

Field Communicator

4-20 mA Fast Keys	1, 3, 3

Method 2: Rerange Using the Communicator and a Pressure Source or Process Pressure

Reranging using the communicator and a pressure source or process pressure is a way of reranging the transmitter when specific 4 and 20 mA points (1 and 5 Vdc points) are not known.

NOTE
The span is maintained when the 4 mA point (1 Vdc point) is set. The span changes when the 20 mA point (5 Vdc point) is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

To rerange using the communicator and a pressure source or process pressure, enter the fast-key sequence above, select *2 Apply values*, and follow the on-line instructions.

Method 3: Rerange Using the Local Zero and Span Buttons and a Pressure Source or Process Pressure

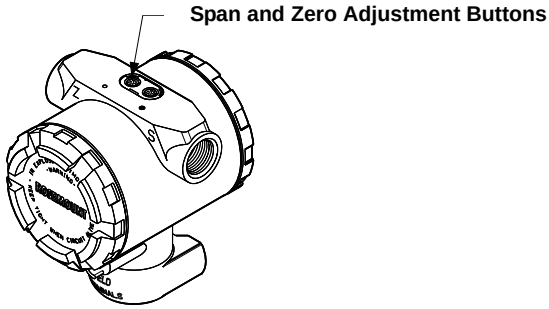
The Rosemount 2088/2090 is equipped with local zero and span adjustment buttons. The buttons are located on the top of the transmitter beneath the certifications label. Use the zero and span adjustments to set the 4 and 20 mA output points.

To rerange the transmitter using the span and zero buttons, perform the following procedure.

1. Loosen the screw holding the nameplate on top of the transmitter housing and rotate the nameplate to expose the zero and span buttons (see Figure 3-5).
2. Using a pressure source with an accuracy three to ten times the desired calibrated accuracy, apply a pressure equivalent to the lower range value.
3. To set the 4 mA point, press and hold the zero button for at least two seconds, then verify that the output is 4 mA. If a display is installed, it will display ZERO PASS.
4. Apply a pressure equivalent to the upper range value.
5. To set the 20 mA point, press and hold the span button for at least two seconds, then verify that the output is 20 mA. If a display is installed, it will display SPAN PASS.

NOTE
If the transmitter security jumper is in the “ON” position, or if the local zero and span adjustments are disabled through the software, you will not be able to make adjustments to the zero and span using the local buttons. Refer to Figure 2-9 on page 2-17 for the proper placement of the transmitter security jumper.

Figure 3-5. Local Zero and Span Adjustments



Disabling the Zero and Span Adjustments

After you rerange the transmitter using the span and zero adjustments, you may wish to disable the adjustments to prevent further reranging. To disable the span and zero adjustments, activate the transmitter security jumper.

Damping

The *Damping* command changes the response time of the transmitter to smooth variations in output readings caused by rapid changes in input. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics of your system. The default damping value is 0.50 seconds and can be reset in fixed increments of 0.05, 0.10, 0.20, 0.40, 0.80, 1.60, 3.20, 6.40, 12.8, or 25.6 seconds.

Field Communicator

4-20 mA Fast Keys	1, 3, 5

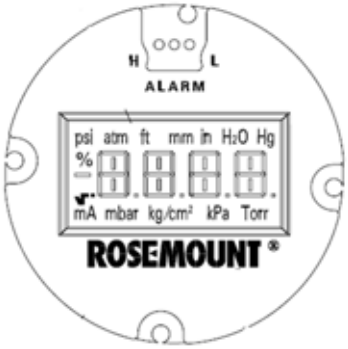
LCD DISPLAY

The LCD display connects directly to the interface board which maintains direct access to the signal terminals. The display indicates output and abbreviated diagnostic messages. A display cover is provided to accommodate the display.

For 4-20 mA HART output, the LCD display features a two-line display. The first line of five characters displays the actual measured value. The second line of six characters displays the engineering units. The LCD can also display diagnostic messages. Refer to Figure 3-6.

For 1-5 Vdc HART Low Power output, the LCD display features a single-line display with four characters that display the actual value. The LCD can also display diagnostic messages. Refer to Figure 3-6.

Figure 3-6. LCD Display

4-20 mA HART	1-5 Vdc HART Low Power
	

LCD Display Configuration for 4-20 mA HART only

The factory default is Percent of Range (M5 option) or Engineering Units (M7 option). The LCD Display Configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items:

- Eng. Units only
- % of Range only
- Custom Display only
- Alternate Eng. Units & % of Range
- Alternate Eng. Units & Custom Display
- Alternate % of Range & Custom Display

Field Communicator

4-20 mA Fast Keys	1, 3, 7

To change the standard default to one of the above options, follow these steps:

1. From the communicators main menu select (1) Device Setup (3) Basic Setup, (7) Meter Options.
2. Select (1) Meter Type. Using the up or down arrows scroll up or down until the desired display has been highlighted. Press ENTER, SEND, and HOME.

AMS

Right click on the device and select “Configuration Properties” from the menu.

1. In the “Local Display” tab, locate the “Meter Type” area. Select the desired options to suit your application needs, click **Apply**.
2. An “Apply Parameter Modification” screen appears. Enter desired information and click **OK**.
3. After carefully reading the warning provided, select **OK**.

Custom Display Configuration 4-20 mA HART only

The user-configurable scale is a feature that enables the LCD display to display flow, level, or custom pressure units. With this feature you can define the decimal point position, the upper range value, the lower range value, the engineering units, and the transfer function.The display can be configured using a Field Communicator or AMS.

The user-configurable scale feature can define:

- decimal point position
- upper range values
- lower range values
- engineering units
- transfer function

To configure the display with a Field Communicator, perform the following procedure:

1. Change the Meter Type to “Custom Meter” by using the Fast Key sequence under “LCD Display Configuration for 4-20 mA HART only” on page 3-12.
2. Next, from the **ONLINE** screen, *Select 1 Device Setup, 3 Basic Setup, 7 Meter Options, 2 Meter Options, 2 Custom Meter Setup.*

To specify decimal point position:

a. Select *1 Sel dec pt pos*. Choose the decimal point representation that will provide the most accurate output for your application. For example, when outputting between 0 and 75 GPM, choose *XX.XXX* or use the decimal point examples below:

XXXXX
XXXX.X
XXX.XX
XX.XXX
X.XXXX

NOTE:
Make sure the selection has been sent and the decimal point has changed before proceeding to the next step.

b. SEND

3. To specify a custom upper range value:
   a. Select *2 CM Upper Value*. Type the value that you want the transmitter to read at the 20 mA point.
   b. SEND
4. To specify a custom lower range value:
   a. Select *3 CM Lower Value*. Type the value that you want the transmitter to read at the 4 mA point.
   b. SEND
5. To define custom units:
   a. Select *4 CM Units*. Enter the custom units (five characters maximum) that you want the display to display.
   b. SEND
6. To choose the transmitter transfer function for the display:
   a. Select *5 CM xfer fnct*. Enter the transmitter transfer function for the display. Select *sq root* to display flow units. The custom meter transfer function is independent of the analog output transfer function.
7. Select **SEND** to upload the configuration to the transmitter.

DETAILED SETUP

Failure Mode Alarm and Saturation

As part of normal operation, the Rosemount 2088/2090 Pressure Transmitter continuously monitors its own operation. This automatic diagnostic routine is a timed series of checks repeated continuously. If the diagnostic routine detects a failure in the transmitter, the transmitter drives its output either below or above specific values depending on the position of the failure mode jumper or switch.

The values to which transmitters drive their output in failure mode depend on whether they are factory-configured to *standard* or *NAMUR-compliant* operation. The values for each are as follows:

Table 3-2. 4-20 mA HART Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA

Table 3-3. NAMUR-Compliant Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.5 mA

Table 3-4. 1-5 Vdc HART Low-Power Alarm and Saturation Values

Level	1–5 V Saturation	1–5 V Alarm
Low	0.97 V	≤ 0.95 V
High	5.20 V	≥ 5.4 V

To determine the failure mode configuration of your transmitter, review the failure mode options using a Field Communicator.

NOTE
The failure mode configuration, whether standard or NAMUR-compliant, is configured at the factory and can not be changed in the field.

Burst Mode

Burst Mode sets the transmitter to maintain digital contact with a Digital Control System that has custom software to support burst mode. When the Rosemount 2088 transmitter is configured for burst mode, it provides faster digital communication from the transmitter to the control system by eliminating the time required for the control system to request information from the transmitter.

Burst mode is compatible with use of the analog signal. Because HART® protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, and/or analog output in mA), and does not affect the way other transmitter data is accessed.

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 3

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A Field Communicator or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the Field Communicator or a control system to initiate a request. The transmitter will receive the request, process the response message, and then continue "bursting" the data approximately three times per second.

Alarm and Saturation Levels for Burst Mode

Transmitters set to burst mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Analog output switches to alarm value
- Primary variable is burst with a status bit set
- Percent of range follows primary variable
- Temperature is burst with a status bit set

Saturation:

- Analog output switches to saturation value
- Primary variable is burst normally
- Temperature is burst normally

Alarm and Saturation Values for Multidrop Mode

Transmitters set to multidrop mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Primary variable is sent with a status bit set
- Percent of range follows primary variable
- Temperature is sent with a status bit set

Saturation:

- Primary variable is sent normally
- Temperature is sent normally

Alarm Level Verification

If the transmitter electronics board, sensor module, or LCD display is repaired or replaced, verify the transmitter alarm level before returning the transmitter to service. This feature is also useful in testing the reaction of the control system to a transmitter in an alarm state. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value.

Save, Recall, or Clone Configuration Data

Data that was entered off-line can be stored in the communicator memory and downloaded to other transmitters later. Data also can be copied from a transmitter in order to be sent to other transmitters in a process known as “cloning.” This is especially useful if you work with a large number of transmitters that require the same configuration data.

Field Communicator

4-20 mA Fast Keys	left arrow, 3 (note)

DIAGNOSTICS AND SERVICE

Test Device

The *Test Device* command initiates a more extensive diagnostic routine than that performed continuously by the transmitter. The transmitter test routine can identify an electronics failure. If the transmitter test detects a problem, the communicator displays messages to indicate the source of the problem.

Field Communicator

4-20 mA Fast Keys	1, 2, 1, 1

Loop Test

The *Loop Test* command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. To initiate a loop test, perform the following procedure:

Field Communicator

4-20 mA Fast Keys	1, 2, 2

1. Connect a reference meter to the transmitter. To do so, either connect the meter to the test terminals on the transmitter terminal block, or shunt the power to the transmitter through the meter at some point in the loop.
2. From the HOME screen, Select *1 Device Setup*, *2 Diagnostics and Service*, *2 Loop Test*, to prepare to perform a loop test.
3. Select “OK” after you set the control loop to manual.
   The communicator displays the loop test menu.
4. Select a discreet milliamp level for the transmitter to output. At the “Choose analog output” prompt, select *1 4mA*, *2 20mA*, or select *3 other* to manually input a value between 4 and 20 mA.
5. Check the current meter installed in the test loop to verify that it reads the value you commanded the transmitter to output. If the readings do not match, the transmitter requires an output trim or the current meter is malfunctioning.

After completing the test procedure, the display returns to the loop test screen and allows you to choose another output value.

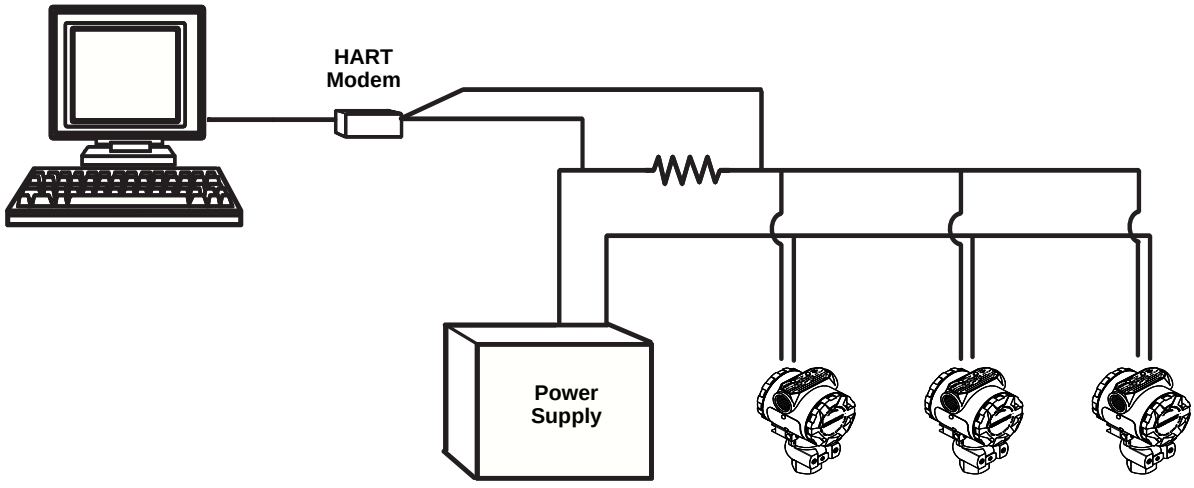
MULTIDROP COMMUNICATION

Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. Many of the Rosemount transmitters can be multidropped. With the HART communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines. Note that Burst Mode Operation is not compatible with multidrop communications.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Multidrop installations are not recommended where intrinsic safety is a requirement. Communication with the transmitters can be accomplished with commercially available HART modems and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Figure 3-7 shows a typical multidrop network. This figure is not intended as an installation diagram. Contact Rosemount product support with specific requirements for multidrop applications.

Figure 3-7. Typical Multidrop Network.



HART-based communicators can test, configure, and format a multidropped transmitter the same way as a transmitter in a standard point-to-point installation.

