Reference Manual
00809-0300-4728, Rev AA
January 2011

Rosemount 644 Temperature Transmitter with Profibus PA

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Rosemount 644 Temperature Transmitter with Profibus PA

Rosemount 644 Hardware Revision 9

NOTICE

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

The United States has two toll-free assistance numbers and one international number.

Customer Central
1-800-999-9307 (7:00 a.m. to 7:00 p.m. CST)

National Response Center
1-800-654-7768 (24 hours a day)
Equipment service needs

International
1-(952) 906-8888

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

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

Table of Contents

Section 1 Introduction

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

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

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure

Electrical shock could cause death or serious injury.

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

USING THIS MANUAL

The sections in this manual provide information on installing, operating, and maintaining the Rosemount 644 with Profibus PA protocol. The sections are organized as follows:

Section 2: Configuration provides instruction on commissioning and operating the Rosemount 644 PA transmitter. Information on software functions, configuration parameters, and online variables is also included.

Section 3: Hardware Installation contains mechanical mounting and installation instructions, and field upgrade options.

Section 4: Electrical Installation contains electrical installation instructions, with wiring and power considerations.

Section 5: Calibration contains techniques for calibration and troubleshooting

Appendix A: Specifications and Reference Data supplies reference and specification data, as well as ordering information.

Appendix B: Product Certifications contains intrinsic safety approval information, European ATEX directive information, and approval drawings.

Appendix C: Profibus Block Information contains Profibus block and parameter information.

TRANSMITTER OVERVIEW

Features of the Rosemount 644 with Profibus PA include:

- Accepts inputs from a wide variety of sensors (T/C, RTD, Ohm, mV)
- Configuration using Siemens SIMATIC PDM
- Electronics that are completely encapsulated in epoxy making the transmitter extremely durable and ensuring long-term reliability
- A compact size and a variety of housing options allowing mounting flexibility for the control room or the field

Refer to the following literature for a full range of compatible connection heads, sensors, and thermowells provided by Emerson Process Management.

- Temperature Sensors and Assemblies Product Data Sheet, Volume 1 (document number 00813-0100-2654)
- Temperature Sensors and Assemblies Product Data Sheet, Volume 2 (document number 00813-0200-2654)
- Rosemount 1067 compact sensor and 1097 Thermowell Product Data Sheet (00813-0100-4951)
- Rosemount 65Q and 65B Resistance Temperature Sensors for Hygienic and Sanitary Applications Product Data Sheet (00813-0100-4827)

NOTE
For Rosemount 644 with HART® or FOUNDATION™ fieldbus, see Rosemount Product Manual 00809-0100-4728.

DEVICE REVISION

Table 1-1. Device Revisions (NE53)

Date	Software Revision	Profibus Profile	Changes to Software	Compatible Files	Manual Revision
11/10	1.01.016	3.02	New Product	644 GSD: EPM1039.gsd Profile:3.02 GSD: pa139700.gsd DD: see Rosemount.com DTM: see Rosemount.com	AA

CONSIDERATIONS

General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to their sensed temperature. The 644 converts the low-level sensor signal to digital Profibus PA signal that is relatively insensitive to lead length and electrical noise. This signal is then transmitted to the control room via two wires.

Commissioning

The transmitter can be commissioned before or after installation. It may be useful to commission it on the bench, before installation, to ensure proper operation and to become familiar with its functionality. Make sure the instruments in the loop are installed in accordance with intrinsically safe, FISCO, or non-incendive field wiring practices.

Mechanical

Location

When choosing an installation location and position, take into account the need for access to the transmitter.

Special Mounting

Special mounting hardware is available for mounting a 644 head mount transmitter to a DIN rail, or assembling a new 644 head mount to an existing threaded sensor connection head (former option code L1).

Electrical

Proper electrical installation is necessary to prevent errors due to sensor lead resistance and electrical noise. For best results, shielded cable should be used in electrically noisy environments.

Make wiring connections through the cable entry in the side of the connection head. Be sure to provide adequate clearance for cover removal.

Environmental

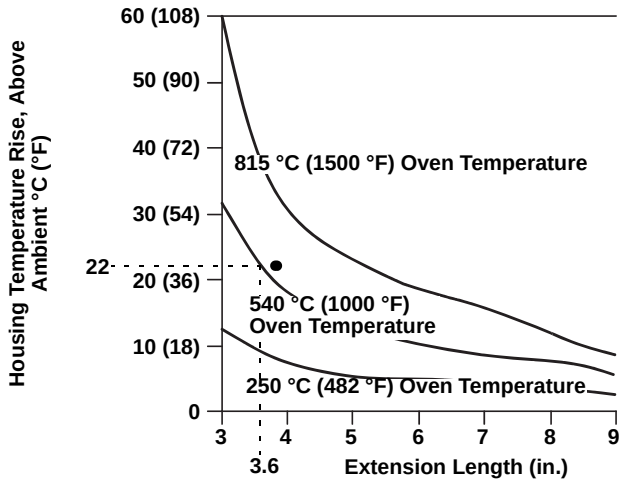
The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

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, and extension nipple, or a remote mounting configuration to isolate the transmitter from the process.

Figure 1-1 provides an example of the relationship between transmitter housing temperature rise and extension length.

Figure 1-1. 644 head mount Transmitter Connection Head Temperature Rise vs. Extension Length



Example

The transmitter specification limit is 85 °C. If the ambient temperature is 55 °C and the process temperature to be measured is 800 °C, the maximum permissible connection head temperature rise is the transmitter specification limit minus the ambient temperature (moves 85 to 55 °C), or 30 °C.

In this case, an extension of 100 mm meets this requirement, but 125 mm provides a margin of 8 °C, thereby reducing any temperature effects in the transmitter.

RETURN OF MATERIALS

To expedite the return process in North America, call the Emerson Process Management National 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 the following information:

- Product model
- Serial numbers
- The last process material to which the product was exposed

The center will provide

- A Return Material Authorization (RMA) number
- Instructions and procedures that are necessary to return goods that were exposed to hazardous substances

For other locations, please contact an Emerson Process Management sales representative.

NOTE
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.

Section 2 Configuration

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

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

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

- Do not remove the connection head cover in explosive atmospheres when the circuit is live.
- Before connecting Profibus devices 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.
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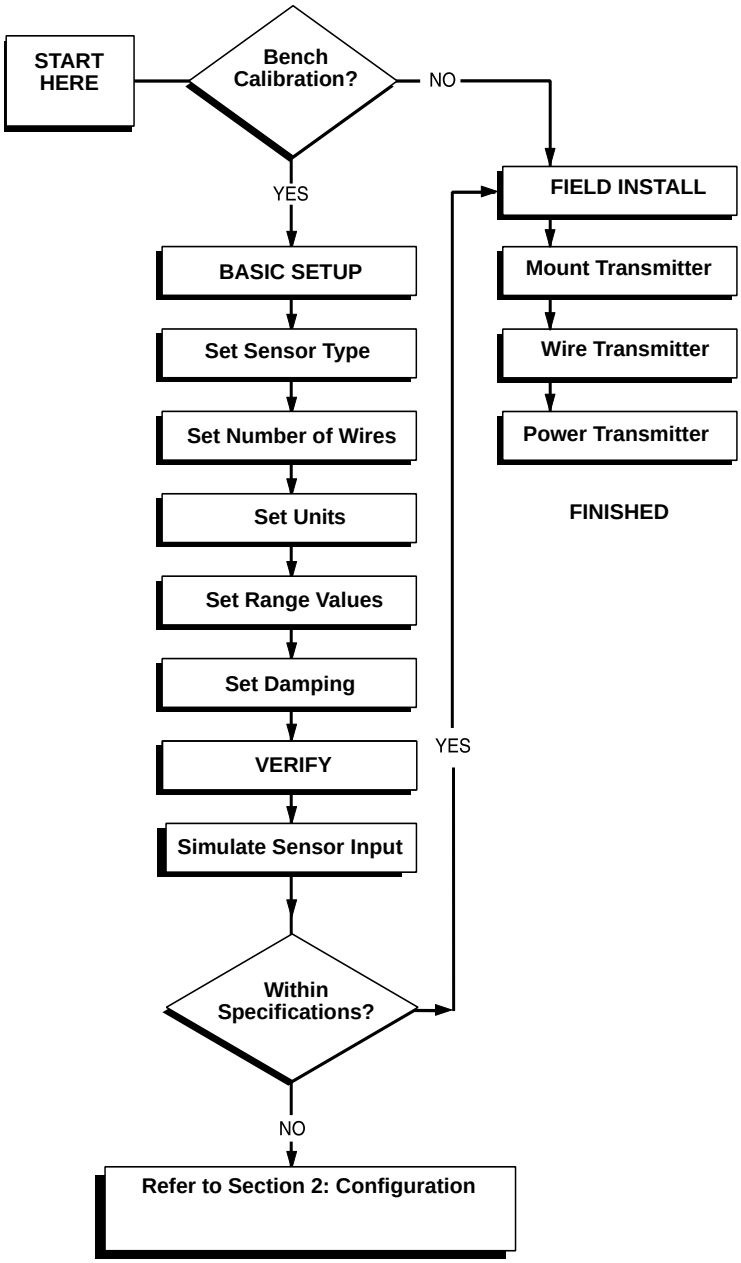
Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

Figure 2-1. Configuration Flowchart



CONFIGURATION GUIDELINES

To configure on the bench, required equipment includes a power supply, a class 2 master with DP/PA coupler, proper cable, and terminators. Verify that the Security hardware jumper is set to the OFF position in order to proceed with configuration. See Figure 4-2 for jumper location.

