

Model 3144 and 3244MV Smart Temperature Transmitters



ROSEMOUNT®

FISHER-ROSEMOUNT™ Managing The Process Better.™

Model 3144 and 3244MV Smart Temperature Transmitters

Model 3144 and 3244MV Revision:

5.2.1

HART Communicator Field Device Revision:

Dev. v2, DD v1

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.

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Introduction

USING THIS MANUAL

This manual is intended to assist in installing, operating, and maintaining Rosemount Model 3144 and 3244MV Smart Temperature Transmitters.

Section 2: Installation

Section 2 explains how to commission transmitters; provides an installation flowchart; and describes electrical, mechanical, and environmental installation considerations.

Section 3: On-line Operations

Section 3 describes how to configure transmitter software, select a sensor type, adjust the input and output electronics; and how to change output characteristics (range settings, output type, damping, and units) and non-output-related transmitter characteristics (including the transmitter tag number, date, and message).

Section 4: Maintenance

Section 4 describes hardware diagnostics, maintenance tasks, and hardware troubleshooting.

Section 5: Specifications and Reference Data

Section 5 lists functional, performance, and physical specification data for the transmitter. This section also includes transmitter drawings, ordering information, and a list of spare parts.

Section 6: Options

Section 6 presents options including the LCD meter, mounting brackets, custom configuration and calibration, trim to special sensor, and external ground-lug assembly.

Appendix A: Transmitter Improvements

Appendix A describes the enhancements that have been made to the Model 3144 and 3244MV Smart Temperature Transmitters, and includes a chart that compares previous transmitter versions to the current improved transmitter version.

Appendix B: Model 275 HART[®] Communicator

Appendix B provides a complete menu tree, a table of fast key sequences, and other information regarding use of the Model 275 HART[®] Communicator.

Appendix C: Model 268 SMART FAMILY[®] Interface

Appendix C provides a complete menu tree and other information regarding use of the Model 268 SMART FAMILY[®] Interface.

Appendix D: Hazardous Area Approval Installation Drawings

Appendix D provides hazardous location installation drawings.

GETTING ACQUAINTED WITH THE TRANSMITTER

The Rosemount Model 3144 and 3244MV Smart Temperature Transmitters are microprocessor-based instruments that accept input from a wide variety of sensors, and transmit temperature data to a control system or transmitter interface. The transmitters combine Rosemount reliability with the flexibility of digital electronics. The transmitters are ideal for applications that require high performance or remote communication.

Each transmitter is designed to communicate with a HART communicator. Communicators are used to interrogate, configure, test, or format the transmitter, as well as other products in the Rosemount family of microprocessor-based instruments. Moreover, HART communicators can communicate with a transmitter from the control room, from the transmitter site, or from any other wiring termination point in the loop where there is between 250 and 1100 ohms resistance between the transmitter power connection and the power supply.

Special dual-sensor features of the Model 3244MV include Hot Backup[®], drift alert, differential and average temperature measurements, and four simultaneous measurement variable outputs in addition to the analog output signal.

SOFTWARE COMPATIBILITY

Software for Rosemount SMART FAMILY products is revised periodically. Replacement transmitters may contain revised software that is incompatible with the existing software in your HART communicator.

Software loaded into the Model 275 HART Communicator that contains device descriptors (DDs) compatible with the Model 3144 and 3244MV transmitters can be included in the communicator initially, or entered at any Rosemount Service Center upon request. Rerange and read-only capabilities can be attained with revision 5.0 or later Model 268 communicator software. The HART Communicator Field Device Revision Dev v2, DD v1 should be loaded into the Model 257 HART Communicator in order to utilize all of the features available in the Model 3144 and 3244MV. See Appendix B: Model 275 HART Communicator for more information concerning device revisions.

Upgrading the Model 268 software to revision 7.0 will allow limited functionality such as changing the sensor type and number of wires, and performing trim functions. The Model 275 HART Communicator is the necessary interface for complete functionality, and is recommended. Contact the Rosemount Service Center nearest you to obtain the appropriate HART communicator software.

Installation

OVERVIEW

The information in this section includes transmitter installation instructions, an installation flowchart (Figure 2-1 on page 2-2), installation drawings, and special installation considerations.

SAFETY MESSAGES

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

Warnings

⚠ WARNING

Explosions could result in death or serious injury:

- Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury:

- Make sure only qualified personnel perform the installation.

⚠ WARNING

Process leaks could result in death or serious injury:

- Install and tighten thermowells or sensors before applying pressure, or process leakage may result.
- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.

⚠ WARNING

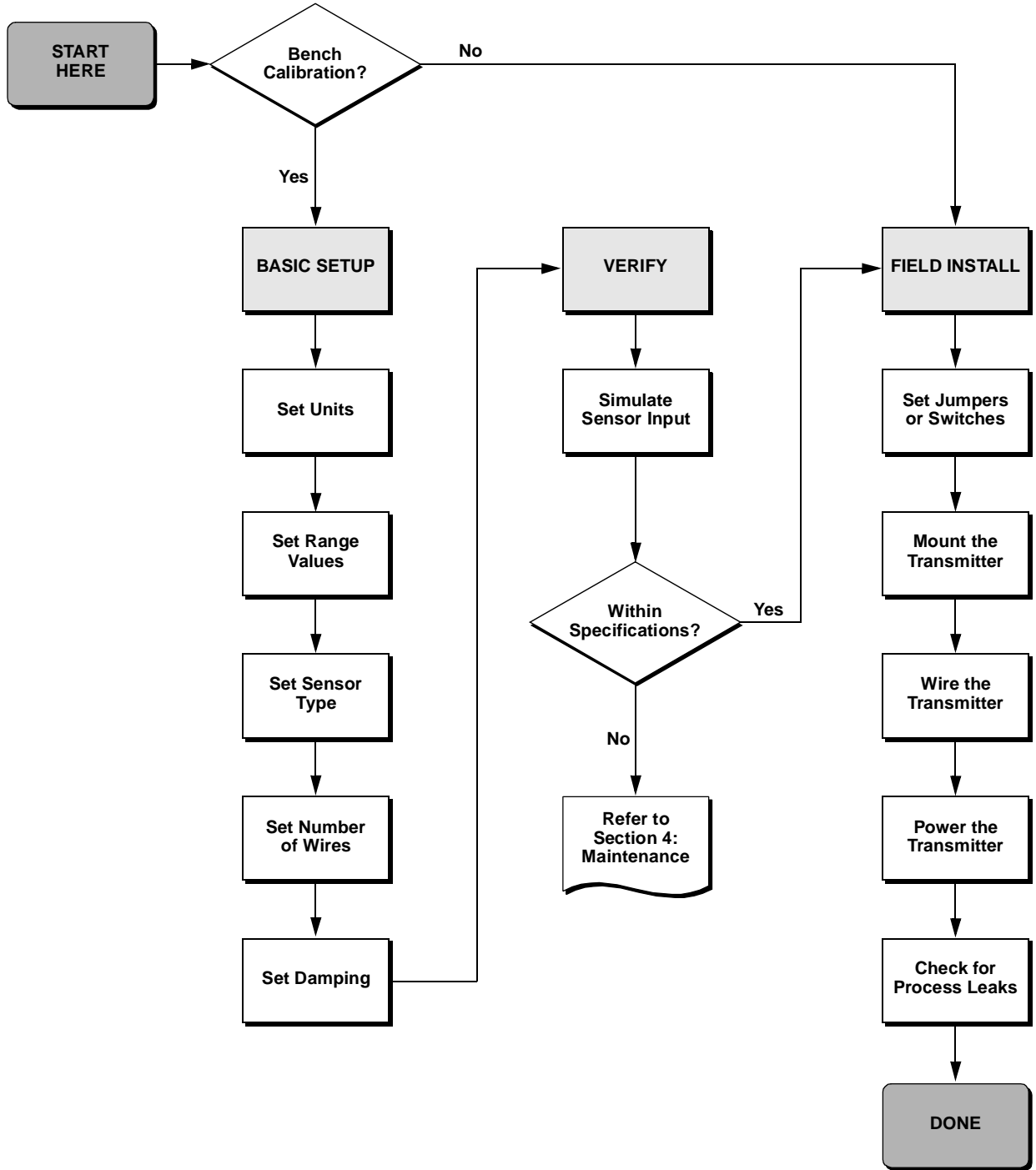
Electrical shock could cause death or serious injury. If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on the transmitter leads and terminals:

- Use extreme caution when making contact with the leads and terminals.

COMMISSIONING: ON THE BENCH OR IN THE LOOP

The transmitter may be commissioned before or after installation. However, it may be useful to commission the transmitter on the bench before installation to ensure proper operation and to familiarize yourself with its functionality.

Figure 2-1. Installation Flowchart.



GENERAL CONSIDERATIONS

Electrical temperature sensors such as resistance temperature detectors (RTDs) and thermocouples (T/Cs) produce low-level signals proportional to temperature. The Model 3144 and 3244MV transmitters convert low-level sensor signals to a standard 4–20 mA dc signal that is relatively insensitive to lead length and electrical noise. This current signal is then transmitted to the control room via two wires.

Figures 2-9 and 2-12 show recommended mounting configurations for transmitters and sensor assemblies. Refer to Section 6: Options for additional transmitter mounting accessories.

ELECTRICAL CONSIDERATIONS

Proper electrical installation is necessary to prevent errors due to sensor lead resistance and electrical noise. Shielded cable should be used for best results in electrically noisy environments. The current loop must have between 250 and 1100 ohms in order to communicate with a HART communicator. Refer to Figure 2-4 on page 2-5 for sensor and current loop connections.

Power Supply

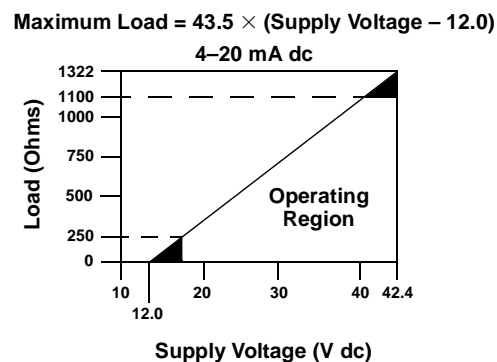
To communicate with a transmitter, you will need a 17.75 V dc minimum power supply. The power supplied to the transmitter should not drop below the transmitter lift-off voltage (see Figure 2-2). If the power drops below the lift-off voltage while the transmitter is being configured, the transmitter may interpret the configuration information incorrectly.

The dc power supply should provide power with less than 2% ripple. The total resistance load is the sum of the resistance of the signal leads and the load resistance of any controller, indicator, or related piece of equipment in the loop. Note that the resistance of intrinsic safety barriers, if used, must be included.

NOTE

Do not allow the voltage to drop below 12.0 V dc at the transmitter terminals when changing transmitter configuration parameters, or permanent damage to the transmitter could result.

Figure 2-2. Load Limits.



Field Wiring

⚠ All power to the transmitter is supplied over the signal wiring. Signal wiring does not need to be shielded, but twisted pairs should be used for the best results. Do not run unshielded signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. High voltage may be present on the leads and may cause electrical shock.

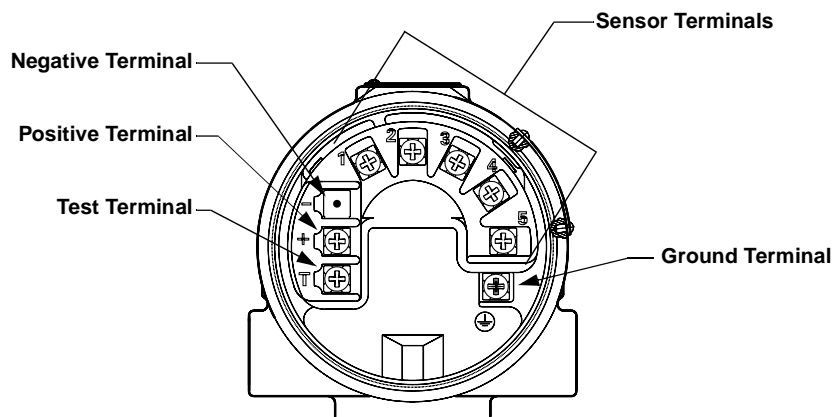
To power the transmitter, follow the steps below.

- ⚠** 1. Remove the transmitter covers. Do not remove the transmitter covers in an explosive atmosphere when the circuit is alive.
2. Connect the positive power lead to the terminal marked “+” and the negative power lead to the terminal marked “-” as shown in Figure 2-3. When wiring to screw terminals, the use of crimped lugs is recommended.
3. Tighten the terminal screws to ensure that good contact is made. No additional power wiring is required.
- ⚠** 4. Replace the transmitter covers. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

NOTE

Do not apply high voltage (e.g., ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit.

Figure 2-3. Transmitter Terminal Block.



3144-0200E01D

Power/Current Loop Connections

Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not go below 12.0 V dc.

1. Connect the current signal leads as shown in Figure 2-4.
2. Recheck the polarity and correctness of connections.
3. Turn the power **ON**.

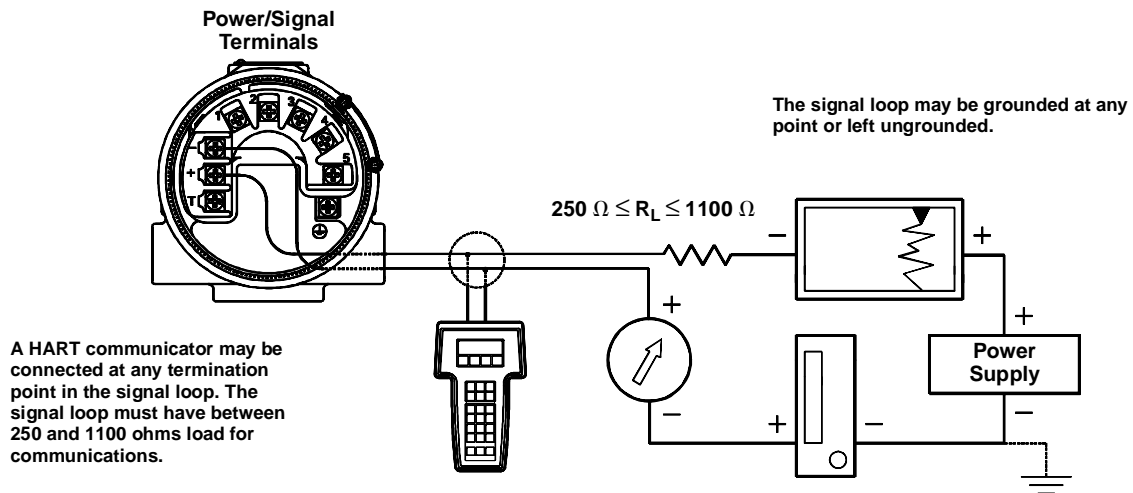
For information about multichannel installations, refer to page 2-6. For information about intrinsically safe installations, refer to page 2-13.

⚠ See “Safety Messages” on page 2-1 for complete warning information.

NOTE

Do not connect the power/signal wiring to the test terminals. The voltage present on the power/signal leads may burn out the reverse-polarity protection diode that is built in to the test terminal. If the test terminals' reverse polarity protection diode is burned out by the power/signal wiring, the transmitter can still be operated by jumping the current from one test terminal to the other.

Figure 2-4. Connecting a Communicator to a Transmitter Loop.



3144-0000A04A

Grounding

Transmitters are electrically isolated to 500 V ac rms. You can ground the signal wiring at any single point, if desired. When using a grounded thermocouple, the grounded junction serves as this point.

NOTE

Do not ground the signal wire at both ends.

Shielded Wire

Recommended grounding techniques for shielded wire usually call for a single grounding point for each shielded wire to avoid grounding the loop. The following two examples employ the single point grounding technique:

Example 1

Connect the shield for the signal wiring to the shield for the sensor wiring. Make sure that the two shields are tied together and electrically isolated from the transmitter housing. Ground the shield at the power supply end.

Example 2

Connect the shield for the sensor wiring to the ground terminal inside of the terminal compartment of the transmitter housing. The shield for the signal wiring should be cut and isolated from the transmitter housing. This shield should be grounded only at the power supply end. Never connect the shield for the signal wiring to the ground terminal inside the transmitter housing.

Transmitter Housing

Ground the transmitter housing in accordance with local electrical requirements. An internal ground terminal is standard. An optional external ground lug assembly (Option Code G1) can also be ordered if needed. Ordering certain hazardous approvals automatically includes an external ground lug (see table on page 5-9). External grounding is recommended when using the optional transient protector (Option Code T1).

Surges/Transients

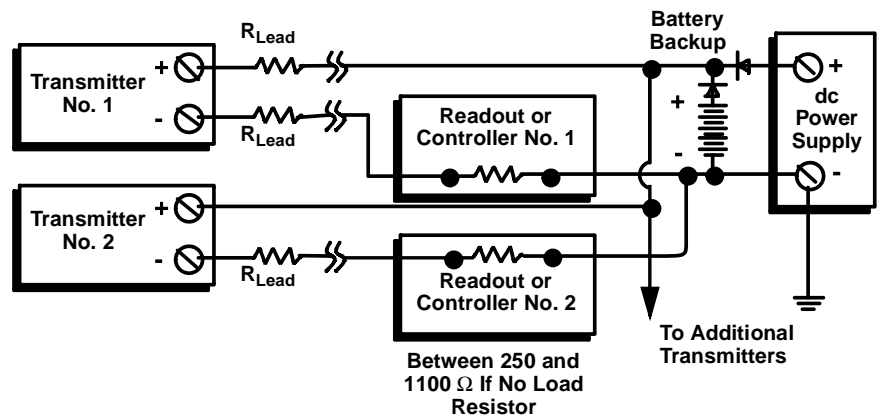
The transmitter will withstand electrical transients of the energy level usually encountered in static discharges or induced switching. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, can damage both the transmitter and the sensor.

To protect against high-energy transients, install either the integral transient protection board (Option Code T1) or the Rosemount Model 470 Transient Protector. The integral transient protection board is available as an ordered option or as an accessory. Refer to “Transient Protection (Option Code T1)” on page 6-4 for more information. The Model 470 transient protector is available only as an accessory. Refer to the Model 470 Transient Protector Product Data Sheet (Rosemount publication no. 00813-0100-4191) for more information.

Multichannel Installations

You can connect several transmitters to a single master power supply, as shown in Figure 2-5. In this case, the system may be grounded only at the negative power supply terminal. In multichannel installations where several transmitters depend on one power supply, and the loss of all transmitters would cause operational problems, consider an uninterruptible power supply or a back-up battery. The diodes shown in Figure 2-5 prevent unwanted charging or discharging of the back-up battery.

Figure 2-5. Multichannel Installations.



3044-0131A

FAILURE MODE AND SECURITY JUMPERS

Failure Mode Jumper

The transmitter monitors itself during normal operation with an automatic diagnostic routine. If the diagnostic routine detects a sensor failure or a failure in the transmitter electronics, the transmitter goes into alarm (high or low, depending on the position of the failure mode jumper).

The analog alarm and saturation values that the transmitter uses depend on whether it is factory configured to standard or NAMUR-compliant operation. The values for each are as follows:

Standard Operation	
Fail High	$21.0 \text{ mA} \geq I \geq 23.0 \text{ mA}$
High Saturation	$I \geq 20.5 \text{ mA}$
Low Saturation	$I \leq 3.90 \text{ mA}$
Fail Low	$I \leq 3.75 \text{ mA}$

NAMUR-Compliant Operation	
Fail High	$21.0 \text{ mA} \geq I \geq 23.0 \text{ mA}$
High Saturation	$I \geq 20.5 \text{ mA}$
Low Saturation	$I \leq 3.8 \text{ mA}$
Fail Low	$I \leq 3.6 \text{ mA}$

Failure Mode Jumper Locations

Without a meter installed:

The failure mode jumper is located on the front side of the electronics module on the electronics side of the transmitter housing, and is labeled FAIL MODE (see Figure 2-6 on page 2-8).

With a meter installed:



The failure mode jumper is located on the LCD faceplate on the electronics module side of the transmitter housing, and is labeled FAIL MODE (see Figure 2-6 on page 2-8).

Transmitter Security Jumper

The transmitter is equipped with a write-protect jumper that can be positioned to prevent the accidental or deliberate change of configuration data. The security jumper is located on the front side of the electronics module and is labeled XMTR SECURITY (see Figure 2-6 on page 2-8).

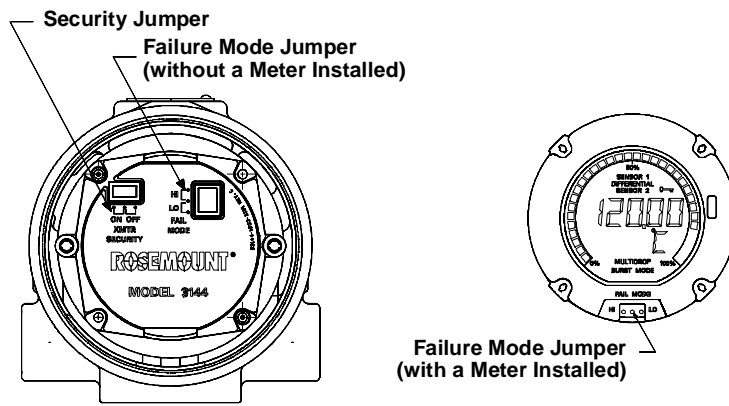
Changing the Position of the Failure Mode or Security Jumper

To change the position of the failure mode or security jumper, follow the steps below.

1. If the transmitter is installed, set the loop to manual.
-  2. Remove the housing cover on the electronics side. Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
3. Set the jumper(s) to the desired position. See Figure 2-6 on page 2-8.
-  4. Replace the transmitter cover. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

 See "Safety Messages" on page 2-1 for complete warning information.

Figure 2-6. Transmitter Jumper Locations.



3144-0200G01A, 2352A01D

SENSOR CONNECTIONS

⚠ Figure 2-7 on page 2-9 shows the correct input connections to the sensor terminals on the transmitter. To ensure an adequate sensor connection, anchor the sensor lead wires beneath the flat washer on the terminal screw. Do not remove the transmitter cover in explosive atmospheres when the circuit is alive. Both transmitter covers must be fully engaged to meet explosion-proof requirements. Use extreme caution when making contact with the leads and terminals.

RTD or Ohm Inputs

If the transmitter is mounted remotely from a 3- or 4-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 10 ohms per lead (equivalent to 1,000 feet of 20 AWG wire). In this case, the leads between the RTD and transmitter should be shielded. If using only two leads (or a compensation loop lead wire configuration), both RTD leads are in series with the sensor element, so significant errors can occur if the lead lengths exceed one foot of 20 AWG wire. For longer runs, attach a third or fourth lead as described above.

Thermocouple or Millivolt Inputs

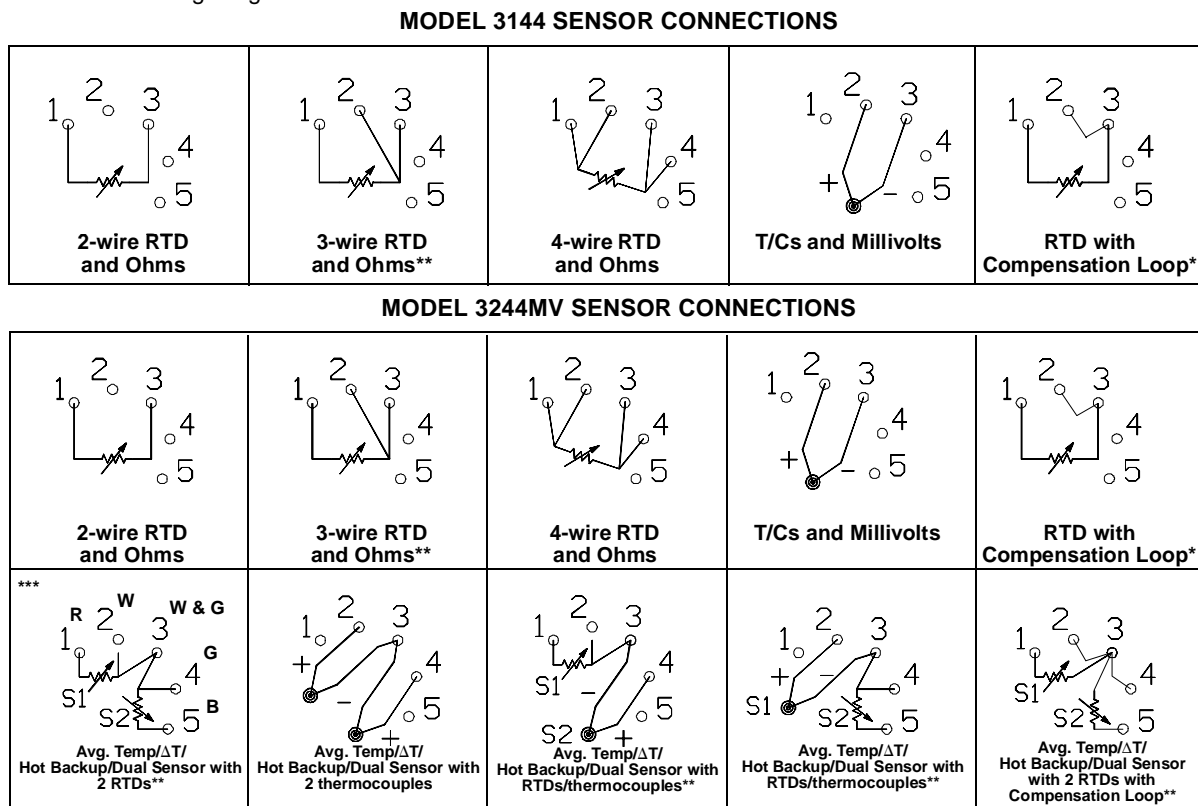
For direct-mount applications, connect the thermocouple directly to the transmitter. If mounting the transmitter remotely from the sensor, use appropriate thermocouple extension wire. Make connections for millivolt inputs with copper wire. Use shielding for long runs of wire.

NOTE

The use of two grounded thermocouples with a Model 3244MV transmitter is not recommended. For applications in which the use of two thermocouples is desired, connect either two ungrounded thermocouples, one grounded and one ungrounded thermocouple, or one dual element thermocouple.

⚠ See "Safety Messages" on page 2-1 for complete warning information.

Figure 2-7. Sensor Wiring Diagram.



* Transmitter must be configured for a 3-wire RTD in order to recognize an RTD with a compensation loop.
 ** Rosemount provides 4-wire sensors for all single-element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.
 *** Typical wiring configuration of a Rosemount dual-element RTD is shown (R=Red, W=White, G=Green, B=Black).

3144-0000E05A, F05A, A04A

MECHANICAL CONSIDERATIONS

Use the following information when preparing the installation site and selecting transmitter options.

Mounting

The transmitter may be mounted directly to or remotely from the sensor. Using optional mounting brackets, the transmitter may be mounted to a flat surface or to a two-inch diameter pipe (see Figure 2-8 on page 2-10).

The transmitter may require supplementary support under high-vibration conditions, particularly if used with extensive thermowell lagging or long extension fittings. Pipe-stand mounting, using one of the optional mounting brackets, is recommended for use in high-vibration conditions.

Access Requirements

Take into account the need for access to the transmitter when choosing an installation location and position.

Housing Rotation

You may rotate the electronics housing up to 90 degrees in either direction to improve field access to the two compartments.

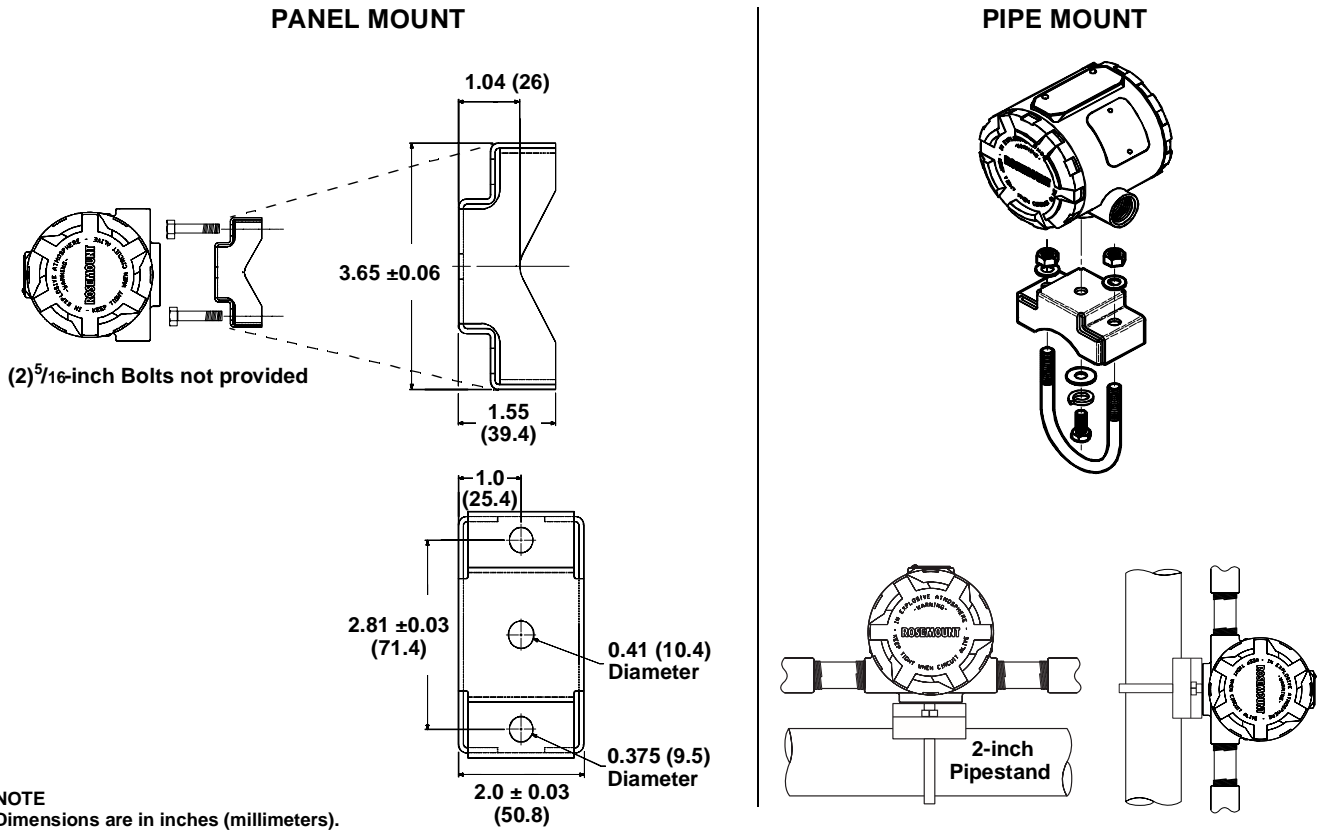
Terminal Side of Electronics Housing

Mount the transmitter so the terminal side is accessible. Be sure to allow adequate clearance for cover removal. Make wiring connections through the conduit openings on the bottom of the housing.

Circuit Side of Electronics Housing

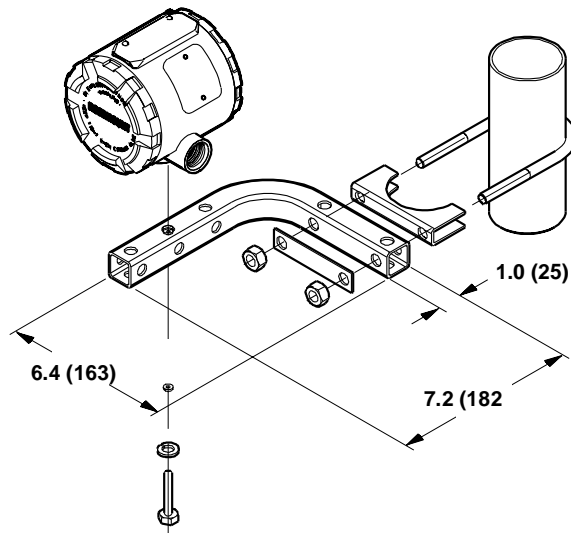
Mount the transmitter so that the circuit side is accessible. Be sure to provide adequate clearance for cover removal. Also, be sure to account for extra room if an LCD meter is installed. Refer to Section 6: Options for more information on the LCD meter option.

Figure 2-8. Option Code B4 Mounting Bracket.



3144-3144A14A, 0000A01A; 3044-2101A01A; 3144-1081A01B

Figure 2-9. Option Code B5 Mounting Bracket.



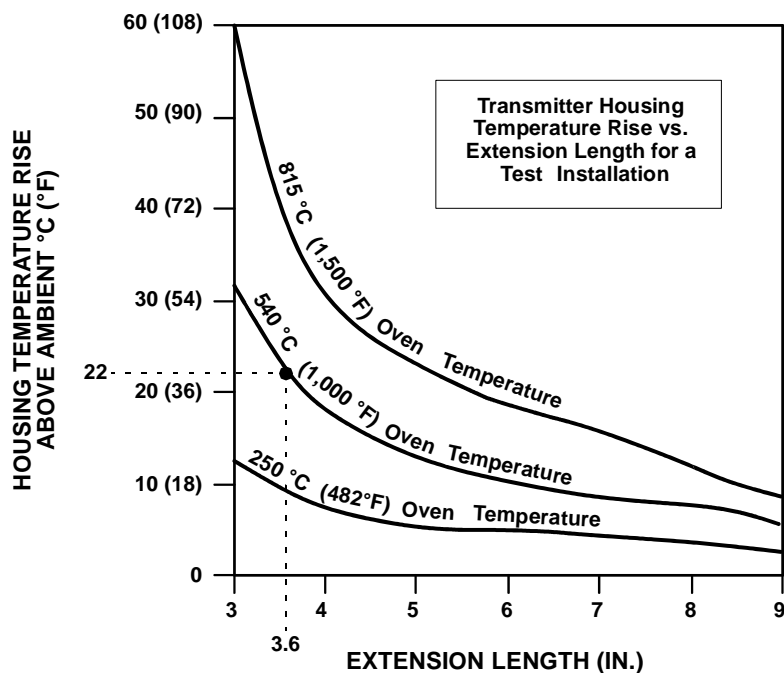
3144-0427B, 0427C

ENVIRONMENTAL CONSIDERATIONS

Temperature Effects

The transmitter will operate within specifications for ambient temperatures between -40 and 185 °F (-40 and 85 °C). Heat from the process is transferred from the thermowell to the transmitter housing. If the expected process temperature is near or beyond specification limits, consider the use of additional thermowell lagging, an extension nipple, or a remote mounting configuration to isolate the transmitter from the process. Figure 2-11 describes the relationship between transmitter housing temperature rise and extension length.