NOTE
The transmitter is set to address 0 at the factory, allowing it to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, you must change the transmitter address to a number from 1 to 15. This change deactivates the 4–20 mA analog output, locking it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale jumper position.

Changing a Transmitter Address

To change the address of a multidropped transmitter, follow these fast key sequences. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15.

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 1

Communicating with a Multidropped Transmitter

To communicate with a multidropped transmitter for the purpose of testing, configuring, or formatting.

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 2

Polling a Multidropped Loop

Polling a multidropped loop determines the model, address, and number of transmitters on the given loop.

Field Communicator

4-20 mA Fast Keys	Left Arrow, 4, 1, 1

Section 4 Operation and Maintenance

OVERVIEW

This section contains information on calibrating and diagnostics messages on the Rosemount 2088/2090 Pressure Transmitters.

Field Communicator and AMS instructions are given to perform configuration functions. For convenience, Field Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

CALIBRATION OVERVIEW

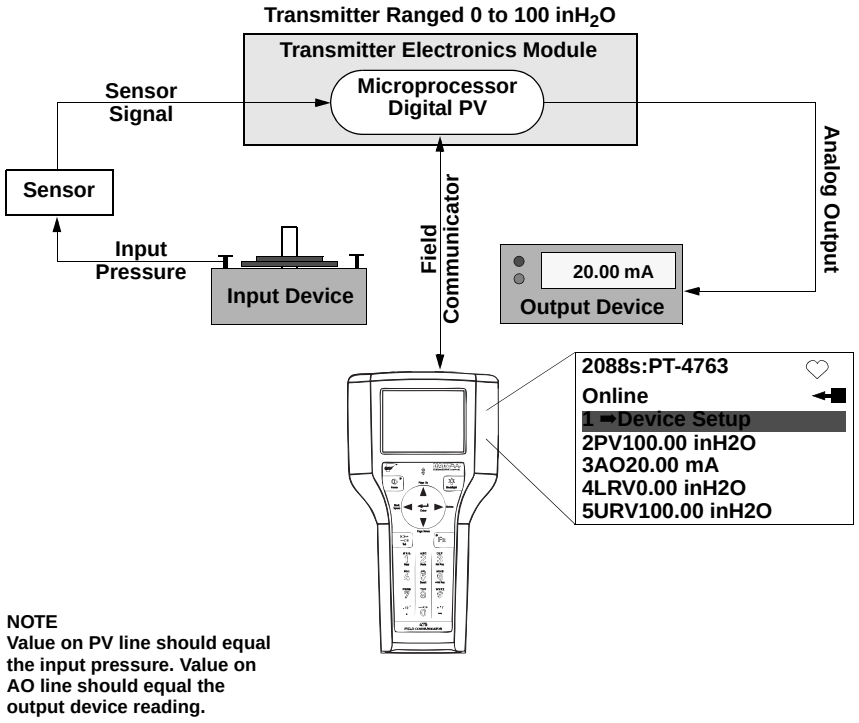
Calibration is defined as the process required to optimize transmitter accuracy over a specific range by adjusting the factory sensor characterization curve located in the microprocessor. Possible procedures are:

- Reranging: Setting the lower and upper range points (4 and 20 mA or 1 and 5 Vdc) points at required pressures. Reranging does not change the factory sensor characterization curve. Refer to page 3-9.
- Analog Output Trim: Adjusts the transmitter's analog characterization curve to match the plant standard of the control loop. There are two types of digital-to-analog output trims. Refer to page 4-5.
  - Digital-to-Analog Output Trim on 4-20 mA HART output (page 4-5)
  - Digital-to-Analog Output Trim on 4-20 mA HART output Using Other Scale (page 4-6)
- Sensor Trim: Adjusts the position of the factory sensor characterization curve due to a change in the sensor characteristics over time or a change in test equipment. Trimming has two steps, zero and sensor trims. Refer to page 4-8.
  - Zero Trim (page 4-9)
  - Sensor Trim (page 4-9)

Figure 4-1 Illustrates the Rosemount 2088/2090 data flow. This data flow can be summarized in four major steps:

1. A change in pressure is measured by a change in the sensor output (Sensor Signal).
2. The sensor signal is converted to a digital format that can be understood by the microprocessor (Analog-to-Digital Signal Conversion).
3. Corrections are performed in the microprocessor to obtain a digital representation of the process input (Digital PV).
4. The Digital PV is converted to an analog value (Digital-to-Analog Signal Conversion).

Figure 4-1. Transmitter Data Flow with Calibration Options



NOTE
The 2088/2090 has been carefully calibrated at the factory. Trimming adjusts the position of the factory characterization curve. It is possible to degrade performance of the transmitter if any trim is done improperly or with inaccurate equipment.

Determining Calibration Frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions. Use the following procedure to determine calibration frequency that meets the needs of your application.

1. Determine the performance required for your application.
2. Determine the operating conditions.
3. Calculate the Total Probable Error (TPE).
4. Calculate the stability per month.
5. Calculate the calibration frequency.

Sample Calculation For A Standard 2088

Step 1: Determine the performance required for your application.

Required Performance: 0.50% of span

Step 2: Determine the operating conditions.

Transmitter: 2088G, Range 1 [URL=30 psi (2,1 bar)]
Calibrated Span: 30 psi (2,1 bar)
Ambient Temperature Change: ± 50 °F (28 °C)

Step 3: Calculate total probable error (TPE).

$$TPE = \sqrt{(ReferenceAccuracy)^2 + (TemperatureEffect)^2 + (StaticPressureEffect)^2} = 0.316\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.10% of span

Ambient Temperature Effect =

$$\pm(0.15\% \text{ URL} + 0.15\% \text{ of span}) \text{ per } 50\ ^\circ F = \pm 0.3\% \text{ of span}$$

Step 4: Calculate the stability per month.

$$\text{Stability} = \pm(0.100 \times \text{URL})\% \text{ of span for 1 year} = \pm 0.0083\% \text{ of span per month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.5\% - 0.316\%)}{0.0083\%} = 22 \text{ months}$$

Choosing a Trim Procedure

To decide which trim procedure to use, you must first determine whether the analog-to-digital section or the digital-to-analog section of the transmitter electronics need calibration. Refer to Figure 4-1 and perform the following procedure:

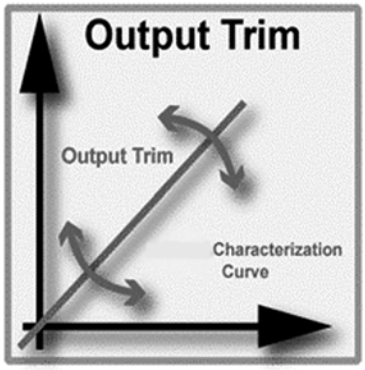
1. Connect a pressure source, a Field Communicator or AMS, and a digital readout device to the transmitter.
2. Establish communication between the transmitter and the Field Communicator.
3. Apply pressure equal to the upper range point pressure.
4. Compare the applied pressure to the pressure process variable valve on the Process Variables menu on the Field Communicator or the Process Variables screen in AMS. For instructions on how to access process variables, see page 3-8 of Section 3: Configuration.
   a. If the pressure reading does not match the applied pressure (with high-accuracy test equipment), perform a sensor trim. See “Sensor Trim Overview” on page 4-8 to determine which trim to perform.
5. Compare the Analog Output (AO) line, on the Field Communicator or AMS, to the digital readout device.

If the AO reading does not match the digital readout device (with high-accuracy test equipment), perform an analog output trim. See “Analog Output Trim” on page 4-5.

ANALOG OUTPUT TRIM

The Analog Output Trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA (1 and 5 Vdc) points to match the plant standards. This command adjusts the digital to analog signal conversion.

Figure 4-2. Output Trim



Digital-to-Analog Trim

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 1

To perform a digital-to-analog trim with a Field Communicator, perform the following procedure.

1. From the **HOME** screen, enter the fast key sequence "Digital-to-Analog Trim." Select **OK** after setting the control loop to manual, see "Setting the Loop to Manual" on page 3-2.
2. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
3. Select **OK** after connecting the reference meter.
4. Select **OK** at the **SETTING FLD DEV OUTPUT TO 4 MA (1 Vdc)** prompt. The transmitter outputs 4.0 mA.
5. Record the actual value from the reference meter, and enter it at the **ENTER METER VALUE** prompt. The Field Communicator prompts you to verify whether or not the output value equals the value on the reference meter.
6. Select 1: Yes, if the reference meter value equals the transmitter output value, or 2: No, if it does not.
   a. If 1 is selected: Yes, proceed to Step 7.
   b. If 2 is selected: No, repeat Step 5.
7. Select **OK** at the **SETTING FLD DEV OUTPUT TO 20 MA (5 Vdc)** prompt, and repeat Steps 5 and 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after the control loop is returned to automatic control.

AMS

Right click on the device and select “Calibrate,” then “D/A Trim” from the menu**.**

1. Click **Next** after setting the control loop to manual.
2. Click **Next** after connecting the reference meter.
3. Click **Next** at the “Setting fld dev output to 4 mA (1 Vdc)” screen.
4. Record the actual value from the reference meter, and enter it at the “Enter meter value” screen and click **Next**.
5. Select **Yes**, if the reference meter value equals the transmitter output value or **No**, if it does not. Click **Next**.
   a. If Yes is selected, proceed to Step 6.
   b. If No is selected, repeat Step 4.
6. Click **Next** at the “Setting fld dev output to 20 mA (5 Vdc)” screen.
7. Repeat Step 4 - Step 5 until the reference meter equals the transmitter output value.
8. Select **Next** to acknowledge the loop can be returned to automatic control.
9. Select **Finish** to acknowledge the method is complete.

Digital-to-Analog Trim Using Other Scale

The Scaled D/A Trim command matches the 4 and 20 mA (1 and 5 Vdc) points to a user selectable reference scale other than 4 and 20 mA (for example, 2 to 10 volts if measuring across a 500 ohm load, or 0 to 100 percent if measuring from a Distributed Control System (DCS)). To perform a scaled D/A trim, connect an accurate reference meter to the transmitter and trim the output signal to scale, as outlined in the Output Trim procedure.

NOTE
Use a precision resistor for optimum accuracy. If you add a resistor to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with additional loop resistance. Refer to “Power Supply” on page 2-18.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 2

AMS

Right click on the device and select “Calibrate,” then “Scaled D/A trim” from the menu**.**

1. Click **Next** after setting the control loop to manual.
2. Select **Change** to change scale, click **Next**.
3. Enter Set scale-Lo output value, click **Next**.
4. Enter Set scale-Hi output value, click **Next**.
5. Click **Next** to proceed with Trim.
6. Click **Next** after connecting the reference meter.
7. Click **Next** at the “Setting fld dev output to 4 mA” screen.
8. Record the actual value from the reference meter, enter it at the “Enter meter value” screen, and click **Next**.
9. Select **Yes**, if the reference meter value equals the transmitter output value or **No**, if it does not. Click **Next**.
   a. If Yes is selected, proceed to Step 10.
   b. If No is selected, repeat Step 8.
10. Click **Next** at the “Setting fld dev output to 20 mA” screen.
11. Repeat Step 8 - Step 9 until the reference meter equals the transmitter output value.
12. Select **Next** to acknowledge the loop can be returned to automatic control.
13. Select **Finish** to acknowledge the method is complete.

Recall Factory Trim—Analog Output

The Recall Factory Trim—Analog Output command allows the restoration of the as-shipped factory settings of the analog output trim. This command can be useful for recovering from an inadvertent trim, incorrect Plant Standard, or faulty meter. This command is only available with 4-20 mA output.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 2

AMS

Right click on the device and select “Calibrate,” then “Recall Factory Trim” from the menu**.**

1. Click **Next** after setting the control loop to manual.
2. Select “Analog output trim” under “Trim to recall” and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

SENSOR TRIM

Sensor Trim Overview

Trim the sensor using either sensor or zero trim functions. Trim functions vary in complexity and are application-dependent. Both trim functions alter the transmitter's interpretation of the input signal.

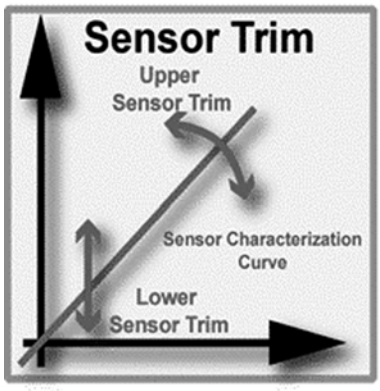
Zero trim is a single-point offset adjustment. It is useful for compensating for mounting position effects and is most effective when performed with the transmitter installed in its final mounting position. Since this correction maintains the slope of the characterization curve, it should not be used in place of a sensor trim over the full sensor range.

When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

NOTE
Do not perform a zero trim on Rosemount 2088/2090 Absolute pressure transmitters. Zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on an Absolute Pressure Transmitter, perform a low trim within the sensor trim function. The low trim function provides an offset correction similar to the zero trim function, but it does not require zero-based input.

Sensor trim is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. Always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The trim values allow you to optimize performance over your specified measuring range at the calibration temperature.

Figure 4-3. Sensor Trim



Zero Trim

NOTE
The transmitter must be within three percent of true zero (zero-based) in order to calibrate with zero trim function.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 3, 1

Calibrate the sensor with a Field Communicator using the zero trim function as follows:

1. Vent the transmitter and attach a Field Communicator to the measurement loop.
2. From the **HOME** screen, follow the fast key sequence “Zero Trim.”
3. Follow the commands provided by the Field Communicator to complete the zero trim adjustment.