Setup for the Rosemount 644 can be done via Siemens SIMATIC® PDM software or any other DD or DTM based Class 2 master.

Profile 3.02 Identification Number Adaptation Mode

Rosemount 644 Profibus Profile 3.02 devices are set to Identification Number Adaptation Mode when shipped from the factory. This mode allows the transmitter to communicate with any Profibus class 1 master with either the generic Profile GSD (9700) or Rosemount 644 specific GSD (1039).

Block Modes

When configuring a device with a class 2 master, it is best practice to set blocks to OOS when downloading parameters that affect the transmitter output. However, the 644 will allow configuration changes made in AUTO to be downloaded to the device. This prevents the class one master from seeing a jump in output without a status change. Setting the blocks OOS and back into Auto is done automatically when using the class two master configuration wizards within the Rosemount 644 DD or DTM. This is done so no additional action is required when configuring the device.

Configuration Tools

The Rosemount 644 can be configured through the factory at order entry or using a class 2 master. The C1 option code must be ordered to obtain addressing and configuration of the device at the factory.

Class 2 masters require either DD or DTM files for configuration. These files can be found at www.rosemount.com or by contacting your local Emerson Process representative.

The remainder of this section will cover the configuration tasks using the Class 2 master configuration tool.

NOTE
Instructions in this section use the terminology found in the class 2 master. See Appendix C: Profibus Block Information to cross reference parameters between the class2 master, and the Profibus specification.

BASIC SETUP TASKS

Device Description

Before configuring the device, ensure the host has the appropriate Device Description file revision for this device. The device descriptor can be found on www.rosemount.com. The initial release of the Rosemount 644 with Profibus PA protocol is device revision 1.

Assign Address

The Rosemount 644 is shipped with a temporary address of 126. This must be changed to a unique value between 1 and 125 in order to establish communication with the class 1 master. Usually, addresses 1-2 are reserved for masters, therefore transmitter addresses between 3 and 125 are recommended for the device.

Address can be set using either:

- Factory Configuration (C1 option code)
- Class 2 master – see respective class 2 master manual for setting instrument addresses

Default Configuration

Unless otherwise specified, the Rosemount 644 will be shipped with the following settings:

Table 2-1. Temperature configuration defaults

Device Address: 126
Sensor Type: RTD, Pt 100 (α = 0.00385, 4 wire)
Damping: 5 sec.
Units of Measurement: °C
Alarm Limits:
- HI-HI: Infinity
- HI: Infinity
- LO: - Infinity
- LO-LO: Infinity

Local Display (when installed): Engineering Units of Temperature
Measurement Range: 0 °C to 100 °C

TRANSMITTER SETUP USING CLASS 2 MASTER

Basic Transmitter Setup

Table 2-2. Basic Transmitter Configuration using Class 2 master

Desired Action	Menu >> Parameter >> Value
Set Sensor Type	Primary Value>>Sensor>>Sensor Type
Set Connection Type (Number of Wires)	Primary Value>>Sensor>>Sensor Connection
Set Units*	Primary Value>>Sensor>>Primary Value Unit
Set Upper Range Value	Primary Value>>Process Value Scale>>Upper Value
Set Lower Range Value	Primary Value>>Process Value Scale>>Lower Value
Set Damping Value	Primary Value>>Sensor>>Damping Value

* Please see “Basic Transmitter Configuration using DD or DTM” on page 2-6 for considerations when changing units.

Process Alarms

Process alarms activate an output alarm status when the configured alarm point is exceeded. A process alarm will be transmitted continuously if the output set points are exceeded. The alarms will reset once the value returns within range.

Process Alarm parameters are defined as follows

- HI-HI Alarm: Changes Output Status to Good – Critical Alarm – Hi Limit
- HI Warning: Changes Output Status to Good – Advisory Alarm – Hi Limit
- LO Warning: Changes Output Status to Good – Advisory Alarm – Lo Limit
- LO-LO Alarm: Changes Output Status to Good – Critical Alarm – Lo Limit
- Alarm Hysteresis: Amount the output value must pass back into range before alarm is cleared.

  Example: Upper Alarm = 100 °C. Alarm Hysteresis = 0.5 °C. After activation at 100 °C, the alarm will clear once the output goes below 99.5 °C = 100 - 0.5 °C.

Process Alerts can be set using,

- Class 2 master – see Table 2-3 for configuration

Table 2-3. Process Alarm Configuration using Class 2 master

Desired Action	Menu Path
Enter Process Alarm Levels	Output>>Output Limits>>LO-LO Alarm
	Output>>Output Limits>>LO Warning
	Output>>Output Limits>>HI Warning
	Output>>Output Limits>>HI- HI Alarm

Simulation

Simulation is in the AI block and used to verify the output from the transducer block. The Rosemount 644 has a simulation jumper located on the transmitter puck top cover that must be set to the ON position in order to simulate.

NOTE
This jumper position is ignored when the transmitter is initially powered. The jumper position must be changed while the transmitter is powered to activate simulation. If power is removed and restored, the simulation mode will be OFF regardless of jumper position.

With simulation enabled, the actual measurement value has no impact on the OUT value or the status. The OUT value will equal the simulated value from the transducer block plus any scaling or linearization effects performed in the AI block.

Once the simulation jumper is set to on, simulation mode can be activated Using a Class 2 master see Table 2-4.

Table 2-4. Simulation configuration using Class 2 master

Desired Action	Menu >> Parameter >> Value
Enable Simulate	Main Setup>>Human Interface>> Simulation Status>>State>> Select Enabled Enter Simulation Value Select Simulation Status>>Press “Download to device” icon
Disable Simulate	Main Setup>>Human Interface>> Simulation Status>>State>> Select Disabled Press “Download to device” icon

TRANSMITTER ONLINE SETUP WITH DD OR DTM

Basic Transmitter Setup

Table 2-5. Basic Transmitter Configuration using DD or DTM

Using Guided Setup

Desired Action	Menu >> Category >> Method
Set Sensor Type	Configure>>Guided Setup>>Configure Sensor Method
Set Connection Type	Configure>>Guided Setup>>Configure Sensor Method
Set Units	Configure>>Guided Setup>>Configure Sensor Method
Set Damping	Configure>>Guided Setup>>Configure Sensor Method

Using Manual Setup

Desired Action	Menu >> Category >> Tab >> Value
Set Sensor Type	Configure>>Manual Setup>>Sensor>>Sensor Type
Set Connection Type (Number of Wires)	Configure>>Manual Setup>>Sensor>>Sensor Connection
Set Units	Configure>>Manual Setup>>Classic View>>Transducer Block>>Primary Value Unit
Set Damping	Configure>>Manual Setup>>Sensor>>Damping Value
Set Upper Range Value	Configure>>Manual Setup>>Classic View>>Analog Input Block>>Analog Input Block_1>>Lower Range
Set Lower Range Value	Configure>>Manual Setup>>Classic View>>Analog Input Block>>Analog Input Block_1>>Upper Range

NOTE
Changes made to the PRIMARY_VALUE_UNIT parameter through **Manual Setup>>Classic View** are only reflected in the Transducer Block parameters. To change the AI OUT units the **PV Scale** and **OUT Scale** need to be updated to mirror the upper and lower sensor limits in the desired units.

Example: (All values are arbitrary)

The default configuration of the device is:

4-wire PT100_A_385	AI.OUT = 23 °C
PRIMARY_VALUE_UNIT = °C	PV_SCALE = 100, 0
PV.VALUE = 23 °C	OUT_SCALE = 100,0, °C
SV.VALUE = 23 °C	
USL = 850 °C	
LSL = -200 °C	

If the user desires to change the units to °F, only the parameters in Bold will change with the PRIMARY_VALUE_UNIT. The AI.OUT will stay in °C until the **PV_SCALE** and **OUT_SCALE** are configured to match each other. (This can be with the measurement range or the sensor limits.

4-wire PT100_A_385	AI.OUT = 23 °C
PRIMARY_VALUE_UNIT = °C	**PV_SCALE = 212, 32**
PV.VALUE = 73 °C	OUT_SCALE = 100,0, °C
SV.VALUE = 73 ° C	
USL = 1562 °C	
LSL = -328 °C	

So the following change is needed:

PV_SCALE = **1562,-328** (make the same as USL and LSL)

OUT_SCALE = **1562,-328,** °**F** (make the same as PV_SCALE)

Process Alarms

Process Alarms can be set using a DD or DTM – see Table 2-6 for configuration.

Table 2-6. Process Alarm Configuration using DD or DTM

Desired Action	Menu Path
Enter Process Alert Levels	Configure>>Alarm Setup>>LO-LO>>[Value]
	Configure>>Alarm Setup>>LO>>[Value]
	Configure>>Alarm Setup>>HI >>[Value]
	Configure>>Alarm Setup>>HI-HI >>[Value]

LCD Display

The LCD display connects directly to the top of the transmitter puck and uses a 10-pin connector to directly connect to the electronics board. A display cover is provided to accommodate the display.