Figure 2-10. Model 3144/3244MV Transmitter Housing Temperature Rise versus Extension Length for a Test Installation.



3044-0123A

EXAMPLE:

The maximum permissible housing temperature rise (T) can be calculated by subtracting the maximum ambient temperature (A) from the transmitter's ambient temperature specification limit (S). For instance, suppose $A = 40$ °C.

$$T = S - A$$

$$T = 85 \text{ °C} - 40 \text{ °C}$$

$$T = 45 \text{ °C}$$

For a process temperature of 540 °C (see Figure 2-10), an extension length of 3.6 inches yields a housing temperature rise (R) of 22 °C, which provides a safety margin of 23 °C. A six-inch extension length ($R = 10$ °C) would offer a higher safety margin (35 °C) and would reduce temperature-effect errors but would probably require extra support for the transmitter. Gauge the requirements for individual applications along this scale. If a thermowell with lagging is used, the extension length may be reduced by the length of the lagging.

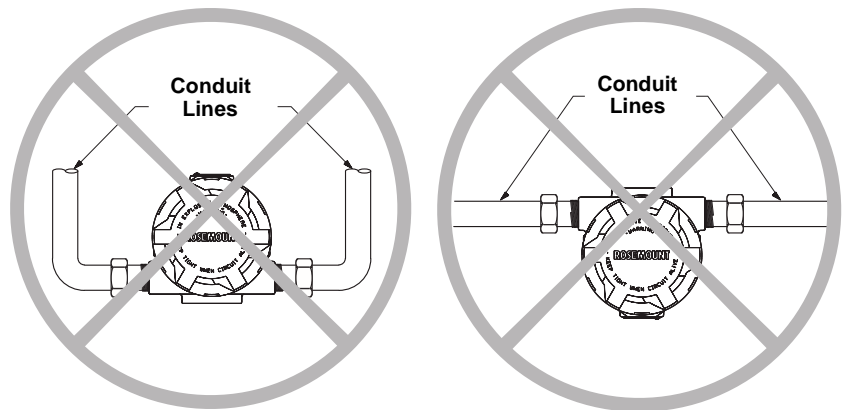
Moist or Corrosive Environments

The Model 3144 and 3244MV transmitters have a highly reliable dual compartment housing designed to resist attack by moisture and corrosives. The sealed electronics module is mounted in a compartment that is isolated from the terminal side conduit entries. O-ring seals protect the interior when the covers are installed. In humid environments, however, it is possible for moisture to accumulate in conduit lines and drain into the housing.

Proper transmitter installation can ensure optimal operation and service life and prevent moisture from accumulating in the housing. Refer to Figure 2-11, and Figure 2-12 before mounting a transmitter.

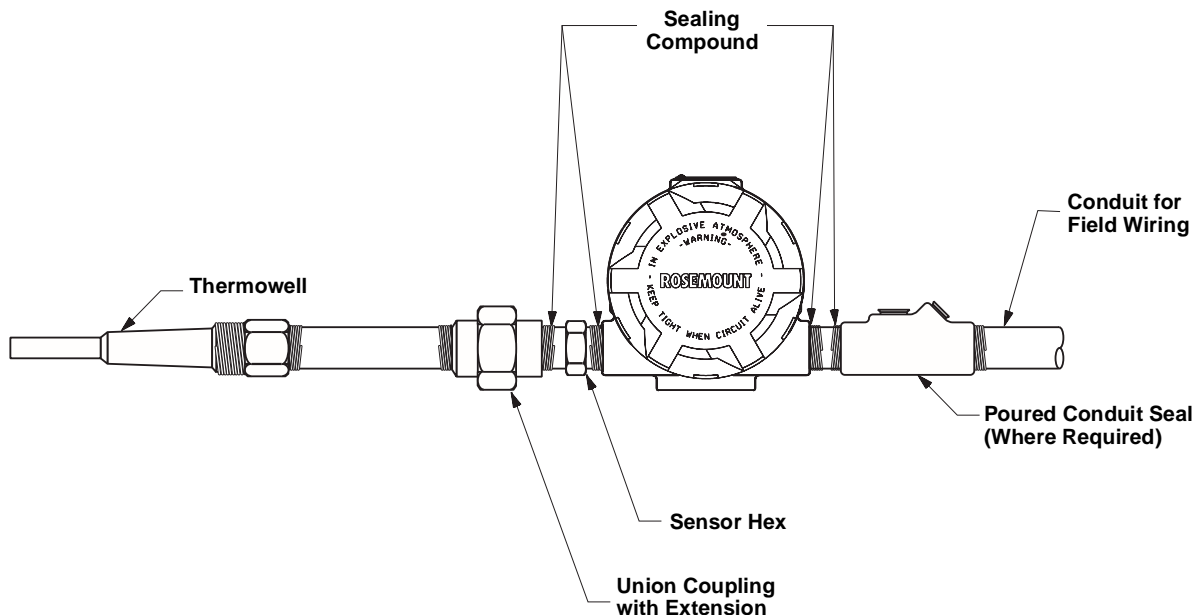
Mount the transmitter at a high point in the conduit run, if possible, so that moisture from the conduits will not drain into the housing. If the transmitter is mounted at a low point in the conduit run, the terminal compartment could fill with water. In some instances, the installation of a poured conduit seal, such as the one pictured in Figure 2-12, is advisable. Remove the terminal compartment cover periodically and inspect the transmitter for moisture and corrosion.

Figure 2-11. Incorrect Conduit Installation.




3144-0429A, 0429B

Figure 2-12. Recommended Mounting with Drain Seal.



3144-0430B

Hazardous Locations Installations

 The transmitter is designed with explosion-proof housings and circuitry suitable for intrinsically safe and non-incendive operation. Each transmitter is clearly marked with a tag indicating the approvals carried. To maintain certified ratings for installed transmitters, install in accordance with all applicable installation codes and approval drawings. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications. Both transmitter covers must be fully engaged to meet explosion proof requirements. Refer to Appendix D: Hazardous Area Approval Installation Drawings for transmitter installation drawings.



IMPORTANT

Once a device labeled with multiple approval types is installed, it should not be reinstalled using any of the other labeled approval types. To ensure this, the approval label should be permanently marked to distinguish the used from the unused approval type(s).

INSTALLATION PROCEDURE

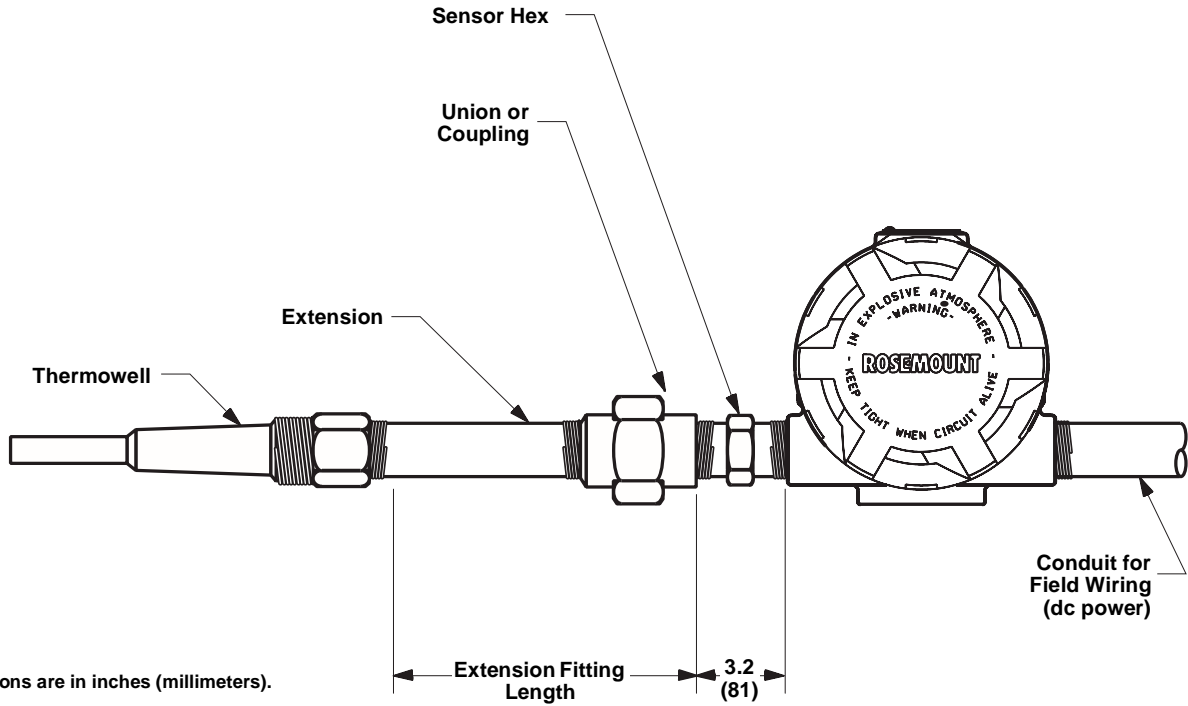
Installation consists of mounting the transmitter and sensor and making electrical connections. If you are mounting the transmitter directly to the sensor assembly, use the process shown in Figure 2-13. If you are mounting the transmitter apart from the sensor assembly, use conduit between the sensor and transmitter. The transmitter accepts male conduit fittings with 1/2–14 NPT, M20 × 1.5 (CM 20), PG 13.5 (PG 11), or JIS G1/2 threads. Make sure only qualified personnel perform the installation.

Typical North American Configuration

-  1. Mount the thermowell to the pipe or process container wall. Be sure to install and tighten thermowells and sensors. Perform a leak check before starting the process.
2. Attach any necessary unions, couplings, and extension fittings. Be sure to seal the fitting threads with silicone or tape (if required).
3. Screw the sensor into the thermowell.
4. Verify all sealing requirements for severe environments or to satisfy code requirements.
5. Attach the transmitter to the thermowell assembly. Be sure to seal all threads with silicone or tape (if required).
6. Pull sensor leads through the extensions, unions, or couplings into the terminal side of the transmitter housing.
7. Install conduit for field wiring to the remaining conduit entry of the transmitter.
-  8. Pull the field wiring leads into the terminal side of the transmitter housing. Avoid contact with the leads and terminals.
9. Attach the sensor leads to the transmitter sensor terminals. Attach the power leads to the transmitter power terminals. Avoid contact with the leads and terminals.
10. Attach and tighten both transmitter covers. Both transmitter covers must be fully engaged to meet explosion-proof requirements.

 See “Safety Messages” on page 2-1 for complete warning information.

Figure 2-13. Typical North American Mounting Configuration.



NOTE
Dimensions are in inches (millimeters).

3144-0433B

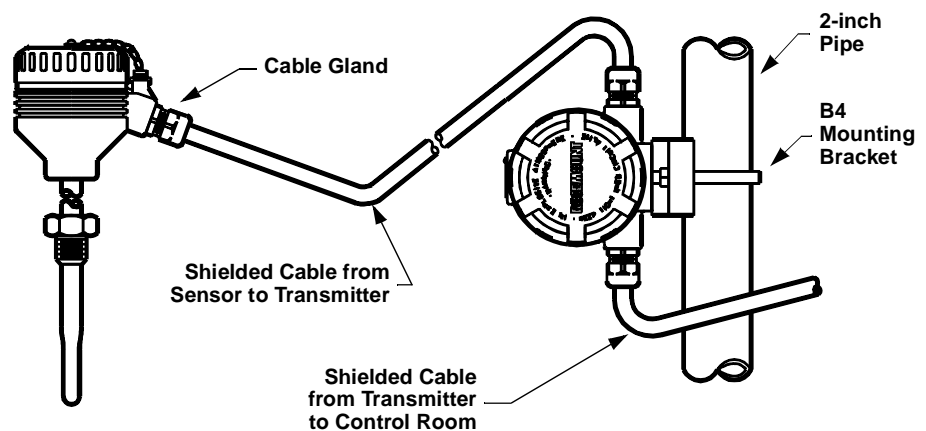
NOTE

The National Electrical Code requires that a barrier or seal be used in addition to the primary (sensor) seal to prevent process fluid from entering the electrical conduit and continuing to the control room. Professional safety assistance is recommended for installations in potentially hazardous processes.

Typical European Configuration

1. Mount the thermowell to the pipe or the process container wall. Install and tighten thermowells and sensors. Perform a leak check before starting the process.
2. Attach a connection head to the thermowell.
3. Insert the sensor into the thermowell and attach it to the connection head.
4. Mount the transmitter to a 2-inch pipe or a suitable panel using one of the optional mounting brackets. The B4 bracket is shown in Figure 2-14.
5. Attach cable glands to the shielded cable running from the connection head to the transmitter and from the transmitter to the control room.
6. Insert the shielded cable leads into the connection head and the transmitter through the cable entries. Connect and tighten the cable glands.
7. Connect the shielded cable leads to the sensor wiring leads inside of the connection head, and the sensor wiring terminals inside of the transmitter housing. Avoid contact with the leads and the terminals.
8. Connect the shielded cable leads to the transmitter power terminals. Avoid contact with the leads and the terminals.

Figure 2-14. Typical European Process Mounting Configuration.



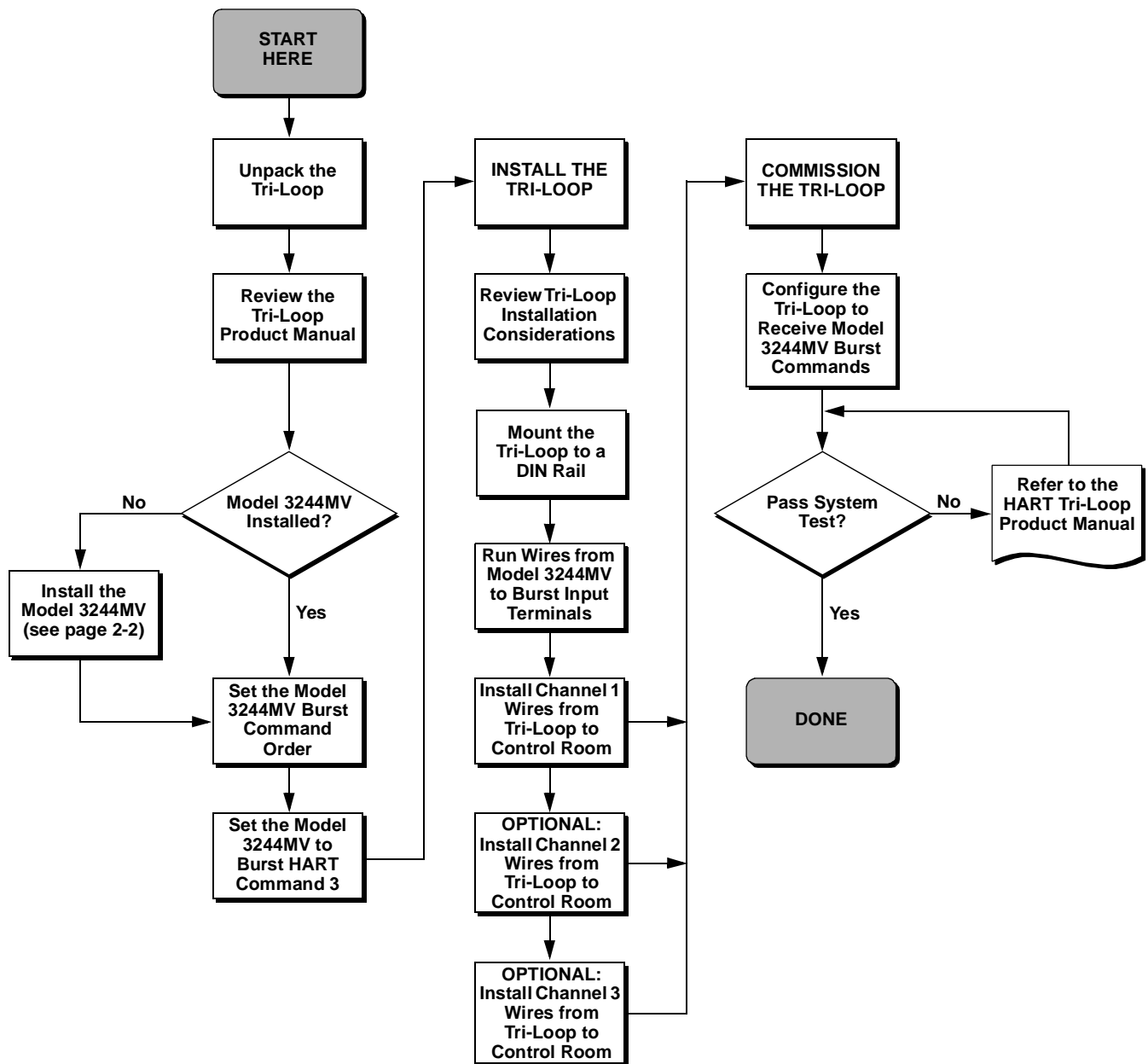
644-0000B05B

INSTALLATION IN CONJUNCTION WITH A MODEL 333 HART TRI-LOOP HART-TO-ANALOG SIGNAL CONVERTER

Use the Model 3244MV transmitter in operation with two sensors in conjunction with a Model 333 HART Tri-Loop® HART-to-Analog Signal Converter to acquire an independent 4–20 mA analog output signal for each sensor input. During normal operation, the Model 3244MV transmitter outputs four out of the five following digital process variables: sensor 1, sensor 2, differential temperature, average temperature, and transmitter terminal temperature. The HART Tri-Loop divides the digital signal and outputs any or all of these variables into as many as three separate 4–20 mA analog channels.

Refer to Figure 2-15 for basic installation information. Refer to the Model 333 HART Tri-Loop HART-to-Analog Signal Converter Product Manual (Rosemount publication number 00809-0100-4754) for complete installation information.

Figure 2-15. HART Tri-Loop Installation Flowchart.



COMMISSIONING THE TRANSMITTER FOR USE WITH THE HART TRI-LOOP

To prepare the Model 3244MV transmitter for use with a Model 333 HART Tri-Loop, you must configure the transmitter to Burst Mode and set the process variable output order. In Burst Mode, the transmitter provides digital information for the analog current in mA to the HART Tri-Loop. The HART Tri-Loop divides the signal into separate 4–20 mA loops for the primary (PV), secondary (SV), tertiary (TV), and quaternary (QV) variables. When using the Model 3244MV transmitter in conjunction with the HART Tri-Loop, you must also consider the configuration of the differential temperature and Hot Backup features, if used.

NOTE

These procedures assume that the sensors and the transmitter are connected, powered, and functioning properly, and that a Model 275 HART Communicator is connected to the transmitter control loop and is communicating successfully. For communicator usage instructions, see Appendix B: Model 275 HART Communicator.

Set the Transmitter to Burst Mode

To set the transmitter to burst mode, follow the steps below.

1. From the Home screen, select *1 Device setup, 4 Detailed setup, 3 Output condition, 2 HART output, 4 Burst option* to prepare to set the transmitter to burst command 3. The communicator displays the Burst option screen.
2. Select *Process vars/crnt*. The communicator returns to the HART output screen.
3. Select *3 Burst mode* to prepare to enable Burst Mode. The communicator displays the Burst Mode screen.
4. Select **On** to enable Burst Mode. The communicator returns to the HART output screen.
5. Select **Send** to download the new configuration information to the transmitter.

Set Process Variable Output Order

To set the process variable output order, follow the steps below.

1. From the Home screen, select *1 Device setup, 1 Process variables, 7 Variable re-map*. Select **OK** to set the control loop to manual. The communicator displays the Primary Variable screen.
2. Select the item you wish to set as the primary variable at the **Select PV** prompt.
3. Repeat step 2 for the SV, TV, and QV. The communicator displays the Variable mapping screen.
4. Select **OK** to accept the order to which the variables are mapped, or **Abort** to abort the entire procedure.

NOTE

Take careful note of the process variable output order. You must configure the HART Tri-Loop to read the variables in the same order.

5. Select **OK** to return the control loop to automatic control.

Special Considerations

To initiate operation between a Model 3244MV transmitter and the HART Tri-Loop, you must consider the configuration of both the differential temperature and the Hot Backup features, if used.

Differential Temperature Measurement

To enable the differential temperature measurement feature of a Model 3244MV transmitter operating in conjunction with the HART Tri-Loop, adjust the range end points of the corresponding channel on the HART Tri-Loop to include zero. For example, if you wish the secondary variable of the transmitter to report differential temperature, configure the transmitter accordingly (see “Set Process Variable Output Order” on page 2-17), and adjust the corresponding channel of the HART Tri-Loop so one range end point is negative and the other is positive.

Hot Backup

To enable the Hot Backup feature of a Model 3244MV transmitter operating in conjunction with the HART Tri-Loop, ensure that the output units of the sensors are the same as the units of the HART Tri-Loop. You may use any combination of RTDs or thermocouples as long as the units of both match the units of the HART Tri-Loop. For more information on configuring the transmitter for Hot Backup, see page 3-10. See “Using the Tri-Loop to Detect Sensor Failures and Sensor Drift” for information on how to use the Tri-Loop to detect sensor failure and sensor drift.

Using the Tri-Loop to Detect Sensor Failures and Sensor Drift

The Model 3244MV transmitter outputs a digital HART signal whenever a sensor failure occurs. If an analog warning is required, the HART Tri-Loop can be configured to produce an analog signal that can be interpreted by the control system as a sensor failure.

To set up the HART Tri-Loop to transmit sensor failure alerts, follow the steps below.

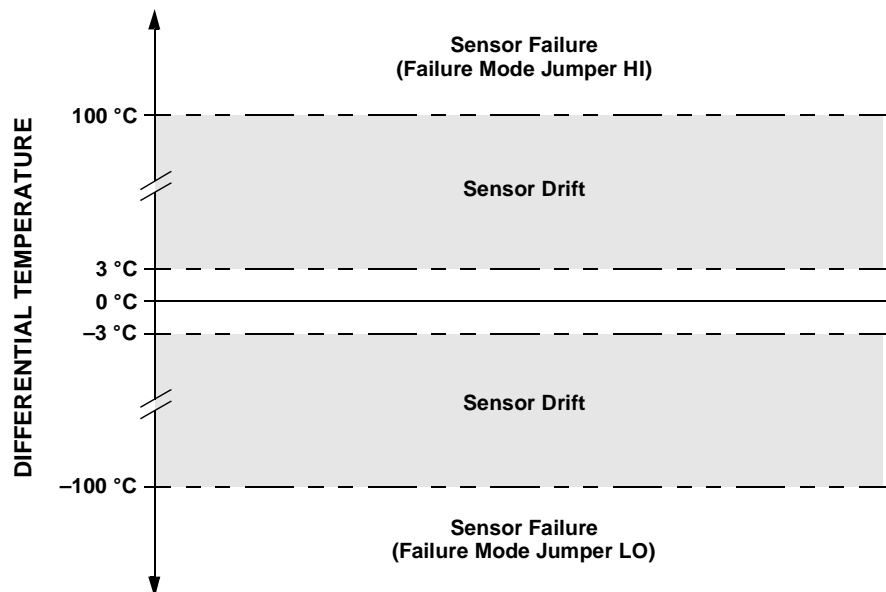
1. Configure the Model 3244MV transmitter variable map as shown in the table.

Variable	Mapping
PV	Sensor 1 or Sensor Average
SV	Sensor 2
TV	Differential Temperature
QV	As Desired

2. Configure Channel 1 of the HART Tri-Loop as TV (differential temperature). If either sensor should fail, the differential temperature output will be +9999 or -9999 (high or low saturation), depending on the position of the Failure Mode Jumper (see “Failure Mode and Security Jumpers” on page 2-7).
3. Select temperature units for Channel 1 that match the differential temperature units of the transmitter.

- Specify a range for the TV such as -100 to 100 °C. If the range is large, then a sensor drift of a few degrees will represent only a small percent of range. If Sensor 1 or Sensor 2 fails, the TV will be $+9999$ (high saturation) or -9999 (low saturation). In this example, zero is the midpoint of the TV range. If a ΔT of zero is set as the lower range limit (4 mA), then the output could saturate low if the reading from Sensor 2 exceeds the reading from Sensor 1. By placing zero in the middle of the range, the output will normally stay near 12 mA, and the problem will be avoided.
- Configure the DCS so that $TV < -100$ °C or $TV > 100$ °C indicates a sensor failure and, for example, $TV \leq -3$ °C or $TV \geq 3$ °C indicates a drift alert. See Figure 2-16.

Figure 2-16. Tracking Sensor Drift and Sensor Failure with Differential Temperature.



On-line Operations

OVERVIEW

This section contains information needed to configure and format the Model 3144 and 3244MV Smart Temperature Transmitters. The transmitters can be configured either on-line or off-line. During on-line configuration, the transmitter is connected to a HART communicator. Data are entered in the working register of the communicator and sent directly to the transmitter. Off-line configuration consists of storing configuration data in a HART communicator while it is not connected to a transmitter. Data is stored in nonvolatile memory and can be downloaded to the transmitter at a later time.

NOTE

The information in this section applies to the use of a Model 275 HART Communicator to communicate with a Model 3144 or 3244MV Smart Temperature Transmitter. For information regarding the use of a Model 268 Communicator, refer to Appendix C: Model 268 SMART FAMILY Interface.

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

WARNING

Explosions may result in death or serious injury.

- Do not remove the instrument cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Both transmitter covers must be fully engaged to meet explosion proof requirements.

WARNING

Electrical shock could cause death or serious injury. If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on transmitter leads and terminals.

- Use extreme caution when making contact with the leads and terminals.

Setting the Loop to Manual

Whenever you are preparing to send or request data that would disrupt the loop or change the output of the transmitter, you must set your process application loop to manual. Both the Model 275 HART Communicator and the Rosemount Model 268 SMART FAMILY Interface will prompt you to set the loop to manual when necessary. Keep in mind that acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; you have to set the loop to manual yourself, as a separate operation.

REVIEW CONFIGURATION DATA

Review all of the factory-set configuration data to ensure that it reflects the current application before operating the Model 3144 or 3244MV transmitters in an actual installation.

Review

HART Fast Keys	1, 5
----------------	------

Review the transmitter configuration parameters set at the factory to ensure accuracy and compatibility with your particular application. After activating the *Review* function, scroll through the data list to check each variable. Refer to “Basic Setup” on page 3-5 if a change to the transmitter configuration data is necessary.

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

HART Fast Keys	1, 1
----------------	------

The process variables for the Model 3144 and 3244MV transmitters provide the transmitter output. The Process Variable menu displays process variables and allows for remapping of the values shown. These process variables are continuously updated. Select *Variable Re-map* to change the sequencing of the process variables. With the Model 3144, two screens follow that allow you to select the primary variable (PV) and the secondary variable (SV). From each screen you can choose either *sensor 1* or *terminal temperature*. With the Model 3244MV, four screens follow that allow you to select the primary variable (PV), secondary variable (SV), tertiary variable (TV), and quaternary variable (QV). Primary variable choices include sensor 1, sensor 2, differential temperature, average temperature, and transmitter terminal temperature. The primary variable is the 4–20 mA analog signal.

See Tables 3-1, 3-2, and 3-3 for a list of interaction rules for varying transmitter configurations.

TABLE 3-1. Valid Options/Outputs Using Sensor 1 (Model 3144 and 3244MV).

Primary Variable	Hot Backup Enabled	Drift Alert Activated	Drift Alarm Mode On	Sensor 1 Fail	Sensor 2 Fail	Analog Output	Digital Status	Diff Temp Value	Term Temp Value	Sensor 1 Value	Sensor 2 Value	Average Temp Value
Any	Y	Y/N	Y/N	Y/N	Y/N			Invalid				
Any	Y/N	Y	Y/N	Y/N	Y/N			Invalid				
Sensor 2	Y/N	Y/N	Y/N	Y/N	Y/N			Invalid				
Differential	N	N	Y/N	N	Y/N	Differential	None	±9999	Normal	Normal	9999	±9999
Any	N	N	Y/N	Y	Y/N	Alarm	Sensor 1 Fail	±9999	Normal	±9999	9999	±9999
Term Temp	N	N	Y/N	N	Y/N	Term Temp	None	±9999	Normal	Normal	9999	±9999
Sensor 1	N	N	Y/N	N	Y/N	Sensor 1	None	±9999	Normal	Normal	9999	±9999
Average	N	N	Y/N	N	Y/N	Average	None	±9999	Normal	Normal	9999	±9999

NOTE: If alarm value is set to low, the value will be -9999, and if set to high the value will be +9999.

NOTE: If a hardware error occurs, all outputs will go to ±9999.

TABLE 3-2. Valid Options/Outputs Using Sensor 2 (Model 3244MV Only).

Primary Variable	Hot Backup Enabled	Drift Alert Activated	Drift Alarm Mode On	Sensor 1 Fail	Sensor 2 Fail	Analog Output	Digital Status	Diff Temp Value	Term Temp Value	Sensor 1 Value	Sensor 2 Value	Average Temp Value
Any	Y	Y/N	Y/N	Y/N	Y/N			Invalid				
Any	Y/N	Y	Y/N	Y/N	Y/N			Invalid				
Sensor 1	Y/N	Y/N	Y/N	Y/N	Y/N			Invalid				
Differential	N	N	Y/N	Y/N	N	Differential	None	±9999	Normal	9999	Normal	±9999
Any	N	N	Y/N	Y/N	Y	Alarm	Sensor 1 Fail	±9999	Normal	9999	±9999	±9999
Term Temp	N	N	Y/N	Y/N	N	Term Temp	None	±9999	Normal	9999	Normal	±9999
Sensor 2	N	N	Y/N	Y/N	N	Sensor 2	None	±9999	Normal	9999	Normal	±9999
Average	N	N	Y/N	Y/N	N	Average	None	±9999	Normal	9999	Normal	±9999

NOTE: If alarm value is set to low, the value will be -9999, and if set to high the value will be +9999.

NOTE: If a hardware error occurs, all outputs will go to ±9999.

Rosemount Model 3144 and 3244MV Smart Temperature Transmitters

TABLE 3-3. Valid Options/Outputs Using Both Sensor 1 and Sensor 2 (Model 3244MV Only).

Primary Variable	Hot Backup Enabled	Drift Alert Activated	Drift Alarm Mode On	Sensor 1 Fail	Sensor 2 Fail	Analog Output	Digital Status	Diff Temp Value	Term Temp Value	Sensor 1 Value	Sensor 2 Value	Average Temp Value
Differential	Y	Y/N	Y/N	Y/N	Y/N			Invalid				
Term Temp	Y	Y/N	Y/N	Y/N	Y/N			Invalid				
Sensor 2	Y	Y/N	Y/N	Y/N	Y/N			Invalid				
Any	N	N	Y/N	N	Y	Alarm	Sensor 2 Fail	±9999	Normal	Normal	±9999	±9999
Any	N	N	Y/N	Y	N	Alarm	Sensor 1 Fail	±9999	Normal	±9999	Normal	±9999
Any	N	N	Y/N	Y	Y	Alarm	Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Any	N	Y	N	N	Y	Alarm	Drift Alert/Sensor 2 Fail	±9999	Normal	Normal	±9999	±9999
Any	N	Y	N	Y	N	Alarm	Drift Alert/Sensor 1 Fail	±9999	Normal	±9999	Normal	±9999
Any	N	Y	N	Y	Y	Alarm	Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Any	N	Y	Y	N	N	Alarm	Drift Alert	Normal	Normal	Normal	Normal	Normal
Any	N	Y	Y	N	Y	Alarm	Drift Alert/Sensor 2 Fail	±9999	Normal	Normal	±9999	±9999
Any	N	Y	Y	Y	N	Alarm	Drift Alert/Sensor 1 Fail	±9999	Normal	±9999	Normal	±9999
Any	N	Y	Y	Y	Y	Alarm	Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Differential	N	N	Y/N	N	N	Differential	None	Normal	Normal	Normal	Normal	Normal
Differential	N	Y	N	N	N	Differential	Drift Alert	Normal	Normal	Normal	Normal	Normal
Term Temp	N	N	Y/N	N	N	Term Temp	None	Normal	Normal	Normal	Normal	Normal
Term Temp	N	Y	N	N	N	Term Temp	Drift Alert	Normal	Normal	Normal	Normal	Normal
Sensor 1	N	N	Y/N	N	N	Sensor 1	None	Normal	Normal	Normal	Normal	Normal
Sensor 1	N	Y	N	N	N	Sensor 1	Drift Alert	Normal	Normal	Normal	Normal	Normal
Sensor 1	Y	N	Y/N	N	N	Sensor 1	None	Normal	Normal	Normal	Normal	Normal
Sensor 1	Y	N	Y/N	N	Y	Sensor 1	Sensor 2 Fail	±9999	Normal	Normal	±9999	Sens 1
Sensor 1 ⁽¹⁾	Y	N	Y/N	Y	N	Sensor 2	Hot BU/Sensor 1 Fail	±9999	Normal	±9999	Normal	Sens 2
Sensor 1 ⁽¹⁾	Y	N	Y/N	Y	Y	Alarm	Hot BU/Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Sensor 1	Y	Y	N	N	N	Sensor 1	Drift Alert	Normal	Normal	Normal	Normal	Normal
Sensor 1	Y	Y	N	N	Y	Sensor 1	Drift Alert/Sensor 2 Fail	±9999	Normal	Normal	±9999	Sens 1
Sensor 1 ⁽¹⁾	Y	Y	N	Y	N	Sensor 2	Drift Alert/Hot BU/Sensor 1 Fail	±9999	Normal	±9999	Normal	Sens 2
Sensor 1 ⁽¹⁾	Y	Y	N	Y	Y	Alarm	Hot BU/Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Any	Y	Y	Y	Y/N	Y/N			Invalid ⁽²⁾				
Sensor 2	N	N	Y/N	N	N	Sensor 2	None	Normal	Normal	Normal	Normal	Normal
Sensor 2	N	Y	N	N	N	Sensor 2	Drift Alert	Normal	Normal	Normal	Normal	Normal
Average	N	N	Y/N	N	N	Average	None	Normal	Normal	Normal	Normal	Normal
Average	N	Y	N	N	N	Average	Drift Alert	Normal	Normal	Normal	Normal	Normal
Average	Y	N	Y/N	N	N	Average	None	Normal	Normal	Normal	Normal	Normal
Average	Y	N	Y/N	N	Y	Average	Sensor 2 Fail	±9999	Normal	Normal	±9999	Sens 1
Average ⁽¹⁾	Y	N	Y/N	Y	N	Sensor 2	Hot BU/Sensor 1 Fail	±9999	Normal	±9999	Normal	Sens 2
Average ⁽¹⁾	Y	N	Y/N	Y	Y	Alarm	Hot BU/Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Average	Y	Y	N	N	N	Average	Drift Alert	Normal	Normal	Normal	Normal	Normal
Average	Y	Y	N	N	Y	Average	Drift Alert/Sensor 2 Fail	±9999	Normal	Normal	±9999	Sens 1
Average ⁽¹⁾	Y	Y	N	Y	N	Sensor 2	Drift Alert/Hot BU/Sensor 1 Fail	±9999	Normal	±9999	Normal	Sens 2
Average ⁽¹⁾	Y	Y	N	Y	Y	Alarm	Hot BU/Sensor 1/Sensor 2 Fail	±9999	Normal	±9999	±9999	±9999
Any	N	N	Y/N	N	Y	Alarm	Sensor 2 Fail	±9999	Normal	Normal	±9999	±9999

NOTE: If alarm value is set to low, the value will be -9999, and if set to high the value will be +9999.