AMS

Right click on the device and select “Calibrate,” then “Zero trim” from the menu**.**

1. Click **Next** after setting the control loop to manual.
2. Click **Next** to acknowledge warning.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Sensor Trim

NOTE
Use a pressure input source that is at least three times more accurate than the transmitter, and allow the input pressure to stabilize for ten seconds before entering any values.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 3

To calibrate the sensor with a Field Communicator using the sensor trim function, perform the following procedure:

1. Assemble and power the entire calibration system including a transmitter, Field Communicator, power supply, pressure input source, and readout device.
2. From the **HOME** screen, enter the fast key sequence under “Sensor Trim.”
3. Select 2: Lower sensor trim. The lower sensor trim value should be the sensor trim point that is closest to zero.

Examples:

Calibration: 0 to 100 inH_2O - lower trim = 0, upper trim = 100

Calibration: -100 to 0 inH_2O - lower trim = 0, upper trim = -100

Calibration: -100 to 100 inH_2O - lower trim = -100 or 100,
upper trim = -100 or 100

NOTE
Select pressure input values so that lower and upper values are equal to or outside the 4 and 20 mA (1 and 5 Vdc) points. Do not attempt to obtain reverse output by reversing the high and low points. This can be done by going to “Rerange” on page 3-9 of Section 3: Configuration. The transmitter allows approximately five percent deviation.

4. Follow the commands provided by the Field Communicator to complete the adjustment of the lower value.
5. Repeat the procedure for the upper value, replacing 2: Lower sensor trim with 3: Upper sensor trim in Step 3.

AMS

Right click on the device and select “Calibrate,” then “Sensor trim” from the menu**.**

1. Select “Lower sensor trim.” The lower sensor trim value should be the sensor trim point that is closest to zero.
2. Click **Next** after setting the control loop to manual.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.
6. Right click on the device and select “Calibrate.” Select “Sensor trim” from the menu**.**
7. Select “Upper sensor trim” and repeat steps 2-5.

Recall Factory Trim—Sensor Trim

The Recall Factory Trim—Sensor Trim command allows the restoration of the as-shipped factory settings of the sensor trim. This command can be useful for recovering from an inadvertent zero trim of an absolute pressure unit or inaccurate pressure source. This command is only available with 4-20 mA output.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 1

AMS

Right click on the device and select “Calibrate,” then “Recall Factory Trim” from the menu**.**

1. Click **Next** after setting the control loop to manual.
2. Select “Sensor trim” under “Trim to recall” and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Section 5 Troubleshooting

OVERVIEW

Table 5-1 provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using Table 5-1 on page 5-2 to identify any potential problem.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

WARNINGS

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Table 5-1. Rosemount 2088/2090Troubleshooting for 4-20 mA output.

Symptom	Corrective Actions
Transmitter milliamp reading is zero	Verify power is applied to signal terminals
	Check power wires for reversed polarity
	Verify terminal voltage is 10.5 to 42.4 Vdc
	Check for open diode across test terminal
Transmitter Not Communicating with Field Communicator	Verify the output is between 4 and 20 mA or saturation levels
	Verify terminal voltage is 10.5 to 42.4 Vdc
	Verify clean DC Power to transmitter (Max AC noise 0.2 volts peak to peak)
	Check loop resistance, 250 Ω minimum (PS voltage -transmitter voltage/loop current)
	Have Field Communicator poll for all addresses
Transmitter milliamp reading is low or high	Verify applied pressure
	Verify 4 and 20 mA range points
	Verify output is not in alarm condition
	Verify if 4 – 20 mA output trim is required
Transmitter will not respond to changes in applied pressure	Check test equipment
	Check impulse piping or manifold for blockage
	Verify the transmitter is not in multidrop mode
	Verify applied pressure is between the 4 and 20 mA set points
	Verify output is not in alarm condition
	Verify transmitter is not in Loop Test mode
Digital Pressure Variable reading is low or high	Check test equipment (verify accuracy)
	Check impulse piping for blockage or low fill in wet leg
	Verify transmitter is calibrated properly
	Verify pressure calculations for application
Digital Pressure Variable reading is erratic	Check application for faulty equipment in pressure line
	Verify transmitter is not reacting directly to equipment turning on/off
	Verify damping is set properly for application
Milliamp reading is erratic	Verify power source to transmitter has adequate voltage and current
	Check for external electrical interference
	Verify transmitter is properly grounded
	Verify shield for twisted pair is only grounded at one end

DIAGNOSTIC MESSAGES

In addition to the output, the LCD displays abbreviated operation, error, and warning messages for troubleshooting the transmitter. Messages appear according to their priority, with normal operating messages appearing last. To determine the cause of a message, use a Field Communicator to further interrogate the transmitter. A description of each LCD diagnostic message follows.

Error

Error messages appear on the LCD display to inform you of serious problems affecting the operation of the transmitter. The display displays an error message until the error condition is corrected, and the analog output is driven to the specified alarm level. No other transmitter information is displayed during an alarm condition.

FAIL

The transmitter CPU board and the sensor module are incompatible.

FAIL MODULE

The sensor module is disconnected or is malfunctioning. Verify that the sensor module ribbon cable is connected to the back of the electronics board. If the ribbon cable is not disconnected, there is a problem within the sensor module. Possible sources of problems include:

- Pressure or temperature updates are not being received in the sensor module.
- A non-volatile memory fault that will affect transmitter operation has been detected in the module by the memory verification routine.

FAIL ELECT

The transmitter electronics module is malfunctioning. Possible causes include:

- Internal fault
- A non-volatile memory fault that will affect transmitter operation has been detected in the module by the memory verification routine

Neither problem is repairable; the electronics board must be replaced.

FAIL CONFIG

A non-volatile memory fault has been detected in the transmitter memory by the memory verification routine. The memory fault is in a location that could affect transmitter operation, and is user-accessible. To correct this problem, use a Field Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory.

Warnings

Warnings appear on the LCD display to alert you of user-repairable problems with the transmitter, or current transmitter operations. Warnings appear alternately with other transmitter information until the warning condition is corrected or the transmitter completes the operation that triggered the warning message.

PRESS LIMIT

The process variable read by the transmitter is outside of sensor range limits.

CURR FIXED

The transmitter is in multidrop mode. The analog output is not tracking pressure changes.

CURR SATURD

The pressure read by the module is outside of the specified range, and the analog output has been driven to saturation levels (see “Transient Protection Terminal Block” on page 2-21).

LOOP TEST

A loop test is in progress. During a loop test or 4–20 mA trim, the analog output is set to a fixed value. The display alternates between the current selected in milliamps and “LOOP TEST.”

XMTR INFO

A non-volatile memory fault has been detected in the transmitter memory by the memory verification routine. The memory fault is in a location containing transmitter information. To correct this problem, use a Field Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory. This warning does not affect the transmitter operation.

Operation

Normal operation messages appear on the LCD display to confirm actions or inform you of transmitter status. Operation messages are displayed with other transmitter information, and warrant no action to correct or alter the transmitter settings.

ZERO PASS

The zero value, set with the local zero adjustment button, has been accepted by the transmitter, and the output should change to 4 mA.

ZERO FAIL
The zero value, set with the local zero adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

SPAN PASS

The span value, set with the local span adjustment button, has been accepted by the transmitter and the output should change to 20 mA.

LOCAL DSBLD

This message appears during reranging with the integral zero and span buttons and indicates that the transmitter local zero and span adjustments have been disabled. The adjustments may have been disabled by the transmitter security jumper on the transmitter circuit board or through software commands from the Field Communicator. Refer to “Transient Protection Terminal Block” on page 2-21 for information on the position of the security jumper, and for information on the software lockout.

WRITE PROTECT

The write protect (SECURITY) jumper is set to disable changes to the transmitter configuration data. Refer to “Transient Protection Terminal Block” on page 2-21 for more information on the security jumper.

Field Communicator Diagnostics

Table 5-2 is a list of messages used by the Field Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with <*variable parameter*>.

Reference to the name of another message is identified by *[another message]*.

Table 5-2. Field Communicator Messages

Message	Description
1k snsr EEPROM error-factory ON	Replace the transmitter
1k snsr EEPROM error-user-no out ON	Use the Field Communicator to reset the following parameters: remote seal isolator, remote seal fill fluid, flange material, o-ring material, transmitter type, remote seal type, flange type, meter type, number of remote seals.
1k snsr EEPROM error-user ON	Perform a full trim to recalibrate the transmitter.
4k micro EEPROM error-factory ON	Replace the electronics board.
4k micro EEPROM error-user-no out ON	Use the Field Communicator to reset the message field.
4k micro EEPROM error-user ON	Use the Field Communicator to reset the following parameters: units, range values, damping, analog output, transfer function, tag, scaled meter values. Perform a D/A trim to ensure that the error is corrected.
4k snsr EEPROM error-factory ON	Replace the transmitter.
4k snsr EEPROM error-user ON	Use the Field Communicator to reset the temperature units and the calibration type.
Add item for ALL device types or only for this ONE device type.	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	The communicator and the device are not communicating correctly. Check all connections between the Field Communicator and the device and resend the information.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
CPU board not initialized ON	The electronics board is not initialized. Replace the electronics board.
CPU EEPROM write failure ON	Message sent to electronics board from HART signal failed. Replace the electronics board.
Device Busy	The connected device is busy performing another task.
Device Disconnected	The device failed to respond to a command. Check all connections between the Field Communicator and the device and resend the command.
Device write protected	Device is in write-protect mode. Data can not be written.

Message	Description
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the Field communicator off and lose the unsent data.
Display value of variable on hotkey menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
Download data from configuration memory to device	Press the SEND softkey to transfer information from the communicator memory to the device.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device-specified description edit format.
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device-specified description edit format.
Ignore next 50 occurrences of status?	Select YES to ignore the next 50 occurrences of device status, or select no to display every occurrence.
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incompatible CPU board and module ON	Upgrade the electronics board or the sensor module to the current revision.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15.
Local buttons operator error ON	Illegal pressure applied during zero or span operation. Repeat the process after verifying the correct pressures.
Mark as read only variable on hotkey menu?	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
Module EEPROM write failure ON	Message sent to the module from the HART signal failed. Replace the transmitter.
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
No hotkey menu available for this device.	There is no menu named “hotkey” defined in the device description for this device.
No pressure updates ON	No pressure updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No offline devices available.	There are no device descriptions available to be used to configure a device offline.
No simulation devices available.	There are no device descriptions available to simulate a device.
No temperature updates ON	No temperature updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device. This menu is required for offline configuration.
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method.
Online device disconnected with unsent data. RETRY or OK to lose data.	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.

Message	Description
Out of memory for hotkey configuration. Delete unnecessary items.	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
Press OK...	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
ROM checksum error ON	Checksum of transmitter software has detected a fault. Replace the electronics board.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
Saving data to configuration memory.	Data is being transferred from a device to configuration memory.
Sending data to device.	Data is being transferred from configuration memory to a device.
Sensor board not initialized ON	The sensor module electronics board is not initialized. Replace the transmitter.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description.
Transmitter Fault	Device returns a command response indicating a fault with the connected device.
Units for <variable label> has changed. Unit must be sent before editing, or invalid data will be sent.	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to online device. SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Upgrade 475 software to access XMTR function. Continue with old description?	The communicator does not contain the most recent 2051 Device Descriptors (DDs). Select YES to communicate using the existing DDs. Select NO to abort communication.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display.
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value. Unit must be sent before editing, or invalid data will be sent.	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

DISASSEMBLY PROCEDURES

⚠ Do not remove the instrument cover in explosive atmospheres when the circuit is live.

Remove from Service

Follow these steps:

- Follow all plant safety rules and procedures.
- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and disconnect conduit.
- Remove the transmitter from the process connection.
  - The Rosemount 2088 transmitter is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process. Do not wrench on neck of transmitter.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution and rinse with clear water.

Remove Terminal Block

Electrical connections are located on the terminal block in the compartment labeled “FIELD TERMINALS.”

1. Remove the housing cover from the field terminal side.
2. Loosen the two small screws located on the assembly in the 9 o’clock and 3 o’clock positions.
3. Pull the entire terminal block out to remove it.

Remove the Electronics Board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board perform the following procedure:

1. Remove the housing cover opposite the field terminal side.
2. If you are disassembling a transmitter with an LCD display, loosen the two captive screws that are visible on the right and left side of the meter display.
3. ⚠ Loosen the two captive screws that anchor the board to the housing. The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components. Use caution when removing the LCD as there is an electronic pin connector that interfaces between the LCD and electronics board. The two screws anchor the LCD display to the electronics board and the electronics board to the housing.
4. Using the two captive screws, slowly pull the electronics board out of the housing. The sensor module ribbon cable holds the electronics board to the housing. Disengage the ribbon cable by pushing the connector release.

⚠ See “Safety Messages” on page 5-1 for complete warning information.

REASSEMBLY PROCEDURES

⚠ Attach the Electronics Board

1. Remove the cable connector from its position inside of the internal black cap and attach it to the electronics board.
2. Using the two captive screws as handles, insert the electronics board into the housing. Make sure the posts from the electronics housing properly engage the receptacles on the electronics board. Do not force. The electronics board should slide gently on the connections.
3. Tighten the captive mounting screws.
4. ⚠ Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet Explosion-Proof requirements.

Install the Terminal Block

1. Gently slide the terminal block into place, making sure the two posts from the electronics housing properly engage the receptacles on the terminal block.
2. Tighten the captive screws.
3. Replace the electronics housing cover. The transmitter covers must be fully engaged to meet Explosion-Proof requirements.

⚠ See “Safety Messages” on page 5-1 for complete warning information.

Appendix A Reference Data

PERFORMANCE SPECIFICATIONS

For zero based spans, reference conditions, silicone fill fluid, SST materials, digital trim values range points. Applies to 4-20 mA HART output only unless otherwise noted.

Conformance To Specification (±3σ (Sigma))

Technology leadership, advanced manufacturing techniques, and statistical process control ensure specification conformance to at least ±3σ.