The display always indicates the transmitter output temperature as well as abbreviated diagnostic status when applicable. When turned on, the display will alternate between the selected variables.

For LCD display configuration using a DD or DTM see Table 2-7.

Table 2-7. LCD Display Configuration using DD or DTM

Desired Action	Menu >> Parameter >> Value
Select Display Parameters	Configure>>Manual Setup>>Display Tab>>Select Parameters to display

Simulation

Once the simulation jumper is set to on, simulation mode can be activated Using DD or DTM see Table 2-8.

Table 2-8. Simulation Configuration using DD or DTM

Desired Action	Menu >> Parameter >> Value
Enable Simulate	Service Tools>>Simulate>>Select Enabled State Enter Simulation Value Select Simulation Status>>Press Transfer button
Disable Simulate	Service Tools>>Simulate>>Select Disabled State >>Press Transfer button

Section 3 Hardware Installation

OVERVIEW

The information in this section covers installation considerations for the Rosemount 644. A Quick Installation Guide is shipped with every transmitter to describe pipe-fitting, wiring procedures, and basic configuration for initial installation.

SAFETY MESSAGES

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

Warnings

⚠WARNING

Explosions could result in death or serious injury:

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

- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock could cause death or serious injury.

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

Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to ““Hazardous Locations Certificates” on page B-2 for information on these approvals.

MOUNTING

Mount the transmitter at a high point in the conduit run to prevent moisture from draining into the transmitter housing.

The 644 head mount installs

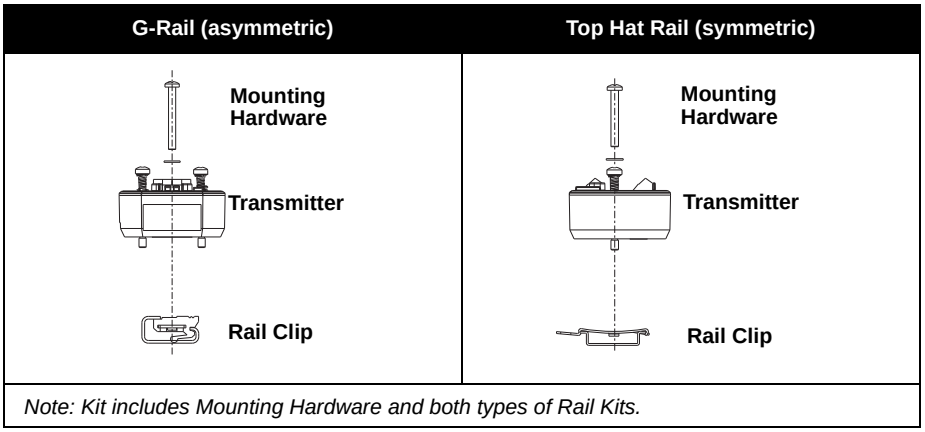
- In a connection head or universal head mounted directly on a sensor assembly
- Apart from a sensor assembly using a universal head
- To a DIN rail using an optional mounting clip.

The 644 rail mount attaches directly to a wall or to a DIN rail.

Mounting a 644H to a DIN Rail

To attach a head mount transmitter to a DIN rail, assemble the appropriate rail mounting kit (part number 00644-5301-0010) to the transmitter as shown in Figure 3-1.

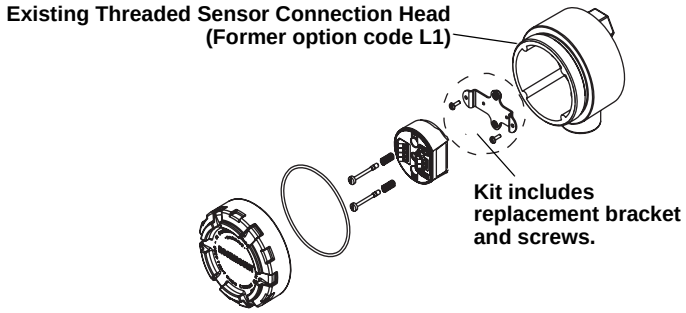
Figure 3-1. Assembling Rail Clip Hardware to a 644



Retrofitting a 644H for Use in an Existing Threaded Sensor Connection Head

To mount a 644 in an existing threaded sensor connection head (former option code L1), order the 644H retrofit kit (part number 00644-5321-0010). The retrofit kit includes a new mounting bracket and all associated hardware necessary to facilitate the installation of the 644H in the existing head. See Figure 3-2.

Figure 3-2. Assembling 644H for Use in an Existing L1 Connection Head

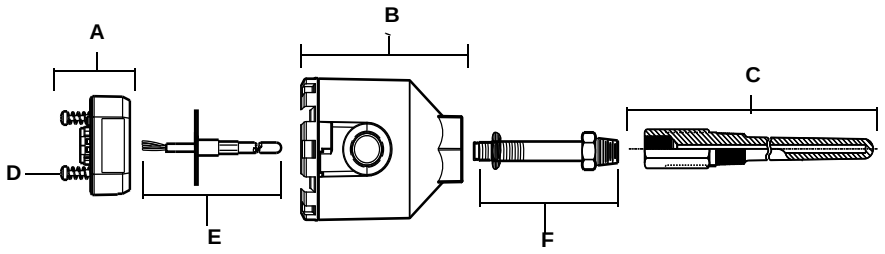


INSTALLATION

Typical European Installation

Head Mount Transmitter with DIN Plate Style Sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell before applying process pressure.
2. Assemble the transmitter to the sensor. Push the transmitter mounting screws through the sensor mounting plate and insert the snap rings (optional) into the transmitter mounting screw groove.
3. Wire the sensor to the transmitter (see Figure 4-3 on page 4-3).
4. Insert the transmitter-sensor assembly into the connection head. Thread the transmitter mounting screw into the connection head mounting holes. Assemble the extension to the connection head. Insert the assembly into the thermowell.
5. Attach conduit or a cable gland to the open connection head entry.
6. Insert the shielded cable leads into the connection head through the conduit or cable entry. Seal the entry properly.
7. Connect the shielded power cable leads to the transmitter power terminals. Avoid contact with sensor leads and sensor connections.
8. Install and tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.

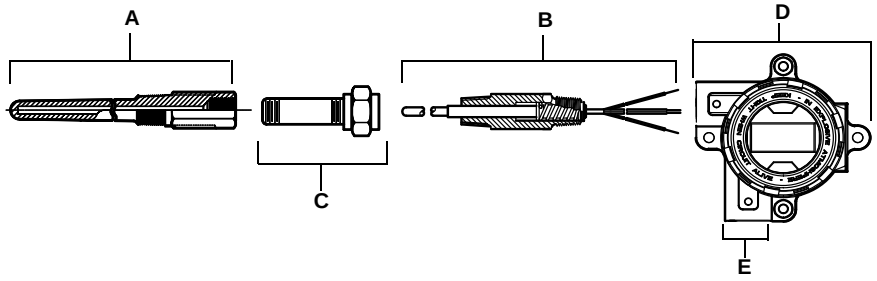


A = 644H Transmitter	D = Transmitter Mounting Screws
B = Connection Head	E = Integral Mount Sensor with Flying Leads
C = Thermowell	F = Extension

Typical North American Installation

Head Mount Transmitter with Threaded Sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten thermowells before applying process pressure.
2. Attach necessary extension nipples and adapters to the thermowell. Seal the nipple and adapter threads with silicone tape.
3. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.
4. Pull the sensor wiring leads through the universal head and transmitter. Mount the transmitter in the universal head by threading the transmitter mounting screws into the universal head mounting holes.
5. Mount the transmitter-sensor assembly into the thermowell. Seal adapter threads with silicone tape.
6. Install a cable gland or conduit for field wiring to the conduit entry of the universal head. Seal threads with silicone tape.
7. Pull the field wiring leads through the conduit into the universal head. Attach the sensor and power leads to the transmitter. Avoid contact with other terminals.
8. Install and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.



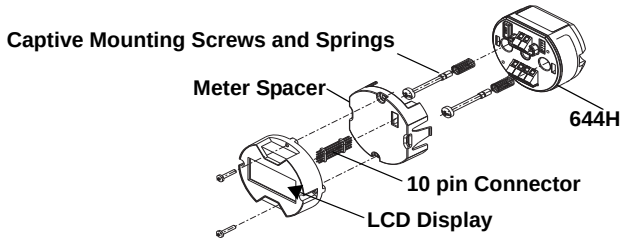
A = Threaded Thermowell
B = Threaded Style Sensor
C = Standard Extension
D = Universal Head
E = Conduit Entry

LCD Display Installation

The LCD display provides local indication of the transmitter output and abbreviated diagnostic messages governing transmitter operation. Transmitters ordered with the LCD display are shipped with the meter installed. After-market installation requires the meter kit (part number 00644-4430-0001), which includes:

- LCD display assembly (includes LCD display, meter spacer, and 2 screws)
- Meter cover with O-ring in place

Figure 3-3. Installing the LCD Display



Use the following procedure to install the meter.

1. If the transmitter is installed in a loop, secure the loop and disconnect the power. If the transmitter is installed in an enclosure, remove the cover from the enclosure.
2. Decide meter orientation (the meter can be rotated in 90° increments). To change meter orientation, remove the screws located above and below the display screen. Lift the meter off the meter spacer. Remove the 10-pin plug and re-insert it in the location that will result in the desired viewing orientation.
3. Reattach the meter to the meter spacer using the screws. If the meter was rotated 90° from its original position it will be necessary to remove the screws from their original holes and re-insert them in the adjacent screws holes.
4. Line up the 10-pin connector with the 10-pin socket and push the meter into the transmitter until it snaps into place.
5. Attach and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.
6. Use a Profibus Class 2 master to configure the meter to the desired display parameters.