NOTE: If a hardware error occurs, all outputs will go to ±9999.

(1) Remapping occurs in this situation.

(2) Hot Backup and Drift Alarm mode can not be used simultaneously.

BASIC SETUP

The transmitters must be configured for certain basic variables in order to be operational. 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.

Select Sensor Type

HART Fast Keys	1, 3, (5 or 7)
----------------	----------------

The *Sensor 1 Conn* and *Sensor 2 Conn* commands designate, for the transmitter, the sensor type and the number of wires to be connected. Note that differential and average temperature measurements can only be made with 2- or 3-wire sensors. The *Sensor 2 Conn* command pertains only to the Model 3244MV transmitter. Select from the following sensor types:

- 2-, 3-, or 4-wire Pt 100, Pt 200, Pt 500, or Pt 1000 ($\alpha = 0.00385$)⁽¹⁾ platinum RTDs
- 2-, 3-, or 4-wire Pt 100 $\alpha = 0.003916$ ⁽¹⁾ platinum RTD
- 2-, 3-, or 4-wire Ni 120 nickel RTDs
- 2-, 3-, or 4-wire Cu 10 copper RTDs
- Type B, E, J, K, N, R, S, and T thermocouples
- NIST Type C thermocouple
- -10 to 100 millivolts
- 2-, 3-, or 4-wire 0 to 2000 ohms
- Special RTD or T/C calibration schedules

Set Output Units

HART Fast Keys	1, 3, 2
----------------	---------

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

- Degrees Celsius
- Degrees Fahrenheit
- Degrees Rankine
- Kelvin
- Ohms
- Millivolts

NOTE

After changing units, press SEND (F2) so the microprocessor will recalculate the associated variables (4–20 mA points, for example). Both models recalculate all variables that depend on units. After the transmitter recalculates the variables, you may change any of the remaining parameters.

(1) Pt 1000 $\alpha = 0.00385$ and Pt 100 $\alpha = 0.003916$ RTD sensor input types are not available in previous versions of the Model 3144 and 3244MV transmitters.

Rerange

HART Fast Keys	1, 3, 3
----------------	---------

The *Range Values* command sets the 4 and 20 mA points or the lower and upper range values. Setting the range values to the limits of expected readings maximizes transmitter performance; the transmitter is most accurate when operated within the expected temperature ranges for your application. The range of expected readings is defined by the Lower Range Value (LRV) and the Upper Range Value (URV). Refer to Table 5-1 on page 5-10 for unit and range limits. You can reset the transmitter range values as often as necessary to reflect changing process conditions.

DETAILED SETUP

50/60 Hz Filter

HART Fast Keys	1,4,1,3
----------------	---------

The *50/60 Hz filter* command sets the transmitter electronic filter to match the frequency of the ac power supply in your plant, which reduces or eliminates electronic noise within the measurement loop.

Terminal Temperature Settings

HART Fast Keys	1,4,1,2
----------------	---------

The *Term Temp Sensor* command sets the terminal temperature units to indicate the ambient temperature of the transmitter.

Signal Condition

HART Fast Keys	1,4,2
----------------	-------

The *Signal Condition* command allows you to view or change primary variable lower and upper range values, sensor percent range, and sensor damping.

Analog Output

HART Fast Keys	1,4,3,1
----------------	---------

The *Analog Output* command allows you to view the analog output signal and alarm setting (high or low). With this command you can also initiate a loop test or make digital trim changes.

Disable Special Sensor

HART Fast Keys	1,4,1,1,4, (1 or 2), 5
----------------	------------------------

The *Dis Spec Snsr* command disables sensor matching or any other special sensor configuration, and returns the transmitter to either the factory or user trim setting, whichever was used previously. **After disabling the special sensor, make certain the transmitter engineering units default correctly before returning the transmitter to service.**

HART Output

HART Fast Keys	1,4,3,2
----------------	---------

The *HART Output* command allows you to make changes to the multidrop address, specify the number of requested preambles, initiate burst mode, and make changes to the burst options.

Meter Settings

HART Fast Keys	1,4,3,3
----------------	---------

The *Meter Settings* command sets meter options including engineering units, decimal point, and bar graph features. Transmitters without meters are shipped set to “UNUSED.” Change the meter settings to reflect necessary configuration parameters when adding a meter or re-configuring the transmitter.

To customize the variables that the meter displays, follow the steps below.

1. Select *1 Device setup, 4 Detailed setup, 3 Output condition, 3 Meter Options, 1 Meter typ* to prepare to customize the meter display.
2. Select the appropriate variable configuration from the Meter Type screen.

NOTE

Selecting **Not Used** from the Meter Type screen will disable the meter.

3. Select **Send** to download the new meter configuration to the transmitter.

For a more detailed description of the meter features and diagnostic messages, refer to “LCD Meter (Option Code M5)” on page 6-6.

Alarm Values⁽¹⁾

HART Fast Keys	1,4,3,4
----------------	---------

The *Alarm Values* command allows the high and low alarm and saturation values to be viewed. Transmitters are factory configured for either Rosemount standard or NAMUR-compliant output levels and cannot be changed in the field. Use the failure mode jumper (see “Failure Mode and Security Jumpers” on page 2-7) to set whether the output will be driven to high alarm or low alarm in the case of failure.

Process Variable Damping

HART Fast Keys	1,3,3
----------------	-------

The *PV Damp* 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 5.0 seconds and can be reset to any value between 0 and 32 seconds.

The value chosen for damping affects the response time of the transmitter. When set to zero (i.e., disabled), the damping function is off and the transmitter output reacts to changes in input as quickly as the intermittent sensor algorithm allows (refer to “Intermittent Sensor Algorithm” on page 5-14). Increasing the damping value increases transmitter response time.

With damping enabled, if the temperature change is within 2 percent of the output range, the transmitter measures the change in input every 500 milliseconds and outputs values according to the following relationship:

$$\text{Damped Value} = (P - N) \times \left(\frac{2T - U}{2T + U} \right) + N$$

P =previous damped value

N =new sensor value

T = damping time constant

U =update rate

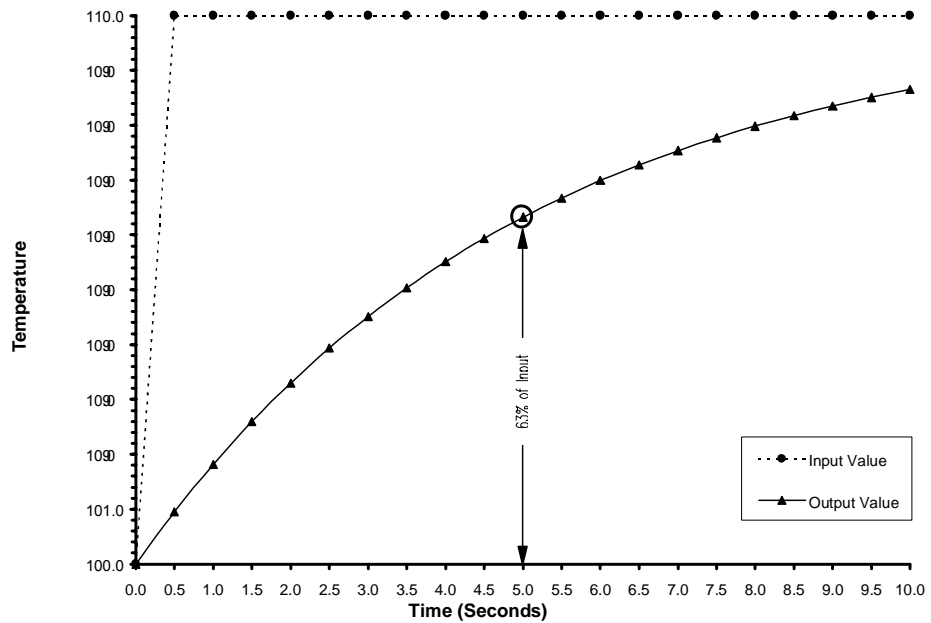
At the value to which the damping time constant is set, the transmitter output is at 63 percent of the input change; it continues to approach the input according to the damping equation above.

For example, as illustrated in Figure 3-1, if the temperature undergoes a step change—within 2 percent of the output range—from 100 degrees to 110 degrees, and the damping is set to 5.0 seconds, the transmitter calculates and reports a new reading every 500 milliseconds using the damping equation. At 5.0 seconds, the transmitter outputs 106.3 degrees, or 63 percent of the input change, and the output continues to approach the input curve according to the equation above.

For information regarding the damping function when the input change is greater than 2 percent of the output range, refer to “Intermittent Sensor Algorithm” on page 5-14.

(1) This command is not available in previous versions of the Model 3144 and 3244MV transmitters.

Figure 3-1. Change in Input versus Change in Output with Damping Enabled.



Differential Temperature Model 3244MV

HART Fast Keys	1,1,8,1
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The Model 3244MV transmitter can accept any two inputs and display the differential temperature between them. Use the following procedure to configure the transmitter to measure differential temperature.

NOTE

This procedure assumes that you wish to report differential temperature as the primary variable analog signal. If this is not the case, assign differential temperature to the secondary, tertiary, or quaternary variable.

1. From the HOME screen, select *1 Device Setup, 1 Process Variable, 8 Variable Re-Map*, to prepare to set the transmitter to display differential temperature. Select **OK** after you set the control loop to manual.
2. Select *1 Diff* from the Primary Variable (PV) menu.
3. Select *3 Snsr 1* or *4 Snsr 2* from the Secondary Variable (SV) menu.
4. Select the remaining sensor from the Tertiary Variable (TV) menu.

NOTE

The transmitter determines differential temperature by subtracting Sensor 2 from Sensor 1 (S1 – S2). Ensure that this order of subtraction is consistent with the desired reading for your application. Refer to Figure 2-7 on page 2-9, or inside the transmitter terminal-side cover for sensor wiring diagrams.

5. Select *2 Term temp* (terminal temperature), *5 Sensor Average*, or *6 Not Used* from the Quaternary Variable (QV) menu.
6. Select **OK** after verifying the variable settings from the variable mapping menu.
7. Select **OK** to return the control loop to automatic control.
8. Select **HOME** to return to the On-line menu.
9. Select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 5 Misc Config, 2 Diff. Units* to set the desired differential units.
10. Select **HOME** to return to the Home screen.
11. Select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 1 Snsr 1 Config, 1 Snsr 1 Conn* to set the sensor type and number of wires for Sensor 1. Repeat for Sensor 2.

If you are using a meter for local indication, configure the meter to read the appropriate variables (see “Meter Settings” on page 3-6).

Average Temperature⁽¹⁾**Model 3244MV**

HART Fast Keys	1,1,8,5
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The Model 3244MV transmitter can output and display the average temperature of any two inputs. Use the following procedure to configure the transmitter to measure average temperature:

NOTE

This procedure assumes that you wish to configure average temperature as the primary variable analog signal. If this is not the case, assign average temperature to the secondary, tertiary, or quaternary variable.

1. From the Home screen, select *1 Device Setup, 1 Process Variable, 8 Variable Re-map*, to prepare to set the transmitter to display differential temperature. Select **OK** after you set the control loop to manual.
2. Select *5 Sensor Average* from the Primary Variable (PV) menu.
3. Select three of the five remaining variables (differential temperature, sensor 1, sensor 2, and terminal temperature) for the Secondary Variable (SV), Tertiary Variable (TV), and Quaternary Variable (QV).
4. Select **OK** after verifying the variable settings from the variable mapping menu.
5. Select **OK** to return the control loop to automatic control.
6. Select **HOME** to return to the Online menu.

(1) Average Temperature is not available in previous versions of the Model 3244MV transmitter.

7. Select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 5 Misc Config, 4 Avg Units* to set the desired average temperature units.
8. Select **HOME** to return to the Home screen.
9. Select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 1 Snsr 1 Config, 1 Snsr 1 Conn* to set the sensor type and number of wires for Sensor 1. Repeat for Sensor 2.

If using a meter for local indication, configure the meter to read the appropriate variables (see “Meter Settings” on page 3-6).

If Sensor 1 and/or Sensor 2 should fail while PV is configured for average temperature and Hot Backup is *not* enabled, the transmitter will go into alarm. For this reason, when PV is Sensor Average it is recommended that Hot Backup be enabled when dual-element sensors are used or when two temperature measurements are taken from the same point in the process. When Hot Backup is enabled while PV is Sensor Average, if a sensor failed occurs, three scenarios could result. First, if Sensor 1 fails, Hot Backup is activated, and Sensor 2 replaces Sensor Average as PV. In the second case, if Sensor 2 fails, PV will remain mapped as Sensor Average. However, it will only be reading from Sensor 1, the working sensor. In both of the above cases where Hot Backup is enabled with Sensor Average as the PV the 4-20 mA signal is not disrupted, and a message is sent to the control system, via HART, specifying which sensor has failed. In the last case where both transmitters fail simultaneously, the transmitter will go into alarm and a message will be sent, via HART, stating that both Sensor 1 and Sensor 2 have failed.

Hot Backup

Model 3244MV

HART Fast Keys	1,4,1,1,3,3
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The *Config Hot BU* command configures the transmitter to automatically use Sensor 2 as the primary sensor if Sensor 1 fails. With Hot Backup enabled, the primary variable (PV) must either be Sensor 1 or Sensor Average⁽¹⁾ (see “Average Temperature” on page 3-9 for details on using Hot Backup when PV is Sensor Average). You can map Sensor 2 as the secondary variable (SV), tertiary variable (TV), or quaternary variable (QV). In the event of a primary variable (Sensor 1) failure, the transmitter enters Hot Backup mode and Sensor 2 becomes the PV. The 4–20 mA signal is not disrupted, and a message is sent to the control system, via HART, that Sensor 1 has failed. An LCD meter, if attached, also displays the failed sensor signal. If Hot Backup is used and the PV is Sensor Average a Sensor 1 failure would result in Sensor 2 being remapped as the PV. However, if Sensor 2 fails, no re-mapping will take place, but the Sensor Average reading will only include Sensor 1—the working sensor.

While configured to Hot Backup, if Sensor 2 fails while Sensor 1 is still operating properly, the transmitter continues to report the PV 4–20 mA analog output signal while sending a HART signal to the control system that Sensor 2 has failed. Once entering the active Hot Backup mode, the transmitter will not use the original PV (Sensor 1 or Sensor Average) to control the 4–20 mA analog output until the Hot Backup mode is reset. Reset Hot Backup either by re-enabling via HART or by briefly powering down the transmitter.

(1) *Sensor Average is not available in previous versions of the Model 3244MV transmitter.*

To set up and enable the Hot Backup feature for the Model 3244MV transmitter, perform the following procedure:

1. Attach two different sensors of any type to the transmitter as shown in Figure 2-7 on page 2-9.
2. From the Home screen, select *1 Device Setup, 1 Process Variables, 8 Variable Re-map* to set primary, secondary, tertiary, and quaternary variables. The communicator displays the PV, SV, TV, and QV menus in succession.
3. Set PV as Sensor 1 or Sensor Average; set SV, TV, and QV as desired.
4. Select **OK** after verifying the variable settings from the Variable Mapping menu.
5. Select **OK** to return the control loop to automatic control, and **HOME** to return to the Home screen.
6. From the Home screen, select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 1 Sensor 1 Config* to configure Sensor 1.
7. Set the sensor type, number of wires, damping, and units for Sensor 1.
8. Select **SEND** to download the new data to the transmitter, and **HOME** to return to the Home screen.
9. Repeat Steps 5 and 6 for Sensor 2.
10. From the Home screen, select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 3 Config Hot Backup* to prepare to configure the transmitter for Hot Backup.
11. Select **OK** after you set the control loop to manual.
12. Select *Hot Backup Enabled*.
13. Select **OK** after you return the control loop to automatic control.

For information on using Hot Backup in conjunction with the HART Tri-Loop see page 2-16.

Drift Alert⁽¹⁾

Model 3244MV

HART Fast Keys	1,4,1,1,4,4
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The Drift Alert command allows you to configure the transmitter to send a message via HART or go into analog alarm when the temperature difference between Sensor 1 and Sensor 2 exceeds a user-defined limit. This feature is especially useful when measuring the same process temperature with two sensors, ideally a dual-element sensor. When Drift Alert Mode is enabled the user will set the maximum allowable difference, in engineering units, between Sensor 1 and Sensor 2. If this maximum difference is exceeded a drift alert warning message will be sent via HART.

When configuring the transmitter for Drift Alert the user also has the option of specifying that the analog output of the transmitter go into alarm when sensor drifting is detected.

(1) Drift Alert is not available in previous versions of the Model 3244MV transmitter.

NOTE

The Drift Alert alarm cannot be enabled while Hot Backup is enabled. The Drift Alert warning, however, can be used simultaneously with Hot Backup. For information on configuring the transmitter for Hot Backup see page 3-10.

To set up and enable the Drift Alert feature of the Model 3244MV transmitter, perform the following procedure:

1. Attach two sensors of any type to the transmitter as shown in Figure 2-7 on page 2-9.
2. From the Home screen, select *1 Device Setup, 1 Process Variables, 8 Variable Re-map* to set primary, secondary, tertiary, and quaternary variables. The communicator displays the PV, SV, TV, and QV menus in succession.
3. Select PV, SV, TV, and QV as desired.
4. Select **OK** after verifying the variable settings from the Variable Mapping menu.
5. Select **OK** to return the control loop to automatic control. Select **HOME** to return to the Home screen.
6. From the Home screen, select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 1 Sensor 1 Config* to configure Sensor 1.
7. Set the sensor type, number of wires, damping, and units for Sensor 1.
8. Select **SEND** to download the new data to the transmitter. Select **HOME** to return to the Home screen.
9. Repeat steps 6 thru 8 for sensor 2.
10. From the Home screen select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 4 Drift Alert* to prepare to configure the transmitter for Drift Alert.
11. Select *2 Drift Units* to set drift alert engineering units (°C, °F, °R, Kelvin, ohm, or mV).
12. Select *3 Drift Limit*. Enter the maximum acceptable difference between Sensor 1 and Sensor 2.
13. Select *4 Drift Damping* to enter a drift alert damping value. This value must be between 0 and 32 seconds.
14. Select *1 Drift Alert Mode* and select *Enable Drift Alert*.

NOTE

Enabling Drift Alert (Step 14) will allow a message to be sent via HART whenever the maximum acceptable difference between Sensor 1 and Sensor 2 has been exceeded. Proceed to Step 15 only if you want the transmitter's analog signal to go into alarm when Drift Alert is detected. The Drift Alert alarm cannot be enabled when Hot Backup is enabled.

15. OPTIONAL—See note above. Select *5 Drift Alarm Status* and select *Enable Alarm*. Select **SEND** to download the alarm setting to the transmitters.

INFORMATION VARIABLES

Access the transmitter configuration variables on-line using a HART communicator or other suitable communications device. The following is a list of transmitter configuration variables. These variables include device identifiers, factory-set configuration variables, and other information. A description of each variable, the corresponding fast key sequence, and a review of its purposes are provided.

Tag

HART Fast Keys	1,3,1
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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 HART 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.

Descriptor

HART Fast Keys	1,4,4
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The *Descriptor* variable provides a longer, user-defined electronic label to assist with more specific transmitter identification than is available with the tag variable. The descriptor may be up to 16 characters long and has no impact on the operation of the transmitter or HART communicator.

Message

HART Fast Keys	1,4,4
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The *Message* variable provides the most specific user-defined means for identifying individual transmitters in multi-transmitter environments. It allows for 32 characters of information and is stored with the other configuration data. The message variable has no impact on the operation of the transmitter or the HART communicator.

Date

HART Fast Keys	1,4,4
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Date is a user-defined variable that provides a place to save the date of the last revision of configuration information. It has no impact on the operation of the transmitter or HART communicator.

Sensor 1 Serial Number

HART Fast Keys	1,3,6
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The *Sensor 1 Sensor s/n* variable provides a location to list the serial number of the attached sensor. It is useful for identifying sensors and tracking sensor calibration information.

Sensor 2 Serial Number

HART Fast Keys	1,3,8
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The *Sensor 2 Sensor s/n* variable is only available on the Model 3244MV transmitter. It provides a location to list the serial number of a second sensor.

DIAGNOSTICS AND SERVICE

Test Device

HART Fast Keys	1,2,1
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The following commands enable various transmitter diagnostics, testing, and measurement functions. Use these commands to customize the transmitter to your particular application.

The *Test Device* command initiates a more extensive diagnostics routine than that performed continuously by the transmitter. The Test Device menu lists the following options:

- *Status* lists error codes. “On” indicates a problem, and “Off” indicates that there are no problems.
- *Self Test* initiates a transmitter self test. Error codes are displayed if there is a problem.
- *Master Test* sends out a master reset command that restarts and tests the transmitter. Performing a master test has the same effect as briefly powering down the transmitter and then powering it back up.

Loop Test

HART Fast Keys	12,2
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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:

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 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, either the transmitter requires an output trim, or the meter is malfunctioning.

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

Sensor Current

Model 3144

HART Fast Keys	1,2,3,3,3
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Model 3244MV

HART Fast Keys	1,2,3,3,5
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The *Sensor Current* command enables or disables the Active Calibrator Mode⁽¹⁾ feature. The transmitter ordinarily operates with pulsating current so that open sensor conditions can be safely detected, but some calibration equipment requires steady current to function properly. Active Calibrator Mode is only available on single sensor calibrations. The transmitter automatically defaults to Active Calibrator Mode whenever performing a sensor trim. When the sensor trim is complete the transmitter will automatically disable Active Calibrator Mode whether or not Active Calibrator Mode was disabled prior to the trim. The Active Calibrator Mode is volatile and will automatically be disabled when power is cycled or when a Master Reset or Master Test is performed via HART.

CALIBRATION

Calibrating the transmitter increases the precision of your measurement system. You may use one or more of a number of trim functions when calibrating.

To understand the trim functions, it is necessary to understand that smart transmitters operate differently from analog transmitters. Smart transmitters are factory-characterized; they are shipped with a standard sensor curve stored in the transmitter firmware. The transmitter uses this information to produce a process variable output, in engineering units, dependent on the sensor input. The trim functions allow you to make corrections to the factory-stored characterization curve by digitally altering the transmitter's interpretation of the sensor input.

The trim functions should not be confused with the rerange functions. Although the rerange command matches a sensor input to a 4–20 mA output, as in conventional calibration, it does not affect the transmitter's interpretation of the input.

Deciding Which Trim Procedure to Use

Sensor Trim

Perform a sensor trim if the unit calibration of the transmitter does not match your plant standard calibration equipment. The sensor trim function calibrates the sensor and transmitter together in engineering units using a site-standard input source. Unless your site-standard input source is NIST-traceable, the sensor trim function will not maintain the NIST-traceability of your system.

Transmitter-Sensor Matching

Perform the sensor matching procedure if you wish to enhance the temperature measurement accuracy of your system, and you have a sensor with Callendar-Van Dusen constants. Sensors with Callendar-Van Dusen constants are NIST-traceable when ordered from Rosemount Inc.

(1) Previous versions of the Model 3144 and 3244MV transmitters use the RTD current or T/C Pulsing Mode commands instead of Active Calibrator Mode where steady current is desired.

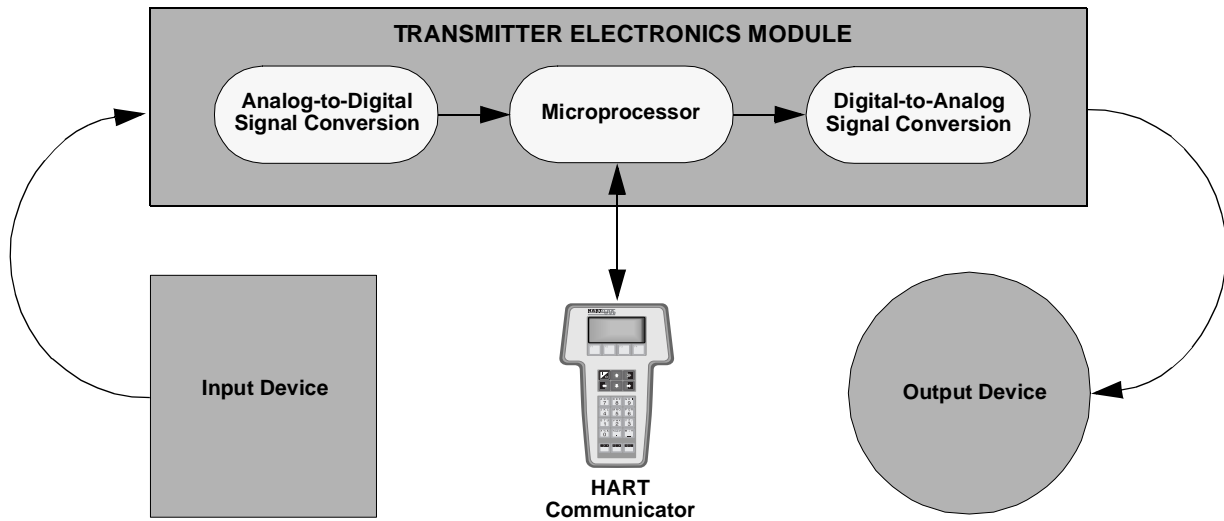
Output Trim or Scaled Output Trim

Perform an output trim or a scaled output trim to adjust the transmitter’s digital-to-analog signal conversion (see Figure 3-2). The output trim function calibrates the transmitter to a 4–20 mA reference scale; the scaled output trim function calibrates to a user-selectable reference scale. Perform a loop test to determine the need for an output trim or a scaled output trim (see “Loop Test” on page 3-14).

Apply Values

Use the apply values function to adjust the interpretation of the analog-to-digital signal conversion (see Figure 3-2), by applying the upper and lower range values based on a scale of your choice.

Figure 3-2. Dynamics of Smart Temperature Measurement.



Sensor Trim

HART Fast Keys	1,2,3,3
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The *Sensor Trim* command allows you to digitally alter the transmitter’s interpretation of the input signal as shown in Figure 3-2. The sensor trim command trims, in engineering (°F, °C, °R, K) or raw (Ω , mV) units, the combined sensor and transmitter system to a site standard using a known temperature source. Sensor trim is suitable for validation procedures or for applications that require calibrating the sensor and transmitter together.

To perform a sensor trim with a Model 3144 or 3244MV transmitter, perform the appropriate procedure:

Model 3144

1. Connect the calibration device to the transmitter. Refer to Figure 2-7 on page 2-9 or inside of the transmitter terminal side cover for sensor wiring diagrams.
2. Connect the communicator to the transmitter loop.
3. From the Home screen, select *1 Device setup*, *2 Diag/Service*, *3 Calibration*, *3 Sensor trim*, *1 Snsr 1 inp trim* to prepare to trim the sensor.
4. Select **OK** after you set the control loop to manual.
5. Select the appropriate sensor trim units at the “Enter snsr 1 trim units” prompt.
6. Select the sensor trim points (*1 upper*, *2 lower*, or *3 both*) at the “Enter snsr 1 Trim points” prompt, or select *4 abort* to abort the trim procedure.
7. Adjust the calibration device to an input value slightly less than the upper range limit provided by the communicator if performing an upper trim, or slightly greater than the lower range limit provided by the communicator if performing a lower trim.
8. Select **OK**.

The communicator displays the output value the transmitter associates with the input value provided by the calibration device.

9. Enter the lower or upper trim point, depending on your selection in Step 7.

IMPORTANT

The Active Calibrator Mode⁽¹⁾ feature will automatically be enabled when a sensor trim is performed and is automatically disabled when a sensor trim is completed. If you choose to verify the trim after trim completion, and you are using calibration equipment that requires steady current, you may need to re-enable Active Calibrator Mode (see “Sensor Current” on page 3-15). Disable Active Calibrator Mode when verification is complete.

(1) Previous transmitter versions use the RTD Current and T/C Pulsing Mode commands instead of Active Calibrator Mode.

Model 3244MV

This procedure assumes that your Model 3244MV transmitter is connected to two sensors and that both are enabled and functioning properly. If you have only one sensor connected and enabled, skip Step 1.

1. Disable Sensor 2.
 - a. Connect the communicator to the transmitter loop.
 - b. From the Home screen, select *1 Device setup, 3 Basic setup, 7 Snsr 2 Conn* to prepare to disable Sensor 2.
 - c. Select **OK** after you set the control loop to manual.
 - d. Select *Not Used* at the “Enter Sensor 2 type” prompt.
 - e. Select **OK** at the “Sensor 2 connection set to: Not Used” prompt.
 - f. Select **OK** to return the control loop automatic control.
2. Connect the calibration device to the transmitter. Refer to Figure 2-7 on page 2-9 or inside of the transmitter terminal side cover for sensor wiring diagrams.
3. Connect the communicator to the transmitter loop.
4. From the Home screen, select *1 Device setup, 2 Diag/Service, 3 Calibration, 3 Sensor trim, 1 Snsr 1 inp trim* to prepare to trim the sensor.
5. Select **OK** after you set the control loop to manual.
6. Select the appropriate sensor trim units at the “Enter snsr 1 trim units” prompt.
7. Select the sensor trim points (*1 upper, 2 lower, or 3 both*) at the “Enter snsr 1 Trim points” prompt. Or select *4 abort* to abort the trim procedure.
8. Adjust the calibration device to an input value slightly less than the upper range limit provided by the communicator if performing an upper trim, or slightly greater than the lower range limit provided by the communicator if performing a lower trim.
9. Select **OK**. The communicator displays the output value the transmitter associated with the input value.
10. Enter the appropriate trim point, depending on your selection in Step 8.
11. Re-enable Sensor 2:
 - a. Connect the communicator to the transmitter loop.
 - b. From the Home screen, select *1 Device setup, 3 Basic setup, 7 Snsr 2 Conn* to prepare to re-enable Sensor 2.
 - c. Select **OK** after you set the control loop to manual.
 - d. Select the appropriate sensor type at the “Enter Sensor 2 type” prompt.
 - e. Select **OK** at the “Sensor 2 connection set to: XXXX” prompt.
 - f. Select **OK** after you return the control loop to automatic control.

NOTE

To trim Sensor 2, repeat the same procedure, but in Step 1 disable Sensor 1 instead of Sensor 2.

IMPORTANT

The Active Calibrator Mode⁽¹⁾ feature will automatically be enabled when a sensor trim is performed and is automatically disabled when a sensor trim is completed. If you choose to verify the trim after trim completion, and you are using calibration equipment that requires steady current, you may need to re-enable Active Calibrator Mode (see “Sensor Current” on page 3-15). Disable Active Calibrator Mode when verification is complete.

Transmitter-Sensor Matching

HART Fast Keys	1,4,1,1,3,1,4
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The Model 3144 and 3244MV transmitters accept Callendar-Van Dusen constants from a calibrated RTD schedule and generate a special custom curve to match that specific sensor curve. Matching the specific sensor curve with the transmitter significantly enhances the temperature sensor measurement accuracy. See the comparison below.

The following input constants, included with specially-ordered Rosemount temperature sensors, are required:

R_o = Resistance at Ice Point

Alpha = Sensor Specific Constant

Beta = Sensor Specific Constant

Delta = Sensor Specific Constant

Refer to the Sensors Assemblies and Accessories Product Data Sheet Volume 1, 2, and 3 to order Rosemount temperature sensors with Callendar-Van Dusen constants.

To input Callendar-Van Dusen constants, perform the following procedure:

1. From the Home screen, select *1 Device Setup, 4 Detailed Setup, 1 Sensors, 1 Process Sensor, 4 Sensor Setup, 1 Snsr 1 Config, 1 Snsr 1 Conn*. Select the appropriate sensor type and number of wires at the prompt. This ensures that the sensor is not specified as “Not Used.”
2. Select **OK** after you set the control loop to manual.
3. Select *4 Spec Snsr 1 Conn* to prepare to input constants.
4. Select the appropriate sensor configuration (2, 3, or 4 wire) at the “Enter Special Sensor 1 Connection” prompt.
5. Select *1 alpha, delta, beta* at the “Select Coeff type” prompt. The communicator prompts you to enter R_o , Alpha, Beta, and Delta successively.
6. Enter the R_o , Alpha, Beta and Delta values from the stainless steel tag attached to the specially-ordered sensor.
7. Select **OK** to accept the computed values for A, B, and C.
8. Select **OK** after you return the control loop to automatic control.