Reference Accuracy

2088
±0.10% of calibrated span. Includes combined effects of linearity, hysteresis, and repeatability.

+/-0.075% of calibrated span (high accuracy option P8)

2090
+/- 0.20% of calibrated span. Includes combined effects of linearity, hysteresis, and repeatability.

+/- 0.10% of calibrated span (high accuracy option P8)

Ambient Temperature Effect

2088
Expressed as a total effect per 50 °F (28 °C). Total effect includes zero and span effects.

+/- (0.15% URL + 0.15% of span) from -40 to 185 °F (-40 to 85 °C)

2090
Expressed as a total effect per 100 °F (56 °C).

± (0.3% URL + 0.3% of span) from –40 to 185 °F (–40 to 85 °C).

Stability

±0.10% of upper range limit for 12 months.

Vibration Effect

Less than ±0.1% of upper range limit when subjected to vibration of: peak to peak constant displacement of 4 mm (5–15 Hz) and constant acceleration of 2 g (15–150 Hz) and 1 g (150–2000 Hz).

Power Supply Effect

Less than 0.01% of calibrated span per volt.

Mounting Position Effect

Zero shift of up to 1.2 inH_2O (3 0.3 kPa), which can be calibrated out. No span effect.

RFI Effect

Less than ±0.25% of upper range limit from 20–1000 MHz at 30 V/m with leads in conduit. Less than ±0.25% of upper range limit at 10 V/m with unshielded twisted pair (no conduit).

Transient Protection (Option Code T1)

IEEE 587 Category B

6 kV Crest (1.2 × 50 μs)
3 kA Crest (8 × 20 μs)
6 kV Crest (0.5 μs by 100 kHz)

IEEE 472

SWC 2.5 kV Crest,1 MHz waveform

General Specifications

Tested to IEC 801-3.

FUNCTIONAL SPECIFICATIONS

Service

Rosemount 2088
Liquid, gas, and vapor applications.

Rosemount 2090P
Liquid, gas, vapor, and high-viscosity applications.

Rosemount 2090F
Liquid, gas, vapor, and hygienic applications.

Rangedown
20 to 1

Ranges for Rosemount 2088

Range	Minimum Span	URL/Max.span/Sensor Limit
1	1.5 psi (103 mbar)	30 psi (2,1 bar)
2	7.5 psi (517 mbar)	150 psi (10,3 bar)
3	40 psi (2,76 bar)	800 psi (55,2 bar)
4	200 psi (13,8 bar)	4000 psi (275,8 bar)

Ranges for Rosemount 2090F

Range	Minimum Span	URL/Max.span/Sensor Limit
1	1.5 psi (103 mbar)	30 psi (2,1 bar)
2	7.5 psi (517 mbar)	150 psi (10,3 bar)
3	40 psi (2,76 bar)	300 psi (20,7 bar)

Ranges for Rosemount 2090P

Range	Minimum Span	URL/Max.span/Sensor Limit
1	1.5 psi (103 mbar)	30 psi (2,1 bar)
2	7.5 psi (517 mbar)	150 psi (10,3 bar)
3	40 psi (2,76 bar)	300 psi (20,7 bar)

Protocols

4–20 mA HART (Output Code S)

Output

Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the *HART* protocol.

Power Supply

External power supply required. Standard transmitter operates on 10.5 to 42.4 Vdc with no load.

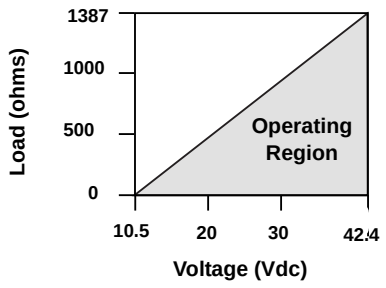
Turn-On Time

Performance within specifications less than 2.0 seconds after power is applied to the transmitter.

Load Limitations

Maximum loop resistance is determined by the power supply voltage, as described by:

Max. Loop Resistance = 43.5 (Power Supply Voltage – 10.5)



The Field communicator requires a minimum loop resistance of 250Ω for communication.

1-5 Vdc HART Low Power (Output Code N)

Output

Three wire 1–5 Vdc output, user-selectable for linear or square root output. Digital process variable superimposed on voltage signal, available to any host conforming to the *HART* protocol.

Power Supply

External power supply required. Standard transmitter operates on 9 to 28 Vdc with no load.

Power Consumption

3.0 mA, 27–84 mW

Output Load

100 kΩ or greater

Turn-On Time

Performance within specifications less than 2.0 seconds after power is applied to the transmitter.

Zero Elevation and Suppression

Zero can be suppressed between atmosphere for gage transmitters, or 0 psia for absolute transmitters, and upper range limit, provided the calibrated span is equal to or greater than the minimum span, and the upper range value does not exceed the upper range limit. Vacuum calibrations are allowed on the Rosemount 2088G, 2090FG, and 2090PG transmitters.

Overpressure Limits

Range 1: 120 psig max.
All other ranges: twice the upper range limit.

Temperature Limits

Process

Rosemount 2088	Silicone fill sensor: –40 to 250 °F (–40 to 121 °C). Inert fill sensor: –22 to 250 °F (–30 to 121 °C).
Rosemount 2090P	–4 to 250 °F (–20 to 121 °C).
Rosemount 2090F	–4 to 284 °F (–20 to 140 °C).

Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio. For example, for process temperature of 195 °F (91 °C), new ambient temperature limit is equal to 170 °F (77 °C). This can be determined as follows: (195 °F - 185 °F) x 1.5 = 15 °F, 185 °F - 15 °F = 170 °F

Ambient

Rosemount 2088	–40 to 185 °F (–40 to 85 °C). –4 to 175 °F (–20 to 80 °C) with LCD display.(1)
Rosemount 2090P	–4 to 185 °F (–20 to 85 °C).
Rosemount 2090F	–4 to 185 °F (–20 to 85 °C).

Storage

Rosemount 2088	–50 to 230 °F (–46 to 110 °C). –40 to 185 °F (–40 to 85 °C) with LCD display.(1)
Rosemount 2090P	–50 to 185 °F (–45 to 85 °C).
Rosemount 2090F	–22 to 185 °F (–30 to 85 °C).

(1) LCD display may not be readable and LCD updates will be slower at temperatures below -4 °F (-20 °C).

Humidity Limits

0–100% relative humidity.

Volumetric Displacement

Less than 0.00042 cm^3.

Failure Mode

If self-diagnostics detect a sensor or microprocessor failure, the analog signal is driven either high or low to alert the user. High or low failure mode is user-selectable with a jumper on the transmitter. The values to which the transmitter drives its output in failure mode depend on whether it is factory-configured to *standard* or *NAMUR-compliant* operation. The values for each are as follows:

Standard Operation			
Output Code	**Linear Output**	**Fail High**	**Fail Low**
S	3.9 ≤ I ≤ 20.8	I ≥ 21.75 mA	I ≤ 3.75 mA
N	0.97 ≤ V ≤ 5.2	V ≥ 5.4 V	V ≤ 0.95 V
N with Code C2	0.78 ≤ V ≤ 3.44	V ≥ 4.0 V	V ≤ 0.77 V

NAMUR-Compliant Operation	**Linear Output**	**Fail High**	**Fail Low**
Output Code S	3.8 ≤ I ≤ 20.5	I ≥ 22.5 mA	I ≤ 3.6 mA

PHYSICAL SPECIFICATIONS

Electrical Connection

Rosemount 2088
1/2–14 NPT, M20 x 1.5 or G 1/2 female (PF 1/2 female) conduit entry.

Rosemount 2090
1/2–14 NPT or M20 x 1.5 conduit entry

Process Connection

Rosemount 2088
1/2–14 NPT female, DIN 16288 G 1/2 male, RC 1/2 female (PT 1/2 female), M20 x1.5 male.

Rosemount 2090P
M44 x 1.25 male, compatible with a 1-in. PMC® process connection.

Rosemount 2090F
1 1/2-inch or 2-inch Tri-Clamp Connection

Process Wetted Parts

Isolating Diaphragm

Rosemount 2088	316L stainless steel or Alloy C-276.
Rosemount 2090P	316L stainless steel.
Rosemount 2090F	316L stainless steel.

Process Connector

Rosemount 2088	316L stainless steel or Alloy C-276.
Rosemount 2090P	316L stainless steel. TFE process connector gasket.
Rosemount 2090F	316L stainless steel.

Non-wetted Parts

Electronics Housing
Low-copper aluminum, NEMA 4X, IP65, IP67, CSA enclosure Type 4X.

Paint
Polyurethane.

Cover O-rings
Buna-N.

Fill Fluid

Rosemount 2088	Silicone or inert fill
Rosemount 2090P	Silicone
Rosemount 2090F	Neobee M20

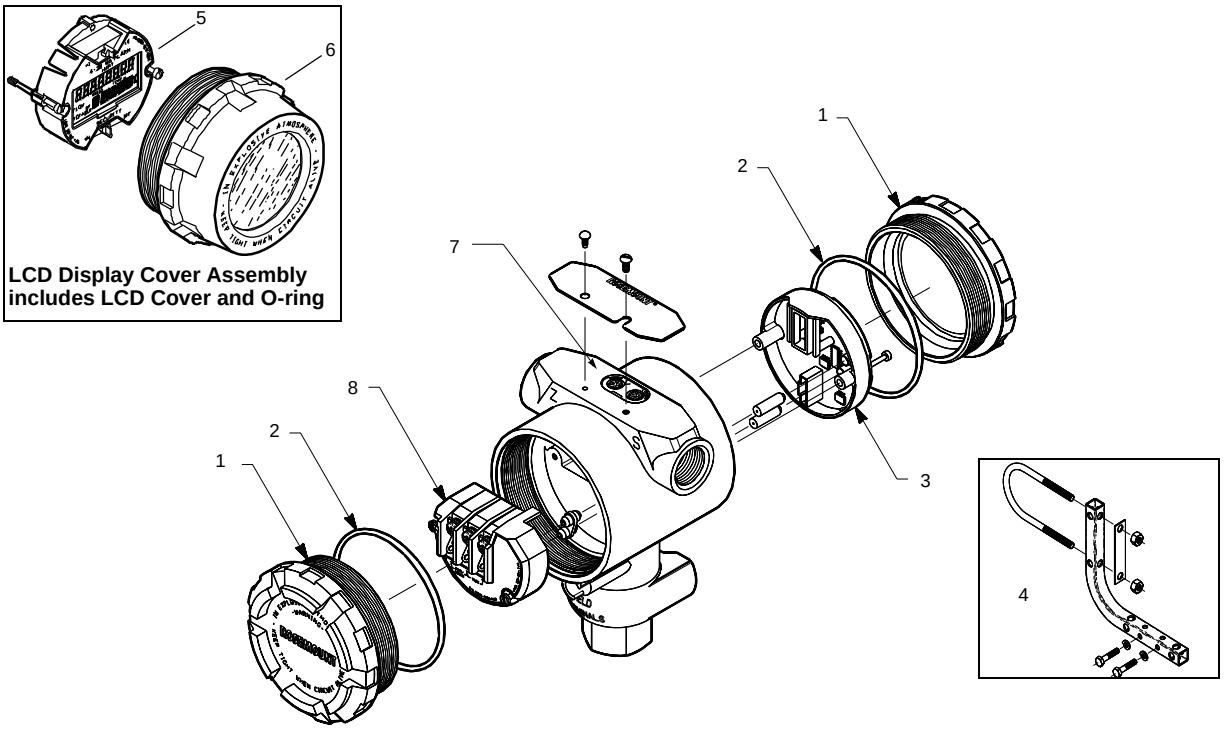
Weight

Rosemount 2088	Approximately 2.44 lb. (1,11 kg).
Rosemount 2090P	Approximately 2.96 lb. (1,34 kg).
Rosemount 2090F	Approximately 2.74 lb. (1,24 kg).

Accessory Block and Bleed Valve (S5 Option)
For information on Rosemount 306 Integral Manifold (pre-assembled to transmitter and leak checked), refer to Product Data Sheet 00813-0100-4733.

SPARE PARTS

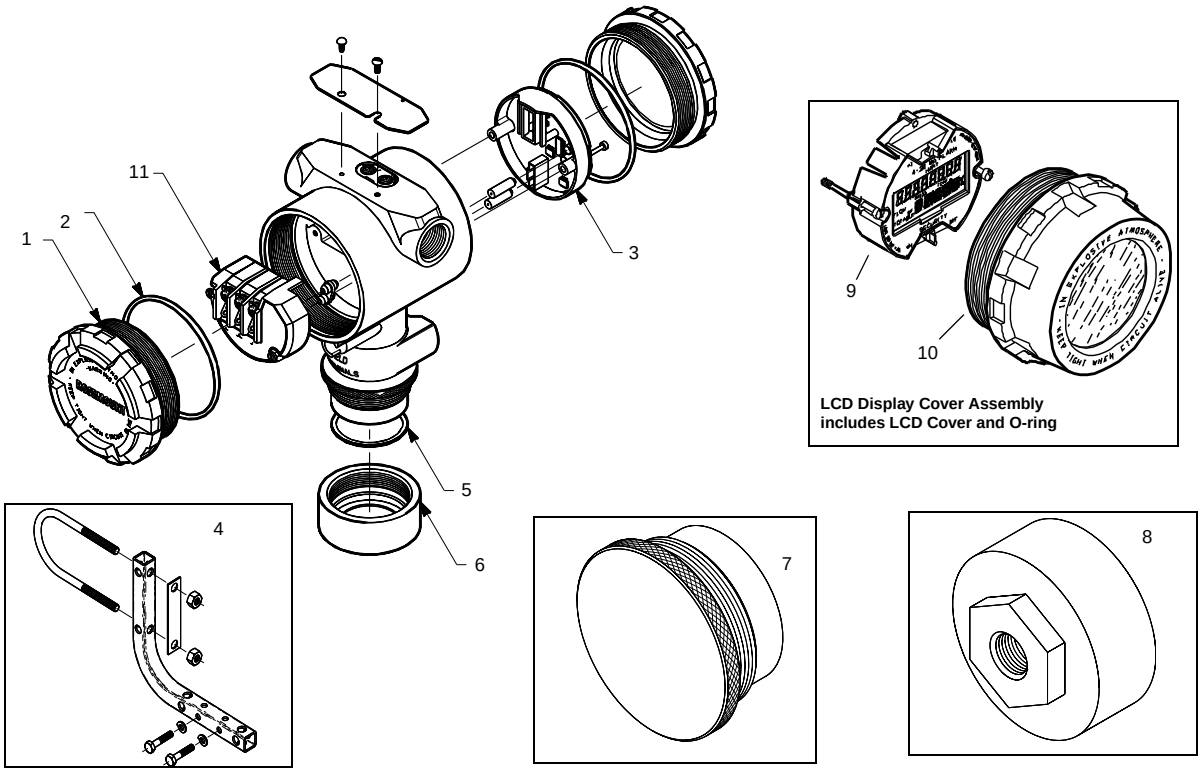
Figure A-1. Replacement Parts for the Rosemount 2088.