NOTE
Observe the following LCD display temperature limits:
Operating: –4 to 185 °F (–20 to 85 °C)
Storage: –50 to 185 °F (–45 to 85 °C)

Section 4 Electrical Installation

OVERVIEW

The information in this section covers installation considerations for the Rosemount 644. A Quick Installation Guide is shipped with every transmitter to describe pipe-fitting, wiring procedures, and basic configuration for initial installation.

SAFETY MESSAGES

Procedures and instructions 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

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

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

- Do not remove the connection head cover in explosive atmospheres when the circuit is live.
- Before powering Profibus devices segment 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.
- All connection head covers must be fully engaged to meet explosion-proof requirements.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

WIRING

All power to the transmitter is supplied over the signal wiring. Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not drop below 9 Vdc for Profibus PA. 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.

NOTE
Do not apply high voltage (e.g., ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit. (Sensor and transmitter power terminals are rated to 42.4 Vdc. A constant 42.4 volts across the sensor terminals may damage the unit.)

The transmitters will accept inputs from a variety of RTD and thermocouple types. Refer to Figure 4-1 when making sensor connections. Refer to Figure 4-2 for Profibus installations.

Use the following steps to wire the power and sensor to the transmitter:

1. Connect the positive power lead to the .+. terminal. Connect the negative power lead to the .-. terminal.
2. Tighten the terminal screws. When tightening the sensor and power wires, the max torque is 6-in.-lbs (0.7 N-m).
3. Apply power.

Figure 4-1. Transmitter Power, Communication and Sensor Terminal

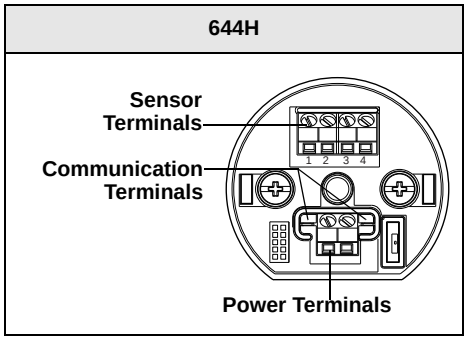
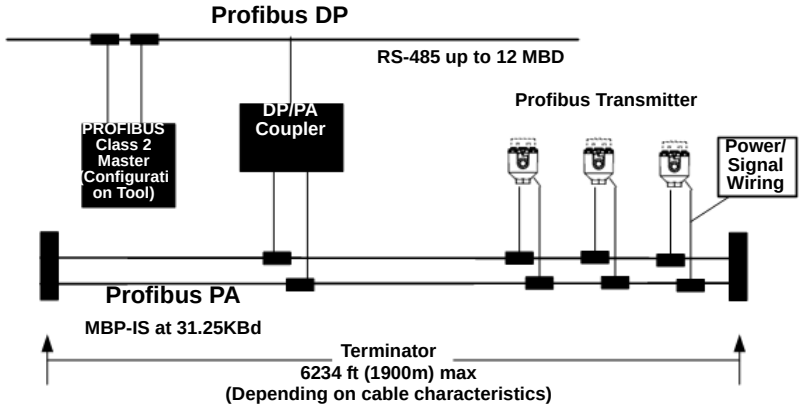


Figure 4-2. Typical connection of a Profibus configuration host to a transmitter loop



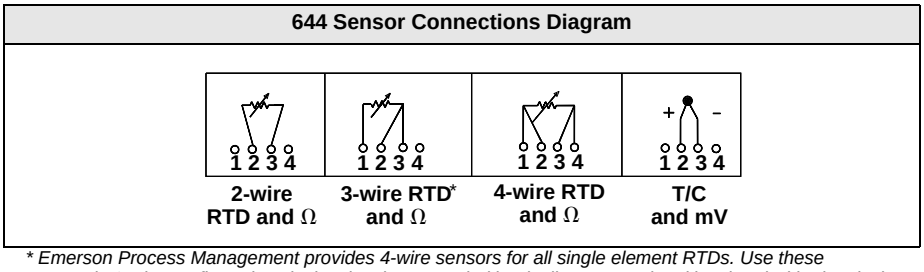
NOTE

1. Each Segment in a Profibus trunk must be terminated at both ends.
2. Some DP/PA couplers contain the power supply, one terminator, and the power conditioner within the coupling device.
3. The configuration tool is typically located in the control room.

Sensor Connections

⚠ The 644 is compatible with a number of RTD and thermocouple sensor types. Figure 4-3 shows the correct input connections to the sensor terminals on the transmitter. To ensure a proper sensor connection, anchor the sensor lead wires into the appropriate compression terminals and tighten the screws.

Figure 4-3. Sensor Wiring Diagrams



** Emerson Process Management provides 4-wire sensors for all single element RTDs. Use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.*

Thermocouple or Millivolt Inputs

The thermocouple can be connected directly to the transmitter. Use appropriate thermocouple extension wire if mounting the transmitter remotely from the sensor. Make millivolt input connections with copper wire. Use shielding for long runs of wire.

RTD or Ohm Inputs

The transmitters will accept a variety of RTD configurations, including 2-wire, 3-wire, and 4-wire. If the transmitter is mounted remotely from a 3-wire or 4-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 60 ohms per lead (equivalent to 6,000 feet of 20 AWG wire). In this case, the leads between the RTD and transmitter should be shielded. If using only two leads, both RTD leads are in series with the sensor element, so significant errors can occur if the lead lengths exceed three feet of 20 AWG wire (approximately 0.05 °C/ft). For longer runs, attach a third or fourth lead as described above.

Sensor Lead Wire Resistance Effect– RTD Input

When using a 4-wire RTD, the effect of lead resistance is eliminated and has no impact on accuracy. However, a 3-wire sensor will not fully cancel lead resistance error because it cannot compensate for imbalances in resistance between the lead wires. Using the same type of wire on all three lead wires will make a 3-wire RTD installation as accurate as possible. A 2-wire sensor will produce the largest error because it directly adds the lead wire resistance to the sensor resistance. For 2- and 3-wire RTDs, an additional lead wire resistance error is induced with ambient temperature variations. The table and the examples shown below help quantify these errors.

Table 4-1. Examples of Approximate Basic Error

Sensor Input	Approximate Basic Error
4-wire RTD	None (independent of lead wire resistance)
3-wire RTD	± 1.0 Ω in reading per ohm of unbalanced lead wire resistance (Unbalanced lead wire resistance = maximum imbalance between any two leads.)
2-wire RTD	1.0 Ω in reading per ohm of lead wire resistance

Examples of Approximate Lead Wire Resistance Effect Calculations

Given:

Total cable length:	150 m
Imbalance of the lead wires at 20 °C:	1.5 Ω
Resistance/length (18 AWG Cu):	0.025 Ω/m °C
Temperature coefficient of Cu (α_{Cu}):	0.039 Ω/Ω °C
Temperature coefficient of Pt(α_{Pt}):	0.00385 Ω/Ω °C
Change in Ambient Temperature (ΔT_{amb}):	25 °C
RTD Resistance at 0 °C (R_o):	100 Ω (for Pt 100 RTD)

- Pt100 4-wire RTD: No lead wire resistance effect.
- Pt100 3-wire RTD:

$$\text{Basic Error} = \frac{\text{Imbalance of Lead Wires}}{(\alpha_{Pt} \times R_o)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Imbalance of Lead Wires})}{(\alpha_{Pt}) \times (R_o)}$$

Lead wire imbalance seen by the transmitter = 0.5 Ω

$$\text{Basic error} = \frac{0.5\ \Omega}{(0.00385\ \Omega / \Omega\ °C) \times (100\ \Omega)} = 1.3\ °C$$

Error due to amb. temp. var. of ± 25 °C

$$= \frac{(0.0039\ \Omega / \Omega\ °C) \times (25\ °C) \times (0.5\ \Omega)}{(0.00385\ \Omega / \Omega\ °C) \times (100\Omega)} = \pm 0.1266°C$$

- Pt100 2-wire RTD:

$$\text{Basic Error} = \frac{\text{Lead Wire Resistance}}{(\alpha_{Pt} \times R_o)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Lead Wire Resistance})}{(\alpha_{Pt}) \times (R_o)}$$

Lead wire resistance seen by the transmitter = 150 m × 2 wires × 0.025 Ω/m = 7.5 Ω

$$\text{Basic error} = \frac{7.5\ \Omega}{(0.00385\ \Omega / \Omega\ °C) \times (100\ \Omega)} = 19.5\ °C$$

Error due to amb. temp. var. of ± 25 °C

$$= \frac{(0.0039\ \Omega / \Omega\ °C) \times (25\ °C) \times (7.5\ \Omega)}{(0.00385\ \Omega / \Omega\ °C) \times (100\Omega)} = \pm 1.9\ °C$$

Profibus PA Installation

Powered over Profibus PA with standard Profibus power supplies; the transmitter operates between 9.0 and 32.0 Vdc, 11 mA maximum. Transmitter power terminals are rated to 42.4 Vdc. The power terminals on the 644 with Profibus are polarity insensitive.