(1) Previous transmitter versions use the RTD Current and T/C Pulsing Mode commands instead of Active Calibrator Mode.

If you are using two sensors with a Model 3244MV, repeat the procedure for the second sensor. In Step 1, replace *1 Snsr 1 Config* with *2 Snsr 2 Config*.

If you are using a Rosemount dual element sensor with Callendar-Van Dusen Constants, two tags are supplied. The two letters at the end of the serial number on each tag (RW for Red/White and GB for Green/Black), indicate the sensing element to which the constants on that tag apply.

To disable the transmitter-sensor matching feature, refer to “Disable Special Sensor” on page 3-6.

NOTE

Selecting *Not Used* at the “Enter Special Sensor” prompt will disable transmitter-sensor matching. When you disable transmitter-sensor matching, the transmitter reverts to either user or factory trim, whichever was used previously. **Make certain the transmitter engineering units default correctly before placing the transmitter into service.**

System Accuracy Comparison at 150 °C Using a Pt 100 (α = 0.00385) RTD with a Span of 0 to 200 °C			
Standard Series 68 Sensor		Matched Series 68 Sensor	
Model 3144	±0.10 °C	Model 3144	±0.10 °C
Standard 68 RTD	±1.05 °C	Matched 68 RTD	±0.18 °C
Total System ⁽¹⁾	±1.05 °C	Total System ⁽¹⁾	±0.21 °C

(1) Calculated using RSS statistical method:

$$Total\ System\ Accuracy = \sqrt{Transmitter\ Accuracy^2 + Sensor\ Accuracy^2}$$

Output Trim

HART Fast Keys	1,2,3,4
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The *Digital-to-Analog Trim* command allows you to alter the transmitter’s conversion of the input signal to a 4–20 mA output (see Figure 3-2 on page 3-16). Adjust the analog output signal at regular intervals to maintain measurement precision. To perform a digital-to-analog trim, perform the following procedure:

1. From the Home screen, select *1 Device setup*, *2 Diag/Service*, *3 Calibration*, *4 D/A trim*. Select **OK** after you set the control loop to manual.
2. Connect an accurate reference meter to the transmitter at the “Connect Reference Meter” prompt. To do so, connect the positive lead to the positive terminal and the negative lead to the test terminal in the transmitter terminal compartment. Refer to Figure 2-3 on page 2-4, or shunt the transmitter power through the reference meter at some point.
3. Select **OK** after connecting the reference meter.
4. Select **OK** at the “Setting fld dev output to 4 mA” prompt. The transmitter outputs 4.00 mA.

5. Record the actual value from the reference meter, and enter it at the “Enter Meter Value” prompt. The 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. *If you select 1 Yes, then proceed to Step 7. If you select 2 No, then repeat Step 5.*
7. Select **OK** at the “Setting fld dev output to 20 mA” prompt, and repeat Steps 5 and 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after you return the control loop to automatic control.

Scaled Output Trim

HART Fast Keys	1,2,3,5
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The *Scaled D/A Trim* command matches the 4 and 20 mA points to a user-selectable reference scale other than 4 and 20 mA (2–10 volts, for example). 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.

Apply Values

HART Fast Keys	1,2,3,1
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The *Apply Values* command uses process inputs to set the 4 and 20 mA values. Calibrating to applied values is a method of adjusting the analog output to a plant-standard input device. Use a decade box, an RTD or thermocouple simulator, or a sensor in a known temperature bath as an input. This function is similar to calibrating an analog transmitter using more lengthy traditional calibration methods

Multidrop Communication

“Multidropping” 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 SMART FAMILY 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. Multidrop installations are not recommended where intrinsic safety is a requirement.

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. Communication with the transmitters can be accomplished with commercially available Bell 202 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 3-3. Typical Multidropped Network.

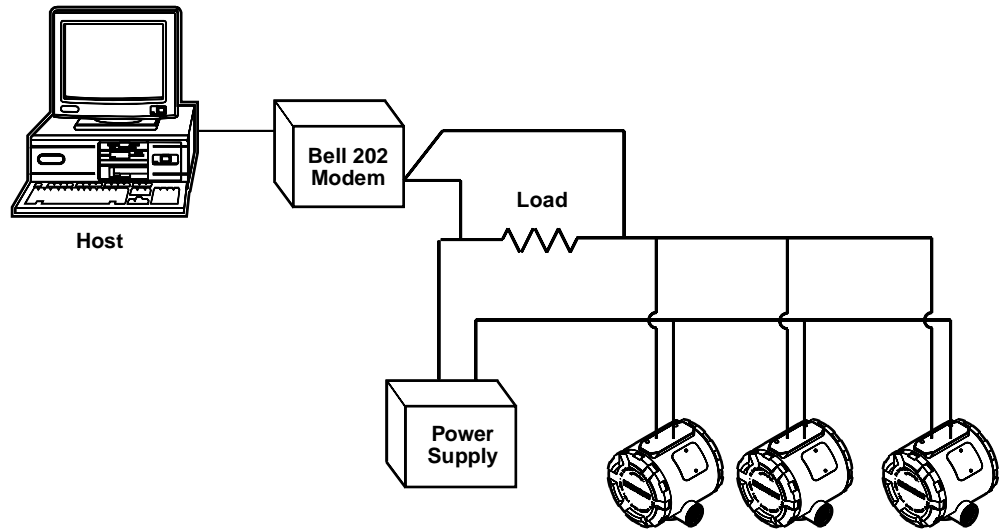


Figure 3-3 shows a typical multidrop network. Do not use this figure as an installation diagram. Contact Rosemount product support with specific requirements for multidrop applications.

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

NOTE

The Model 3144 and 3244MV transmitters are set to address 0 at the factory, allowing them to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number between 1 and 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. The failure mode current also is disabled.

Maintenance

OVERVIEW

This section contains transmitter diagnostics and maintenance information.

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warning

⚠ WARNING

Explosions may result in death or serious injury.

- Do not remove the instrument cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠ WARNING

Electrical shock could cause death or serious injury. If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on transmitter leads and terminals.

- Use extreme caution when making contact with the leads and terminals.

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury:

- Make sure only qualified personnel perform the installation.

⚠ WARNING

Process leaks could result in death or serious injury:

- Install and tighten thermowells or sensors before applying pressure, or process leakage may result.
- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.

HARDWARE DIAGNOSTICS

If you suspect a malfunction despite the absence of diagnostics messages on the HART communicator display, follow the procedures described in Table 4-1 to verify that transmitter hardware and process connections are in good working order. Under each of four major symptoms, specific suggestions are offered for solving problems. Always deal with the most likely and easiest-to-check conditions first.

TABLE 4-1. Troubleshooting.

SYMPTON	POTENTIAL SOURCE	CORRECTIVE ACTION
Transmitter Does Not Communicate with HART Communicator	Loop Wiring	<ul style="list-style-type: none"> • Check the revision level of the transmitter device descriptors (DDs) stored in your communicator (see Appendix B: Model 275 HART Communicator). The communicator should report Dev v2, DD v1 (improved), or Dev v1, DD v3, v7, or v8 (previous). Contact Rosemount Customer Central for assistance. • Check for a minimum of 250 ohms resistance between the power supply and HART communicator connection. • Check for adequate voltage to the transmitter. If a HART communicator is connected and 250 ohms resistance is properly in the loop, then the transmitter requires a minimum of 12.0 V at the terminals to operate (over entire 3.90 to 20.5 mA operating range), and 17.5 V minimum to communicate digitally. • Check for intermittent shorts, open circuits, and multiple grounds.
High Output	Sensor Input Failure or Connection	<ul style="list-style-type: none"> • Connect a HART communicator and enter the transmitter test mode to isolate a sensor failure. • Check for a sensor open circuit. • Check the process variable to see if it is out of range.
	Loop Wiring	<ul style="list-style-type: none"> • Check for dirty or defective terminals, interconnecting pins, or receptacles.
	Power Supply	<ul style="list-style-type: none"> • Check the output voltage of the power supply at the transmitter terminals. It should be 12.0 to 42.4 V dc (over entire 3.90 to 20.5 mA operating range).
	Electronics Module	<ul style="list-style-type: none"> • Connect a HART communicator and enter the transmitter test mode to isolate module failure. • Connect a HART communicator and check the sensor limits to ensure calibration adjustments are within the sensor range.
Erratic Output	Loop wiring	<ul style="list-style-type: none"> • Check for adequate voltage to the transmitter. It should be 12.0 to 42.4 V dc at the transmitter terminals (over entire 3.90 to 20.5 mA operating range). • Check for intermittent shorts, open circuits, and multiple grounds. • Connect a HART communicator and enter the loop test mode to generate signals of 4 mA, 20 mA, and user-selected values.
	Electronics Module	<ul style="list-style-type: none"> • Connect a HART communicator and enter the transmitter test mode to isolate module failure.

SYMPTON	POTENTIAL SOURCE	CORRECTIVE ACTION
Low Output or No Output	Sensor Element	<ul style="list-style-type: none"> • Connect a HART communicator and enter the transmitter test mode to isolate a sensor failure. • Check the process variable to see if it is out of range.
	Loop Wiring	<ul style="list-style-type: none"> • Check for adequate voltage to the transmitter. It should be 12.0 to 42.4 V dc (over entire 3.90 to 20.5 mA operating range). • Check for shorts and multiple grounds. • Check for proper polarity at the signal terminal. • Check the loop impedance. • Connect a HART communicator and enter the loop test mode. • Check wire insulation to detect possible shorts to ground.
	Electronics Module	<ul style="list-style-type: none"> • Connect a HART communicator and check the sensor limits to ensure calibration adjustments are within the sensor range. • Connect a HART communicator and enter the transmitter test mode to isolate an electronics module failure.


HARDWARE MAINTENANCE

The Model 3144 and 3244MV transmitters have no moving parts and require a minimum amount of scheduled maintenance. Both transmitters feature modular design for easy maintenance. If you suspect a malfunction, check for an external cause before performing the diagnostics as discussed later in this section. If you must return failed transmitters or parts to a Rosemount Service Center for inspection, repair, or replacement, refer to “Return of Materials” on page 4-6 for more information.


Test Terminals

The test terminal, marked as TEST or T on the terminal block, and the negative terminal accept MINIGRABBER™ or alligator clips, and facilitate in-process checks (see Figure 2-3 on page 2-4). The test and the negative terminals are connected across a diode through which the loop signal current passes. The test equipment shunts the diode when connected to the test terminals; so long as the voltage across the receptacles is kept below the diode threshold voltage, no current passes through the diode. To ensure that there is no leakage current through the diode while making a test reading, or while an indicating meter is connected, the resistance of the test connection or meter should not exceed 10 ohms. A resistance value of 30 ohms will cause an error of approximately 1.0 percent of reading.

Sensor Checkout

 If the sensor is installed in a high-voltage environment and a fault condition or installation error occurs, the sensor leads and transmitter terminals could carry lethal voltages. Use extreme caution when making contact with the leads and terminals.

To determine whether the sensor is at fault, either replace it with another sensor or connect a test sensor locally at the transmitter to test remote sensor wiring. Transmitters with Option Code C7 (Trim to Special Sensor), are matched to a specific sensor. You may select any standard, off-the-shelf sensor for use with the transmitter, or consult the factory for a replacement special sensor/transmitter combination.

 See “Safety Messages” on page 4-1 for complete warning information.

Disassembling the Electronics Housing

The transmitter is designed with a dual-compartment housing; one compartment contains the electronics module, and the other compartment contains all wiring terminals and the communication receptacles.

Removing the Electronics Module

The electronics module of the Model 3144 and 3244MV transmitters is located in the compartment opposite the wiring terminals (see Figure 4-1).

Use the following procedure to remove the electronics module.

NOTE

The electronics are sealed in a moisture-proof plastic enclosure referred to as the electronics module. The module is a non-repairable unit; if a malfunction occurs the entire unit must be replaced.



1. Disconnect the power to the transmitter.
2. Remove the cover from the electronics side of the transmitter housing (see Figure 4-1). Do not remove the covers in explosive atmospheres when the circuit is alive. Remove the LCD meter, if applicable.
3. Loosen the two screws that anchor the electronics module assembly to the transmitter housing.
4. Firmly grasp the screws and assembly and pull it straight out of the housing, taking care not to damage the interconnecting pins.

NOTE

Note the transmitter's security jumper position (ON or OFF) and the failure mode jumper position (LO or HI). If you are replacing the electronics module with a new one, make sure the security switch is set in the same position.

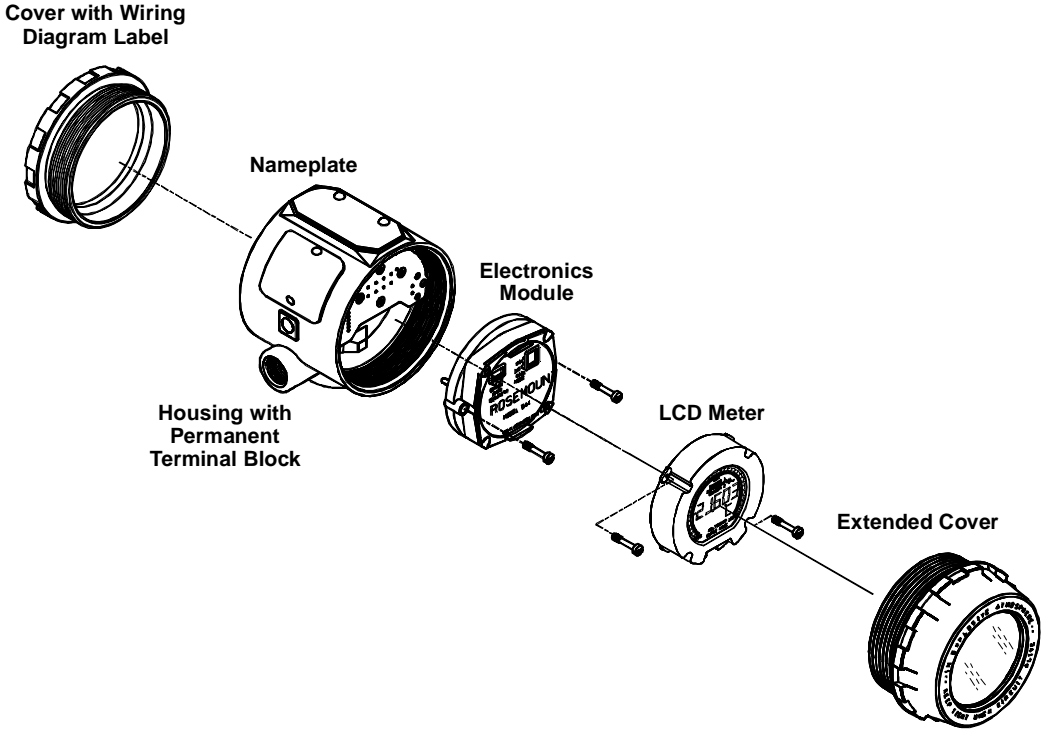
Transmitter Security and Failure Mode Jumpers

The transmitter security and failure mode jumpers are located on the front of the electronics module, as shown in Figure 4-2 on page 4-5. See "Failure Mode and Security Jumpers" on page 2-7 for more information.



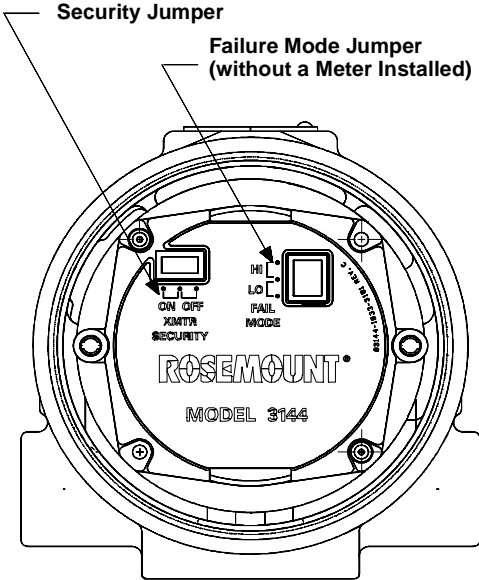
See "Safety Messages" on page 4-1 for complete warning information.

Figure 4-1. Models 3144 and 3244MV
Exploded View.



3144-0001B01B

Figure 4-2. Electronics Module.



3144-0201G01A

Assembling the Electronics Housing

Replacing the Electronics Module

Use the following procedure to reassemble the electronics housing for the Model 3144 and 3244MV transmitters:

1. Examine the electronics module to ensure that the failure mode and transmitter security jumpers are in the desired positions.
2. Carefully insert the electronics module to mate the interconnecting pins with the necessary receptacles on the electronics board.
3. Tighten the two mounting screws. Replace the LCD meter, if applicable.



4. Replace the cover. Tighten $\frac{1}{6}$ of a revolution after the cover begins to compress the O-ring. Both transmitter covers must be fully engaged to meet explosion proof requirements.

RETURN OF MATERIALS

To expedite the return process, call the Rosemount North American Response Center toll-free at 800-654-7768. 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 name of the last process material to which the product was exposed, and will detail the additional information and procedures necessary to return goods exposed to hazardous substances. If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned materials.



See "Safety Messages" on page 4-1 for complete warning information.

Specifications and Reference Data

SPECIFICATIONS

Functional Specifications

Inputs

User-selectable (see Table 5-1 on page 5-10)

Output

Two-wire 4–20 mA, linear with temperature or linear with input. Digital output signal superimposed on 4–20 mA signal, available for HART communicator or control system interface.

Isolation

Input/output isolation tested up to 500 V rms (707 V dc)

Power Supply

External power supply required. Transmitters operate on 12.0 to 42.4 V dc transmitter terminal voltage (with 250 ohm load, 17.75 V dc power supply is required). Transmitter power terminals rated to 42.4 V dc.

Indication

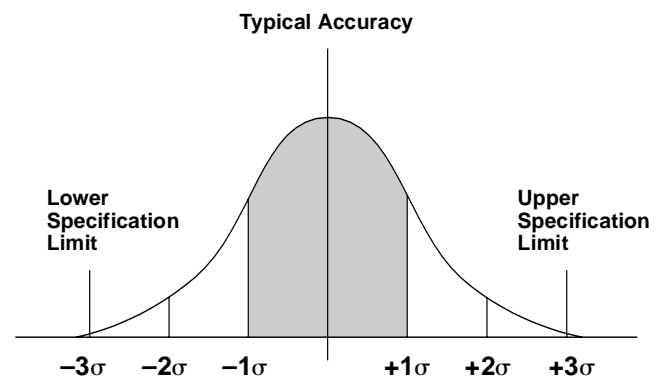
Optional five-digit LCD meter includes 0–100% bar graph. Digits are 0.4 inches (8 mm) high. Display options include engineering units (°F, °C, °R, K, ohms, and millivolts), percent, and milliamps. The display can also be set to alternate between engineering units/milliamps, Sensor 1/Sensor 2, and Sensor 1/Sensor 2/Differential Temperature. All display options, including the decimal point, may be reconfigured in the field using a Model 275 HART Communicator or AMS.

ROSEMOUNT CONFORMANCE TO SPECIFICATIONS

You can be confident that a Rosemount product not only meets our published specifications, but probably exceeds them. Our advanced manufacturing techniques and use of Statistical Process Control provide specification conformance to at least $\pm 3\sigma$ ⁽¹⁾. In addition, our commitment to continual improvement ensures that product design, reliability, and performance get better every year.

For example, the Reference Accuracy distribution for the Models 3144 and 3244MV Temperature Transmitters is shown to the right⁽²⁾. Our Specification Limits are ± 0.10 °C, but, as the shaded area shows, approximately 68% of the units perform three times better than the limits. Therefore, it is very likely that you will receive a device that performs much better than our published specifications.

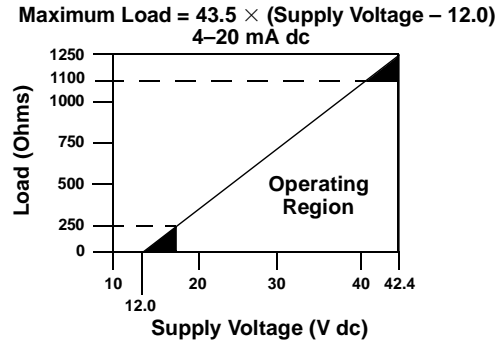
Conversely, a vendor who “grades” product without using Process Control, or who is not committed to $\pm 3\sigma$ performance, will ship a much higher percentage of units that are barely within (or even outside of) advertised specification limits.



(1) Sigma (σ) is the Standard Deviation of a statistical distribution, and describes the dispersion (spread) of the distribution.

(2) Accuracy distribution shown is for Model 3144 and 3244MV transmitters, Pt 100 RTD sensor, Range 0 to 100 °C.

Load Limitations



NOTE

HART communication requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 V dc at the transmitter terminals.

Hazardous Locations Certifications

Factory Mutual (FM) Approvals

- E5** Explosion Proof for Class I, Division 1, Groups A, B, C, and D.
Dust-Ignition Proof for Class II, Division 1, Groups E, F, and G.
Dust-Ignition Proof for Class III, Division 1 hazardous locations.
Non-Incendive for Class I, Division 2, Groups A, B, C, and D (T4A).
Indoor and outdoor use. Ambient Temperature Limit: -50 to 85 °C.
Explosion Proof approval only when connected in accordance with Rosemount drawing 03144-0220. For Group A, seal all conduits within 18 inches of enclosure; otherwise, conduit seal not required for compliance with NEC 501-5a(1).
- K5** Combination of E5 and the following:
Intrinsically Safe for Class I, II, and III, Division 1, Groups A, B, C, D, E, F, and G. Non-Incendive Field Circuit for Class I, II, III; Division 2, Groups A, B, C, D, F, and G. Ambient Temperature Limit: -50 to 60 °C. Intrinsically Safe and Non-Incendive field circuit approval only when installed in accordance with Rosemount drawing 03144-0221.

Canadian Standards Association (CSA) Approvals

- C6** Combination of the following:
Explosion Proof for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 hazardous locations. Class I, Division 2, Groups A, B, C, and D. Factory sealed. Ambient Temperature Limit: -50 to 85 °C.
Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 hazardous locations when installed in accordance with Rosemount drawing 03144-0222.

Factory Mutual and Canadian Standards Association Approvals

- KB** Combination of K5 and C6

Institut Scientifique de Service Public (ISSeP)/CENELEC Flameproof Approval

E9 EEx d IIC T6 ($T_{amb} = -20$ to 60 °C)

British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA) Approvals

N1 Type N Approval

Ex N IIC T6 ($T_{amb} = -40$ to 50 °C)

Ex N IIC T5 ($T_{amb} = -40$ to 75 °C)

Special Conditions for Safe Use (x):

The transmitter is not capable of withstanding the electrical strength test required by BS 6941, Clause 6.1 (1998). This condition must be taken into account during installation.

I1 CENELEC Intrinsic Safety,

EEx ia IIC T6 ($T_{amb} = -40$ to 50 °C)

EEx ia IIC T5 ($T_{amb} = -40$ to 75 °C)

Input Entity Parameters:

Power/Loop	Sensor
$U_{max:in} = 30$ V dc	$U_{max:in} = 4.5$ V dc
$I_{max:in} = 300$ mA	$I_{max:in} = 51$ mA
$P_{max:in} = 1.0$ W	$P_{max:in} = 0.057$ W
$C_{eq} = 0.005$ μ F	$U_{max:out} = 24.2$ V dc
$L_{eq} = 20$ μ H	$I_{max:out} = 35$ mA
	$P_{max:out} = 0.041$ W
	$C_a = 0.2$ μ F (Group IIC)
	$L_a = 31$ mH (Group IIC)
	$C_a = 0.6$ μ F (Group IIB)
	$L_a = 93$ mH (Group IIB)
	$C_a = 1.6$ μ F (Group IIA)
	$L_a = 248$ mH (Group IIA)

Special Conditions for Safe Use (x):

The transmitter is not capable of withstanding the insulation test required by EN50 020, Clause 5.7 (1977). This condition must be taken into account during installation.

Standard Australia Quality Assurance Services (SAA)

E7 Flameproof Approval

Ex d IIC T6 ($T_{amb} = -20$ to 60 °C)

N7 Type N Approval

Ex n IIC T6 ($T_{amb} = -40$ to 50 °C)

Ex n IIC T5 ($T_{amb} = -40$ to 75 °C)

I7 Intrinsic Safety

Ex ia IIC T5 ($T_{amb} = -40$ to 75 °C)

Input Entity Parameters:

Power/Loop	Sensor
$U_{\max:\text{in}} = 30 \text{ V dc}$	$U_{\max:\text{in}} = 4.5 \text{ V dc}$
$I_{\max:\text{in}} = 300 \text{ mA}$	$I_{\max:\text{in}} = 51 \text{ mA}$
$P_{\max:\text{in}} = 1.0 \text{ W}$	$P_{\max:\text{in}} = 0.057 \text{ W}$
$C_{\text{eq}} = 0.005 \mu\text{F}$	$U_{\max:\text{out}} = 24.2 \text{ V dc}$
$L_{\text{eq}} = 20 \mu\text{H}$	$I_{\max:\text{out}} = 35 \text{ mA}$
	$P_{\max:\text{out}} = 0.041 \text{ W}$
	$C_a = 0.2 \mu\text{F}$ (Group IIC)
	$L_a = 31 \text{ mH}$ (Group IIC)
	$C_a = 0.6 \mu\text{F}$ (Group IIB)
	$L_a = 93 \text{ mH}$ (Group IIB)
	$C_a = 1.6 \mu\text{F}$ (Group IIA)
	$L_a = 248 \text{ mH}$ (Group IIA)

Special Conditions for Safe Use (x):

The equipment has been assessed to the “Entity” concept. The Entity Parameters must be taken into account during installation.

Centro de Pesquisas de Energia Eletrica (CEPEL) Approval

IE Intrinsic Safety

BR-Ex ia IIC T6 ($T_{\text{amb}} = 60 \text{ }^\circ\text{C}$)

Input Entity Parameters:

Power/Loop	Sensor
$V_{\max} = 30 \text{ V dc}$	$V_t = 10.7 \text{ V dc}$
$I_{\max} = 130 \text{ mA}$	$I_t = 15.3 \text{ mA}$
$P_{\max} = 1.0 \text{ W}$	$P_{\max} = 40 \text{ mW}$
$C_i = 5 \text{ nF}$	$C_a = 2.23 \mu\text{F}$
$L_i = 0.02 \text{ mH}$	$L_a = 140\text{mH}$

Special Conditions for Safe Use (x):

The transmitter can only be mounted in an area where it is protected against mechanical impacts. Only the sensor (T/C or RTD) can be mounted in Zone 0.

Japanese Industrial Standard (JIS) Flameproof Certification

E4 Without optional meter:

Ex d IIB T6 ($T_{\text{amb}} = 60 \text{ }^\circ\text{C}$)

With optional meter:

Ex d IIB T4 ($T_{\text{amb}} = 60 \text{ }^\circ\text{C}$)

GOSTANDART

Tested and approved by Russian Metrological Institute GOSTANDART.

DNV Type Approval for Shipboard and Offshore Installations

If DNV Type approval is required, you must specify the Transient Protector option (Option Code T1).

Location Classes:	
Temperature	D
Vibration	B/C
Humidity	B
Enclosure	D

Transient Protection (Option Code T1)

The transient protector helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are contained in an add-on assembly that attaches to the standard transmitter terminal block. The transient protector has been tested per the following standard:

ASME B 16.5 (ANSI)/IEEE C62.41-1991 (IEEE 587)/ Location Categories A2, B3.

- 1kV peak (10 × 1000 mS Wave)
- 6kV/3kA peak (1.2 × 50 mS Wave 8 × 20 mS Combination Wave)
- 6kV/0.5kA peak (100 kHz Ring Wave)
- 4kV peak EFT (5 × 50 nS Electrical Fast Transient)

Loop resistance added by protector: 22 ohms max.

Nominal clamping voltages: 90 V (common mode), 77 V (normal mode)

Failure Mode

The Model 3144 and 3244MV transmitters feature software-driven alarm diagnostics as well as an independent circuit designed to provide separate, backup alarm output in case the microprocessor electronics hardware or software fails.

The alarm levels are user selectable by the Failure Mode Jumper (see “Failure Mode Jumper” on page 2-7). The position of the jumper determines the direction in which the output is driven (HI or LO) in case of alarm. The jumper switch feeds into the D/A converter, which drives the proper alarm output even if the microprocessor fails.

The values to which the transmitter drives its output in failure depend on whether it is factory configured to standard or NAMUR-compliant operation. The values for each are as follows:

Standard Operation	
Linear Output:	$3.9 \leq I \leq 20.5 \text{ mA}$
Fail High:	$21.0 \leq I \leq 23.0 \text{ mA}$
Fail Low:	$I \leq 3.75 \text{ mA}$

NAMUR-Compliant Operation	
Linear Output:	$3.8 \leq I \leq 20.5 \text{ mA}$
Fail High:	$21.0 \leq I \leq 23.0 \text{ mA}$
Fail Low:	$I \leq 3.6 \text{ mA}$

Temperature Limits

Operating	Storage
-40 to 185 °F (-40 to 85 °C)	-60 to 250 °F (-50 to 120 °C)
-40 to 185 °F (-20 to 85 °C) for transmitters with optional LCD meter	-50 to 185 °F (-45 to 85 °C) for transmitters with optional LCD meter

Humidity Limits

0–100% relative humidity

Turn-on Time

Performance within specifications less than 5.0 seconds after power is applied to transmitter

Update Time

Approximately 0.5 seconds

Performance Specifications

The Model 3144 and 3244MV transmitters maintain a specification conformance of at least 3 σ .

Accuracy

Refer to Table 5-1 on page 5-10.

Stability

$\pm 0.1\%$ of reading or 0.1 °C, whichever is greater, for 24 months for RTDs

$\pm 0.1\%$ of reading or 0.1 °C, whichever is greater, for 12 months for thermocouples

5 Year Stability

$\pm 0.25\%$ of reading or 0.25 °C, whichever is greater, for 5 years for RTDs

$\pm 0.5\%$ of reading or 0.5 °C, whichever is greater, for 5 years for thermocouples

Power Supply Effect

Less than $\pm 0.005\%$ of span per volt

RFI Effect

Worst case RFI effect is equivalent to the transmitter’s nominal accuracy specification per Table 1 on page 13 when tested in accordance with ENV 50140, 30 V/m, 80 to 1000 MHz, with unshielded cable.

Vibration Effect

Transmitters tested to the following specifications with no effect on performance:

Frequency	Acceleration
10–60 Hz	0.21 mm peak displacement
60–2000 Hz	3 g

Self Calibration

The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Ambient Temperature Effect

Transmitters may be installed in locations where the ambient temperature is between -40 and 85 °C. Each transmitter is individually characterized over this ambient temperature range at the factory in order to maintain excellent accuracy performance in dynamic industrial environments. The factory characterization technique is accomplished through extreme hot and cold temperature profiling with individual adjustment factors programmed into each transmitter. Transmitters automatically adjust for component drift caused by changing environmental conditions. Refer to Table 5-2 on page 5-11.

Physical Specifications

Conduit Connections

½-14 NPT, PG13.5 (PG11), M20 × 1.5 (CM20), or JIS G ½ conduit. HART communicator connections permanently fixed to power/signal block.

Materials of Construction

Electronics Housing

Low-copper aluminum or CF-8M (cast version of 316 SST)

Paint

Polyurethane

Cover O-rings

Buna-N

Mounting

Transmitters may be attached directly to the sensor. Optional mounting brackets B4 and B5 permit remote mounting. See Figure 6 on page 11.

Weight

Add 1.0 lb (0.5 kg) for meter or bracket options.

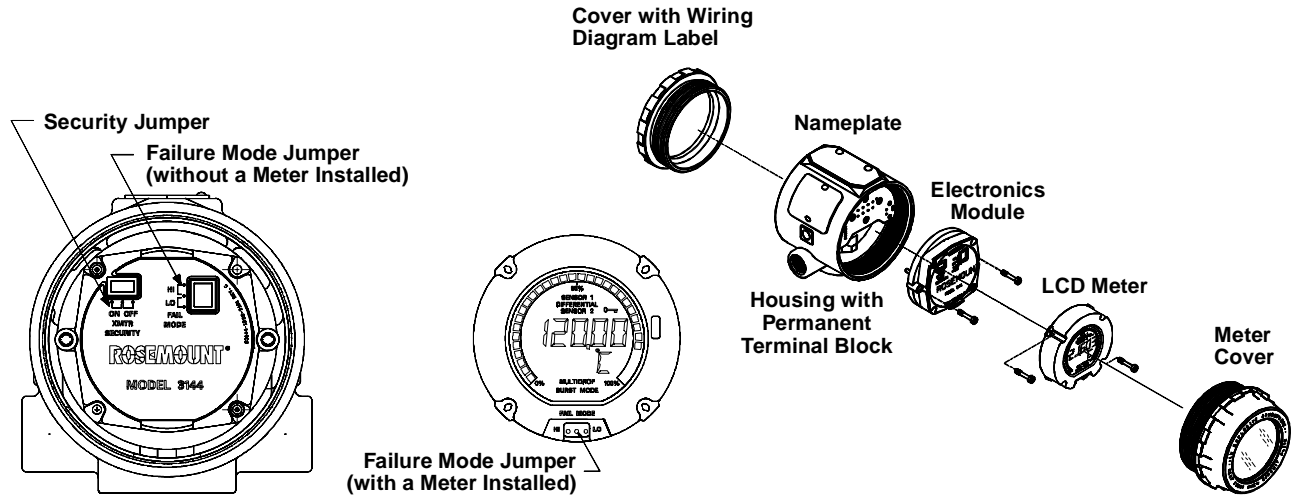
Aluminum	Stainless Steel
2.5 lb. (1.1 kg)	7.2 lb (3.3 kg)

Enclosure Ratings

NEMA 4X, CSA Enclosure Type 4X, IP66, and IP68

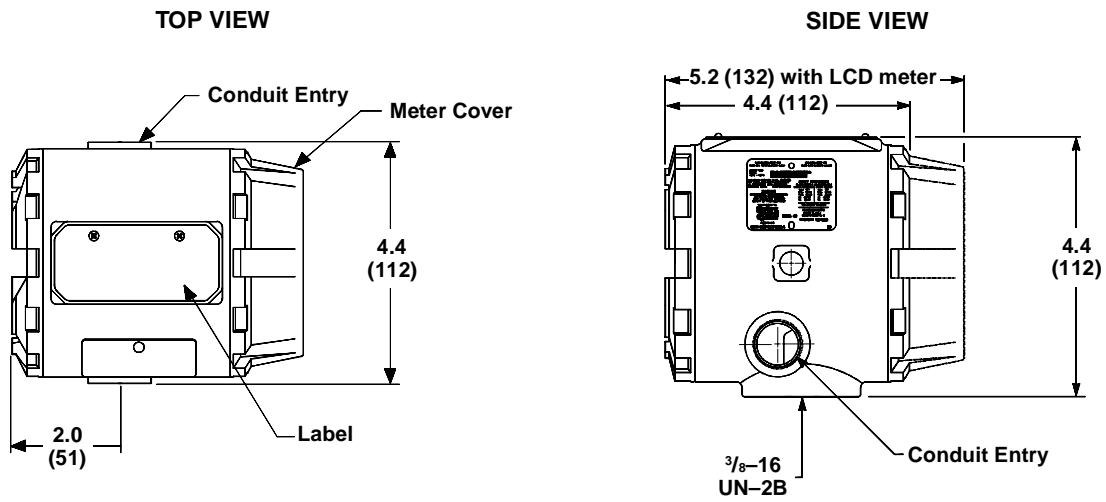
TRANSMITTER DIMENSIONAL DRAWINGS

Figure 5-1. Transmitter Exploded View, Jumper Locations, and Meter Faceplate.