Item No.	Part Description	Part Number	Spares Category[1]
1, 2	Transmitters (Output Code S) Electronics Cover (with O-ring)	03031-0292-0001	—
6	LCD Display Cover Assembly	03031-0193-0002	B
2	Cover O-rings	03031-0232-0001	B
3 3	Electronics Board Kits S Output (4–20 mA/Digital HART Protocol) S Output (NAMUR Compliant Operation)	02088-0306-0002 02088-0306-0003	A A
4	Optional Mounting Bracket (with 2-inch U-Bolt for Pipe Mounting)	02088-0071-0001	—
5, 6 5	LCD Display Kit with Cover LCD Display Kit without Cover	03031-0193-0101 03031-0193-0103	— A
7	Local Zero and Span Kit	3031-0293-0002	A
8 8	Standard Terminal Block Transient Protection Block	03031-0332-0011 03031-0332-0012	B B

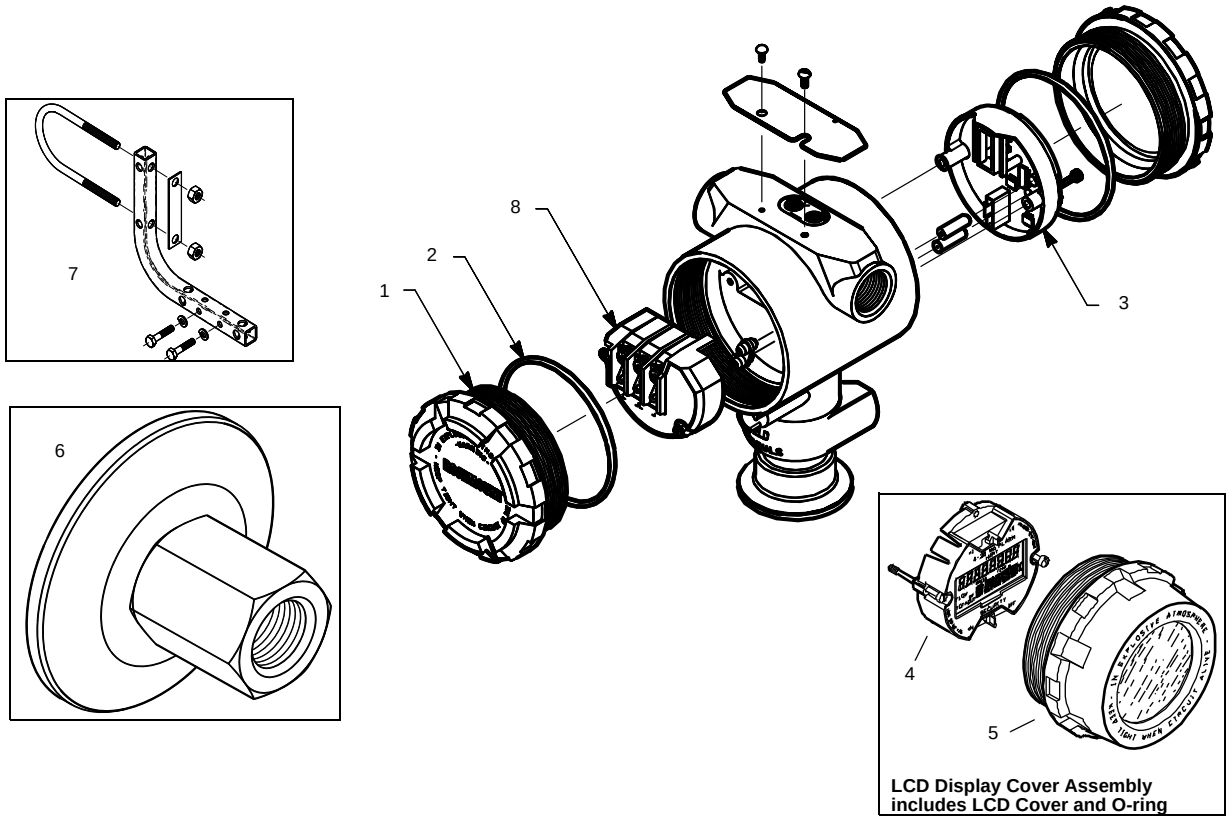
(1) One spare part is recommended for every 25 transmitters in category A, and one spare part for every 50 transmitters in category B.

Figure A-2. Replacement Parts for the Rosemount 2090P.



Item No.	Part Description	Part Number
	Transmitters (Output Code S)	
1,2	Electronics Cover (with O-ring)	03031-0292-0001
10	LCD Display Cover Assembly	03031-0193-0002
2	Cover O-rings	03031-0232-0001
	Electronics Boards	
3	S Output (4–20 mA/Digital HART Protocol)	02088-0306-0002
3	S Output (NAMUR Compliant Operation)	02088-0306-0003
	Optional Mounting Bracket	
4	(with 2-inch U-Bolt for Pipe Mounting)	02088-0071-0001
9, 10	LCD Display Kit with Cover	03031-0193-0101
9	LCD Display Kit without Cover	03031-0193-0103
8	Calibration Adapter	02088-0197-0001
5	*PTFE* Gaskets (package of 12)	02088-0078-0001
6	316 SST Weld Spud with Heat Isolator Groove	02088-0295-0003
7	316 SST Plug/Heat Sink	02088-0196-0001
11	Standard Terminal Block	03031-0332-0011
11	Transient Terminal Block	03031-0332-0012
	1-in. Flush Mount Weld Spud	02088-0285-0001
	1-in. Flush Mount Calibration Adapter	02088-0198-0002
	$1^1/_2$-in. Threaded Weld Spud Kit	02088-0295-0003

Figure A-3. Replacement Parts for the Rosemount 2090F.



Item No.	Part Description	Part Number
	Transmitters (Output Code S)	
1	Electronics Cover (with O-ring)	03031-0292-0001
5	LCD Display Cover Assembly	03031-0193-0002
2	O-rings	03031-0232-0001
	Electronics Boards	
3	S Output (4–20 mA/Digital HART Protocol)	02088-0306-0002
3	S Output (NAMUR Compliant Operation)	02088-0306-0003
	Optional Mounting Bracket	
7	(with 2-inch U-Bolt for Pipe Mounting)	02088-0071-0001
4, 5	LCD Display Kit with Cover	03031-0193-0101
4	LCD Display Kit without Cover	03031-0193-0103
6	Calibration Adapter, $1^1/_2$ inch	02088-0197-0011
6	Calibration Adapter, 2 inch	02088-0197-0012
8	Standard Terminal Block	03031-0332-0011
8	Transient Terminal Block	03031-0332-0012

NOTE: Sanitary clamp and gasket to be supplied by user.

ORDERING INFORMATION

Table A-1. Rosemount 2088 Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

Model	Product description			
2088	Pressure Transmitter			
Transmitter Type				
Standard				**Standard**
A	Absolute			★
G	Gage			★
Pressure Ranges				
Standard				**Standard**
	2088G		**2088A**	
1	-14.7 to 30 psi /(-1,01 to 2,1 bar)		0 to 30 psi (0 to 2,1 bar)	★
2	-14.7 to 150 psi (-1,01 to 10,3 bar)		0 to 150 psi (0 to 10,3 bar)	★
3	-14.7 to 800 psi (-1,01 to 55,2 bar)		0 to 800 psi (0 to 55,2 bar)	★
4	-14.7 to 4,000 psi(-1,01 to 275,8 bar)		0 to 4,000 psi (0 to 275,8 bar)	★
Transmitter Output				
Standard				**Standard**
S	4–20 mA dc/Digital HART® Protocol			★
N	1-5 Vdc Low Power/ Digital HART protocol			★
Materials of Construction				
Standard				**Standard**
	Process connection	**Isolating diaphragm**	**Fill Fluid**	
22(1)	316L SST	316L SST	Silicone	★
33(1)	Alloy C-276	Alloy C-276	Silicone	★
Expanded				
2B(1)	316L SST	316L SST	Inert	
Process Connection				
Standard				**Standard**
A	½–14 NPT Female			★
B(2)	DIN 16288 G ½ Male			★
D(2)(3)	M20 × 1.5 Male			★
Expanded				
C(2)(3)	RC ½ Female (PT ½ Female)			
Conduit Entry				
Standard				**Standard**
1	½–14 NPT			★
2(2)	M20 × 1.5 Female			★
Expanded				
4(2)	G ½ Female (PF ½ Female)			
Options (Include with selected model number)				
Diaphragm seal assemblies				
Standard				**Standard**
S1(4)(5)	Assemble to one Rosemount 1199 diaphragm seal			★
Display and Interface Options				
Standard				**Standard**
M5	LCD display, configured for percent of range			★
M7	LCD display, configured for engineering units			★

Table A-1. Rosemount 2088 Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

Mounting Brackets		
Standard		**Standard**
B4	SST mounting bracket with SST Bolts	★
Product Certifications		
Standard		**Standard**
C6	CSA Explosion-Proof, Intrinsically Safe, and non-Incendive	★
E2	INMETRO Flameproof	★
E3	China Flameproof	★
E4[(2)(6)]	TIIS Flameproof	★
E5	FM Explosion-Proof, Dust Ignition-proof	★
E7	IECEx Flameproof	★
ED	ATEX Flameproof	★
I1[(2)]	ATEX Intrinsic Safety	★
I2	INMETRO Intrinsic Safety	★
I3	China Intrinsic Safety	★
I5	FM Intrinsically safe, Division 2	★
I7	SAA Intrinsic Safety	★
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K5	FM Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K6[(2)]	ATEX and CSA Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K7	SAA Intrinsic Safety and Type n; IECEx Flameproof and Dust	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
KH[(2)]	FM Approvals and ATEX Explosion-Proof and Intrinsically Safe	★
N1[(2)]	ATEX Type n	★
N3	China Type n	★
N7	SAA Type n	★
ND[(2)]	ATEX Dust	★
NK	IECEx Dust	★
Shipboard Approvals		
Standard		**Standard**
SBS	American Bureau of Shipping (ABS) Type Approval	★
SBV	Bureau Veritas (BV) Type Approval	★
SDN	Det Norske Veritas (DNV) Type Approval	★
SLL	Lloyd's Register (LR) Type Approval	★
Pressure Testing		
Expanded		
P1	Hydrostatic testing	
Terminal Block		
Standard		**Standard**
T1	Transient protection	★
Special Cleaning		
Expanded		
P2	Cleaning for special service	
Calibration Certificate		
Standard		**Standard**
Q4	Calibration certificate	★
Quality Traceability Certification		
Standard		**Standard**
Q8	Material Traceability Certification per EN 10204 3.1B	★

Table A-1. Rosemount 2088 Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

Digital Signal		
Standard		**Standard**
C4[2]	NAMUR alarm and saturation levels, high alarm	★
CN[2]	NAMUR alarm and saturation levels, low alarm	★
Configuration		
Standard		**Standard**
C9	Software configuration	★
Manifold Assemblies		
Standard		**Standard**
S5[4][5]	Assemble to Rosemount 306 integral manifold	★
Calibration Accuracy		
Standard		**Standard**
P8[7]	0.075% accuracy to 10:1 turndown	★
Water Approval		
Standard		**Standard**
DW[8]	NSF drinking water approval	★
Low Output for Low Power		
Expanded		
C2	0.8 - 3.2 Vdc output with HART protocol, Output code N only.	
Surface Finish		
Standard		**Standard**
Q16	Surface finish certification for sanitary remote seals	★
Toolkit Total System Performance Reports		
Standard		**Standard**
QZ	Remote Seal System Performance Calculation Report	★
Typical Model Number: 2088 G 2 S 22 A 1 B4 M5		

(1) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(2) Not available with low-power Output code N.
(3) Not available with Alloy C-276, Materials of Construction code 33.
(4) Use 1/2 - 14 NPT Female Process Connection code A.
(5) "Assemble-to" items are specified separately and require a completed model number.
(6) Only available with Conduit Thread code 4.
(7) Available with Output code S, stainless steel isolators, and silicone fill.
(8) Requires Materials of Construction code 22 with Process Connection code A.