Ground the Transmitter

The transmitter will operate with the current signal loop either floating or grounded. However, the extra noise in floating systems affects many types of readout devices. If the signal appears noisy or erratic, grounding the current signal loop at a single point may solve the problem. The best place to ground the loop is at the negative terminal of the power supply. Do not ground the current signal loop at more than one point.

The transmitter is electrically isolated to 500 Vdc/ac rms (707 Vdc), so the input circuit may also be grounded at any single point. When using a grounded thermocouple, the grounded junction serves as this point.

Neither side of the loop should be grounded on Profibus PA devices. Only the shield wire should be grounded.

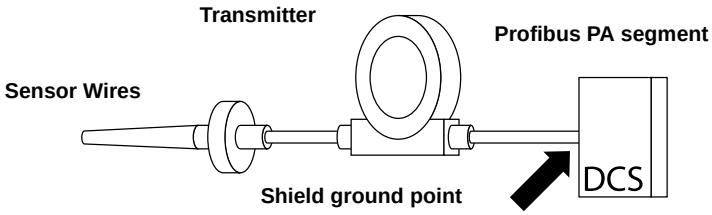
NOTE
Do not ground the signal wire at both ends.

Ungrounded Thermocouple, mV, and RTD/Ohm Inputs

Each process installation has different requirements for grounding. Use the grounding options recommended by the facility for the specific sensor type, or begin with grounding Option 1 (the most common).

Option 1:

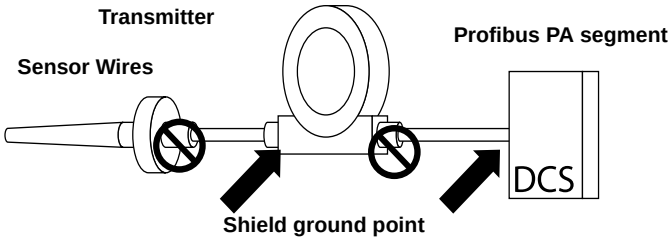
1. Connect signal wiring shield to the sensor wiring shield.
2. Ensure the two shields are tied together and electrically isolated from the transmitter housing.
3. Ground shield at the power supply end only.
4. Ensure that the sensor shield is electrically isolated from the surrounding grounded fixtures.



Connect shields together, electrically isolated from the transmitter.

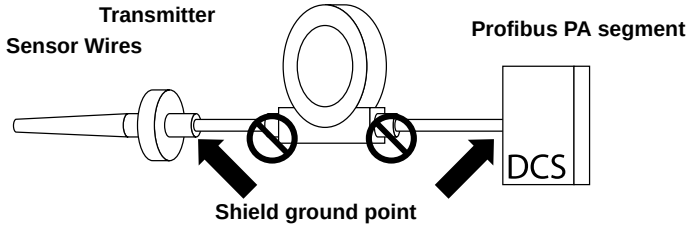
Option 2:

1. Connect sensor wiring shield to the transmitter housing (only if the housing is grounded).
2. Ensure the sensor shield is electrically isolated from surrounding fixtures that may be grounded.
3. Ground signal wiring shield at the power supply end.



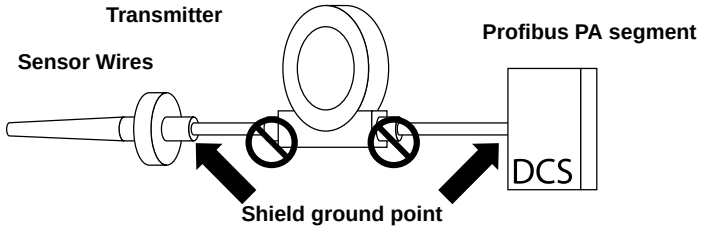
Option 3:

1. Ground sensor wiring shield at the sensor, if possible.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



Grounded Thermocouple Inputs

1. Ground sensor wiring shield at the sensor.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



Section 5 Calibration

OVERVIEW

This section contains information on calibrating the Rosemount 644 Profibus Temperature Transmitter using either the Local Operator Interface (LOI) or a class two master.

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

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

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

Sensor Transducer Block

Sensor Calibration, Lower and Upper Trim Methods

In order to calibrate the transmitter, run the Lower and Upper Trim Methods. If your system does not support methods, manually configure the Transducer Block parameters listed below.

1. Set TARGET_MODE to OOS
2. Set SENSOR_CAL_METHOD to User Trim
3. Set CAL_UNIT to supported engineering units in the Transducer Block
4. Apply temperature that corresponds to the lower calibration point and allow the temperature to stabilize. The temperature must be between the range limits defined in PRIMRY_VALUE_RANGE.
5. Set values of CAL_POINT_LO to correspond to the temperature applied by the sensor.
6. Set SENSOR_CAL_METHOD to User Trim
7. Apply temperature, temperature corresponding to the upper calibration
8. Allow temperature to stabilize.
9. Set CAL_POINT_HI

NOTE
CAL_POINT_HI must be less than UPPER_SENSOR_LIMIT and greater than CAL_POINT_LO + CAL_MIN_SPAN

10. Set SENSOR_CAL_DATE to the current date.
11. Set SENSOR_CAL_WHO to the person responsible for the calibration.
12. Set SENSOR _CAL_LOC to the calibration location.
13. Set TARGET_MODE to AUTO

NOTE
If trim fails the transmitter will automatically revert to factory trim. Excessive correction or sensor failure could cause device status to read “calibration error”. To clear this, trim the transmitter.

Recall Factory Trim

To recall a factory trim on the transmitter, run the Recall Factory Trim. If your system does not support methods, manually configure the Transducer Block parameters listed below.

1. Set TARGET_MODE to OOS
2. Set SENSOR_CAL_METHOD to Factory Trim.
3. Set SENSOR_CAL_DATE to the current date.
4. Set SENSOR_CAL_WHO to the person responsible for the calibration.
5. Set SENSOR _CAL_LOC to the calibration location.
6. Set TARGET_MODE to AUTO.

NOTE
When sensor type is changed, the transmitter reverts to the factory trim. Changing sensor type causes you to loose any trim performed on the transmitter.

Section 6 Troubleshooting

OVERVIEW

This section contains information on how to troubleshoot the Rosemount 644 Profibus Pressure Transmitter.

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

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

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

DIAGNOSTICS IDENTIFICATION AND RECOMMENDATION

The Rosemount 644 Profibus device diagnostics can be used to warn a user about a potential transmitter error. There is a transmitter error if the Output Status reads anything but *Good or Good - Function Check*, or the LCD reads *ERROR SENSOR* or *ERROR DEVICE*. Use Table 6-1 to identify what Diagnostic Condition exists based on the combination of errors under the *Physical Block Diagnostic Extension and PV Status* columns. Once the condition is identified, use the *Recommended Actions* column to remedy the error.

Diagnostics	Physical Block Diagnostic Extension	PV Status	Recommended Actions
Alert Simulation Active (Simulate Active)	PV Simulate Active	N/A	1. To disable Simulation Mode, set the Simulate switch on the device to OFF.
Configuration Error	Invalid configuration	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Verify that the sensor type and number of wires matches the Sensor Configuration of the device. 2. If the error persists, contact Rosemount Customer Central.
Sensor Measurement Degraded (Primary Value Degraded)	Sensor Degraded	UNCERTAIN, Process Related, No Maintenance, Not Limited	1. Verify the process temperature is within the sensor type's specified operating range. 2. Check the terminal connection and terminal blocks for corrosion, wire thinning, and faulty connections. 3. If error persists, check installation for stray voltages. 4. If error persists, verify that the transmitter is properly grounded. 5. If error persists, verify the integrity of the sensor and lead wires. 6. If error persists, replace the sensor.
Terminal Temperature Out of Operating Range	Secondary Value Degraded	NA (PV Status unchanged)	1. Independently measure the ambient temperature of the transmitter's environment. 2. If the ambient temperature is above the transmitter's operating range, modify the installation to correct the ambient temperature. 3. If the ambient temperature is within the transmitter's operating range, replace the transmitter.
Calibration Error	Calibration Error	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Revert to Factory Calibration. 2. Re-calibrate the device. Make sure the user entered calibration points are close to the applied calibration temperature.
Electronics Failure	ASIC RCV Error ASIC TXError ASIC Interrupt Error Reference Error ASIC Configuration Error	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Restart the processor. 2. If the condition persists, replace the electronics or the transmitter.
Hardware/Software Incompatible	Hardware/Software Incompatible	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. If possible, revert to the previous software revision. 2. Contact a Service Center and verify the transmitter information using the Show Transmitter Information button.
Memory Error	Manufacturing Block Integrity Error NV memory integrity Error ROM integrity error	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Restart the processor. 2. If the error persists, download the transmitter configuration. 3. If the error persists, replace the electronics or the transmitter.