3144-0001B01B, 2352A01D, 0000A03B

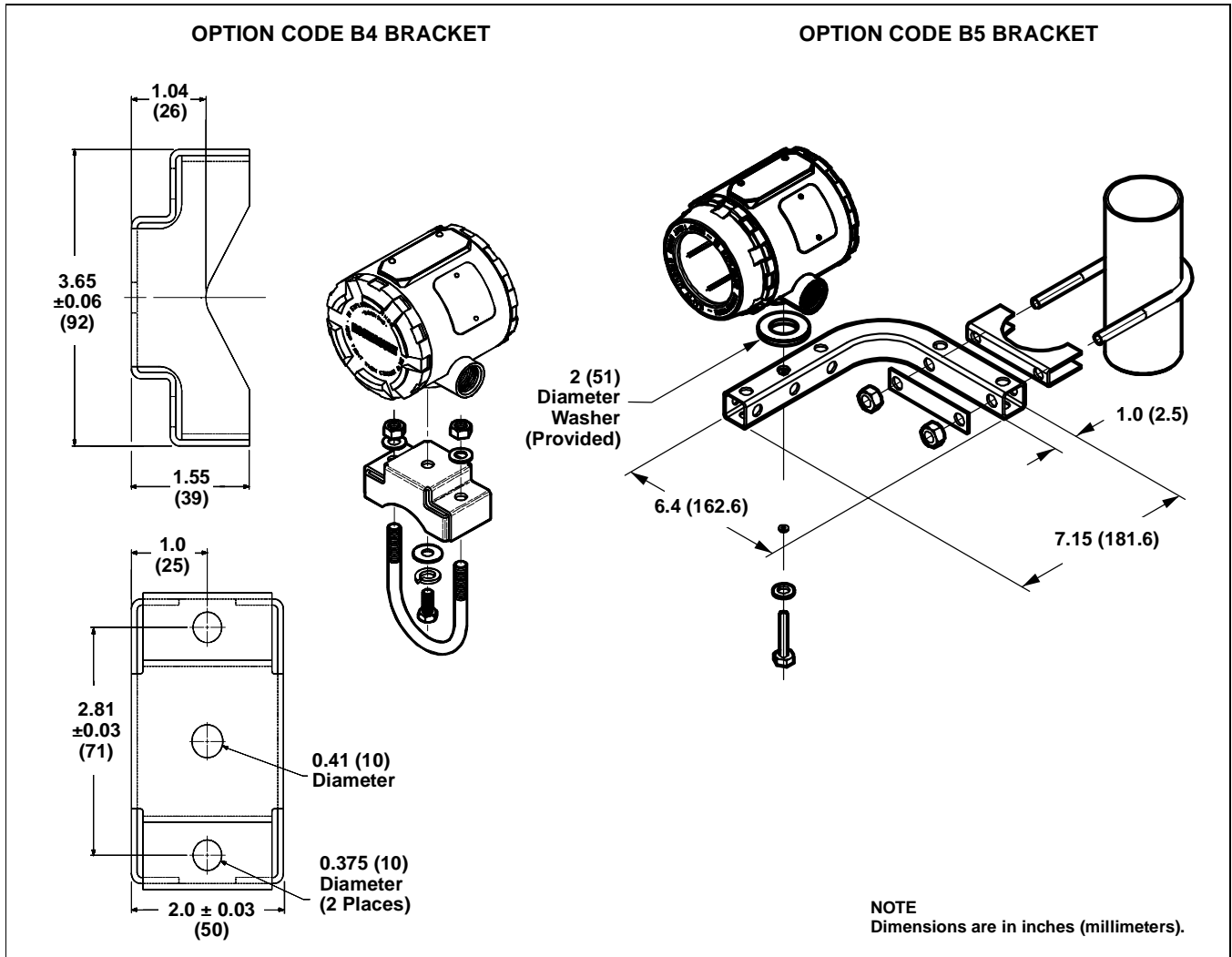
Figure 5-2. Transmitter Dimensional Drawings.



NOTE
Dimensions are in inches (millimeters).

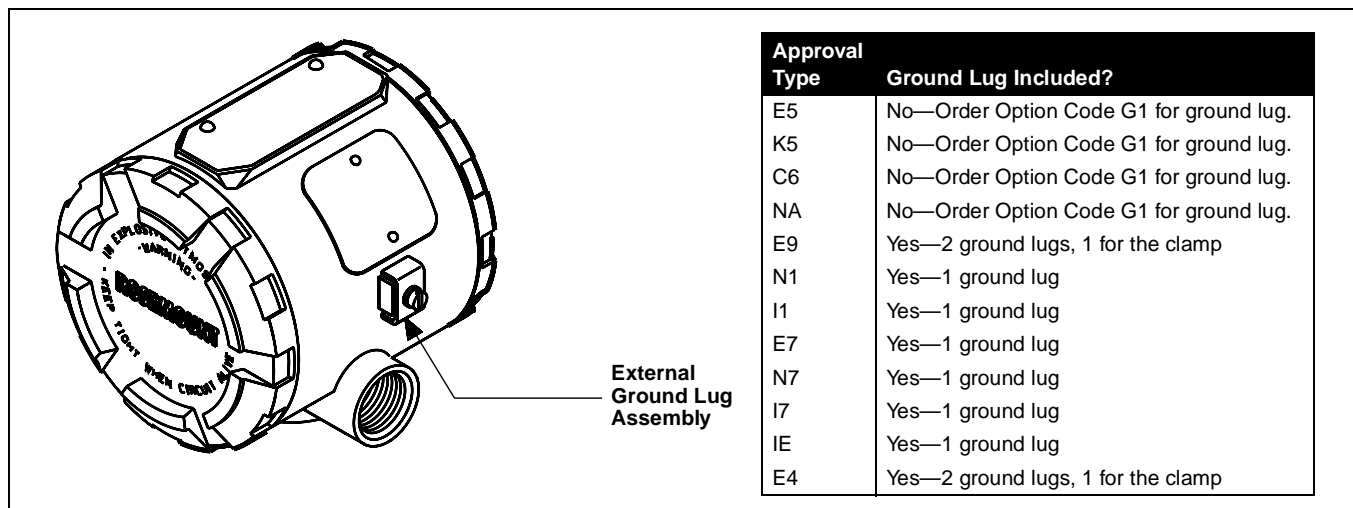
3144-0204B02A, 0000A07A

Figure 5-3. Optional Transmitter Mounting Brackets.



3044-2101A01A; 3144-3144A14A; 1081A01A

Figure 5-4. Option Code G1 External Ground Lug Assembly Installed on the Transmitter.



3144-0204A02A

REFERENCE DATA

TABLE 5-1. Models 3144 and 3244MV Input Options and Accuracy.

Sensor Options		Sensor Reference	Input Ranges		Recommended Min. Span ⁽¹⁾		Digital Accuracy ⁽²⁾		D/A Accuracy ⁽³⁾
			°C	°F	°C	°F	°C	°F	
2, 3, or 4 Wire RTDs									
Pt 100	IEC 751; $\alpha = 0.00385$ (ITS-90) 1995		-200 to 850	-328 to 1562	10	18	±0.10	±0.18	±0.02% of span
Pt 100	JIS 1604; $\alpha = 0.003916$ 1981		-200 to 645	-328 to 1193	10	18	±0.10	±0.18	±0.02% of span
Pt 200	IEC 751; $\alpha = 0.00385$ (ITS-90) 1995		-200 to 850	-328 to 1562	10	18	±0.22	±0.40	±0.02% of span
Pt 500	IEC 751; $\alpha = 0.00385$ (ITS-90) 1995		-200 to 850	-328 to 1562	10	18	±0.14	±0.25	±0.02% of span
Pt 1000	IEC 751; $\alpha = 0.00385$ (ITS-90) 1995		-200 to 300	-328 to 572	10	18	±0.10	±0.18	±0.02% of span
Ni 120	Edison Curve No.7		-70 to 300	-94 to 572	10	18	±0.08	±0.14	±0.02% of span
Cu 10	Edison Copper Winding No. 15		-50 to 250	-58 to 482	10	18	±1.00	±1.80	±0.02% of span
<i>NOTE: Using Pt 100 ($\alpha = 0.003916$) and Pt 1000 ($\alpha = 0.00385$) RTDs may require you to update your Model 275 HART Communicator. If you order the transmitter preconfigured with the new sensor input types, your Model 275 HART Communicator must contain the appropriate device descriptor in order to establish communications. Refer to Appendix B: Model 275 HART Communicator for more information.</i>									
Thermocouples⁽⁴⁾									
NIST Type B ⁽⁵⁾	NIST Monograph 175		100 to 1820	212 to 3308	25	45	±0.75	±1.35	±0.02% of span
NIST Type E	NIST Monograph 175		-50 to 1000	-58 to 1832	25	45	±0.20	±0.36	±0.02% of span
NIST Type J	NIST Monograph 175		-180 to 760	-292 to 1400	25	45	±0.25	±0.45	±0.02% of span
NIST Type K ⁽⁶⁾	NIST Monograph 175		-180 to 1372	-292 to 2502	25	45	±0.25	±0.45	±0.02% of span
NIST Type N	NIST Monograph 175		0 to 1300	32 to 2372	25	45	±0.40	±0.72	±0.02% of span
NIST Type R	NIST Monograph 175		0 to 1768	32 to 3214	25	45	±0.60	±1.08	±0.02% of span
NIST Type S	NIST Monograph 175		0 to 1768	32 to 3214	25	45	±0.50	±0.90	±0.02% of span
NIST Type T	NIST Monograph 175		-200 to 400	-328 to 752	25	45	±0.25	±0.45	±0.02% of span
Millivolt Input⁽⁷⁾			-10 to 100 mV		3 mV		±0.015 mV		±0.02% of span
2, 3, or 4 Wire Ohm Input			0 to 2000 ohms		20 ohm		±0.35 ohm		±0.02% of span

- (1) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specifications with damping at zero seconds.
- (2) Digital Accuracy: Digital output can be accessed by a HART communicator or a HART-based control system.
- (3) Total Analog Accuracy is the sum of digital and D/A accuracies.
- (4) Total Digital Accuracy for thermocouple only: sum of Digital Accuracy + 0.25 °C (cold junction accuracy).
- (5) Digital Accuracy for NIST Type B T/C is ±2.0 °C (5.4 °F) from 100 to 300 °C (212 to 572 °F).
- (6) Digital Accuracy for NIST Type K T/C is ±0.5 °C (0.9 °F) from -180 to -90 °C (-292 to -130 °F).
- (7) Millivolt inputs are not approved for use with CSA Option Code I6.

Reference Accuracy Example

When using a Pt 100 ($\alpha = 0.00385$) sensor input with a 0–100 °C span: Digital Accuracy would be ±0.10 °C, D/A accuracy would be ±0.02% of 100 °C or ±0.02 °C, Total = ±0.12 °C.

Additional Notes for Model 3244MV Transmitters

NOTE 1: DIFFERENTIAL CAPABILITY EXISTS BETWEEN ANY TWO SENSOR TYPES

For all differential configurations, the input range is X to +Y where X = Sensor 1 minimum – Sensor 2 maximum and Y = Sensor 1 maximum – Sensor 2 minimum.

NOTE 2: DIGITAL ACCURACY FOR DIFFERENTIAL CONFIGURATIONS

Sensor types are similar (e.g., both RTDs or both T/Cs):
 Digital Accuracy = 1.5 times worst case accuracy of either sensor type.
 Sensor types are dissimilar (e.g., one RTD, one T/C):
 Digital Accuracy = Sensor 1 Accuracy + Sensor 2 Accuracy

TABLE 5-2. Model 3144 and 3244 Ambient Temperature Effects.

Sensor Options	Digital Accuracy per 1.0 °C (1.8 °F) Change in Ambient ⁽¹⁾	D/A Effect per 1.0 °C Change in Ambient
2, 3, or 4 Wire RTDs		
Pt 100 ($\alpha = 0.00385$)	0.0015 °C	0.001% of span
Pt 100 ($\alpha = 0.003916$)	0.0015 °C	0.001% of span
Pt 200	0.0023 °C	0.001% of span
Pt 500	0.0015 °C	0.001% of span
Pt 1000	0.0015 °C	0.001% of span
Ni 120	0.0010 °C	0.001% of span
Cu 10	0.015 °C	0.001% of span
<i>NOTE: Using Pt 100 ($\alpha = 0.003916$) and Pt 1000 ($\alpha = 0.00385$) RTDs may require you to update your Model 275 HART Communicator. If you order the transmitter preconfigured with the new sensor input types, your Model 275 HART Communicator must contain the appropriate device descriptor in order to establish communications. Refer to Appendix B: Model 275 HART Communicator for more information.</i>		
Thermocouples		
NIST Type B	0.014 °C if reading ≥ 1000 °C 0.029 °C – 0.0021% of (reading – 300) if 300 °C \leq reading < 1000 °C 0.046 °C – 0.0086% of (reading – 100) if 100 °C \leq reading < 300 °C	0.001% of span
NIST Type E	0.004 °C + 0.00043% of reading	0.001% of span
NIST Type J	0.004 °C + 0.00029% of reading if reading ≥ 0 °C 0.004 °C + 0.0020% of abs. val. reading if reading < 0 °C	0.001% of span
NIST Type K	0.005 °C + 0.00054% of reading if reading ≥ 0 °C 0.005 °C + 0.0020% of abs. val. reading if reading < 0 °C	0.001% of span
NIST Type N	0.005 °C + 0.00036% of reading	0.001% of span
NIST Type R	0.015 °C if reading ≥ 200 °C 0.021 °C – 0.0032% of reading if reading < 200 °C	0.001% of span
NIST Type S	0.015 °C if reading ≥ 200 °C 0.021 °C – 0.0032% of reading if reading < 200 °C	0.001% of span
NIST Type T	0.005 °C if reading ≥ 0 °C 0.005 °C + 0.00036% of abs. val. reading if reading < 0 °C	0.001% of span
Millivolt Input	0.00025 mV	0.001% of span
2, 3, or 4 Wire Ohm Input	0.007 Ω	0.001% of span

(1) Change in ambient is in reference to the calibration temperature of the transmitter (20 °C [68 °F]) typical from factory.

Temperature Effects Example

When using a Pt 100 ($\alpha = 0.00385$) sensor input with a 0 to 100 °C span at 30 °C ambient temperature, the following statements would be true:

Digital Temp Effects

$$0.0015 \text{ °C} \times [(30 - 20)] = 0.015 \text{ °C}$$

D/A Effects

$$[0.001\% \text{ of } 100] \times [(30 - 20)] = 0.01 \text{ °C}$$

Worst Case Error

$$\text{Digital} + \text{D/A} + \text{Digital Temp Effects} + \text{D/A Effects} = 0.10 \text{ °C} + 0.02 \text{ °C} + 0.015 \text{ °C} + 0.01 \text{ °C} = 0.145 \text{ °C}$$

Total Probable Error

$$\sqrt{0.10^2 + 0.02^2 + 0.015^2 + 0.01^2} = 0.10 \text{ °C}$$

ORDERING INFORMATION

TABLE 1. Model 3144 and 3244MV Ordering Information. (• = Applicable, — = Not Applicable)

Model	Product Description	3144	3244MV
3244MV	Smart Temperature Transmitter with Dual-Sensor Input	—	•
3144	Smart Temperature Transmitter	•	—
Code	Transmitter Mounting Type		
D	Dual-Compartment Field Mount Transmitter (Model 3144 Only)	•	—
Code	Housing	Conduit Thread	
1	Aluminum	1/2–14 NPT	•
2	Aluminum	M20 × 1.5 (CM20)	•
3	Aluminum	PG13.5 (PG11)	•
4	Aluminum	JIS G 1/2	•
5	Stainless Steel	1/2–14 NPT	•
6	Stainless Steel	M20 × 1.5 (CM20)	•
7	Stainless Steel	PG13.5 (PG11)	•
8	Stainless Steel	JIS G 1/2	•
Code	Hazardous Locations Certifications		
E5	FM Explosion-Proof Approval	•	•
K5	FM Intrinsic Safety, Non-Incendive and Explosion-Proof Approval Combination	•	•
KB	FM and CSA Intrinsic Safety and Explosion-Proof Combination	•	•
C6	CSA Intrinsic Safety, Non-Incendive and Explosion-Proof Approval Combination	•	•
E9	ISSEP/CENELEC Flameproof Approval	•	•
N1	BASEEFA Type N Approval	•	•
I1	CENELEC/BASEEFA Intrinsic Safety Approval	•	•
E7	SAA Flameproof Approval	•	•
N7	SAA Type N Approval	•	•
I7	SAA Intrinsic Safety Approval	•	•
IE	CEPEL Intrinsic Safety Approval	•	•
E4	JIS Flameproof Approval; requires either Housing Code 4 (aluminum housing with JIS G 1/2 conduit threads) or Housing Code 8 (stainless steel housing with JIS G 1/2 conduit threads).	•	•
NA	No Approval	•	•
<i>Other approvals available or pending. Call Rosemount Customer Central for more information.</i>			
Code	Options		
Accessory Options			
B4	Universal Mounting Bracket for 2-inch Pipe and Panel Mounting—SST Bracket and Bolts	•	•
B5	Universal “L” Mounting Bracket for 2-inch Pipe Mounting—SST Bracket and Bolts	•	•
M5	LCD Meter	•	•
G1	External Ground Lug Assembly (See Table on page 5-9)	•	•
T1	Integral Transient Protector	•	•
Configuration Options			
U1	Hot Backup	—	•
U2	Average Temperature with Hot Backup and Drift Alert	—	•
U4	Two Independent Sensors	—	•
U5	Differential Temperature	—	•
U6	Average Temperature	—	•
C1	Factory Configuration of Date, Descriptor, and Message Fields (completed CDS 00806-0100-4724 required with order)	•	•
C2	Trim to Specific Rosemount RTD Calibration Schedule (Sensor Matching)	•	•
C4	5-Point Calibration (Use Option Code Q4 to Generate a Calibration Certificate)	•	•
C7	Trim to Special Non-Standard Sensor (Special Sensor—Customer Must Provide Sensor Information), May Be Used As Sensor Input for Either Sensor 1 or Sensor 2	•	•
F5	50 Hz Line Voltage Filter	•	•
A1	Analog Output Levels Compliant with NAMUR Recommendation NE-43, 27-June-1996	•	•
CN	Analog Output Levels Compliant with NAMUR Recommendation NE-43, 27-June-1996, Alarm Configuration—Low	•	•
<i>Note: NAMUR-compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>			
Assembly Options			
X1	Assemble Transmitter to a Sensor Assembly (hand tight, Teflon (PTFE) tape where appropriate, fully wired)	•	•
X2	Assemble Transmitter to a Sensor Assembly (hand tight, no Teflon (PTFE) tape, unwired)	•	•
X3	Assemble Transmitter to a Sensor Assembly (wrench tight, Teflon (PTFE) tape where appropriate, fully wired)	•	•
<i>Note: Option codes X1 and X3 are not available with CSA approval.</i>			

TABLE 1. Model 3144 and 3244MV Ordering Information. (• = Applicable, — = Not Applicable)

Model	Product Description	3144	3244MV
Q4	Calibration Certification Options Calibration Certificate (3-Point standard; use C4 with Q4 option for a 5-Point Calibration Certificate)	•	•
Typical Model Number: 3244 MV 1 E5 B4 M5 U2			

Tagging

Hardware Tag

The transmitter will be tagged at no charge in accordance with customer requirements. All tags are stainless steel. The standard hardware tag is permanently attached to the transmitter. Tag character height is 1/16 inch (1.6 mm).

Software Tag

The transmitter can store a software tag up to eight characters in its memory. The transmitter can be ordered with different software and hardware tags. However, if the software tag characters are not specified, the software tag will default to the first eight characters of the hardware tag.

Standard Configuration (Models 3144 and 3244MV)

Unless specified, the transmitter will be shipped as follows:

Standard Configuration	
Sensor Type	4-wire Pt 100 $\alpha = 0.00385$ RTD
4 mA value	0 °C
20 mA value	100 °C
Damping	5 seconds
Output	Linear with temperature
Failure Mode	High
Line Voltage Filter	60 Hz
Software Tag	See "Tagging" below
Integral Meter	None (meter not installed) Units and mA (meter installed)

3144 Standard Output Configuration	
Primary Variable (4–20 mA)	Sensor 1
Secondary Variable	Terminal Temperature
Tertiary Variable	Not Available
Quaternary Variable	Not Available

3244MV Standard Output Configuration	
Primary Variable (4–20 mA)	Sensor 1
Secondary Variable	Sensor 2
Tertiary Variable	Terminal Temperature
Quaternary Variable	Not Used

All standard configuration settings may be changed in the field with a HART communicator.

PARTS LIST

TABLE 5-3. Models 3144 and 3244MV Parts List. (• = Applicable, — = Not Applicable)

Part Description	Part Number	3144	3244MV
Model 3144 Electronics Module	03144-3011-0007	•	—
Model 3244MV Electronics Module	03144-3012-1007	—	•
M5 Meter Kit—Aluminum (includes meter display, captive mounting hardware, 6-pin interconnection header, and cover kit)	03144-3020-0001	•	•
Meter (includes meter display, captive mounting hardware, and 6-pin interconnection header)	03144-3020-0002	•	•
Aluminum Meter Cover (includes O-ring)	03144-1043-0001	•	•
Stainless Steel Meter Cover Kit (includes O-ring)	03144-1043-0011	•	•
B4 Mounting Bracket Kit	03044-2131-0001	•	•
B5 Mounting Bracket Kit	03144-1081-0001	•	•
Model 3144 Aluminum Housing Cover (includes O-ring and wiring diagram label)	03144-1042-3101	•	—
Model 3144 Stainless Steel Housing Cover (includes O-ring and wiring diagram label)	03144-1042-3111	•	—
Model 3244MV Aluminum Housing Cover (includes O-ring and wiring diagram label)	03144-1042-3201	—	•
Model 3244MV Stainless Steel Housing Cover (includes O-ring and wiring diagram label)	03144-1042-3211	—	•
O-ring for Cover (package of 12)	01151-0033-0003	•	•
Model 3144 Aluminum Housing Kit (does not include covers)	03144-1041-3101	•	—
Model 3144 Aluminum Housing Kit with External Ground Lug Assembly (does not include covers)	03144-1041-3102	•	—
Model 3144 Stainless Steel Housing Kit (does not include covers)	03144-1041-3111	•	—
Model 3144 Stainless Steel Housing Kit with External Ground Lug Assembly (does not include covers)	03144-1041-3112	•	—
Model 3244MV Aluminum Housing Kit (does not include covers)	03144-1041-3201	—	•
Model 3244MV Aluminum Housing Kit with External Ground Lug Assembly (does not include covers)	03144-1041-3202	—	•
Model 3244MV Stainless Steel Housing Kit (does not include covers)	03144-1041-3211	—	•
Model 3244MV Stainless Steel Housing Kit with External Ground Lug Assembly (does not include covers)	03144-1041-3212	—	•
Screw/Washer Combination for Sensor/Power Terminals (package of 12)	03144-1044-0001	•	•
Jumper (2-pin)—Security and Alarm (package of 12)	03144-1045-0001	•	•
Jumper (6-pin)—Meter Interconnection Header	03144-1046-0001	•	•
External Ground Lug Assembly	03144-1047-0001	•	•
Integral Transient Protector Kit (includes terminal screws and transient protector)	03144-3040-0001	•	•

INTERMITTENT SENSOR ALGORITHM

The electronics for the Model 3144 and 3244MV transmitters contain an intermittent sensor algorithm that monitors the input signal during operation. The signal diagnostics routine, which occurs at each temperature update (every 500 milliseconds), eliminates output pulsing in an intermittent open sensor condition. Further, it validates the input signal before the digital-to-analog (D/A) conversion takes place.

If the process temperature changes, the intermittent sensor algorithm causes the transmitter to respond according to one of the three possible cases described below. The definition of *threshold value* is the maximum change in reading (as a percentage of output range) within one update cycle (500 ms). The default threshold value is 2% of output range and can be specified in the field using a HART communicator.

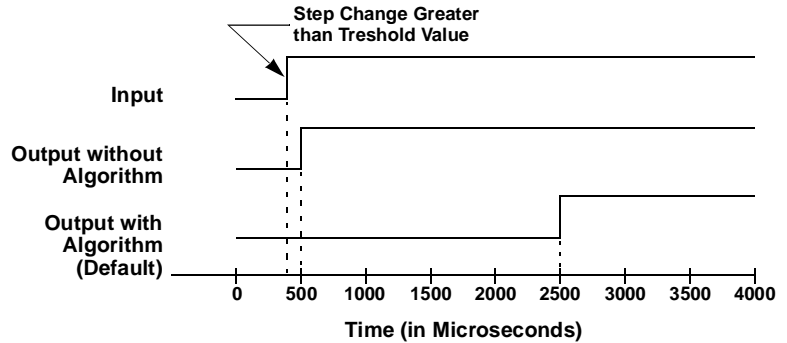
Case 1: Open Sensor

If the algorithm detects an open sensor, the transmitter immediately goes into alarm (high or low, depending on the position of the failure mode switch).

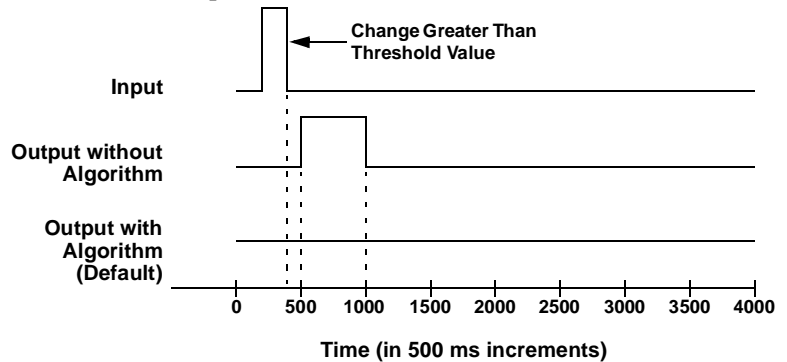
Case 2: Temperature Change Greater than the Threshold Value

If the algorithm detects a process temperature change greater than the threshold value, but which is not a true open sensor condition, the transmitter will go into a hold period. During the hold period, the transmitter determines whether or not this temperature measurement is valid by using three additional measurement points. In the meantime, the output remains unchanged at the initial reading (Time = 0 ms).

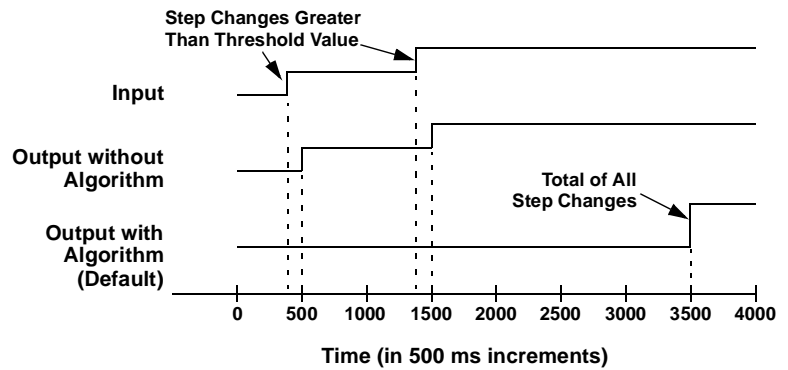
- a. If these next three readings are within the new threshold value (at Time = 500 ms), this measurement is validated. The output changes to reflect this, and the transmitter is no longer in a hold period. In this case, the output delay is 1.75 to 2.00 seconds.



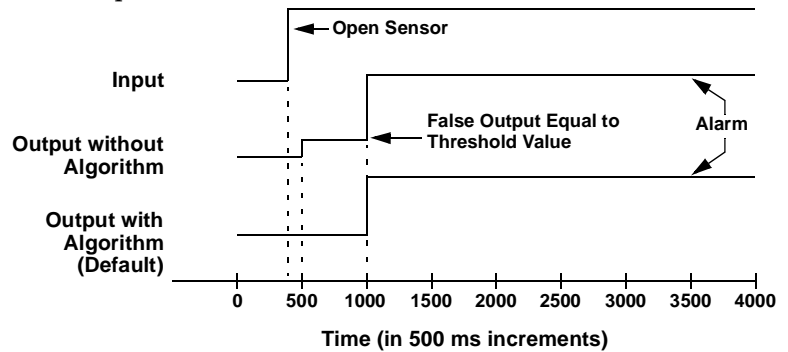
- b. If the reading drops back within the original threshold value (at Time = 0 ms) during the hold period, the transmitter interprets the reading(s) outside the threshold value as a spike, and the output changes to reflect the latest reading. The transmitter is no longer in a hold period, and the spike is not seen at the output.



- c. If any of the next three measurements is outside the new threshold value (at Time = 500 ms), the output remains unchanged at the initial reading (Time = 0 ms). The transmitter remains in a hold period until four consecutive measurements are within the threshold value of the first in the series.



- d. If an open sensor is validated at the end of the first update cycle (Time = 500 ms), the output will go directly to alarm level. The original spike (at Time = 0 ms) will not be seen at the output.



Case 3: Temperature Change Within the Threshold Value

If the transmitter detects an input change that is within the threshold value, it reports the new value within one output cycle (500 ms).

Intermittent Sensor Algorithm and Damping

If the transmitter has both intermittent sensor detect and damping enabled, the output reading is calculated by the following formula:

$$\text{Damped Value} = (P - N) \times \left(\frac{2T - U}{2T + U} \right) + N$$

- P = previous damped value
- N = new sensor value
- T = damping time constant
- U = update rate

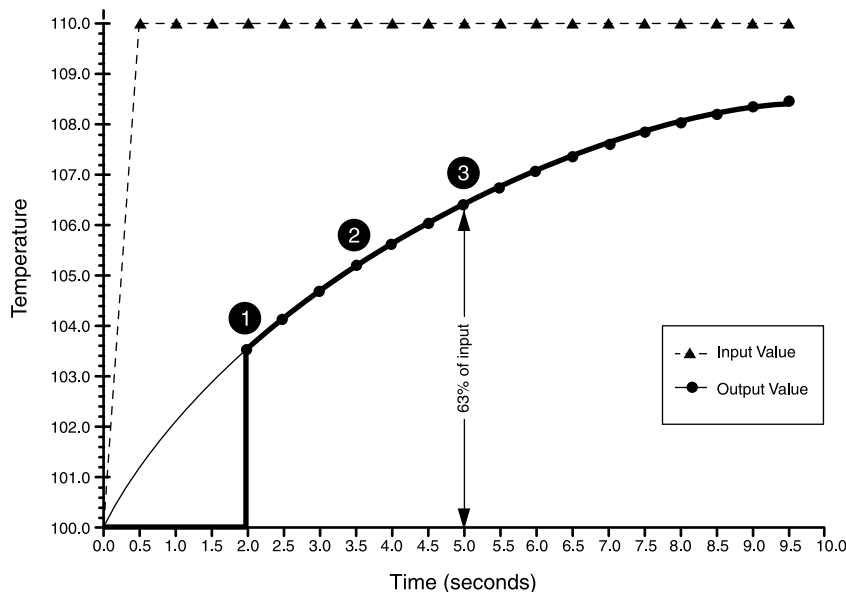
The transmitter outputs the corresponding value on the damping curve within 1.75 to 2.0 seconds and updates the output reading every 500 ms thereafter, according to the damping equation above. At the value to which the damping time constant is set, the transmitter output is at 63 percent of the input change.

Figure 5-5 illustrates an example of intermittent sensor detect with damping enabled. If the temperature undergoes a step change greater than the threshold value, or from 100 degrees to 110 degrees, and the damping is set to 5.0 seconds, the transmitter calculates a new reading every 500 ms using the damping equation, but holds the output at 100 degrees for between 1.75 and 2.0 seconds. Within 1.75 and 2.0 seconds, the transmitter outputs the reading that corresponds to the damping curve at that time (❶), and continues to calculate and update the output reading every 500 ms thereafter (❷) according to the damping equation. After 5 seconds, the transmitter outputs 106.3 degrees, or 63 percent of the input change (❸), and the output continues to approach the input curve according to the equation above.

NOTE

If the damping time constant is set between 0 and 2 seconds, the transmitter does not report the output change until the intermittent sensor algorithm validates the input signal. After validating the input signal, the transmitter outputs the value that corresponds to the damping curve at that time.