Table A-2. Rosemount 2090P Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

Model	**Product Description**			
2090P	Pulp & Paper Pressure Transmitter			
Transmitter Type				
Standard				**Standard**
A	Absolute			★
G	Gage			★
Pressure Ranges				
	Range			
Standard				**Standard**
1	0–30 psi (0–2.1 bar)			★
2	0–150 psi (0–10.3 bar)			★
3	0–300 psi (0–20.7 bar)			★
Output				
Standard				**Standard**
S	4–20 mA dc/Digital HART Protocol			★
Material of Construction				
	Process Connection	**Isolating Diaphragm**	**Fill Fluid**	
Standard				**Standard**
22	316L SST	316L SST	Silicone	★
Process Connection				
Standard				**Standard**
A	1 1/2-in. Threaded, No Weld Spud, 1 1/2-in. PTFE Gasket			★
C	1 1/2-in. Threaded, 316L SST Weld Spud with Stress Isolation and PTFE Gasket			★
D	1-in. Flush Mount			★
G	1-in. Flush Mount with weld-on nipple			★
Conduit Entry				
Standard				**Standard**
1	1/2–14 NPT			★
2	M20 × 1.5			★
Options (Include with selected model number)				
Digital Display				
Standard				**Standard**
M5	LCD display, configured for percent of range			★
M7	LCD display, configured for engineering units			★
Mounting Brackets				
Standard				**Standard**
B4	SST mounting bracket with SST Bolts			★
Product Certifications				
Standard				**Standard**
E5	FM Explosion-Proof, Dust Ignition-proof			★
ED	ATEX Flameproof			★
I5	FM Intrinsically safe, Division2			★
K5	FM Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			★
I1	ATEX Intrinsic Safety			★
N1	ATEX Type n			★
C6	CSA Explosion-Proof, Intrinsically Safe, and Non-incendive			★
KB	FM and CSA Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			★
KH	FM Approvals and ATEX Explosion-Proof and Intrinsically Safe			★
ND	ATEX Dust			★

Table A-2. Rosemount 2090P Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

NK	IECEx Dust	★
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n; IECEx Flameproof and Dust	★
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K6	CSA and ATEX Explosion-Proof and Intrinsically Safe Approvals	★
I3	China Intrinsic Safety	★
E3	China Flameproof	★
Terminal Blocks		
Standard		**Standard**
T1	Transient Protection	★
Special Certificate		
Standard		**Standard**
Q4	Calibration Certificate	★
Alarm Limit		
Standard		**Standard**
C4	NAMUR alarm and saturation levels, high alarm	★
CN	NAMUR alarm and saturation levels, low alarm	★
Wetted O-ring Material		
Standard		**Standard**
W2	Buna-N	★
W3	Ethylene-Propylene	★
Special Procedures		
Expanded		
P2	Cleaning for Special Service	
Calibration Accuracy		
Standard		**Standard**
P8	0.1% Accuracy to 10:1 Turndown	★
P Specials		
Standard		**Standard**
PXXXX	Special that needs to be created	★
Typical Model Number: 2090PG 2 S 22 A 1		

Table A-3. Rosemount 2090F Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

Model	**Product Description**			
2090F	Hygienic Pressure Transmitter			
Transmitter Type				
Standard				**Standard**
A	Absolute			★
G	Gage			★
Pressure Ranges				
	Range			
Standard				**Standard**
1	0–30 psi (0–2 bar)			★
2	0–150 psi (0–10.3 bar)			★
3	0–300 psi (0–20.7 bar)			★
Output				
Standard				**Standard**
S	4–20 mA dc/Digital HART Protocol			★
Material of Construction				
	Process Connection	**Isolating Diaphragm**	**Oil Fill**	
Standard				**Standard**
2D	316L SST	316L SST	*Neobee*	★
Code	**Process Connection**			
Standard				**Standard**
E	1 1/2–in. *Tri-Clamp* Connection			★
F	2–in. *Tri-Clamp* Connection			★
Conduit Entry				
Standard				**Standard**
1	1/2–14 NPT			★
2	M20 × 1.5			★
Options (Include with selected model number)				
Digital Display				
Standard				**Standard**
M5	LCD display, configured for percent of range			★
M7	LCD display, configured for engineering units			★
Mounting Brackets				
Standard				**Standard**
B4	SST mounting bracket with SST Bolts			★
Product Certifications				
Standard				**Standard**
E5	FM Explosion-Proof, Dust Ignition-proof			★
ED	ATEX Flameproof			★
I5	FM Intrinsically safe, Division2			★
K5	FM Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			★
I1	ATEX Intrinsic Safety			★
N1	ATEX Type n			★
C6	CSA Explosion-Proof, Intrinsically Safe, and Non-incendive			★
KB	FM and CSA Explosion-Proof, Dust Ignition-proof, Intrinsically Safe, Division 2			★
KH	FM Approvals and ATEX Explosion-Proof and Intrinsically Safe			★
ND	ATEX Dust			★
NK	IECEx Dust			★
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n; IECEx Flameproof and Dust			★

Table A-3. Rosemount 2090F Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K6	CSA and ATEX Explosion-Proof and Intrinsically Safe Approvals	★
I3	China Intrinsic Safety	★
E3	China Flameproof	★
Terminal Blocks		
Standard		**Standard**
T1	Transient Protection	★
Special Certificate		
Standard		**Standard**
Q4	Calibration Certificate	★
Alarm Limit		
Standard		**Standard**
C4	NAMUR alarm and saturation levels, high alarm	★
CN	NAMUR alarm and saturation levels, low alarm	★
Wetted O-ring Material		
Standard		**Standard**
W2	Buna-N	★
W3	Ethylene-Propylene	★
Special Procedures		
Expanded		
P2	Cleaning for Special Service	
Calibration Accuracy		
Standard		**Standard**
P8	0.1% Accuracy to 10:1 Turndown	★
P Specials		
Standard		**Standard**
PXXXX	Special that needs to be created	★
Typical Model Number: 2090FG 2 S 2D E 1		

Appendix B Approval Information

OVERVIEW

This Appendix contains information on approved manufacturing locations, European directive information. Ordinary Location certification, Hazardous Locations Certifications and approval drawings.

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota USA
Emerson Process Management GmbH & Co. — Wessling, Germany
Emerson Process Management Asia Pacific Private Limited — Singapore
Beijing Rosemount Far East Instrument Co., LTD — Beijing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

2088/2090 Pressure Transmitters

— Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (2004/108/EC)

All Model 2088/2090 Pressure Transmitter:
EN 61326-1:2006

Hazardous Locations Certifications

North American Certifications

Factory Mutual (FM)

E5 Explosion-proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition-Proof for Class II, Division 1, Groups E, F, G, Class III, Division 1, indoor and outdoor (NEMA 4X) hazardous locations; factory sealed. Temperature Class T5 Ta = 85 °C.

I5 Intrinsically safe for use in Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, and G; and Class III, Division 1 when connected in accordance with Rosemount drawing 02088-1018. Non-incendive for Class I, Division 2, Groups A, B, C, and D. Temperature Class T4 Ta = 85 °C; indoor and outdoor (NEMA 4X) hazardous locations. For input parameters see control drawing 02088-1018.

Canadian Standards Association (CSA)

2088 CSA hazardous approved transmitters are certified per ANSI/ISA 12.27.01-2003.

C6 Explosion-proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition-Proof for Class II, Division 1, Groups E, F, G, Class III, indoor and outdoor hazardous locations. CSA enclosure Type 4X; factory sealed. Suitable for Class I, Division 2, Groups A, B, C, and D. 2088 is Single Seal.

Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D. Temp. Code T3C. Intrinsically safe when connected with approved barriers in accordance with Rosemount drawing 02088-1024. 2088 is Single Seal.
For input parameters see control drawing 02088-1024.

European Certifications

I1 BASEEFA ATEX Intrinsic Safety

Certificate No.: BAS00ATEX1166X ⟨Ex⟩ II 1 G
Ex ia IIC T5 (–55 °C ≤ T_{amb} ≤ 40 °C)
Ex ia IIC T4 (–55 °C ≤ T_{amb} ≤ 70 °C)

CE 1180

Table B-1. Input Parameters

Loop/Power
U_i = 30 Vdc
I_i = 200 mA
P_i = 0.9 W
C_i = 0.012 μ F

Special Conditions for Safe Use (x):

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500 V r.m.s. test to case. This must be taken into account on any installation in which it is used, for example by assuring that the supply to the apparatus is galvanically isolated.

N1 BASEEFA ATEX Type n
Certification No.: BAS00ATEX3167X ⟨Ex⟩ II 3 G
Ex nA nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)
U_i = 50 Vdc max

Special Conditions for Safe Use (x):

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500 V r.m.s. test to case. This must be taken into account on any installation in which it is used, for example, by assuring that the supply to the apparatus is galvanically isolated.

ND BASEEFA ATEX Dust
Certificate No.: BAS01ATEX1427X ⟨Ex⟩ II 1 D
Ex tD A20 T105°C (-20 °C ≤ T_{amb} ≤ 85 °C)
IP66

CE 1180

Vmax = 36 Vdc

Special Conditions for Safe Use (x):

1. The user must ensure that the maximum rated voltage and current (36 volts, 24 mA, D.C.) are not exceeded. All connections to other apparatus or associated apparatus shall have control over this voltage and current equivalent to a category “ib” circuit according to EN50020.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
4. Cable entries and blanking plugs must be suitable for the ambient range of the apparatus and capable of withstanding a 7J impact test.
5. The 2088/2090 sensor module must be securely screwed in place to maintain the ingress protection of the enclosure.

ED KEMA ATEX Flameproof
Certification No.: KEMA97ATEX2378X ⟨Ex⟩ II 1/2 G
Ex d IIC T6 (-40 °C ≤ T_{amb} ≤ 40 °C)

T4 (-40 °C ≤ T_{amb} ≤ 80 °C)

CE 1180
Vmax = 36 Vdc (with Output Code S)
Vmax = 14 Vdc (with Output Code N)

Special Conditions for Safe Use (x):

1. The cable and conduit entry devices shall be of a certified flameproof type Ex d, suitable for the conditions of use and correctly installed.
2. With the use of conduit entries a sealing device shall be provided immediately on the entrance thereto.
3. Unused apertures shall be closed with suitable Ex d certified blanking elements.
4. Suitable heat-resisting cables shall be used when the ambient temperature at the cable or conduit entries exceed 65 ˚C.
5. This device contains a thin wall diaphragm. Installation, maintenance, and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
6. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

Japanese Certifications

E4 TIIS Flameproof

Ex d IIC T6 (T_{amb} = 85 °C)

Certificate	Description
TC15874	2088 with Alloy C-276 wetted parts (with display)
TC15873	2088 with Alloy C-276 wetted parts (no display)
TC15872	2088 with SST wetted parts (with display)
TC15871	2088 with SST wetted parts (no display)

Australian Certifications

I7 SAA Intrinsic Safety

Certification No.: AUS Ex 1249X

Ex ia IIC T4 (T_{amb} = 70 °C)

Ex ia IIC T5 (T_{amb} = 40 °C)

IP66

When connected per Rosemount drawing 03031-1026

Table B-2. Input Parameters

Loop/Power
U_{max} = 30 V
I_{max} = 200 mA
P_{max} = 0.9 W
C_i = 0.01 μ F
L_i = 10 μ H

Special Conditions for Safe Use (X):

Observe barrier/entity parameters during installation. A passive current limited power source must be used. The power source must be such that Po ≤ (Uo * Io)/4. For modules using transient protection in the terminal assembly (T1 transient protection models), the apparatus enclosure is to be electrically bonded to the protective earth. The conductor used for the connection shall be equivalent to a copper conductor of 4mm^2 minimum cross-sectional area.

N7 SAA Type n (Non-Sparking)

Certificate No.: AUS Ex 1249X

Ex n IIC T4 (T_{amb} = 70 °C)

Ex n IIC T5 (T_{amb} = 40 °C)

IP66

Special Conditions for Safe Use (X):

Where the equipment is installed such that there is an unused conduit entry, it must be sealed with a suitable blanking plug to maintain the IP66 degree of protection. Any blanking plug used with the equipment shall be of a type which requires the use of a tool to effect its removal. Voltage source shall not exceed 60 Vac or 75 Vdc.

NK IECEx Dust Ignition Proof

IECEx Certificate number: IECEx KEM 06.0021X

Ex tD A22 IP66 T90°C (-20 °C ≤ T_{amb} ≤ 80 °C)

Vmax = 55 Vdc

Ii = 23 mA

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance, and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Unused cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
4. Cable entries and blanking plugs must be suitable for the ambient range of the apparatus and capable of withstanding a 7J impact.
5. The 2088/2090 sensor module must be securely screwed in place to maintain the ingress protection of the enclosure.

E7 KEMA IECEx Flameproof

Certification No.: IECEx KEM 06.0021X

Ex d IIC T4 (-40 °C ≤ T_{amb} ≤ 80 °C)

CE 1180

Vmax = 36 Vdc (with Output Code S)

Vmax = 14 Vdc (with Output Code N)

Brazil Certifications

I2 INMETRO Intrinsic Safety
Certification No.: CEPEL-Ex-063/97-1X
BR-Ex ia IIC T5/T4

Special Conditions for Safe Use (X):

Only the sensor piezo-resistive can be installed in Zone 0. The transmitter must be installed in Zone 1 or 2.