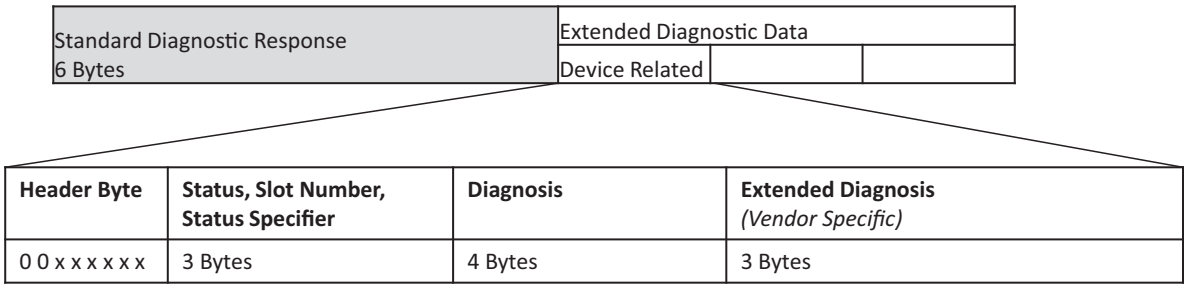
Diagnostics	Physical Block Diagnostic Extension	PV Status	Recommended Actions
Sensor Failure	Sensor Open Sensor Shorted	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Verify the sensor configuration. 2. If the error persists, verify the sensor connection and wiring. Refer to the device and sensor wiring diagrams to ensure proper wiring. 3. If the error persists, verify the integrity of the sensor and sensor lead wires. If the sensor is faulty, repair or replace the sensor.
Sensor Beyond Operating Limits	Sensor Beyond Operating Limits	BAD, Maintenance Alarm, More Diagnosis Available, Lo / Hi Limited	1. Verify the process temperature is within the specified sensor type's range. 2. If the error persists, verify the sensor connection and wiring. Refer to the device and sensor wiring diagrams to ensure proper wiring. 3. If the error persists, verify the integrity of the sensor and sensor lead wires. If the sensor is faulty, repair or replace the sensor.
Terminal Temperature Failure	Terminal Temperature Failure	BAD, Maintenance Alarm, More Diagnosis Available, Not Limited	1. Verify the temperature of the transmitter's ambient environment is within the transmitter's specified operating limits. Refer to the product manual for the transmitter's operating limits. 2. If the ambient temperature is within the specified operating limits, replace the transmitter.
Terminal Temperature Beyond Operating Limits	Terminal Temperature Beyond Operating Limits	UNCERTAIN, Process Related, No Maintenance, Not Limited	1. Verify the temperature of the transmitter's ambient environment is within the transmitter's specified operating limits. Refer to the product manual for the transmitter's operating limits. 2. If the ambient temperature is within the specified operating limits, replace the transmitter.

Extended Diagnostics Identification with class one master

If using a class one master to identify *Physical Block Diagnostic Extensions*, see Figure 6-1 and Figure 6-2 for diagnostic bit information. Table 6-1 and Table 6-2 list the diagnostic description for each bit.

NOTE
A class two master will automatically decode bits and provide diagnostic names.

Figure 6-1. Extended Diagnostics Identification



Header Byte	Status, Slot Number, Status Specifier	Diagnosis	Extended Diagnosis *(Vendor Specific)*
0 0 x x x x x x	3 Bytes	4 Bytes	3 Bytes

Figure 6-2. Diagnoses and Extended Diagnoses Bit Identification

Diagnosis

	Byte 1								Byte 2							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Unit_Diag_Bit[1]	31	30	29	28	27	26	25	24	39	38	37	36	35	34	33	32

	Byte 3								Byte 4							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	47	46	45	44	43	42	41	40	55	54	53	52	51	50	49	48

Extended Diagnosis

	Byte 1								Byte 2							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Unit_Diag_Bit[1]	63	62	61	60	59	58	57	56	71	70	69	68	67	66	65	64

	Byte 3							
	7	6	5	4	3	2	1	0
	79	78	77	76	75	74	73	72

Table 6-1. Diagnosis Descriptions

Device Related Diagnosis		
Byte-Bit	**Unit_Diag_Bit (1)**	**Diagnostic Description**
2-3	35	Restart
2-4	36	Cold Start
2-5	37	Maintenance Required
2-7	39	Ident_Number violation
3-0	40	Failure of the device
3-1	41	Maintenance demanded
3-2	42	Function Check
3-3	43	Process not returning valid values
4-7	55	Extension Available

(1) Unit_Diag_Bit located in GSD file

Table 6-2. Extended Diagnosis Descriptions(1)

Diagnostic Extension Byte-Bit		
Byte-Bit	**Unit_Diag_Bit (1)**	**Diagnostic Description**
6-0	96	Invalid Configuration
6-1	97	ASIC RCV Error
6-2	98	ASIC TX Error
6-3	99	ASIC Interrupt Error
6-4	100	Reference Error
6-5	101	ASIC Configuration Error
6-6	102	Sensor Open
6-7	103	Sensor Shorted
5-0	88	Terminal Temperature Failure
5-1	89	Sensor out of Operating Range
5-2	90	Sensor Beyond Operating Limits
5-3	91	Terminal Temperature Out of Operating Range
5-4	92	Terminal Temperature Out of Operating Limits
5-5	93	Sensor Degraded
5-6	94	Calibration Error
5-7	95	Manufacturing Block Integrity Error
4-0	80	Hardware/Software Incompatible
4-1	81	Non-Volatile Memory Integrity Error
4-2	82	ROM Integrity Error

(1) Unit_Diag_Bit located in GSD file

PLANTWEB AND NE107 DIAGNOSTICS

Table 6-3 describes the recommended status of each diagnostic condition based on PlantWeb and Namur NE107 recommendations.

Table 6-3. Output Status

Name	PlantWeb Alert Category	NE107 Category
PV Simulation Enabled	Advisory	Check
AI in Manual Mode	Advisory	Check
Sensor Out of Operating Range	Maintenance	Out of spec
Sensor Degraded	Maintenance	Out of spec
Terminal Temperature Out of Operating Range	Maintenance	Out of spec
Terminal Temperature Out of Operating Limits	Maintenance	Out of spec
Electronics Failure	Failure	Failure
Sensor Open	Failure	Failure
Sensor Shorted	Failure	Failure
Sensor Beyond Operating Limits	Failure	Failure
Terminal Temperature Failure	Failure	Failure
Memory Failure	Failure	Failure
Hardware/Software Incompatible	Failure	Failure
Configuration Error	Failure	Failure
Calibration Error	Failure	Failure

ALERT MESSAGES AND FAIL SAFE TYPE SELECTION

Table 6-4 defines the output status and LCD messages that will be driven by a diagnostic condition. This table can be used to determine what type of fail safe value setting is preferred. Fail safe type can be set with a class two master under fail safe >> fail safe mode.

Table 6-4. Alert Messages

Diagnostic	Output Status (based on Fail Safe Type)			LCD Output
	FSAFE_TYPE 0 (Failsafe Value)	FSAFE_TYPE 1 (Last usable Value)	FSAFE_TYPE 2 (Wrong calculated Value)	
Configuration Error	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR SENSOR”
Electronics Failure	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR DEVICE”
Primary Value Failure - Sensor is Open	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR SENSOR”
Primary Value Failure - Sensor is Shorted	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR SENSOR”
Primary Value Degraded - Sensor Out of Operating Range	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	N/A
Primary Value Failure - Sensor Beyond Operating Limits	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	37 or 38 - BAD, Maintenance Alarm, Lo / Hi Limited	“ERROR SENSOR”
Primary Value Degraded - Sensor Degraded	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	“ERROR SENSOR”
Terminal Temperature Failure	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR DEVICE”
Terminal Temperature Out of Operating Range	NA (Status unchanged)	NA (Status unchanged)	NA (Status unchanged)	N/A

Diagnostic	Output Status (based on Fail Safe Type)			LCD Output
Terminal Temperature Beyond Operating Limits	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	120 - UNCERTAIN, Process Related, No Maintenance, Not Limited	“ERROR SENSOR”
Calibration Error	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR SENSOR”
Memory Failure	75 - Uncertain, Substitute set, Constant	75 - Uncertain, Substitute set, Constant	36 - BAD, Maintenance Alarm, Not Limited	“ERROR DEVICE”

Table 6-5. Output Status Bit Definition

Condensed Status	AI Block OUT Status Parameter	
Description	**HEX**	**DECIMAL**
Bad - passivated	0x23	35
Bad, maintenance alarm, more diagnostics available	0x24	36
Bad, process related - no maintenance	0x28	40
Uncertain, substitute set	0x4B	75
Uncertain, process related, no maintenance	0x78	120
Good, ok	0x80	128
Good, update event	0x84	132
Good, advisory alarm, low limit	0x89	137
Good, advisory alarm, high limit	0x8A	138
Good, critical alarm, low limit	0x8D	141
Good, critical alarm, high limit	0x8E	142
Good, function check	0xBC	188

Appendix A Specifications and Reference Data

PROFIBUS PA SPECIFICATIONS

Functional

Inputs
User-selectable; sensor terminals rated to 42.4 Vdc. See “Accuracy” on page A-5 for sensor options.

Output
Single 2-wired device with digital output with Profibus PA (compliant with profile 3.02).

Isolation
Input/output isolation tested to 620 Vac (880 Vdc) at 50/60 Hz for 2 seconds minimum.

Local Display
The optional five-digit integral LCD Display includes a floating or fixed decimal point. It can also display engineering units (°F, °C, °R, K, Ω, and millivolts), milliampere, and percent of span. The display can be configured to alternate between selected display options. Display settings are preconfigured at the factory according to the standard transmitter configuration. They can be reconfigured in the field using a Profibus Class 2 master.