Figure 5-5. Damping Function when Input Change is Greater Than the Threshold Value.



644-644_02A

Intermittent Sensor Detect (Advanced Function)⁽¹⁾

NOTE

The Intermittent Sensor Detect feature is not available in previous versions of the Model 3144 and 3244MV transmitters (see Appendix A: Transmitter Improvements).

The Intermittent Sensor Detect feature is designed to guard against process temperature spikes caused by intermittent sensor conditions (an intermittent sensor condition is an open sensor condition that lasts less than 0.7 seconds). By default, the transmitter is shipped with the Intermittent Sensor Detect feature switched ON and the threshold value set at 2% of output range. In most applications, this is the preferred setting. The Intermittent Sensor Detect feature can be switched ON or OFF, and the threshold value can be changed to any value between 0 and 100% of output range with a HART communicator.

Transmitter Behavior with Intermittent Sensor Detect ON

When the Intermittent Sensor Detect feature is switched ON, the transmitter can eliminate the output pulsing caused by intermittent open sensor conditions. Process temperature changes within the threshold value will be tracked normally by the transmitter's output. A temperature change greater than the threshold value will activate the intermittent sensor algorithm. True open sensor conditions will cause the transmitter to go into alarm. A detailed description of the intermittent sensor algorithm can be found under "Intermittent Sensor Algorithm" on page 5-15.

The threshold value should be set at a level that allows the normal range of process temperature fluctuations: too high and the algorithm will not be able to filter out intermittent conditions; too low and the algorithm will be activated unnecessarily. The default threshold value is 2% of output range.

Transmitter Behavior with Intermittent Sensor Detect OFF

When the Intermittent Sensor Detect feature is OFF, the transmitter tracks all process temperature changes, even if these are the consequence of an intermittent sensor. (The transmitter in effect behaves as though the threshold value had been set at 100%.) The output delay due to the intermittent sensor algorithm will be eliminated.

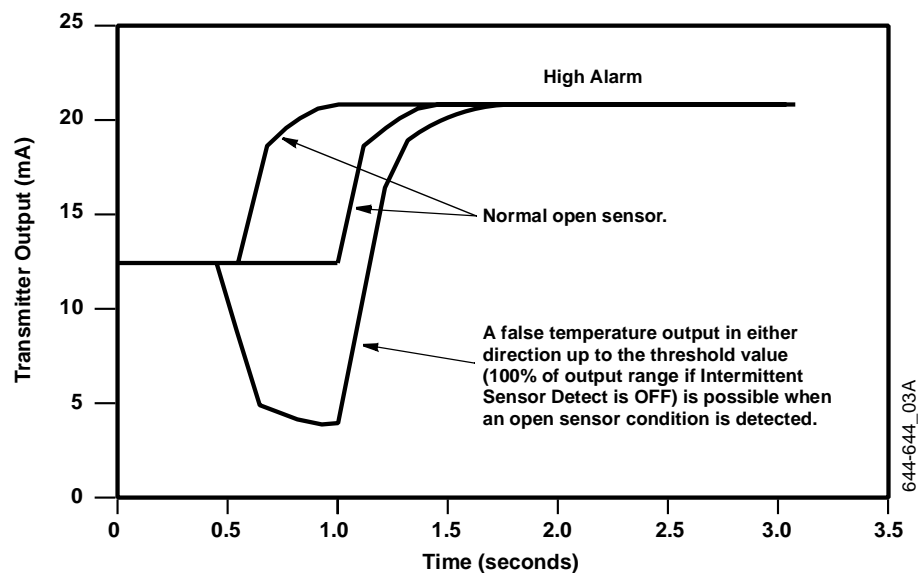
(1) The Intermittent Sensor Detect command is not available in previous versions of the Model 3144 and 3244MV transmitters.

Implementation

The Intermittent Sensor Detect feature can be turned ON or OFF when the transmitter is connected to a Model 275 HART Communicator. Select *1 Device Setup, 4 Detailed Setup, 3 Output Conditioning, 5 Intermit Detect, 1 Intermit Detect*. Choose “On” or “Off”. “On” is the normal setting. The threshold value can be changed from the default value of 2% by proceeding with the following steps: Select *1 Device Setup, 4 Detailed Setup, 3 Output Conditioning, 5 Intermit Detect, 2 Threshold Val*.

Turning the Intermittent Sensor Detect feature OFF or leaving it ON and increasing the threshold value above the default does not affect the time needed for the transmitter to output the correct alarm signal after detecting a true open sensor condition. However, the transmitter may briefly output a false temperature reading for less than 0.5 seconds in either direction (see Figure 5-6) up to the threshold value (100% of output range if Intermittent Sensor Detect is OFF).

Figure 5-6. Open Sensor Reponse with Damping On (3 Cases).



Unless rapid response rate is necessary, the suggested setting of the Intermittent Sensor Detect mechanism is ON.

Options

OVERVIEW

This section contains descriptions of the options available with the Models 3144 and 3244MV Smart Temperature Transmitters. The available options enhance operation and facilitate various installation configurations.

SAFETY MESSAGES

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

Warnings

⚠ WARNING

Explosions could result in death or serious injury:

- Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

Custom Transmitter Configuration (Option Code C1)

Option Code C1 allows you to specify the following data in addition to the standard configuration parameters.

Option Code C1 Data

Date	day, month, year
Descriptor	16 alphanumeric characters
Message	32 alphanumeric characters

Trim to Specific Rosemount RTD Calibration Schedule (Transmitter-Sensor Matching) (Option Code C2)

Option Code C2 allows you to order the transmitter trimmed to a specific calibration schedule. This option requires that you specify a Rosemount Series 65, 68, or 78 RTD sensor ordered with a special calibration schedule. An additional special curve will be added to the sensor input choices. For information on ordering sensors calibrated to specific calibration schedules, refer to the Rosemount Sensors Product Data Sheet, publication no. 00813-0100-2654 (Volume 1) or publication no. 00813-0101-2654 (Volume 2).

Five-Point Calibration (Option Code C4)

Option Code C4 specifies that the transmitter be verified at the the following five-point calibrations: 0, 25, 50, 75, and 100% analog and digital output points.

**Calibration Certificate
(Option Code Q4)**

Option Code Q4 specifies that a calibration certificate be shipped with the transmitter. If a Five-Point Calibration (Option Code C4) is also ordered, calibration data for five points will be included on the calibration certificate. If Option Code C4 is not ordered, only three points (0, 50, and 100% analog and digital output points) will be on the certificate.

**Trim to Special Sensor
(Option Code C7)**

You may order the transmitter trimmed to a special sensor (Option Code C7). Order this option when using a non-standard sensor type. Refer to Table 5-1 on page 5-10 for a list of standard sensor types.

A characterization schedule for any RTD can be entered as Callendar-Van Dusen constants with a Model 275 HART Communicator. The constants can be entered on site or at the factory. For information on ordering sensors matched to the transmitter using Callendar-Van Dusen constants, refer to the Rosemount Sensors Product Data Sheet publication no. 00813-0100-2654 (Volume 1) or 00813-0101-2654 (Volume 2).

When a non-standard sensor is used as the input to the transmitter, the resistance versus temperature curve for a non-standard RTD, or the millivolt versus temperature curve for a non-standard thermocouple, is stored in the transmitter memory. This process is performed at the factory. The transmitter must be configured for a “special” sensor calibration to access the special curve, but you may use any standard input when the transmitter is configured for a “standard” sensor.

When a Model 3244MV transmitter is ordered with Option Code C7, only one sensor input can be configured as the “special” sensor. The other input must be configured as one of the “standard” sensor types available on the transmitter.

**Mounting Brackets
(Option Codes B4 and B5)**

The transmitter can be mounted directly to the sensor, or in a remote location with one of two stainless steel mounting brackets. Refer to Figure 2-9 on page 2-10. The brackets facilitate mounting to a panel or a 2-inch pipe, and include stainless steel bolts. When installing the transmitter with a bracket, torque the bolts to 125 in.-lb (14 n-m).

Assembly Options (Option Code X1, X2, and X3)

Option Code X1, X2, or X3 specifies that the transmitter will be assembled to a sensor. The same option code must be included on the Rosemount sensor model number. These options are only available with the transmitter when ordered in conjunction with an integral connection head.

Assembly descriptions for each option code:

NOTE

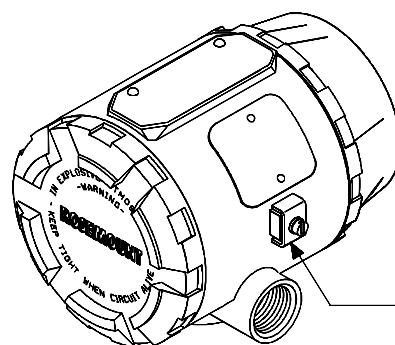
X1 and X3 are not available with CSA Approvals Option (Codes C6 and I6).

Code	Description
X1	Assemble transmitter to Sensor Assembly (hand tight, <i>Teflon</i> , [PTFE] tape where appropriate, fully wired)
X2	Assemble transmitter to Sensor Assembly (hand tight, <i>Teflon</i> , no [PTFE] tape, unwired)
X3	Assemble transmitter to Sensor Assembly (wrench tight, <i>Teflon</i> , [PTFE] tape where appropriate, fully wired)

External Ground Lug Assembly (Option Code G1)

Figure 6-1. External Ground Lug Assembly Installed on a Model 3144/3244MV Transmitter.

The external ground-lug assembly provides an auxiliary grounding point for the transmitter housing. The lug attaches to either side of the housing. Refer to Figure 6-1.



NOTE
See table on page 5-9 for ground lug and approval information.

External Ground
Lug Assembly

3144-0204A02A

50 Hz Line Voltage Filter (Option Code F5)

Option Code F5 specifies that the transmitter be calibrated to a 50 Hz line voltage filter instead of the standard 60 Hz. Option Code F5 is recommended for transmitters in Europe and other areas where 50 Hz ac power is standard. Use the Model 275 HART Communicator to change the line voltage filter after the transmitter is installed (see “50/60 Hz Filter” on page 3-6).

NAMUR Compliant Operation (Option Codes A1 and CN)

Option Codes A1 and CN specify that the transmitter linear output and alarm levels be pre-set at the factory to comply with NAMUR standards. Option Code CN is set to low alarm. For more information on the A1 and CN options, refer to “Failure Mode” on page 5-5.

**Transient Protection
(Option Code T1)**

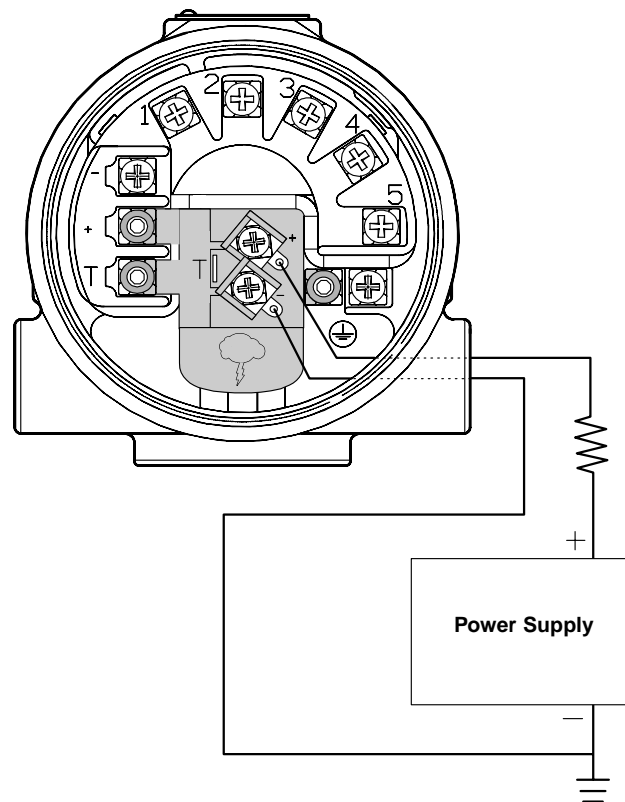
The transient protector helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are contained in an add-on assembly that attaches to the standard transmitter terminal block. The transient protector has been tested per the following standard:

- ANSI/IEEE C62.41-1991 (IEEE 587), Location Categories A2, B3.
- 1kV peak (10 3 1000 mS Wave)
- 6kV / 3kA peak (1.2 3 50 mS Wave 8 3 20 mS Combination Wave)
- 6kV / 0.5kA peak (100 kHz Ring Wave)
- 4kV peak EFT (5 3 50 nS Electrical Fast Transient)

Loop resistance added by protector: 22 ohms max.

Nominal clamping voltages: 90 V (common mode), 77 V (normal mode)

Figure 6-2. Transmitter Terminal Block with the Transient Protector Installed.



**Hot Backup
(Option Code U1)**

This configuration should be selected in critical applications where Sensor 1 is the preferred measurement. If Sensor 1 fails, Hot Backup will be activated and Sensor 2 will become the primary variable.

Option Code U1 3244MV Custom Output Configuration	
Primary Variable (4–20 mA)	Sensor 1
Secondary Variable	Sensor 2
Tertiary Variable	Terminal Temperature
Quaternary Variable	Not Used

Average Temperature with Hot Backup and Drift Alert (Option Code U2)⁽¹⁾

This configuration is ideal for critical applications such as safety interlocks and control loops. The Model 3244MV transmitter should be used in conjunction with a dual-element sensor or two sensing elements measuring the same process temperature. This configuration will output the average of the two measurements and send an alert if the temperature difference between the two measurements exceeds the set maximum differential. If a sensor fails, an alert will be sent and the primary variable will hold the measurement of the working sensor.

Option Code U2 3244MV Custom Output Configuration	
Primary Variable (4–20 mA)	Sensor Average
Secondary Variable	Sensor 1
Tertiary Variable	Sensor 2
Quaternary Variable	Terminal Temperature

Two Independent Sensors (Option Code U4)

Sensor 1 will be configured as the primary (4–20 mA) variable in this configuration and Sensor 2 will be configured as the secondary variable. This configuration may be useful in non-critical applications which use the digital output to measure two separate process temperatures.

Option Code U4 3244MV Custom Output Configuration	
Primary Variable (4–20 mA)	Sensor 1
Secondary Variable	Sensor 2
Tertiary Variable	Terminal Temperature
Quaternary Variable	Not Used

Differential Temperature (Option Code U5)

The differential temperature of two process temperatures will be configured as the primary (4–20 mA) variable in this configuration.

Option Code U5 3244MV Custom Output Configuration	
Primary Variable (4–20 mA)	Differential Temperature
Secondary Variable	Sensor 1
Tertiary Variable	Sensor 2
Quaternary Variable	Terminal Temperature

Average Temperature (Option Code U6)

This configuration can be used when the average measurement of two different process temperatures is needed. If a sensor fails, an alert will be sent and the primary variable will hold the measurement of the working sensor.

Option Code U6 3244MV Custom Output Configuration	
Primary Variable (4–20 mA)	Sensor Average
Secondary Variable	Sensor 1
Tertiary Variable	Sensor 2
Quaternary Variable	Terminal Temperature

(1) Default Drift Alert Configuration: Temperature difference limit = 3 °C (5.4 °F), Damping = 5 seconds

LCD METER (OPTION CODE M5)

The LCD meter for the Model 3144 and 3244MV transmitters provides local indication of the transmitter output, and abbreviated diagnostic messages governing transmitter operation. The meter features a five-character liquid crystal display that provides a direct reading of the digital signal from the microprocessor. During normal operation, and depending on the configuration, the meter displays one of the following:

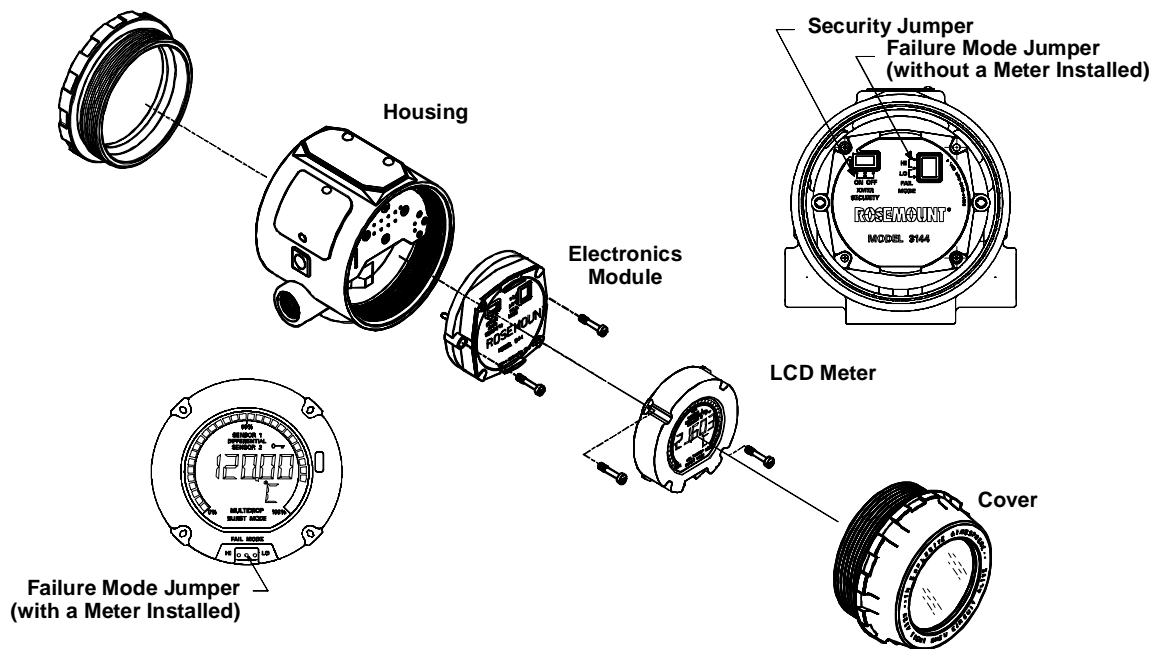
- Engineering Units
- Percent of Range
- Milliamps
- Alternating Between Engineering Units and mA
- Sensor 1 Engineering Units
- Sensor 2 Engineering Units (*Model 3244MV only*)
- Alternating Between Sensor 1 and Sensor 2 (*Model 3244MV only*)
- Differential Temperature (*Model 3244MV only*)
- Alternating Between Sensor 1, Sensor 2, and Differential Temperature (*Model 3244MV only*)

If configured for engineering units and mA, the display alternates every three seconds between the two readings. With a Model 275 HART Communicator you can also change the engineering units displayed by the meter. Select from mA, percent of span, ohms, mV, °C, °F, °R, and K.

The meter will display the output type that corresponds to each reading on the *Output Type* line of the meter (see Figure 6-4 on page 6-9). The words “Sensor 1” and “Sensor 2” will appear on the *Output Type* line when average temperature is being displayed.

The meter can also simultaneously display the analog output signal using a percent scale bar graph around the perimeter of the display face as shown in Figure 6-2 on page 6-4. Turn the bar graph on and off with the Model 275 HART Communicator. The meter lights all segments immediately after power-up, during a transmitter self-test, or during a master reset sent by a host supporting the Rosemount HART Protocol.

Figure 6-3. Transmitter and Meter Exploded View.



3144-2352A01D, 0000A03B, 0200G01A

Installing the Meter

Transmitters ordered with the LCD meter option (Option Code M5) are shipped with the meter installed. After-market installation of the meter on a conventional Model 3144 or 3244MV transmitter requires a small instrument screwdriver and the meter kit, which includes:

- LCD meter assembly
- Extended cover with cover O-ring in place
- Captive screws (quantity 2)
- 6-pin interconnection header

Use the following procedure to install the meter. Once the meter is installed, configure the transmitter to recognize the meter option. Refer to “Meter Settings” on page 3-6.

Installation Procedure




1. If the transmitter is installed in a loop, *then* secure the loop and disconnect the power.
2. Remove the cover from the electronics side of the transmitter. Do not remove the transmitter covers in explosive atmospheres if the circuit is alive.
3. Remove the failure mode jumper and the plastic insulating pins from the six-pin socket on the face of the electronics module. Refer to Figure 6-3.
4. Ensure that the transmitter security mode jumper is set to the **Off** position. *If* transmitter security is **On**, *then* you will not be able to configure the transmitter to recognize the LCD meter.



See “Safety Messages” on page 6-1 for complete warning information.

NOTE

Do not remove the transmitter security jumper from the face of the electronics module. The LCD meter installs over the transmitter security jumper.

5. Insert the interconnection header in the six-pin socket on the face of the electronics module. Insert the longer set of pins into the electronics module socket.
6. Decide which direction to orient the meter. The meter can be rotated in 90-degree increments for easy viewing. Position one of the four six-pin sockets on the back of the meter to accept the interconnection header, and insert the long meter screws into the two holes on the meter assembly that coincide with the appropriate holes on the electronics module.
7. Attach the meter assembly to the interconnection pins. Thread the long meter screws into the holes on the electronics module and tighten to secure the meter assembly.
8. Insert the failure mode jumper, removed in Step 3, in the appropriate position in the three-pin socket on the face of the meter (see “Failure Mode Jumper” on page 2-7).
-  9. Attach the extended cover; tighten at least one-third turn after the O-ring contacts the transmitter housing. Both transmitter covers must be fully engaged to meet explosion proof requirements.
10. Use a Model 275 HART Communicator to change the transmitter meter setting from **UNUSED** to the desired display. Refer to “Meter Settings” on page 3-6, for information on configuring the transmitter to recognize the LCD meter. Before connecting a HART communicator, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

NOTE

Observe the following LCD meter temperature limits:

Operating: -4 to 185 °F (-20 to 85 °C)

Storage: -50 to 185 °F (-45 to 85 °C)

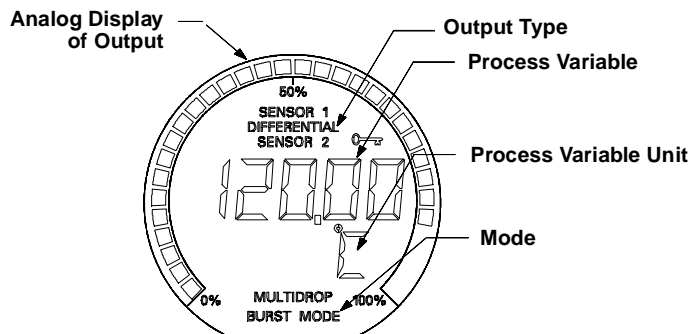
Diagnostic Messages

In addition to the output, the LCD meter displays abbreviated diagnostic messages for troubleshooting the transmitter. To accommodate two-word messages, the display alternates between the first and second word. Some diagnostic messages have a higher priority than others, so messages appear according to their priority, with normal operating messages appearing last. The meter displays messages simultaneously on the *Process Variable* and *Process Variable Unit* lines as shown in Figure 6-4. Messages on the *Process Variable* line refer to general device conditions, while messages on the *Process Variable Unit* line refer to specific causes for these conditions. A description of each diagnostic message follows.



See “Safety Messages” on page 6-1 for complete warning information.

Figure 6-4. Meter Message Display.



3144-2352A01C

[BLANK]

If the meter does not appear to function, make sure the transmitter is configured for the meter option you desire. The meter will not function if the integral meter units are set to NOT USED.

PASS

The transmitter self-test procedure (initiated from a HART communicator or from the power-up sequence) has passed with no problems detected.

FAIL -or- HDWR FAIL

This message indicates one of several conditions including:

- The transmitter has experienced an electronics module failure while attempting to store information.
- The transmitter self-test has failed.

If diagnostics indicate a failure of the electronics module, replace the electronics module with a new one. Contact the nearest Rosemount Field Service Center if necessary.

SNSR 1 FAIL -or- SNSR 2 FAIL

The transmitter has detected an open sensor condition. The sensor(s) might be disconnected, connected improperly, or malfunctioning. Check the sensor connections and sensor continuity.

SNSR 1 RNGE -or- SNSR 2 RANGE

The temperature sensed by the transmitter exceeds the sensor limits for this particular sensor type.

HOUSG RNGE

The transmitter operating temperature limits (–40 to 185 °F [–40 to 85 °C]) have been exceeded.

LOOP FIXED

During a loop test or a 4–20 mA output trim, the analog output defaults to a fixed value. The *Process Variable* line of the display alternates between the amount of current selected in milliamperes and “WARN.” The *Process Variable Unit* line toggles between “LOOP,” “FIXED,” and the amount of current selected in milliamperes.

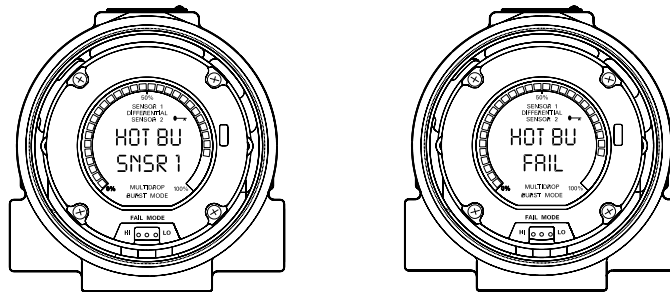
OFLOW

The location of the decimal point, as configured in the meter setup, is not compatible with the value to be displayed by the meter. For example, if the meter is measuring a process temperature greater than 9.9999 degrees, and the meter decimal point is set to 4 digit precision, the meter will display an “OFLOW” message because it is only capable of displaying a maximum value of 9.9999 when set to 4 digit precision.

HOT BU

Hot Backup is enabled and Sensor 1 has failed. This message is displayed on the *Process Variable* line and is always accompanied by a more descriptive message on the *Process Variable Unit* line. In the case of a Sensor 1 failure with Hot Backup enabled, for example, the *Process Variable* line displays “HOT BU,” and the *Process Variable Unit* line alternates between “SNSR 1” and “FAIL.”

Figure 6-5. Hot Backup Display.

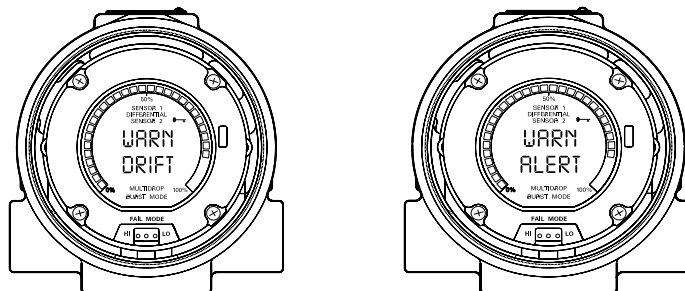


3144-3144_03A_03B

WARN DRIFT → WARN ALERT

Drift Alert warning is enabled and the difference between Sensor 1 and Sensor 2 has exceeded the user-specified limit. One of the sensors may be malfunctioning. The *Process Variable* line displays “WARN” and the *Process Variable Unit* line alternates between “DRIFT” and “ALERT.”

Figure 6-6. Sensor Drift Alert Display.



3144-3144_03C_03D

ALARM DRIFT → ALARM ALERT

The analog output is in alarm. Drift Alert alarm is enabled and the difference between Sensor 1 and Sensor 2 has exceeded the user-specified limit. The transmitter is still operating, but one of the sensors may be malfunctioning. The *Process Variable* line displays “ALARM” and the *Process Variable Unit* line alternates between “DRIFT” and “ALERT.”

ALARM

The digital and analog outputs are in alarm. Possible causes of this condition include, but are not limited to, an electronics failure or an open sensor. This message is displayed on the *Process Variable* line and is always accompanied by a more descriptive message on the *Process Variable Unit* line. In the case of a Sensor 1 failure, for example, the *Process Variable* line displays “ALARM,” and the *Process Variable Unit* line alternates between “SNSR 1” and “FAIL.”

WARN

The transmitter is still operating, but something is not correct. Possible causes of this condition include, but are not limited to, an out-of-range sensor, a fixed loop, or an open sensor condition. In the case of a Sensor 2 failure with Hot Backup enabled, the *Process Variable* line displays “WARN,” and the *Process Variable Unit* line alternates between “SNSR 2” and “RANGE.”

The device sometimes requires further interrogation to determine the source of the warning. Contact Rosemount Customer Central at (800) 999-9307 for technical support.

Transmitter Improvements

OVERVIEW

This appendix describes the additional features available in the improved Model 3144 and 3244MV transmitters. Both the field device and the software revision numbers have been changed. To determine which Model 3144 or 3244MV transmitter version you have, first establish communications with the Model 275 HART Communicator. Select *1 Device Setup*, then *5 Review*. Scroll through the information until you find the Field Device Revision screen and the Software Revision screen. Compare the revisions named in the Model 275 HART Communicator to those below.

REVISION DIFFERENCES SUMMARY

TABLE A-1. Model 3144 and 3244MV Transmitter Revision Differences.

Improved Model 3144 and 3244MV	Previous Model 3144 and 3244MV
Field Device Revision number 2	Field Device Revision number 1
Software Revision number 1	Software Revision number 4
Added sensor input types: Pt 1000 $\alpha = 0.00385$ and Pt 100 $\alpha = 0.003916$	NA
Platinum $\alpha = 0.00385$ RTD curves reference the ITS-90 standard (IEC 751, 1995)	Platinum $\alpha = 0.00385$ RTD curves reference the IPTS-68 standard (IEC 751, 1983, 1986)
Analog output and alarm levels can be ordered to be NAMUR-compliant with option codes A1 and CN	NA
EMF compensation is performed on 3-wire and 4-wire sensors to improve measurement accuracy	NA
Average Temperature is available as a device variable	NA
Drift Alert feature is available	NA
Active Calibrator Mode is available for use when certain calibration equipment is used that requires steady current to function properly	Both RTD Current and T/C Pulsing Mode are available, providing the same functionality that the single Calibrator Mode command provides
The intermittent sensor detect algorithm can be turned on or off, and the output response threshold can be adjusted via HART	The intermittent sensor algorithm is always on and the output response threshold is always 2% of output range
The CJC Calibration Value command is no longer valid	CJC Calibration Value command is utilized when the electronics are replaced in the field

See page B-1 for instructions on determining whether or not your HART communicator contains the appropriate device descriptor for communicating with the improved transmitter.

Model 275 HART Communicator

OVERVIEW

This appendix describes the Model 275 HART Communicator keypad, connections, menu structure, and fast-key sequence features, and it provides an introduction to using the communicator in connection with the Model 3144 and 3244MV transmitters.

The Model 275 HART Communicator Product Manual (Rosemount publication no. 00809-0100-4275) provides more detailed instructions on the use and features of the Model 275. The brief summary of information contained in this appendix will familiarize you with the communicator but is not meant to replace the actual product manual.

NOTE

You may need to upgrade the software in your Model 275 HART Communicator in order to take advantage of the additional features of the improved transmitters (field device revision 2). To determine whether or not you need to upgrade, turn on your communicator, select *4 Utility*, then *5 Simulation*. Choose “Rosemount” from the list of manufacturers and “3244 Temp” (“3144 Temp” if applicable) from the list of models. If the **Fld Dev Rev** choices include “Dev v2, DD v1,” then you do not need to upgrade. If the only choice is “Dev v1” (with any DD version), then you should upgrade your communicator.

If you initiate communication with an improved transmitter using a communicator that has a previous version of the transmitter device descriptors (DDs), the communicator will display the following message:

NOTICE: Upgrade 275 software to access new XMTR functions.
Continue with old description?

If you select **YES**, the communicator will communicate properly with the transmitter using the existing transmitter DDs. However, software features added since the revision of the DDs in the communicator will not be accessible. If you select **NO**, the communicator will default to a generic transmitter functionality.

If you select **YES** when the transmitter is already configured to utilize the new features of the improved transmitters, such as Sensor Average or one of the added sensor input types (Pt 100 $\alpha = 0.003916$ or Pt 1000 $\alpha = 0.00385$), you will experience trouble communicating with the transmitter. You will be prompted to turn the communicator off. To keep this from happening, either upgrade your communicator to the latest DD or answer **NO** to the question above and default to the generic transmitter functionality.

To see a list of enhancements included in the improved transmitters, see “Revision Differences Summary” on page A-1.

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠ WARNING
<p>Explosions could result in death or serious injury.</p> <ul style="list-style-type: none">• Do not make connections to the serial port or NiCad recharger jack in an explosive atmosphere.• Before connecting a HART communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

MODEL 3144 AND 3244MV MENU TREES

Figure B-1 displays a complete menu tree for use with the Model 275 HART Communicator. Options listed in bold type indicate that a selection provides other options. For ease of operation, changing calibration and setup such as sensor type, number of wires, and range values can be completed in several locations. Refer to Table A-1 on page A-3 for an alphabetical listing of Model 275 HART Communicator functions and their corresponding fast-key sequences.

Figure B-1. HART Communicator Menu Tree for the Model 3144 and 3244MV.