E2 INMETRO Flameproof
Certification No.: CEPEL-Ex-076/97-1
BR-Ex d IIC T6/T5

China Certifications

I3 China (NEPSI) Intrinsic Safety
NEPSI Certificate No. (2088 manufactured in Chanhassen, MN): GYJ111063X
NEPSI Certificate No. (2088 manufactured in Beijing, China): GYJ071129
NEPSI Certificate No. (2088 manufactured in Singapore): GYJ111063X
NEPSI Certificate No. (2090 Manufactured in Beijing, China): GYJ071131
2090 RTC & SMMC Certificate No. GYJ111065X
Ex ia IIC T4

Special Conditions for Safe Use

1. Symbol “X” is used to denote specific conditions of use:
   - This apparatus is not capable of withstanding the 500 V r.m.s. insulation test required by Clause 6.4.12 of GB3836.4-2000.
2. The ambient temperature range is:

T Code	Ambient Temperature
T5	-55°C ≤T_a ≤ 40 °C
T4	-55°C ≤T_a ≤ 70 °C

3. Intrinsically safe parameters:

Maximum input voltage: U_i (V)	Maximum input current: I_i (mA)	Maximum input power: P_i (W)	Maximum Internal Parameters	
			C_i(nF)	L_i (mH)
30	200	0.9	112	0

4. The pressure transmitter should be used with Ex-certified linear associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the pressure transmitter and associated apparatus.
5. The cable between the pressure transmitter and associated apparatus should be insulated, shielded cable. The cable shield must be grounded in a non-hazardous area.
6. End users are not permitted to change internal components. Contact the manufacturer to avoid damaging the pressure transmitter.
7. During installation, use, and maintenance of the pressure transmitter, observe the following standards:

   a. GB3836.13-1997 “Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres”

   b. GB3836.15-2000 “Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)”

   c. GB3836.16-2006 “Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)”

   d. GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”

E3 China (NEPSI) Flameproof
NEPSI Certificate No. (2088 manufactured in Chanhassen, MN): GYJ111062
NEPSI Certificate No. (2088 manufactured in Beijing, China): GYJ071128
NEPSI Certificate No. (2090 manufactured in Beijing, China): GYJ071130
2090 RTC & SMMC Certificate No. GYJ111065X
NEPSI Certificate No. (2088 manufactured in Singapore): GYJ111062
Ex d IIB+H2 T4/T5

Special Conditions for Safe Use

1. The ambient temperature range is:

T Code	Ambient Temperature
T6	-20°C ≤T_a ≤ 40 °C
T4	-20°C ≤T_a ≤ 80 °C

2. The earth connection facility on the enclosure should be connected reliably.
3. During installation in a hazardous location, use cable glands, conduits, and blanking plugs that are certified by state-appointed inspection bodies with Ex d IIC type protection.
4. During installation, use, and maintenance in explosive gas atmospheres, observe the warning, “Do not open when energized.”
5. During installation, there should be no mixture harm to flameproof housing.
6. End users are not permitted to change internal components. Contact the manufacturer to avoid damaging the pressure transmitter.
7. Maintenance should be done in non-hazardous locations.
8. During installation, use, and maintenance of the pressure transmitter, observe the following standards:

   a. GB3836.13-1997 “Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres”

   b. GB3836.15-2000 “Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)”

   c. GB3836.16-2006 “Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)”

   d. GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”

N3 China Type n Non - Sparking
NEPSI Cert No. (2088 manufactured in Beijing, China): GYJ101126X

Ex nA nL IIC T5

Special Conditions for Safe Use (x)

1. Symbol “X” is used to denote specific conditions of use: The apparatus is not capable of withstanding the 500 V test to earth for one minute. This must be taken into consideration during installation.
2. The ambient temperature range of the device is: -40 °C ≤ Ta ≤ 70 °C.
3. Minimum input voltage is 50 V.
4. Metal cable glands, conduit, or blanking plugs, certified by NEPSI with Ex e or Ex n protection type should be used on external connections and redundant cable entries.
5. Maintenance should be done in non-hazardous locations.
6. End users are not permitted to change any internal components.
7. During installation, use, and maintenance of the pressure transmitter, observe the following standards:

   a. GB3836.13-1997 “Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmosphere”

   b. GB3836.15-2000 “Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)”

   c. GB3836.16-2006 “Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)”

   d. GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”

Combinations of Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

KB K5 and C6 combination

KH K5, ED, and I1 combination

K5 E5 and I5 combination

K6 C6, I1, and ED combination

K7 I7, N7, E7, and NK combination

K1 I1, N1, ED, and ND combination

Figure B-1. F.M. Intrinsically Safe Approvals for Rosemount 2088 and 2090

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB	CORRECT ENTITY PARAMETERS FOR SMART OUTPUT "S"	RTC1007653	J.D.J.	10/25/99
AC	ADD SMART LOW POWER OUTPUT OPTION CODE "N"	RTC1013268	N.J.H.	7/23/02
AD	ADD CABLE PARAMETERS	RTC1013829	N.J.H.	9/24/02
AE	REMOVE ANALOG TRANSMITTER	RTC1030658	J.G.K.	4/6/10

ENTITY APPROVALS

THE ROSEMOUNT 2088 / 2090 TRANSMITTER IS F.M. APPROVED AS INTRINSICALLY SAFE WHEN USED IN CIRCUIT WITH F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED IN THE CLASS I, II, AND III, DIVISION 1 GROUPS INDICATED, ADDITIONALLY, THE ROSEMOUNT 751 FIELD SIGNAL INDICATOR IS F.M. APPROVED AS INTRINSICALLY SAFE WHEN CONNECTED IN CIRCUIT WITH ROSEMOUNT MODEL 2088 / 2090 AND F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED FOR CLASS I, II, AND III, DIVISION 1, GROUPS INDICATED.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM INDICATED ON SHEET 3.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]

FRACTIONS ± 1/32 ANGLES ± 2°

DO NOT SCALE PRINT

Form Rev AC

CONTRACT NO.

DR. Myles Lee Miller 10/3/90

CHK'D

APP'D KAREN CARLSON 10/10/90

APP'D. GOVT.

EMERSON. Process Management

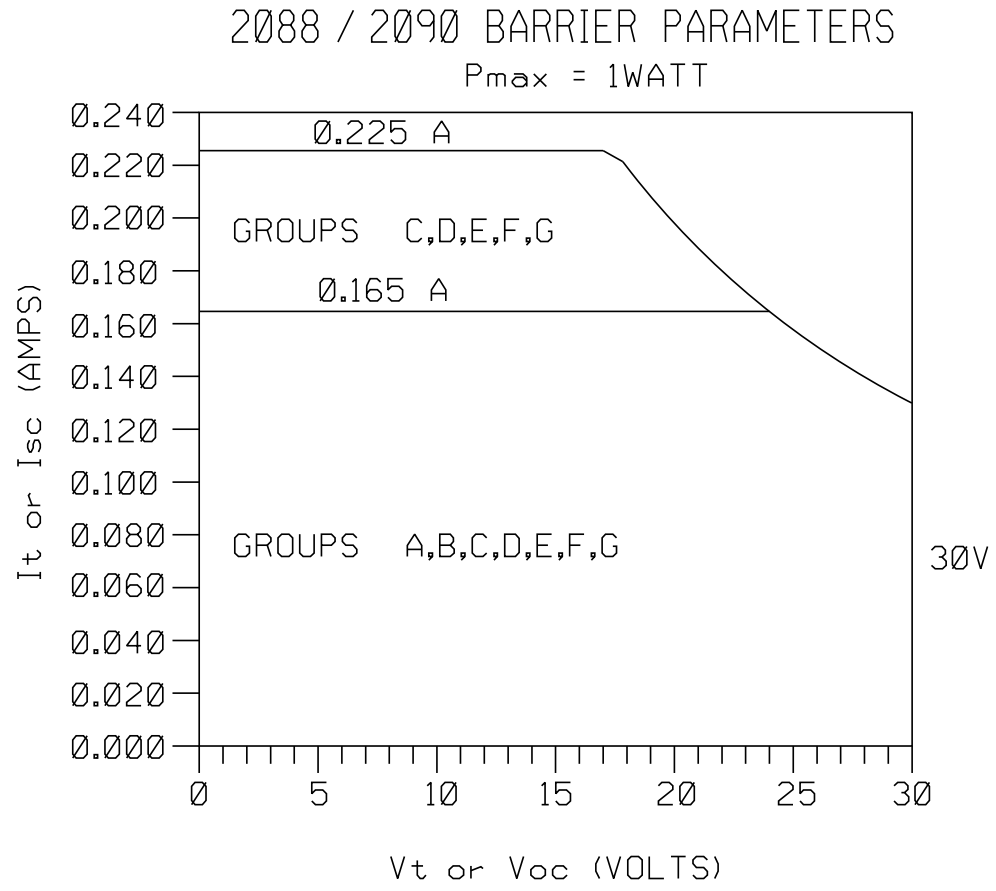
ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE INDEX OF I.S. F.M. FOR 2088 / 2090

SIZE A | FSCM NO | DWG NO. 02088-1018

SCALE N/A | WT. ——— | SHEET 1 OF 6

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE				



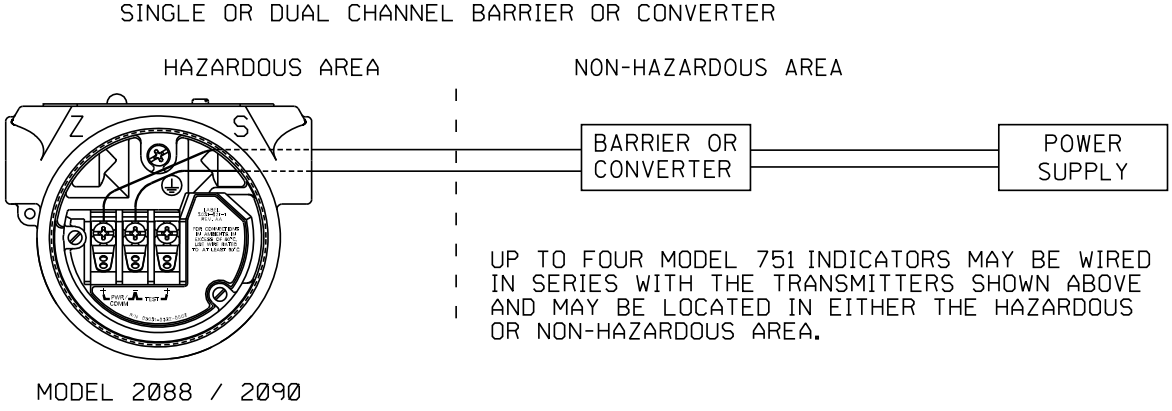
Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02088-1018
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 6

Form Rev AC

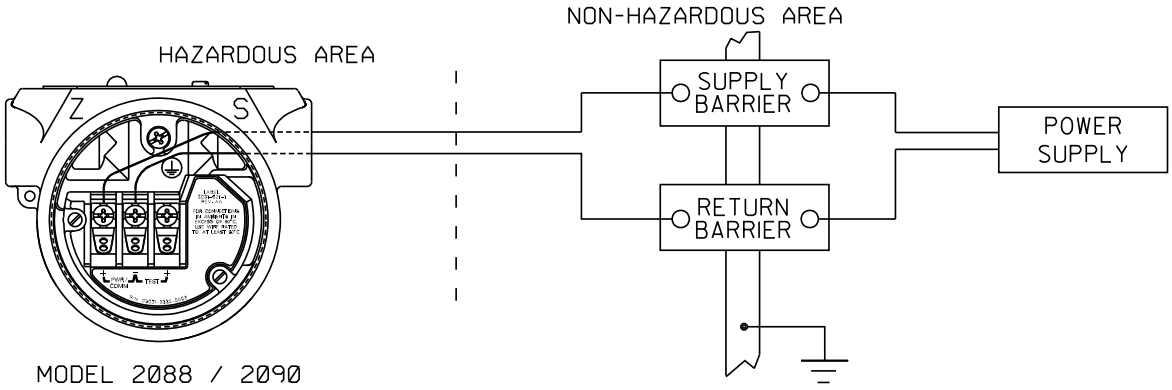
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE				

2088 & 2090 TRANSMITTER ("S" OUTPUT: 4-20mA)

CIRCUIT DIAGRAM 1
SINGLE OR DUAL CHANNEL BARRIER OR CONVERTER



CIRCUIT DIAGRAM 2 FOR
SUPPLY AND RETURN BARRIERS
APPROVED IN THIS CONFIGURATION



UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. Ø2088-1Ø18
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 6

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE				

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAXIMUM OPEN CIRCUIT VOLTAGE (Voc or Vt) AND MAXIMUM SHORT CIRCUIT CURRENT (Isc or It) AND MAXIMUM OUTPUT POWER (Voc X Isc/4), OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAXIMUM ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAXIMUM ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

MODEL 2088 / 2090 ("S" OUTPUT)

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	Vt or Voc IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 165mA	It or Isc IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	(Voc X Isc/4) or (Vt X It/4) IS LESS THAN OR EQUAL TO 1 WATT
C_I = 0.01 μF	C_A IS GREATER THAN 0.01 μF + C_{CABLE}
L_I = 10 μH	L_A IS GREATER THAN 10 μH + L_{CABLE}

FOR T1 OPTION:

I_{MAX} = 160mA	It or Isc IS LESS THAN OR EQUAL TO 145mA
L_I = 1.06 mH	L_A IS GREATER THAN 1.06 mH + L_{CABLE}

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	Vt or Voc IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	It or Isc IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	(Voc X Isc/4) or (Vt X It/4) IS LESS THAN OR EQUAL TO 1 WATT
C_I = 0.01 μF	C_A IS GREATER THAN 0.01 μF + C_{CABLE}
L_I = 10 μH	L_A IS GREATER THAN 10 μH + L_{CABLE}

FOR T1 OPTION:

L_I = 1.06 mH	L_A IS GREATER THAN 1.06 mH + L_{CABLE}

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

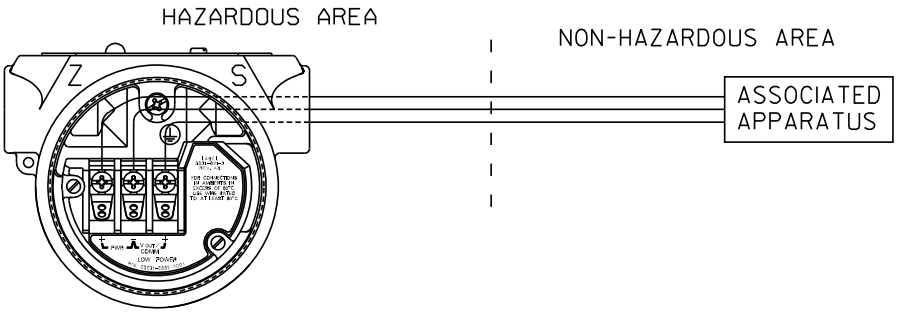
CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02088-1018
ISSUED	SCALE N/A	WT. ———	SHEET 4 OF 6