Humidity Limits
0–99% relative humidity

Update Time
≤ 0.5 seconds

Physical

Electrical Connections

Model	Power and Sensor Terminals
644H	Compression screws permanently fixed to terminal block

Materials of Construction

Electronics Housing and Terminal Block	
644H	*Noryl*® glass reinforced
Enclosure (Option code J5 or J6)	
Housing	Low-copper aluminum
Paint	Polyurethane
Cover O-ring	Buna-N

Materials of Constructions (Stainless Steel Housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications)

Housing and Standard Meter Cover

- 316 SST

Cover O-Ring

- Buna-N

Mounting

The 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Weight

Code	Options	Weight
644H	Profibus Head Mount Transmitter	92 g (3.25 oz)
M5	LCD Display	38 g (1.34 oz)
J5, J6	Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Universal Head, Meter Cover	667 g (23.53 oz)

Weight (Stainless Steel Housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications)

Option Code	Standard Cover	Meter Cover
S1	840 g (27 oz)	995 g (32 oz)
S2	840 g (27 oz)	995 g (32 oz)
S3	840 g (27 oz)	995 g (32 oz)
S4	840 g (27 oz)	995 g (32 oz)

Enclosure Ratings (644H)

All option codes (S1, S2, S3, S4, J5, J6, J7, and J8) are NEMA 4X, IP66, and IP68. Option code J6 is CSA Enclosure Type 4X.

Sanitary Housing Surface

Surface finish is polished to 32 RMA. Laser etched product marking on housing and standard covers.

Performance

CE Mark

The 644 meets all requirements listed under IEC 61326: Amendment 1, 1998.

Power Supply Effect

Less than ±0.005% of span per volt

Stability

RTDs and thermocouples have a stability of ±0.15% of output reading or 0.15 °C (whichever is greater) for 24 months

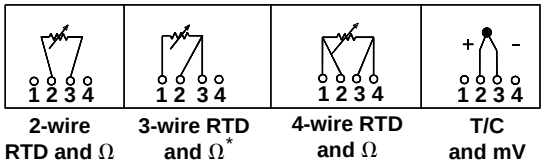
Vibration Effect

The 644 is tested to the following specifications with no effect on performance:

Frequency	Vibration
10 to 60 Hz	0.21 mm displacement
60 to 500 Hz	3 g peak acceleration

Sensor Connections

644 Sensor Connections Diagram



* *Rosemount Inc. 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.*

Function Blocks

Physical Block

- The Physical Block contains physical transmitter information including manufacturer identification, device type, software tag, and unique identification.

Transducer Block

- The Transducer Block contains the actual temperature measurement data, including sensor 1 and terminal temperature. It includes information about sensor type and configuration, engineering units, linearization, re-ranging, damping, temperature correction, and diagnostics.

Analog Input Block (AI)

- The Analog Input Block processes the measurement and makes it available on the Profibus segment. Allows filtering, alarming, and engineering unit changes.

Turn on time

Performance within specifications in less than 20 seconds after power is applied, when damping value is set to 0 seconds.

Power Supply
Powered over Profibus with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 Vdc,12 mA maximum. The power terminals are rated to 42.4 Vdc (max.)

Alarms
The AI function block allows the user to configure the alarms to HI-HI, HI, LO, or LO-LO with hysteresis settings.

Accuracy

Table A-1. Rosemount 644 Input Options and Accuracy.

Sensor Options	Sensor Reference	Input Ranges		Recommended Min. Span[1]		Digital Accuracy[2]		D/A Accuracy[3]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Pt 100 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 500 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.19	± 0.34	±0.03% of span
Pt 1000 (α = 0.00385)	IEC 751	–200 to 300	–328 to 572	10	18	± 0.19	± 0.34	±0.03% of span
Pt 100 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.27	± 0.49	±0.03% of span
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	10	18	± 0.15	± 0.27	±0.03% of span
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	10	18	±1.40	± 2.52	±0.03% of span
Pt 50 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	± 0.30	± 0.54	±0.03% of span
Pt 100 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	± 0.15	± 0.27	±0.03% of span
Cu 50 (α = 0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 10 (α = 0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 10 (α = 0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.67	± 1.20	±0.03% of span
Cu 10 (α = 0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.67	± 1.20	±0.03% of span
Thermocouples[4]								
Type B[5]	NIST Monograph 175, IEC 584	100 to 1820	212 to 3308	25	45	± 0.77	± 1.39	±0.03% of span
Type E	NIST Monograph 175, IEC 584	–50 to 1000	–58 to 1832	25	45	± 0.20	± 0.36	±0.03% of span
Type J	NIST Monograph 175, IEC 584	–180 to 760	–292 to 1400	25	45	± 0.35	± 0.63	±0.03% of span
Type K[6]	NIST Monograph 175, IEC 584	–180 to 1372	–292 to 2501	25	45	± 0.50	± 0.90	±0.03% of span
Type N	NIST Monograph 175, IEC 584	–200 to 1300	–328 to 2372	25	45	± 0.50	± 0.90	±0.03% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.75	± 1.35	±0.03% of span

(1) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
(2) The published digital accuracy applies over the entire sensor input range. Digital output can be accessed by Profibus Communications or Rosemount control system.
(3) Total Analog accuracy is the sum of digital and D/A accuracies. This is not applicable for FOUNDATION fieldbus.
(4) Total digital accuracy for thermocouple measurement: sum of digital accuracy +0.5 °C. (cold junction accuracy).
(5) Digital accuracy for NIST Type B T/C is ±3.0 °C (±5.4 °F) from 100 to 300 °C (212 to 572 °F).
(6) Digital accuracy for NIST Type K T/C is ±0.70 °C (±1.26 °F) from –180 to –90 °C (–292 to –130 °F).

Ambient Temperature Effect

Sensor Options	Sensor Reference	Input Range (°C)	Temperature Effects per 1.0 °C (1.8 °F) Change in Ambient Temperature[1]	Range
2-, 3-, 4-wire RTDs				
Pt 100 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Pt 200 (α = 0.00385)	IEC 751	-200 to 850	0.004 °C (0.0072 °F)	Entire Sensor Input Range
Pt 500 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Pt 1000 (α = 0.00385)	IEC 751	-200 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Pt 100 (α = 0.003916)	JIS 1604	-200 to 645	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Pt 200 (α = 0.003916)	JIS 1604	-200 to 645	0.004 °C (0.0072 °F)	Entire Sensor Input Range
Ni 120	Edison Curve No. 7	-70 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Cu 10	Edison Copper Winding No. 15	-50 to 250	0.03 °C (0.054 °F)	Entire Sensor Input Range
Pt 50 (α = 0.00391)	GOST 6651-94	-200 to 550	0.004 °C (0.0072 °F)	Entire Sensor Input Range
Pt 100 (α = 0.00391)	GOST 6651-94	-200 to 550	0.003 °C (0.0054 °F)	Entire Sensor Input Range
Cu 50 (α = 0.00426)	GOST 6651-94	-50 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range
Cu 50 (α = 0.00428)	GOST 6651-94	-185 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range
Cu 100 (α = 0.00426)	GOST 6651-94	-50 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range
Cu 100 (α = 0.00428)	GOST 6651-94	-185 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range
Thermocouples				
Type B	NIST Monograph 175, IEC 584	100 to 1820	0.014 °C	T ≥ 1000 °C
			0.032 °C – (0.0025% of (T – 300))	300 °C ≤ T < 1000 °C
			0.054 °C – (0.011% of (T – 100))	100 °C ≤ T < 300 °C
Type E	NIST Monograph 175, IEC 584	-50 to 1000	0.005 °C + (0.0043% of T)	All
Type J	NIST Monograph 175, IEC 584	-180 to 760	0.0054 °C + (0.00029%of T)	T ≥ 0 °C
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C
Type K	NIST Monograph 175, IEC 584	-180 to 1372	0.0061 °C + (0.0054% of T)	T ≥ 0 °C
			0.0061 °C + (0.0025% of absolute value T)	T < 0 °C
Type N	NIST Monograph 175, IEC 584	-200 to 1300	0.0068 °C + (0.00036% of T)	All
Type R	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C
			0.023 °C – (0.0036% of T)	T < 200 °C
Type S	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C
			0.023 °C – (0.0036% of T)	T < 200 °C
Type T	NIST Monograph 175, IEC 584	-200 to 400	0.0064 °C	T ≥ 0 °C
			0.0064 °C +(0.0043% of absolute value T)	T < 0 °C
DIN Type L	DIN 43710	-200 to 900	0.0054 °C + (0.00029% of T)	T ≥ 0 °C
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C
DIN Type U	DIN 43710	-200 to 900	0.0064 °C	T ≥ 0 °C
			0.0064 °C + (0.0043% of absolute value T)	T < 0 °C
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	0.016 °C	T ≥ 200 °C
			0.023 °C – (0.0036% of T)	T < 200 °C
GOST Type L	GOST R 8.585-2001	-200 to 800	0.007 °C	T ≥ 0 °C
			0.007 °C – (0.003% of absolute value T)	T < 0 °C
Other Input Types				
Millivolt Input		-10 to 100 mV	0.0005 mV	Entire Sensor Input Range
2-, 3-, 4-wire Ohm		0 to 2000 Ω	0.0084 Ω	Entire Sensor Input Range

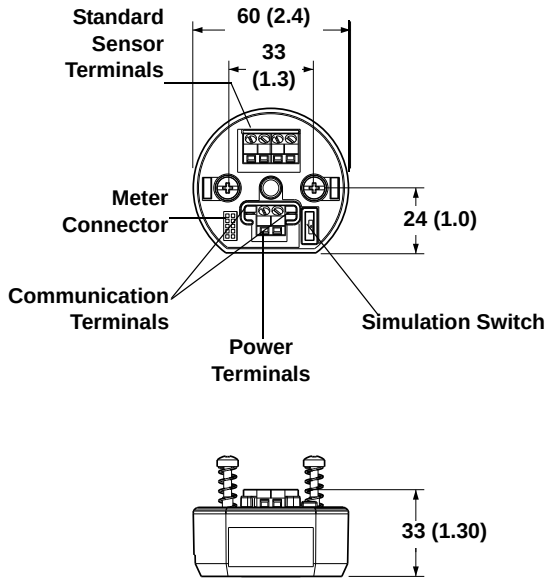
(1) Change in ambient is with reference to the calibration temperature of the transmitter 68 °F (20 °C) from factory.