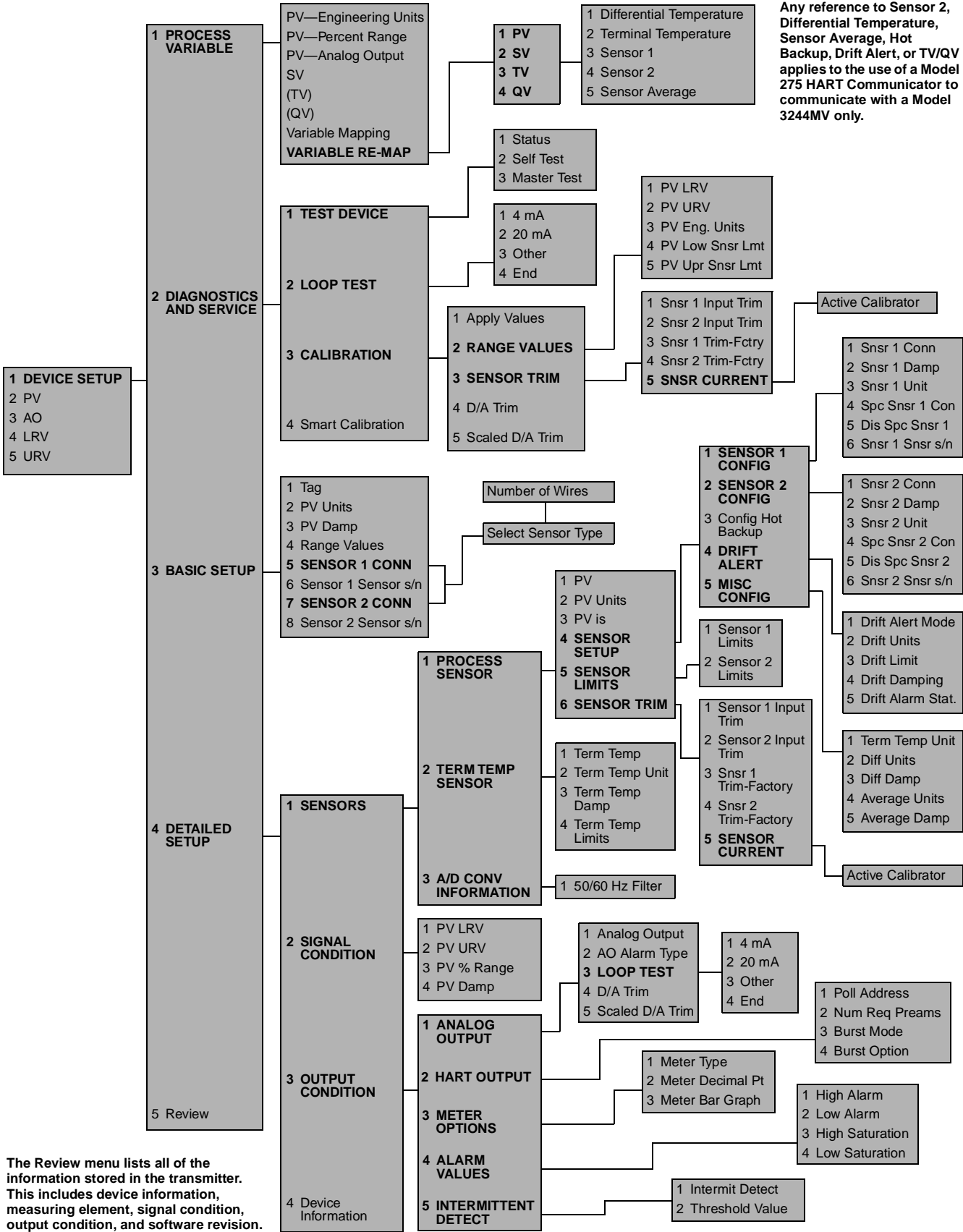



TABLE B-1. HART fast-key Sequences for the Model 3144 and 3244MV Transmitters.

Function	HART Communicator Fast Keys
Active Calibrator	1, 2, 3, 3, 5, 1
Alarm Values	1, 4, 3, 4
Analog Output	1, 4, 3, 1, 1
AO Alarm Type	1, 4, 3, 1, 2
Apply Values	1, 2, 3, 1
Basic Setup	1, 3
Burst Mode	1, 4, 3, 2, 3
Burst Option	1, 4, 3, 2, 4
Calibration	1, 2, 3
Configure <i>Hot Backup</i> (3244MV)	1, 4, 1, 1, 4, 3
D/A Trim	1, 4, 3, 1, 4
Damping Values	1, 3, 3
Date	1, 4, 4
Descriptor	1, 4, 4
Detailed Setup	1, 4
Device Info	1, 4, 4
Diagnostics and Service	1, 2
Drift Alert (3244MV)	1, 4, 1, 1, 4, 4
Filter 50/60 Hz	1, 4, 1, 3, 1
Hardware Rev	1, 5
Hart Output	1, 4, 3, 2
Loop Test	1, 2, 2
LRV (Lower Range Value)	1, 2, 3, 2, 1
LSL (Lower Sensor Limit)	1, 2, 3, 2, 4
Message	1, 4, 4
Meter Options	1, 4, 3, 3
Num Req Preams	1, 4, 3, 2, 2
Output Conditioning	1, 4, 3
Percent Range	1, 1, 2
Poll Address	1, 4, 3, 2, 1
Process Temperature	1, 1

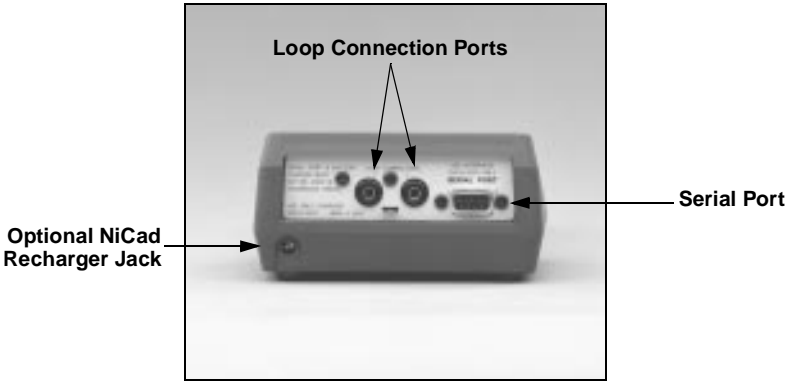
Function	HART Communicator Fast Keys
Process Variables	1, 1
PV Unit	1, 3, 2
Range Values	1, 3, 4
Review	1, 5
Sensor Current	1, 2, 3, 3, 5
Scaled D/A Trim	1, 4, 3, 1, 5
Secondary Variable	1, 1, 4
Sensor 1 Configuration	1, 4, 1, 1, 4, 1
Sensor 2 Configuration (3244MV)	1, 4, 1, 1, 4, 2
Sensor 1 Connection	1, 3, 5
Sensor 2 Connection (3244MV)	1, 3, 7
Sensor Limits	1, 4, 1, 1, 5
Sensor 1 Serial Number	1, 3, 6
Sensor 2 Serial Number (3244MV)	1, 3, 8
Sensor Setup	1, 4, 1, 1, 4
Sensor Trim	1, 2, 3, 3
Sensor Type	1, 3, 5
Signal Conditioning	1, 4, 2
Software Revision	1, 5
Special Constants	1, 4, 1, 1, 4, 1, 4
Special Sensor	1, 4, 1, 1, 4, 1, 4
Status	1, 2, 1, 1
Tag	1, 3, 1
Terminal Temperature	1, 4, 1, 2
Test Device	1, 2, 1
URV (Upper Range Value)	1, 2, 3, 2, 2
USL (Upper Sensor Limit)	1, 2, 3, 2, 5
Variable Remap (3144)	1, 1, 6
Variable Remap (3244MV)	1, 1, 8
Wires	1, 3, 5

CONNECTIONS AND HARDWARE

 The Model 275 HART Communicator can interface with a transmitter from the control room, the instrument site, or any wiring termination point in the loop through the rear connection panel as shown in Figure B-2. To communicate, connect the communicator in parallel with the instrument or load resistor. The connections are non-polarized. Do not make connections to the serial port or NiCad recharger jack in an explosive atmosphere. Before connecting the communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

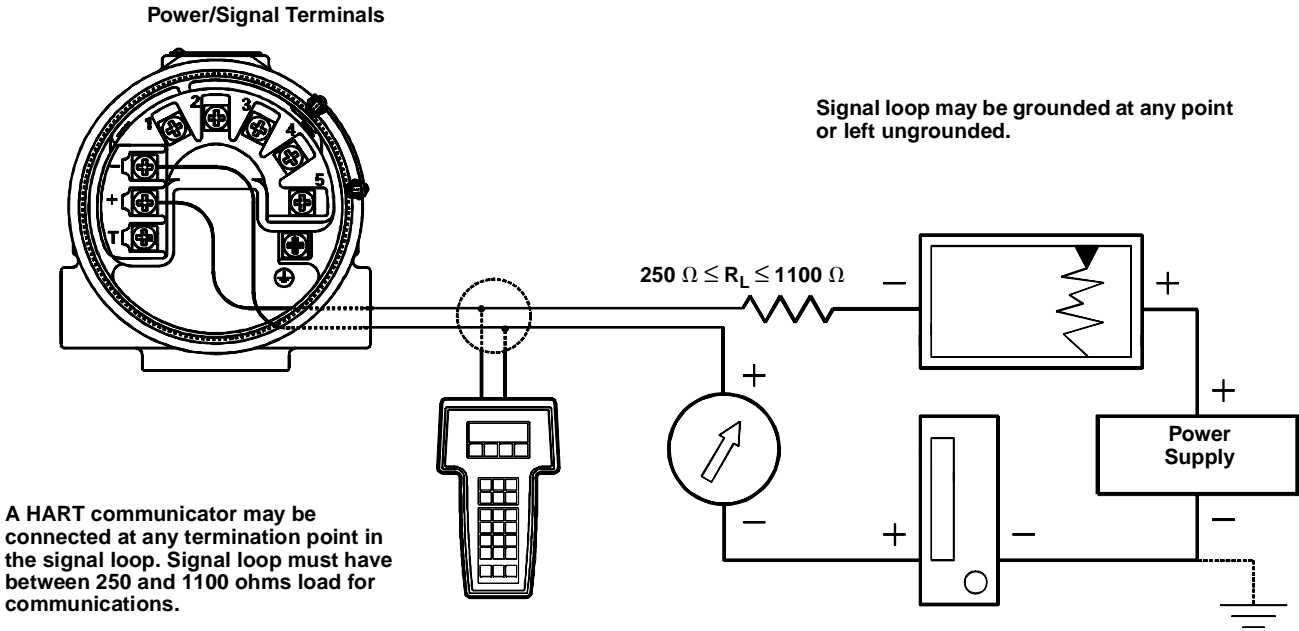
 See "Safety Messages" on page B-2 for complete warning information.

Figure B-2. Rear Connection Panel with Optional NiCad Recharger Jack.



275-008AB

Figure B-3. Connecting the Model 275 to a Transmitter Loop.



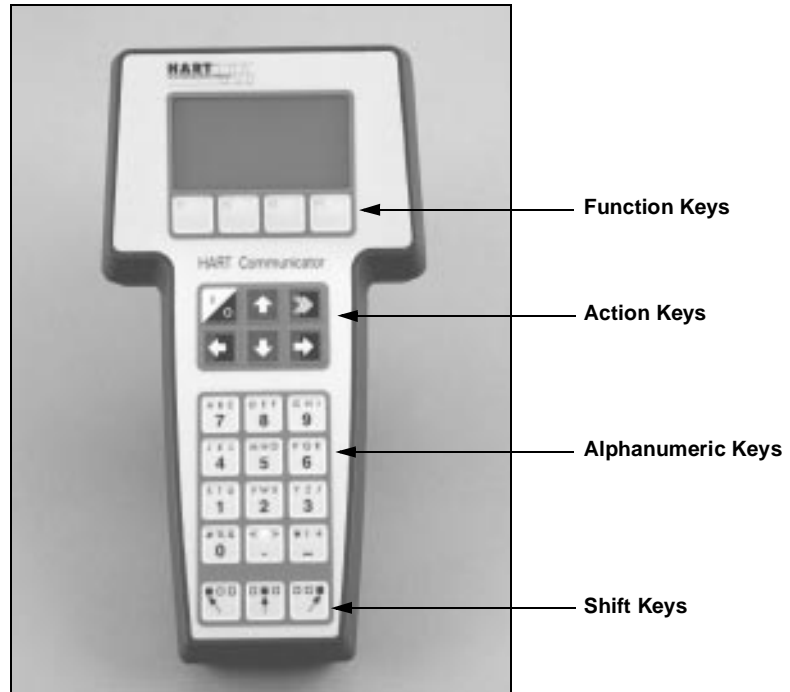
A HART communicator may be connected at any termination point in the signal loop. Signal loop must have between 250 and 1100 ohms load for communications.

3144-0200H01A, 268-1151F05C

COMMUNICATOR KEYS

The keys of the Model 275 HART Communicator include action, function, alphanumeric, and shift keys.

Figure B-4. The Model 275 HART Communicator.



275-011AB

Action Keys

As shown in Figure B-4, the action keys are the six blue, white, and black keys located above the alphanumeric keys. The function of each key is described as follows:

ON/OFF Key

Use this key to power the communicator. When the communicator is turned on, it searches for a transmitter on the 4–20 mA loop. If a device is not found, the communicator displays the message, “No Device Found. Press OK.”

If a HART-compatible device is found, the communicator displays the Online Menu with device ID and tag.

Directional Keys

Use these keys to move the cursor up, down, left, or right. The right arrow key also selects menu options, and the left arrow key returns to the previous menu.

Hot Key

Use this key to quickly access important, user-selectable options when connected to a HART-compatible device. Pressing the Hot key turns the communicator on and displays the Hot Key Menu. See “Customizing the Hot Key Menu” in the Model 275 HART Communicator Product Manual (Rosemount publication no. 00809-0100-4275) for more information.

Function Keys

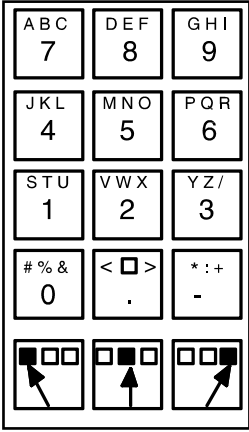


Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys. For example, in menus providing access to on-line help, the **HELP** label may appear above the F1 key. In menus providing access to the Online Menu, the **HOME** label may appear above the F3 key. Simply press the key to activate the function. See the Model 275 HART Communicator Product Manual (Rosemount publication no. 00809-0100-4275) for details on specific function key definitions.

Alphanumeric and Shift Keys

The alphanumeric keys (Figure B-4) perform two functions: the fast selection of menu options and data entry.

Figure B-5. Model 275 HART Communicator Alphanumeric and Shift Keys.



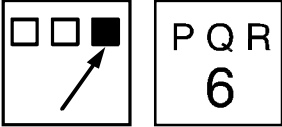
275-0383A

Data Entry

Some menus require data entry. Use the alphanumeric and shift keys to enter all alphanumeric information into the communicator. If you press an alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (—).

To enter an alphabetic character, first press the shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter R, first press the right shift key, then the “6” key (see Figure B-6). Do not press these keys simultaneously, but one after the other.

Figure B-6. Data Entry Key Sequence.



Fast-Key Sequences

HART fast-key sequences provide quick on-line access to transmitter variables and functions. Instead of stepping your way through the menu structure using the action keys, you can press a HART fast-key sequence to move from the Online menu to the desired variable or function. On-screen instructions guide you through the rest of the screens.

Fast-Key Sequence Conventions

The fast-key sequences for the Model 275 use the following conventions for their identification:

1 through 9—Refer to the keys located directly below the dedicated keypad.

Left Arrow—Refers to the left arrow directional key.

Fast-Key Sequence Example

HART fast-key sequences are made up of the series of numbers corresponding to the individual options in each step of the menu structure. For example, from the Online menu you can change the date. Following the menu structure, press *1 Device Setup*, press *4 Detailed Setup*, press *4 Device Info*, press *1 Date*. The corresponding HART fast-key sequence is 1, 4, 4, 1.

HART fast-keys are operational only from the Online menu. If you use them consistently, you will need to return to the Online menu by pressing **HOME** (F3) when it is available. If you do not start at the Online menu, the HART fast-key sequences will not function properly.

Use Table B-1 on page B-4, an alphabetical listing of every on-line function, to find the corresponding HART fast-key sequences. These codes are applicable only to Models 3144 and 3244MV transmitters and the Model 275 HART Communicator.

MENUS AND FUNCTIONS

The communicator uses a menu driven system. Each screen provides a menu of options that can be selected as outlined above, or provides direction for input of data, warnings, messages, or other instructions.

Main Menu

When the communicator is turned on, one of two menus will appear. If the communicator is connected to an operating loop, then the communicator will find the device and display the Online menu (see below). If it is not connected to a loop, the communicator will indicate that no device was found. When you press OK (F4), it will display the Main menu.

The Main menu provides the following options:

- *Offline*—The Offline option provides access to offline configuration data and simulation functions.
- *Online*—The Online option checks for a device and if it finds one, brings up the Online menu.
- *Transfer*—The Transfer option provides access to options for transferring data either from the communicator (memory) to the transmitter (device) or vice versa. Transfer is used to move off-line data from the communicator to the transmitter, or to retrieve data from a transmitter for off-line revision.

NOTE

Online communication with the transmitter automatically loads the current transmitter data to the communicator. Changes in on-line data are made active by pressing SEND (F2). The transfer function is used only for off-line data retrieval and sending.

- *Frequency Device*—The Frequency Device option displays the frequency output and corresponding pressure output of current-to-pressure transmitters.
- *Utility*—The Utility option provides access to the contrast control for the communicator LCD screen and to the autopoll setting used in multidrop applications.

Once selecting a Main menu option, the communicator provides the information you need to complete the operation. If further details are required, consult the Model 275 HART Communicator Product Manual (Rosemount publication no. 00809-0100-4275).

Online Menu

The Online menu can be selected from the Main menu as outlined above, or it may appear automatically if the communicator is connected to an active loop and can detect an operating transmitter.

NOTE

The Main menu can be accessed from the Online menu. Press the left arrow action key to deactivate the on-line communication with the transmitter and to activate the Main menu options.

When configuration variables are reset in the on-line mode, the new settings are not activated until the data are sent to the transmitter. Press SEND (F2) when it is activated to update the process variables of the transmitter.

On-line mode is used for direct evaluation of a particular meter, re-configuration, changing parameters, maintenance, and other functions.

Diagnostic Messages

The following is a list of messages used by the Model 275 HART Communicator 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]*.

Message	Description
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	Either a device sends back a response indicating that the message it received was unintelligible, or the HC cannot understand the response from the device.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.

Message	Description
Device busy	The connected device is busy performing another task.
Device disconnected	Device fails to respond to a command.
Device write protected	Device is in write-protect mode. Data can not be written.
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the HC 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	Prompts user to press SEND softkey to initiate a memory to device transfer.
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?	Asked after displaying device status. Softkey answer determines whether next 50 occurrences of device status will be ignored or displayed.
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.
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.
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.
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 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 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.
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.

Message	Description
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.
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.
There are write only variables which have not been edited. Please edit them	There are write-only variables that 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.
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.

Model 268 SMART FAMILY Interface

OVERVIEW

The Rosemount Model 268 SMART FAMILY Interface provides a common communications link to the Rosemount family of microprocessor-based instruments. The Model 268 communicates with any of the Rosemount smart instruments from any wiring termination point in the loop, provided there is between 250 and 1100 ohms resistance between the connection and the power supply.

This section introduces the Model 268 display, keypad, menu structure and Function Key Sequences for the transmitter and Model 268.

The Model 268 Revisions 5.0 through 6.2 can communicate with the Model 3144 and 3244MV with limited functionality. The transmitter information is read-only except for reranging the 4–20 mA signal.

The Model 268 revision 7.0 communicates with the Model 3144 and 3244MV and has the ability to perform such tasks as changing sensor type and number of wires. However, dual sensor and sensor matching features are not available using any revision of the Model 268. The Model 275 HART Communicator is the necessary interface for complete functionality, and is recommended.

Contact a Rosemount Service Center to upgrade the revision level of a Model 268.

SAFETY MESSAGES

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

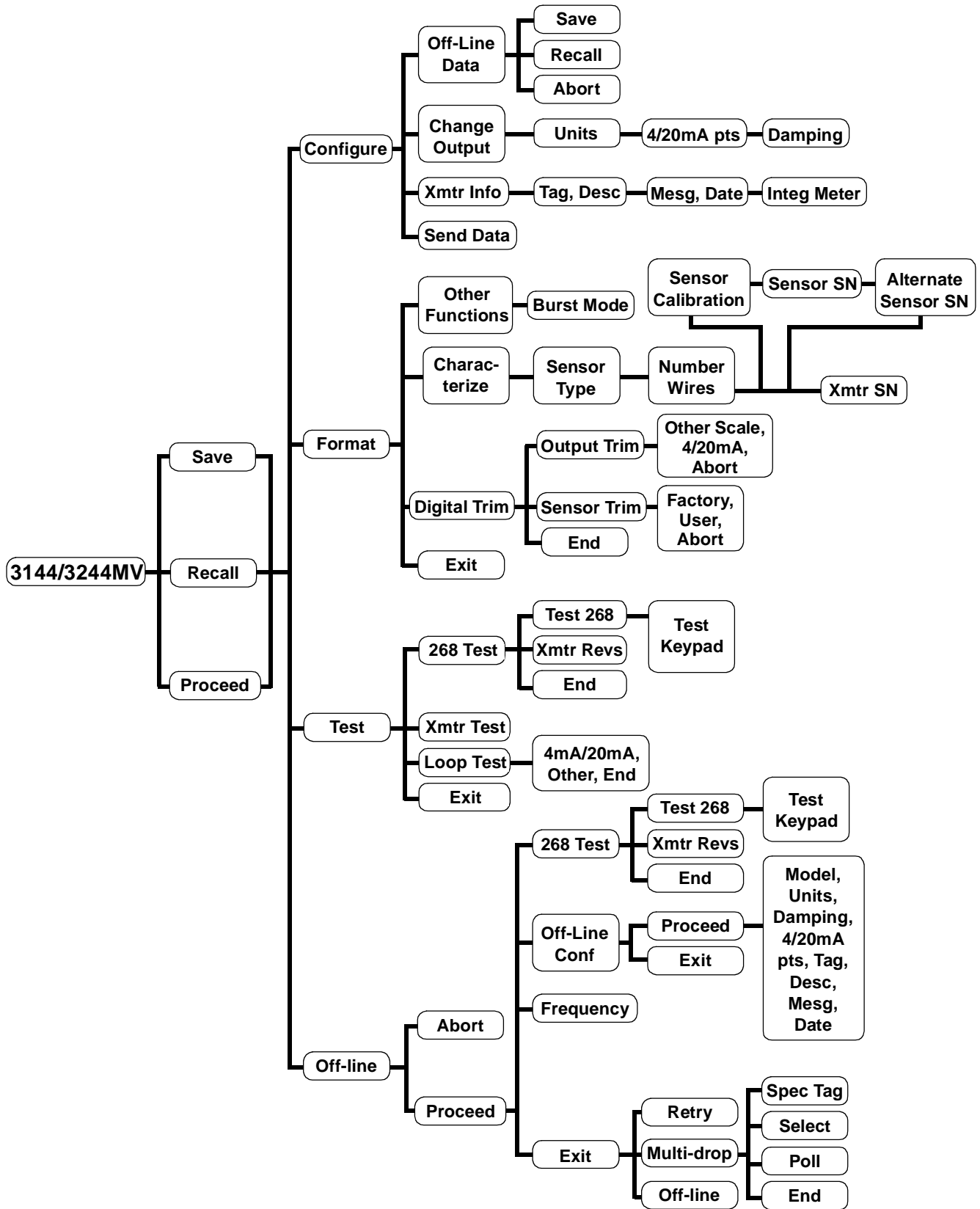
Warnings

WARNING

Explosions could result in death or serious injury.

- Before connecting the communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

Figure C-1. Model 268 Menu Tree for the Models 3144 and 3244MV.



CONNECTIONS AND HARDWARE


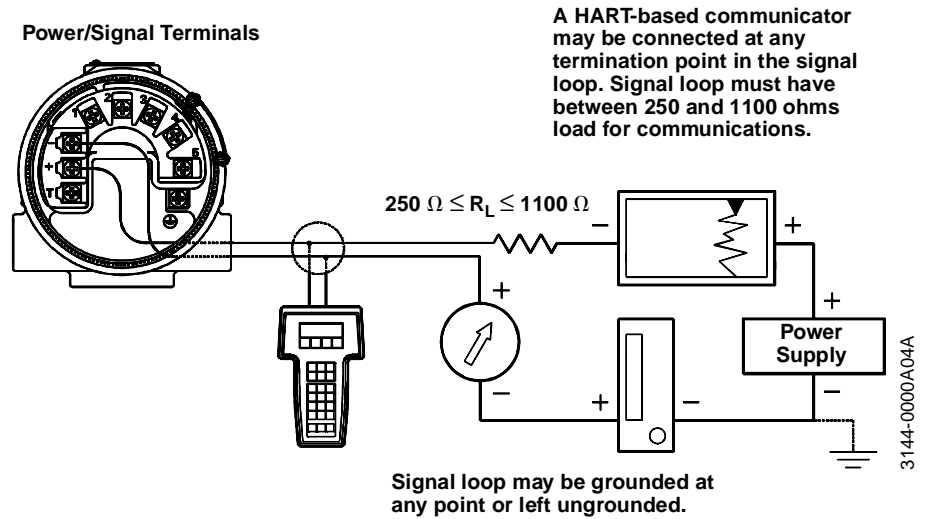
 The Model 268 can communicate with a transmitter from the control room, the transmitter site, or any other wiring termination point in the loop. To communicate, it must be connected in parallel with the transmitter; the connections are non-polarized.

Figure C-2. Connecting the Model 268 to a Transmitter Loop.



BASIC FEATURES

The basic features of the Model 268 include the Alphanumeric Keys, Dedicated Keys, and Function Keys. The dedicated key functions are always the same; the functions of the function keys vary depending on the task being performed.

Dedicated Keys

On/Off

Use this key to turn the unit on and off. When you first turn on the Model 268 it searches for a smart transmitter in the 4–20 mA loop. If it does not find a smart transmitter, the Model 268 offers the opportunity to try again. To do so, select “MULT DROP” or “OFF-LINE.”

Process Variable

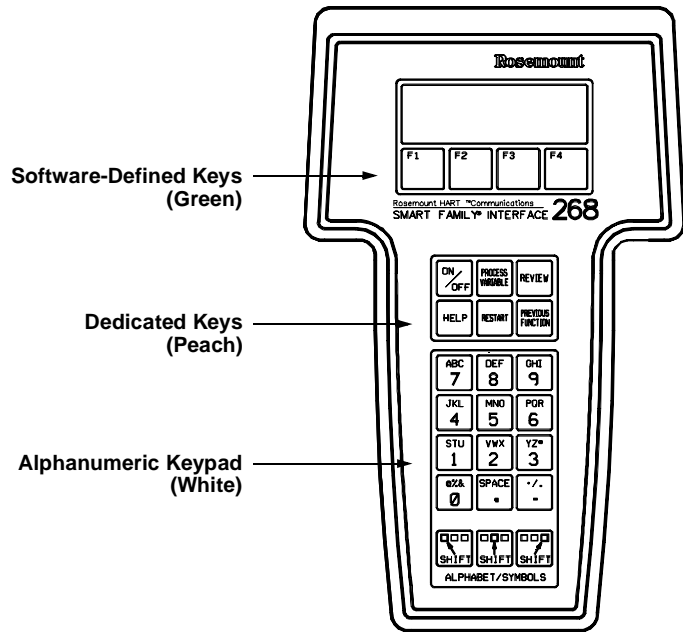
Use the Process Variable key to display up-to-date process variable readings from the transmitter in engineering units, milliamps, pulse rate, and shedding rate. It also displays totalized flow.

Review

The Review key allows you to step through all the information currently held in the four memory locations of the transmitter and Model 268—SAFE MEM, OFLN MEM, WORK REG, and XMTR MEM.

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

Figure C-3. Model 268 Keypad.



268-2681A01C

Help

Use the Help key to explain the software-defined key functions (F1–F4) in detail.

Restart

Use the Restart key to initiate communication with a smart transmitter while the Model 268 is still turned on. Upon connection to a new transmitter, pressing this key loads information from the new transmitter into the Model 268 Working Register.

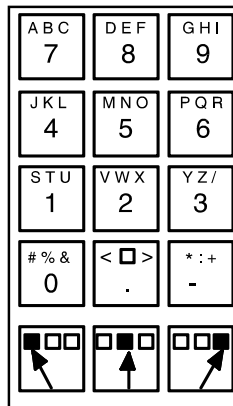
Previous Function

The Previous Function key returns you to the previous decision level and allows you to select a different software-defined key function.

Alphanumeric and Shift Keys

Some menus require data entry. Use the Alphanumeric and Shift keys to enter all alphanumeric information into the Model 268.

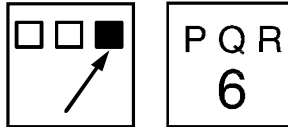
Figure C-4. HART Communicator Alphanumeric and Shift Keys.



If you press an Alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These characters include the numbers zero through nine, the decimal point (.), and the dash symbol (-).

To enter an alphabetic character, first press the Shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter R, first press the right Shift key, then the “6” key (see Figure B-3). Do not press the keys simultaneously; press them one after the other.

Figure C-5. Data Entry Key Sequence.



Function Keys

Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys.

Function Key Sequences

The Model 268 Function Key feature provides quick on-line access to transmitter variables and functions. Instead of stepping your way through the menu structure, you can press a Function Key sequence to move from the Home Menu to the desired variable or function. On-screen instructions guide you through the rest of the screens.

Function Key Sequence Conventions

The Function Key Sequences for the Model 268 use the following conventions for their identification:

- **F1, F2, F3, F4**—Refer to each function key located directly below the LCD on the Model 268.
- **F2(x7)**—Means to push the F2 key 7 consecutive times. Likewise, F3(x5) would mean to push the F3 key 5 consecutive times.
- **(F1)**—The function key symbol enclosed in parentheses means that you may have to press that key one or more times to bring up the proper screen. After finishing the preceding sequence, you may have to press the F1 key to bring up the desired function.

The Function Key Sequences are applicable only from the Home Screen. The Home Screen lists the Model and Tag, and labels the four function keys Offline, Test, Configure and Format. After completing a task, return to the Home Menu if you intend to use the Function Key Sequences. Function Key Sequences **will not work** from any other Model 268 screen.

To return to the Home Menu, use the Function Keys to Exit the current task and press PREVIOUS FUNCTION as many times as necessary. When the Home Menu appears, you can use another Function Key Sequence to reach a desired task.

NOTE

Certain tasks require that you set the control loop to manual control before completing them. One of the Function Key Sequence steps often includes the warning to return the loop to manual. If the loop is not in manual control, be sure to watch for this screen. If it comes up during the Function Key sequence, set the loop to manual before continuing with the task.

Function Key Sequence Examples

Date

To change the Date following the Menu Structure, start at the Home Menu and press F3 for **Configure**, F3 for **Xmtr Info**, and F1 three times in a row to reach the Date function. The Function Key Sequence is F3, F3, F1(×3).

Loop Test

To perform the Loop Test, start at the Home Menu and press F2 for **Test**, F3 for **Loop Test**, and F4 for **Proceed** (after the loop is set to manual). The Function Key Sequence is F2, F3, F4.

Diagnostics Messages

The following provides a guide to Model 268 HART Communicator diagnostic messages.

Message	Description
CAUTION–Progressing will clear OfIn Mem	OFLN Memory is cleared for new information.
Data saved in OFLN Mem for downloading	Off-line configuration data are saved in the Off-line Memory and can be downloaded or sent to the transmitter at an appropriate time.
Different XMTR type connected–XMTR Mem not changed	Transmitter did not accept data sent because the data is meant for a different type of transmitter.
End of List	Marks the end of a list of diagnostic messages.
ERR–Hard/software is not compatible	Transmitter cannot interpret Model 268 message. Perform a transmitter test. If OK, make note of conditions and keystrokes leading to failure, and contact Rosemount Service Center.
ERR–Not in output mode	Transmitter must be in output mode to complete this operation.
ERR–Not xmtr command	Transmitter does not understand the command sent by the Model 268. Press F4, RESTART to restart the transmitter, or press F3 to suppress the error message and REVIEW the software revision level. You may need to contact the Rosemount Service Center.
ERR–Out of range	The value chosen is outside the sensor range limits. Enter an acceptable value.
ERR–PV out of limits	The transmitter is in a high flow rate condition or has experienced a sensor failure.
ERR–Update failure	The Model 268 has missed several communications from the transmitter. Check for noise on the loop and adjust filters. If no noise is present, test the Model 268 and the transmitter.
ERR–Value was too hi	Enter an acceptable value.
ERR–Value was too lo	Enter an acceptable value.
ERR–Xmtr fault support command	Model 268 is detecting a possible problem with the transmitter. Perform the transmitter self-test and use the diagnostic messages to locate the problem.
ERR–Xmtr will not support command	The transmitter does not understand the Model 268 command. Press F4, RESTART or press F3, REVIEW to review the software revision level of the transmitter. Check compatibility.
ERR–268 Data err	Transmitter cannot interpret Model 268 inquiry. Perform a transmitter test. If OK, make note of conditions and keystrokes leading to failure, and contact Rosemount Service Center.

Message	Description
Errors Detected–XMTR Mem not changed	Transmitter did not accept data because it contained non-permissible values. Data errors must be corrected and the data sent again.
FAILURE–Electronics	The transmitter electronics has experienced a component or software failure. Contact Field Service Center.
Gen failure–No. 1	Transmitter has given improper response to Model 268. Perform a transmitter test. If OK, make note of conditions and keystrokes leading to failure, and contact Rosemount Service Center.
Making changes permanent–PLEASE WAIT	Data is being sent to transmitter and transmitter is accepting the data.
No data modified to send	Data with no changes is being sent. Press F4 to continue.
No data saved in OFLN Mem	There are no data in the Off-line Memory to review.
No data saved in SAFE Mem	There are no data in the Safe Memory to review.
Ofln Mem not compatible with WORK REGS–Data not transferred	The data stored in Off-line Memory and Working Register are from different kinds of transmitters, or the Off-line Memory is empty. Press F4, REVIEW, F2 to see the data in Off-line Memory and connect the Model 268 to similar transmitter.
SAFE Mem from diff Xmtr than WORK REGS–Data not transferred	Data in the Safe Memory and Working Register are from different transmitters. Press F4, REVIEW, F1 and find the transmitter serial number. Connect the Model 268 to the transmitter with that serial number and press RESTART.
SAFE Mem not compatible with WORK REGS–Data not transferred	The unique identifier in the Safe Memory and the transmitter are different. Press F4, REVIEW, F1 to see the data in the Safe Memory. Connect the Model 268 to the matching transmitter and press RESTART.
WARN–Used nearest legal table value	The value entered has too many decimal places. The Model 8800 defaults to the closest value available.
WARN–Value at limit reverse direction	The entered value is beyond the upper or lower limit. Adjust to a value within the limits.
WARN–Value entered is illegal, re-enter	The Model 268 will not accept the entered value. Enter an acceptable value (see relevant section in manual).
WARN–Value out of limits, altered by 268, re-check data	The Model 268 could not store the entered value so it changed to the maximum allowable value. Check the new value.
WARNING–Analog output outside range points	Process variable information is outside the 4–20 mA range points. Rerange the transmitter.
WARNING–Control loop should be in manual	Before sending the data that could affect the 4–20 mA output signal, set the loop to manual control. After it is set, press F4.
WARNING–Data transmission error	Previous communication between Model 268 and the transmitter was not successful. If this message appears repeatedly, check the loop for a source of noise that could corrupt the signal.
WARNING–Loop may be returned to auto	After completing a communication that required the loop to be set in manual, you may return the loop to automatic control.
WARNING–Match xmtr S/N to nameplate S/N	Check to be sure that the entered transmitter serial number is the same as that on the transmitter nameplate.
WARNING–Not on line	The key you have pressed is not applicable for off-line configuration tasks.
WARNING–Process has been aborted	Indicates that the self-test has been aborted by pressing any key.
WARNING–PV out of range	Process variable information of the transmitter exceeds sensor limits. Check flow rate. If it is too high, correct the flow. If not, the sensor has a malfunction and needs to be replaced.
WARNING–Some of the changes were not saved in the xmtr mem	Transmitter did not receive all configuration changes. Note differences in configuration data and reconfigure the transmitter accordingly.