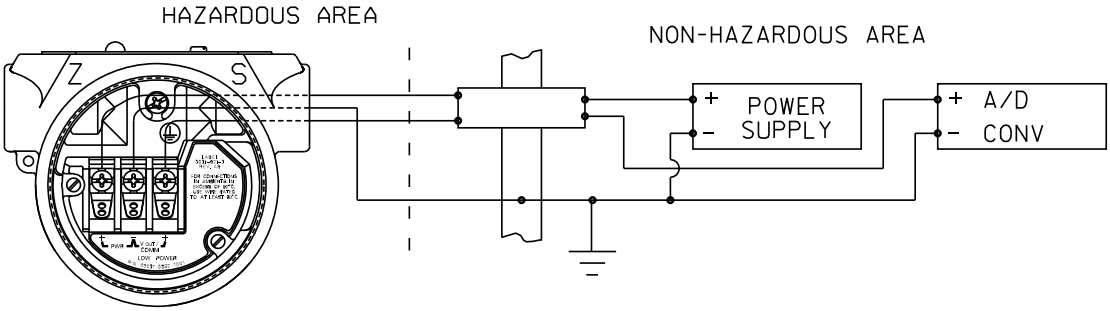
Form Rev AG

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE				

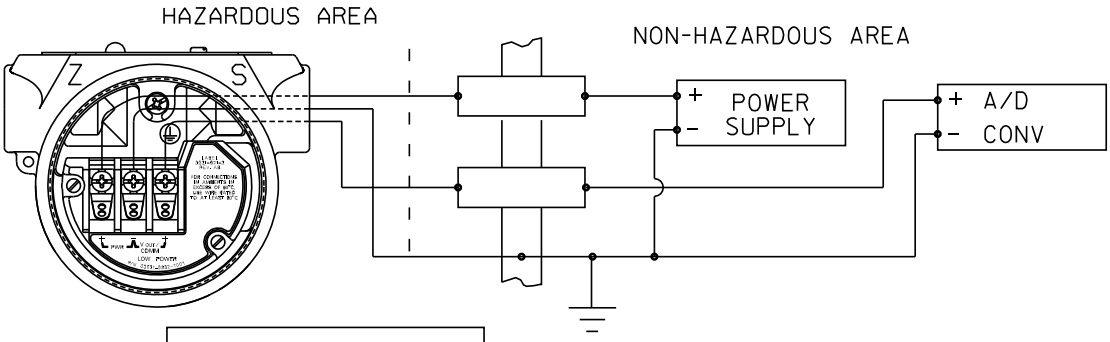
2088 TRANSMITTER (OUTPUT CODE "N": 1-5 V)



CIRCUIT DIAGRAM 3
ONE DUAL CHANNEL BARRIER



CIRCUIT DIAGRAM 4
TWO SINGLE CHANNEL BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



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DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. Ø2088-1Ø18	
ISSUED	SCALE N/A	WT. ———	SHEET 5 OF 6	

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AE				

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAXIMUM OPEN CIRCUIT VOLTAGE (Voc or Vt) AND MAXIMUM SHORT CIRCUIT CURRENT (Isc or It) AND MAXIMUM OUTPUT POWER (Voc X Isc/4), OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAXIMUM ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAXIMUM ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

MODEL 2088 ("N" OUTPUT)

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 165mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	$(\frac{V_T X I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf + C_{CABLE}
L_I =10μH	L_A IS GREATER THAN 10μH + L_{CABLE}

* FOR T1 OPTION:

L_I =0.75mH	L_A IS GREATER THAN 0.75mH + L_{CABLE}

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T X I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf + C_{CABLE}
L_I =10μH	L_A IS GREATER THAN 10μH + L_{CABLE}

* FOR T1 OPTION:

L_I =0.75mH	L_A IS GREATER THAN 0.75mH + L_{CABLE}

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DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02088-1018
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 6

Form Rev AC

Figure B-2. CSA Intrinsic Safety Approvals for Rosemount 2088 and 2090

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

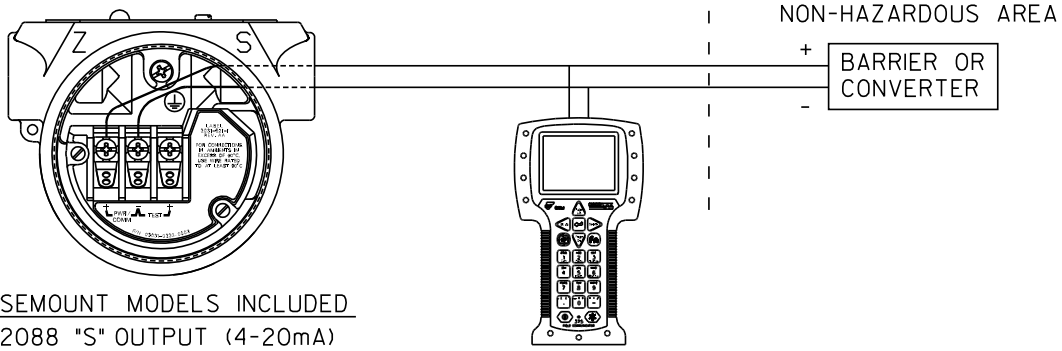
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB	ADD SMART LOW POWER OPTION CODE "N"	RTC1013268	N.J.H.	7/23/02
AC	REMOVE ANALOG TRANSMITTER	RTC1030658	J.G.K.	4/6/10

CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE



ROSEMOUNT MODELS INCLUDED

2088 "S" OUTPUT (4-20mA)
2090 "S" OUTPUT (4-20mA)

ROSEMOUNT
MODEL 375 / 475 SMART
FAMILY INTERFACE

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]

FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. SANDI MANSON 12/12/90

CHK'D

APP'D KAREN CARLSON 12/20/90

APP'D. GOVT.

EMERSON. Process Management

ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE INDEX OF I.S. CSA FOR 2088 / 2090

SIZE	FSCM NO	DWG NO.	
A		02088-1024	
SCALE N/A	WT.	SHEET 1 OF 3	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC				

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 330 OHMS OR MORE 28 V OR LESS 300 OHMS OR MORE 25 V OR LESS 200 OHMS OR MORE 22 V OR LESS 180 OHMS OR MORE	GROUPS A, B, C, D
FOXBORO CONVERTER 2AI-I2V-CGB, 2AI-I3V-CGB, 2AS-I3I-CGB, 3A2-I2D-CGB, 3A2-I3D-CGB, 3AD-I3I-CGB, 3A4-I2D-CGB, 2AS-I2I-CGB, 3F4-I2DA		GROUPS B, C, D
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

LOW POWER, ("N" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
	Supply ≤ 28V, ≥300 Ω Return ≤ 10V, ≥47 Ω	GROUPS A, B, C, D
CSA APPROVED SAFETY BARRIER	Supply ≤ 30V, ≥150 Ω Return ≤ 10V, ≥47 Ω	GROUPS C, D

* MAY BE USED WITH ROSEMOUNT MODEL 375 or 475 SMART FAMILY INTERFACE.

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. SANDI MANSON	SIZE A	FSCM NO	DWG NO. 02088-1024	
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 3	

Form Rev AC

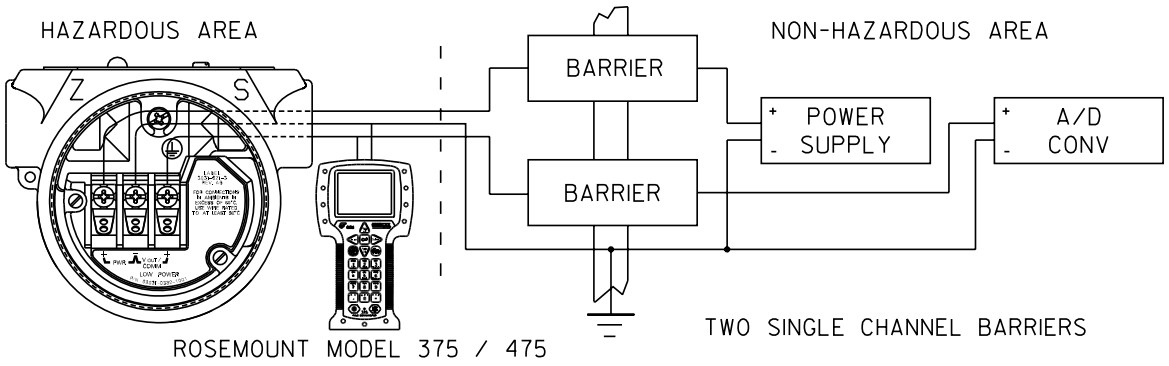
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC				

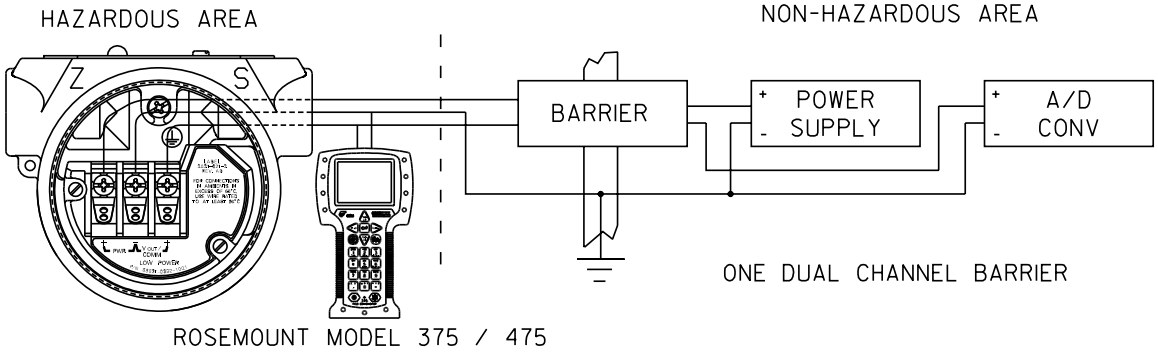
CSA INTRINSIC SAFETY APPROVALS

2088 SMART LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE





2088 LOW POWER
2088 "N" OUTPUT (1-5 V)

APPROVED FOR CLASS I, DIVISION I, GROUPS A,B,C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +PWR LINE, AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE, OR ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER, AS ABOVE.

APPROVED FOR CLASS I, DIVISION I, GROUPS C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +PWR LINE AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02088-1024
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 3

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Appendix C Glossary

Some of the terms used in this manual relate specifically to the operation of Rosemount transmitters, hand-held Field Communicators, and other Rosemount products. The following list provides brief definitions. See the sections listed for additional information.

Analog Output Trim
Digital trim operation that allows adjustment of the output electronics to conform to the plant standard of current. Two types of analog output trim are available: 4–20 mA output trim and 4–20 mA other scale.

Cloning
Off-line operation that uses a Field Communicator to copy configuration data from one transmitter to one or more other transmitters that require the same data.

Commissioning
Functions performed with the Field Communicator and the transmitter that test the transmitter and test the loop, and verify transmitter configuration data.

Configuration
Process of setting parameters that determine how the transmitter operates.

Damping
Output function that increases the response time of the transmitter to smooth the output when there are rapid input variations.

Descriptor
Sixteen-character field for additional identification of the transmitter, its use, or location. The descriptor is stored in the transmitter and can be changed using the Field Communicator.

Digital Trim
Format function that allows you to adjust the transmitter characterization for purposes of digital calibration to plant standards. Digital trim includes two separate operations: sensor trim and analog output trim.

Failure Mode Alarm
Transmitter function that drives the analog output to a jumper-selectable high or low value in the event of an electronics failure.

Factory Characterization
Factory process during which each sensor module is subjected to pressures and temperatures covering the full operating range.
The sensor module memory stores data generated from this process for use by the microprocessor in correcting the transmitter output during operation.

Full Trim
Sensor trim function in which two accurate, end-point pressures are applied and all output is linearized between them. The selected end points should always be equal to or outside the LRV and URV.

HART (Highway Addressable Remote Transducer) Protocol
Communications standard that provides simultaneous analog and digital signal transmission between control rooms and field devices such as transmitters.

Lower Range Limit (LRL)
Lowest value of the measured variable that the transmitter can be configured to measure.

Lower Range Value (LRV) Lowest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Multidropping The connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated.

Reranging Configuration function that changes the transmitter 4 and 20 mA settings.

Send Data Field Communicator command that transfers configuration data from the hand-held communicator's memory to the transmitter memory.

Sensor Trim Digital trim function that allows you to adjust the digital process variable reading to a precise pressure input. Zero trim and sensor trim are the two sensor trim functions.

Smart Term used to describe instruments that are microprocessor-based and feature advanced communications capabilities.

Span Algebraic difference between the upper and lower range values.

Tag Eight-character field for identifying the transmitter. The tag is stored in the transmitter and can be changed using the Field Communicator and the transmitter information function.

Transmitter Address Unique number (1-15) used to identify a multidropped transmitter. Transmitters that are not multidropped have 0 as an address.

Transmitter Security Jumper-selectable feature that prevents accidental or deliberate changes to configuration data.

Upper Range Limit (URL) Highest value of the measured variable that the transmitter can be configured to measure.

Upper Range Value (URV) Highest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Zero Trim A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects or zero shifts caused by static pressure.

Index

Reference Manual
00809-0100-4690, Rev FC
June 2011

Rosemount 2088 and 2090

Emerson Process Management

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