Rosemount Models 3144 and 3244MV Smart Temperature Transmitters

Message	Description
WARNING—This address already being used	Another transmitter is already using the entered multi-drop address. Enter a new address.
WARNING—This will erase work reg	Data in the Working Register will be replaced with data from another location.
WARNING—Xmtr/268 not in communication	Model 268 did not get answer from transmitter: <ul style="list-style-type: none"> • Check connections • Check that power is reaching transmitter • Check for minimum 250 ohms resistance in loop
WARNING—Xmtr in output mode	During start-up and restart, the transmitter milliamp output does not reflect the process variable. Press F4.
WARNING—Xmtr is not communicating	Model 268 did not get answer from transmitter: <ul style="list-style-type: none"> • Check connections • Check that power is reaching transmitter • Check for minimum 250 ohms resistance in loop
WARNING—268 does not know this Xmtr	Model 268 recognizes a Rosemount transmitter in the loop but cannot communicate with it. The message usually indicates a software revision level incompatibility between the Model 268 and the transmitter.
XMTR Mem diff than WORK Regs—XMTR not changed	Data in the Working Register and in the transmitter have different unique identifiers. The Model 268 was probably connected to different transmitter without RESTART or power-off/power-on sequence. Press RESTART to erase the Working Register or save the Working Register to the Off-line Memory and download to the proper transmitter at a later time.
Xmtr Security: On—XMTR will not accept changes to Memory	Transmitter lockout security switch is ON and electronics will not accept changes to configuration. Reset switch to remove this message.
Xmtr still busy	Transmitter is running a computational or diagnostic routine and cannot respond to the Model 268 instructions. Press the PREVIOUS FUNCTION key to cancel.
XXXX=YYYY ERR—Illegal value	Unacceptable value entered.
XXXX=YYYY ERR—Out of range	The difference between LRV and URV is greater than the maximum span allowed by the transmitter. Enter a new value.
XXXX=YYYY ERR—Span too small	The difference between LRV and URV is less than the minimum span allowed by the transmitter. Enter a new value.
XXXX=YYYY ERR—Valu was too hi	See instructions for the selected parameter. Enter a new value that is acceptable.
XXXX=YYYY ERR—Valu was too lo	See instructions for the selected parameter. Enter a new value that is acceptable.
XXXX=YYYY ERR—LRV too hi	LRV was set to a value above the URL. Enter a new value.
XXXX=YYYY ERR—LRV too lo	LRV was set to a value above the LRL. Enter a new value.
XXXX=YYYY ERR—LRV & URV out limits	Both the LRV and URV were outside the sensor's range limits. Enter a new value.
XXXX=YYYY ERR—URV too hi	URV was set to a value above the URL. Enter a new value.
XXXX=YYYY ERR—URV too lo	URV was set to a value below the LRL. Enter a new value.
XXXX=YYYY ERR—268 data err	Transmitter cannot interpret a Model 268 inquiry. Make note of conditions and keystrokes leading to failure, and contact Rosemount Service Center.
268 Failure—No. 2	Model 268 has detected bug in its software. Make note of conditions and keystrokes leading to failure, and contact Rosemount Service Center.
268 Test: FAIL	Model 268 is not functioning properly. Turn OFF and contact Rosemount Service Center.

Hazardous Area Approval Installation Drawings

OVERVIEW

This section contains transmitter hazardous location installation drawings. You must follow the installation guidelines presented by these drawings in order to maintain certified ratings for installed transmitters.

This section contains the following drawings:

Rosemount Drawing 03144-0220, 1 Sheet:
Factory Mutual Explosion-proof Installation Drawing.

Rosemount Drawing 03144-0221, 2 Sheets:
Factory Mutual Intrinsic Safety and Nonincendive Field Circuit Configuration Installation Drawing.

Rosemount Drawing 03144-0222, 1 Sheet:
CSA Intrinsic Safety Approval Configuration Installation Drawing.

Rosemount Drawing 03144-0224, 1 Sheet:
ISSEP/CENELEC Flame-proof Temperature Measurement Assembly Installation Drawing.

Rosemount Drawing 03144-0225, 1 Sheet:
SAA Flameproof Temperature Measurement Assembly Installation Drawing.

IMPORTANT

Once a device labeled with multiple approval types is installed, it should not be reinstalled using any of the other labeled approval types. To ensure this, the approval label should be permanently marked to distinguish the used from the unused approval type(s).

Rosemount Model 3144 and 3244MV Smart Temperature Transmitters

Figure D-1. Factory Mutual
Explosion-Proof Installation Drawing
03144-0220, Rev. D.

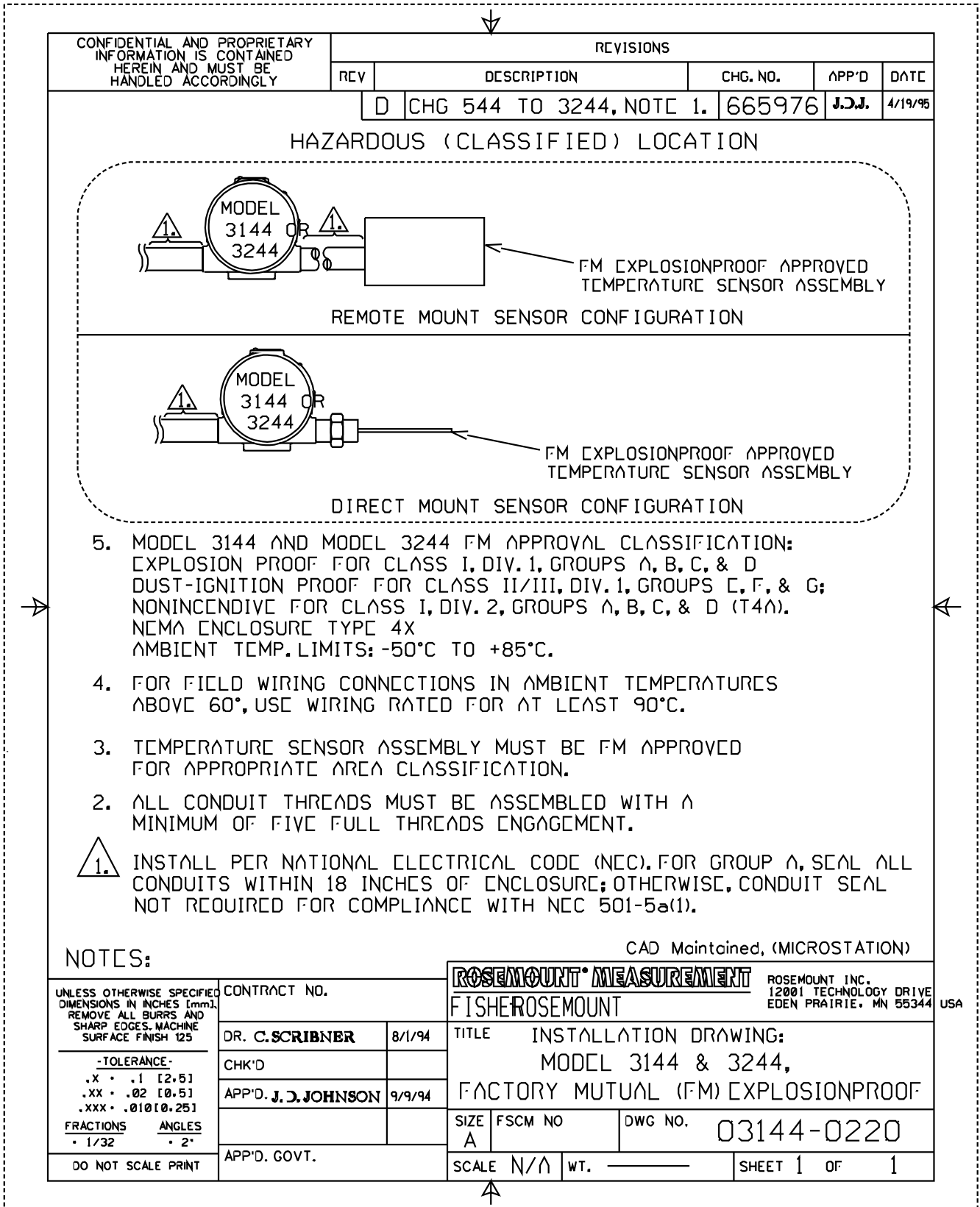


Figure D-2. Factory Mutual Intrinsic Safety and Noncendive Field Circuit Configuration Installation Drawing 03144-0221, Rev. AA.

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS			
	REV	DESCRIPTION	CHG. NO.	APP'D DATE
	AA	ADD FIELDBUS PG'S 3&4	RTC1005145	D.S. 10/13/98

FMRC INTRINSIC SAFETY APPROVAL

THE ROSEMOUNT 3144 & 3244MV TEMPERATURE TRANSMITTERS ARE FMRC APPROVED AS INTRINSICALLY SAFE WHEN INSTALLED PER THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 504 WITH FMRC APPROVED ASSOCIATED APPARATUS WHICH MEET THE ENTITY PARAMETERS INDICATED BELOW.

CLASS I, DIV. 1, GROUPS A, B, C, D; CLASS II, DIV. 1, GROUPS E, F, G; CLASS III, DIV. 1 HAZARDOUS LOCATIONS

POWER / LOOP PARAMETERS (TERMINALS "+", "-", AND "T")	ASSOCIATED APPARATUS PARAMETERS
$V_{MAX} = 30VDC$ $I_{MAX} = 300MA DC$ $P_{MAX} = 1.0W$ $C_I = 0.005\mu F$ $L_I = 20\mu H$	$V_{OC} OR I_V \leq 30V$ $I_{SC} OR V \leq 300MA$ $\frac{V_{OC} * I_{SC}}{4} OR P_{MAX} \leq 1.0W$ $C_A > C_{CABLE} + C_I$ $L_A > L_{CABLE} + L_I$

AMBIENT TEMPERATURE LIMIT: -50°C TO +60°C

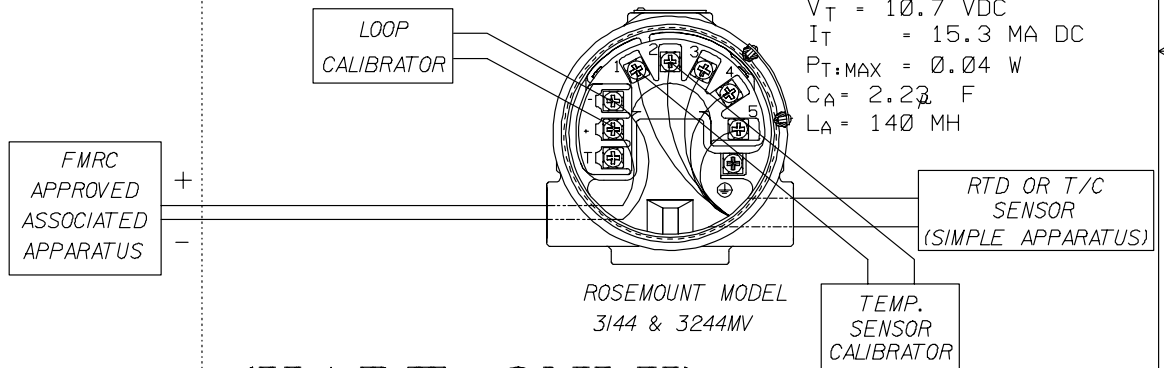
NON-HAZARDOUS AREA

DIVISION 1 OR 2 HAZARDOUS AREA

FMRC INTRINSICALLY SAFE APPROVED LOOP CALIBRATOR CAN BE CONNECTED TO TERMINALS "+", "-", OR "T"

SENSOR TERMINAL PARAMETERS (TERMINALS "1" THRU "5")

$V_T = 10.7 VDC$
 $I_T = 15.3 MA DC$
 $P_{T:MAX} = 0.04 W$
 $C_A = 2.2\mu F$
 $L_A = 140 MH$



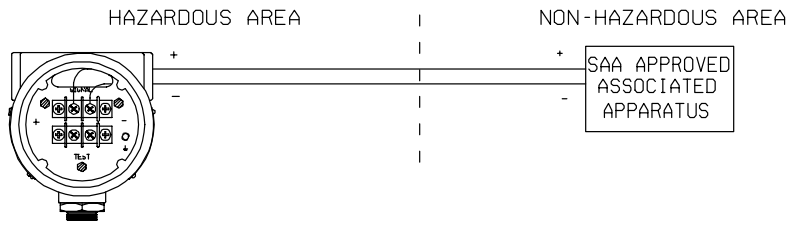
(HART ONLY)

FMRC INTRINSICALLY SAFE APPROVED TEMP. SENSOR CALIBRATOR CAN BE CONNECTED TO TERMINALS "1" - "5".

ANSI/ISA RP12.6 (SIMPLE APPARATUS) DEFINITION:
 A DEVICE THAT WILL NEITHER GENERATE NOR STORE MORE THAN 1.2 VOLTS, 0.1 AMPS, 25 MILLIWATTS, OR 20 MICROJouLES.

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 * .01 [0.25] FRACTIONS ANGLES * 1/32 * 2° DO NOT SCALE PRINT	CONTRACT NO.		ROSEMOUNT MEASUREMENT FISHER-ROSEMOUNT ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA	
	DR. C. SCRIBNER	11/18/94		
	CHK'D		FM I/S & NONINCENDIVE FIELD CIRCUIT CONFIGURATIONS for MODELS 3144 & 3244MV	
	APP'D. J. EHRESMANN	1/25/95	SIZE A	FSCM NO.
APP'D. GOV'T.		SCALE N/A	WT. _____	SHEET 1 OF 4



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

FMRC NONINCENDIVE FIELD CIRCUIT APPROVAL

THE ROSEMOUNT 3144 & 3244MV TEMPERATURE TRANSMITTERS ARE FMRC APPROVED FOR NON-INCENDIVE FIELD CIRCUITS WHEN INSTALLED PER THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 501-4(B) EXCEPTION OR 502-4(B) EXCEPTION WITH FMRC APPROVED NONINCENDIVE FIELD CIRCUIT OUTPUT APPARATUS WHICH MEET THE PARAMETERS INDICATED BELOW.

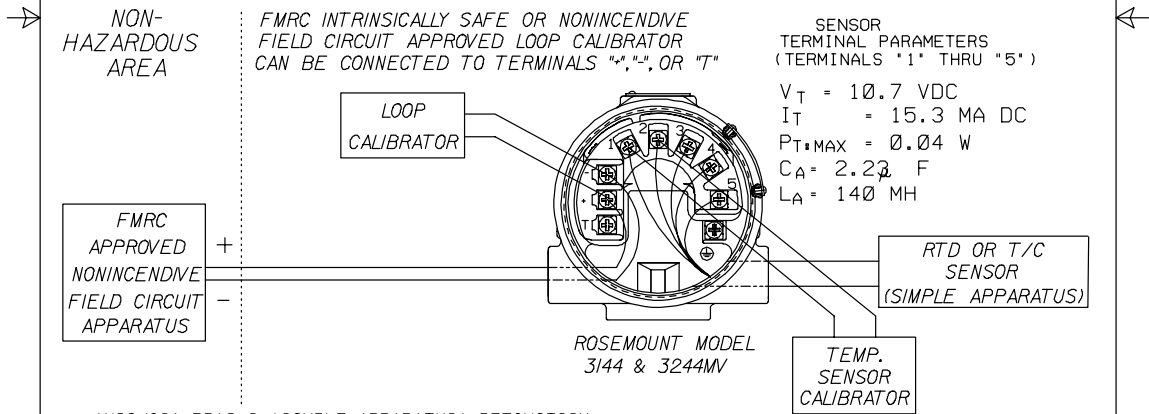
ARTICLE 501-4(B) / 502 4(B) EXCEPTION: WIRING IN NONINCENDIVE CIRCUITS SHALL BE PERMITTED USING ANY OF THE METHODS SUITABLE FOR WIRING IN ORDINARY LOCATIONS.

CLASS I, DIV. 2, GROUPS A, B, C, D; CLASS II, DIV. 2, GROUPS F, G; CLASS III, DIV. 2 HAZARDOUS LOCATIONS

POWER / LOOP PARAMETERS (TERMINALS "1", "2", AND "T")		NONINCENDIVE FIELD CIRCUIT PARAMETERS
V_{MAX}	I_{MAX}	$V_{OC} \text{ OR } V_T \leq V_{MAX}$
30 VDC	135 MA	$I_{SC} \text{ OR } I_T \leq I_{MAX}$
40 VDC	73 MA	
55 VDC	45 MA	$C_A \geq C_{CABLE} + C_L$
$C_I = 0.005 \mu F$		$L_A \geq L_{CABLE} + L_I$
$L_I = 20 \mu H$		

AMBIENT TEMPERATURE LIMIT: -50°C TO +85°C

DIVISION 2 HAZARDOUS AREA



ANSI/ISA RP12.6 (SIMPLE APPARATUS) DEFINITION:
A DEVICE THAT WILL NEITHER GENERATE NOR STORE MORE THAN 1.2 VOLTS, 0.1 AMPS, 25 MILLIWATTS, OR 20 MICROJOULES.

FMRC INTRINSICALLY SAFE OR NONINCENDIVE FIELD CIRCUIT APPROVED TEMP. SENSOR CALIBRATOR CAN BE CONNECTED TO TERMINALS "1" - "5".

ROSEMOUNT INC.
12001 TECHNOLOGY DRIVE
EDEN PRAIRIE, MN 55344 USA

(HART ONLY)

CAD Maintained, (MICROSTATION)

DR. C. SCRIBNER	SIZE A	FSCM NO	DWG NO. 03144-0221
ISSUED	SCALE N/A	WT.	SHEET 2 OF 4

Figure D-3. CSA Intrinsic Safety Approval Configuration Installation
Drawing 03144-0222, Rev. B.

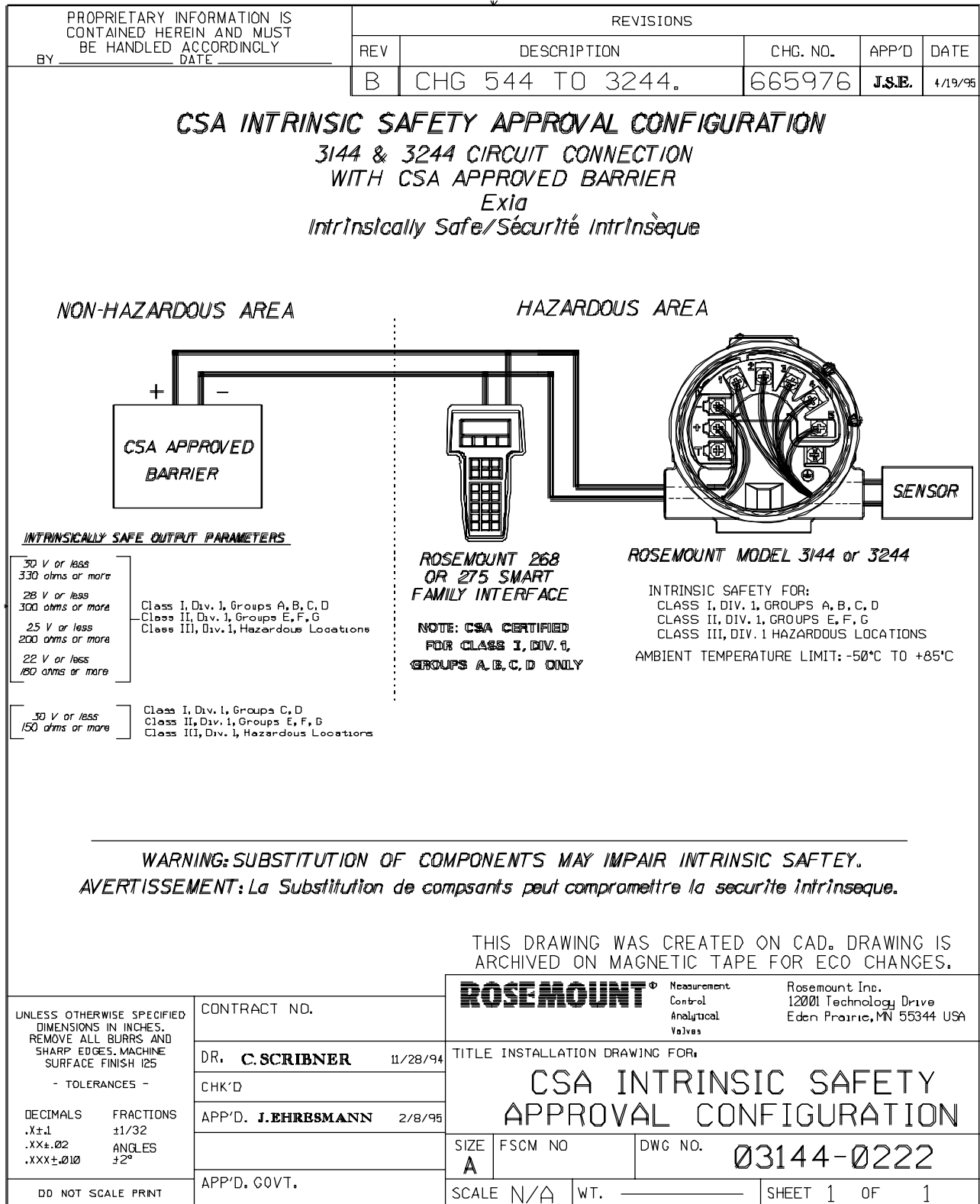


Figure D-4. ISSEP\CENELEC
Flame-Proof Temperature
Measurement Assembly Installation
Drawing 031444-0224, Rev. C.

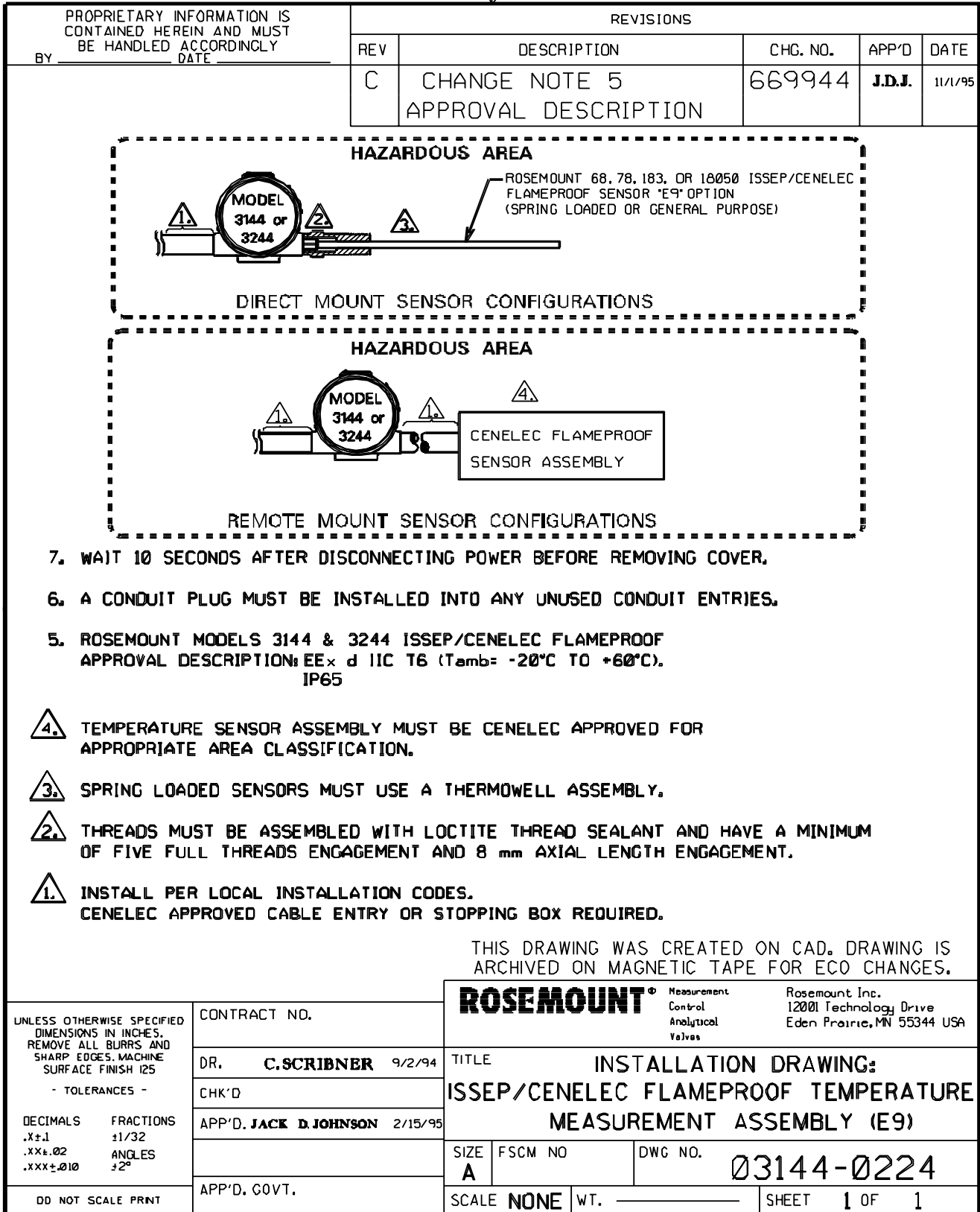
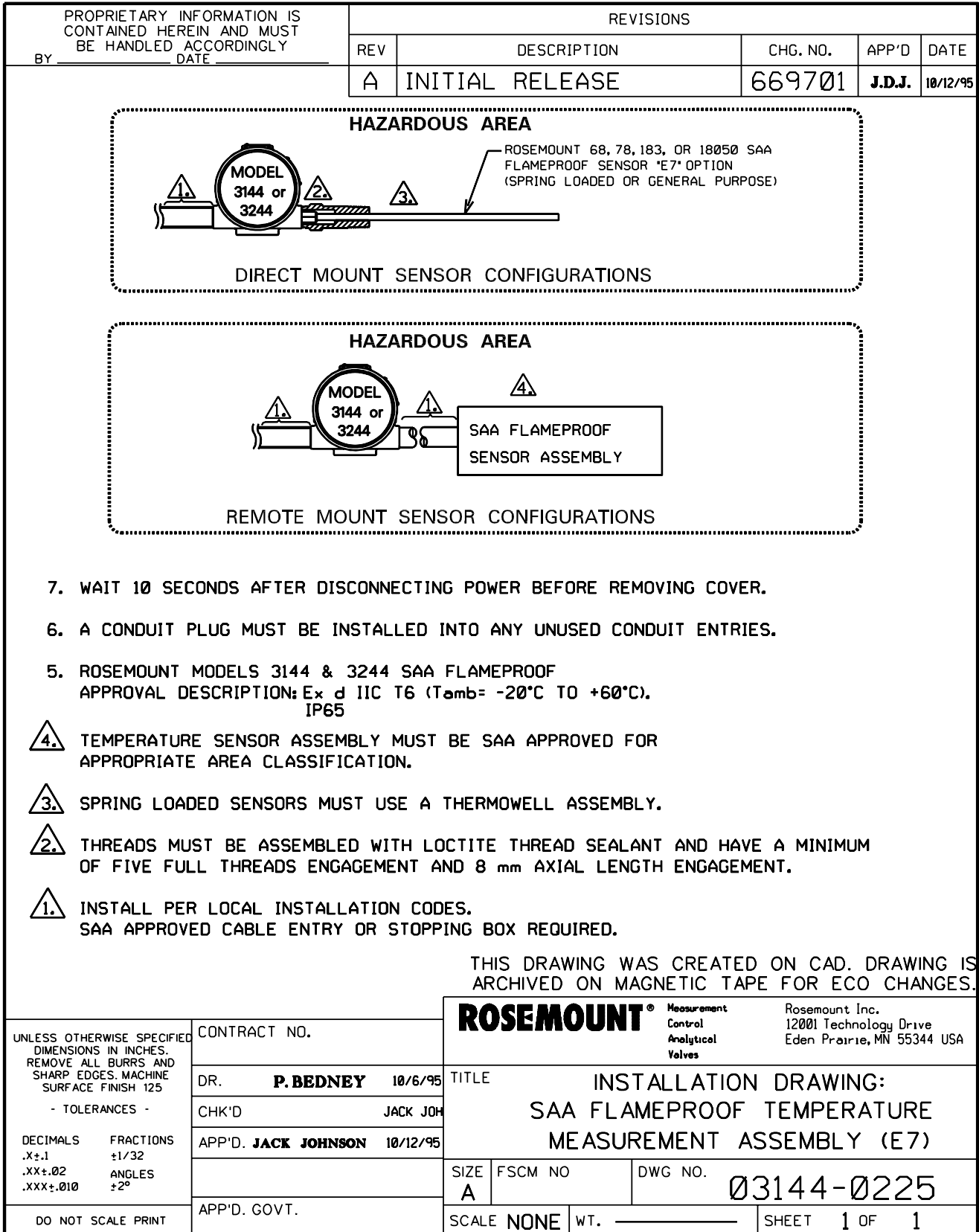


Figure D-5. Standard Australia Quality Assurance Services Flameproof Temperature Measurement Assembly Installation Drawing.





Glossary

OVERVIEW

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

50 or 60 Hz Setting

Hardware- or factory-selectable option to reject line frequency noise present on the sensor leads. It should be set to the frequency of your powerline frequency value.

Burst

Burst mode is an extension to the HART protocol that provides the continuous transmission of standard HART command response by a field device.

Characterize

Format function that allows you to configure the transmitter for a specific input sensor type, set the number of sensor wires, and store the sensor and transmitter serial numbers. Characterize and Digital Trim are the two Format functions.

Cloning

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

Commissioning

Functions performed with a HART communicator and the transmitter to test the transmitter and loop and verify transmitter configuration data.

Configuration

Parameters that determine how the transmitter operates. Configuration may be performed on-line or off-line.

Damping

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

Descriptor

16-character field for additional identification of the transmitter, its use, or location. The descriptor is stored in the transmitter and can be changed using a HART communicator and the transmitter information function.

Digital Trim

Format function that allows you to make corrections to the factory-stored characterization curve used by the transmitter to produce a process variable output.

Drift Alert

Detects drifting in the sensors by sending a warning or alarm when the user-acceptable difference between Sensor 1 and Sensor 2 is exceeded.

Failure Mode

Transmitter function that drives the output to a hardware-selectable high or low setting during an input sensor failure or a failure in the transmitter electronics.

Format Functions	Set-up functions performed with a HART communicator and transmitter that configure the transmitter for a specific sensor input and adjust the transmitter electronics to conform to plant standards. Characterize and Digital Trim are the two Format functions.
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. All Rosemount SMART FAMILY products communicate using the HART protocol.
Hot Backup	Automatic redundancy for Sensor 1.
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 transmitter is currently configured to measure in the 4–20 loop. Digital output is not affected by the LRV.
Message	24-character field for any additional information the user may want to include.
Multidropping	The connection of several transmitters to a single communications transmission line.
Off-Line Configuration	Using a HART communicator to enter and store configuration data without a transmitter connected. The data can later be downloaded to one or more transmitters.
Off-Line Memory	Memory location in a HART communicator that stores transmitter configuration data that was entered off-line for later downloading to a transmitter.
Off-Line Operation	Any of several functions that may be performed with a HART communicator without a transmitter connected.
On-Line Configuration	Configuration of the transmitter operational parameters using a HART communicator connected to a transmitter.
Output Trim	Digital Trim function that allows you to alter the transmitter's conversion of the input sensor signal into a 4–20 mA output. Output Trim and Sensor Trim are the two Digital Trim functions.
Reranging	Configuration function that changes the transmitter 4 and 20 mA settings.
Safe Memory	Memory location in a HART communicator where existing transmitter information can be saved upon start-up.
Send Data	A HART communicator command that transfers configuration data from the hand-held communicator's Working Register to the Transmitter Memory.
Sensor Trim	Digital Trim function that allows you to alter the transmitter's interpretation of the input signal. Sensor Trim and Output Trim are the two Digital Trim functions.

Smart	Term used to describe instruments that are microprocessor-based and feature advanced communications capabilities.
SMART FAMILY	Rosemount pressure, temperature, level, and flow instruments with microprocessor-based digital electronics.
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 a HART communicator and the transmitter information function.
Transmitter Address	Unique two-digit number used to identify a multidropped transmitter.
Transmitter Memory	Nonvolatile memory location in the transmitter that stores configuration data.
Transmitter Security	Hardware-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 measure. The limit of the current sensor.
Upper Range Value (URV)	Highest value of the measured variable that the transmitter is currently configured to measure in the loop output (the 20 mA set point). Digital output is not affected by the URV.
Working Register	Memory location in a HART communicator that temporarily stores data as it is being entered.

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