Transmitters can be installed in locations where the ambient temperature is between –40 and 85 °C (–40 and 185 °F). In order to maintain excellent accuracy performance, each transmitter is individually characterized over this ambient temperature range at the factory.

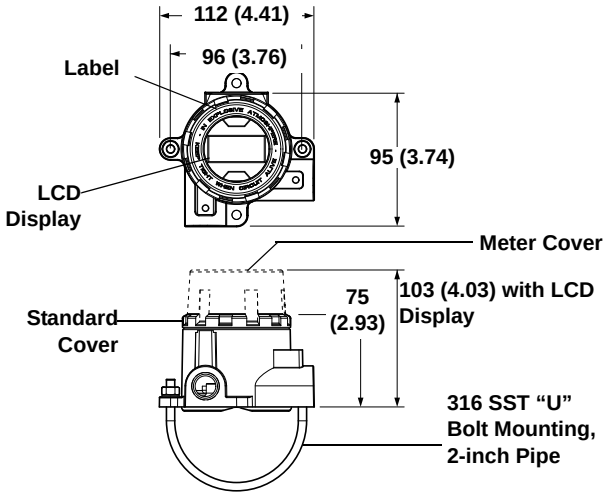
DIMENSIONAL DRAWINGS

644H (DIN A Head Mount)

Shown with Standard Compression Screw Terminals

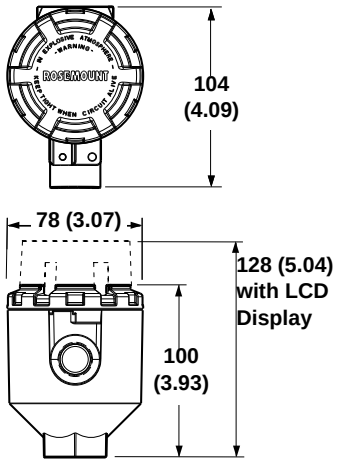


Threaded-Sensor Universal Head (Option code J5, J6, J7 or J8)



Note: A "U" Bolt is shipped with each universal head unless assembly option XA is ordered. Since the head is integrally mounted to the sensor, it may not need to be used.

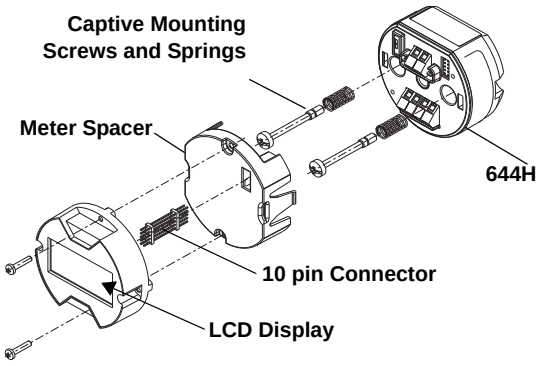
Integral DIN Style Sensor Connection Head (see Sensor PDS for ordering options)



Note: If ordering the transmitter with a DIN style sensor, it is required that the enclosure be ordered within the Sensor Model (Product Data Sheet doc # 00813-0200-2654) rather than within the transmitter model, this is in order to drive necessary parts.

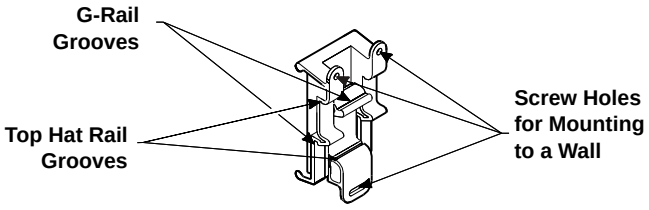
Dimensions are in millimeters (inches)

644H with LCD Display



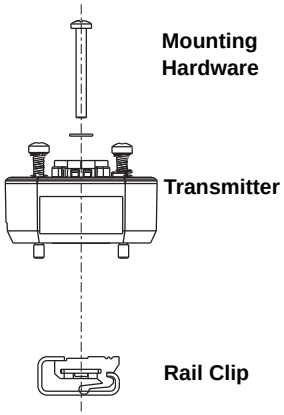
Mounting Kits for 644H

644R Rail & Walls Clips

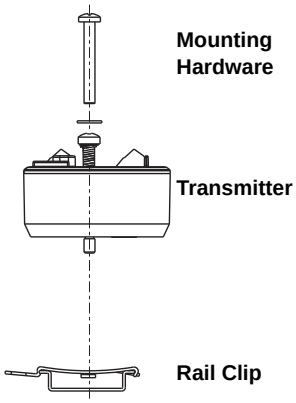


644H Rail Clips

G-Rail (asymmetric)

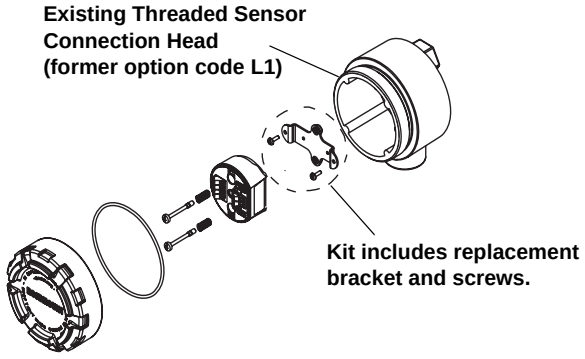


Top Hat Rail (symmetric)



Note: Kit (part number 00644-5301-0010) includes mounting hardware and both types of rail kits.

644H Retrofit Kit



Note: Kit (part number 00644-5321-0010) includes a new mounting bracket and the hardware necessary to facilitate the installation.

ORDERING INFORMATION

Table A-2. Rosemount 644 Smart Temperature Transmitter Ordering Information

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

● = Available
– = Not Available

Model	Product Description					
644	Smart Temperature Transmitter					
Transmitter Type						
Standard						**Standard**
H	Head Mount (suitable for mounting in the field with enclosure options below)					★
R	Rail Mount					★
Output		**Head**			**Rail**	
Standard						**Standard**
A	4–20 mA with Digital Signal based on HART protocol	●			●	★
F	FOUNDATION fieldbus digital signal (includes 2 AI function blocks and Backup Link Active Scheduler)	●			–	★
W	Profibus PA digital signal	●			–	★
Product Certifications						
Hazardous Locations Certificates (consult factory for availability)		**A**	**F**	**W**	**A**	
Standard						**Standard**
E5(1)	FM Explosion–Proof	●	●	●	–	★
I5(2)	FM Intrinsic Safety (includes standard I.S. and FISCO for fieldbus units)	●	●	●	●	★
K5(2)	FM Intrinsic Safety and Explosion–Proof combination (includes standard I.S. and FISCO for fieldbus units)	●	●	●	–	★
KC	FM/CSA Intrinsic Safety and Non-incendive Approval	●	●	●	–	★
I6(2)	CSA Intrinsic Safety (includes standard I.S. and FISCO for fieldbus units)	●	●	●	–	★
K6(1)(3)	CSA Intrinsic Safety and Explosion–Proof combination (includes standard I.S. and FISCO for fieldbus units)	●	●	●	–	★
I3	NEPSI Intrinsic Safety	●	●	●	–	★
E3	NEPSI Flameproof	●	●	●	–	★
E1(1)	ATEX Flameproof	●	●	●	–	★
N1(1)	ATEX Type n	●	●	●	–	★
NC	ATEX Type n Component	●	●	●	●	★
ND(1)	ATEX Dust Ignition–Proof	●	●	●	–	★
I1(2)	ATEX Intrinsic Safety (includes standard I.S. and FISCO for fieldbus units)	●	●	●	●	★
E7(1)	IECEx Flameproof and Dust	●	●	●	–	★
I7(3)(2)	IECEx Intrinsic Safety (includes standard I.S. and FISCO for fieldbus units)	●	●	●	●	★
N7(1)(3)	IECEx Type n	●	●	●	–	★
NG	IECEx Type n Component	●	●	●	●	★
E4(1)(3)	TIIS Explosion–Proof	●	●	●	●	★
E2	INMETRO Flameproof	●	●	●	–	★
NA	No approval	●	●	●	●	★
OPTIONS		**A**	**F**	**W**	**A**	
Plant Web Software Functionality						
Standard						**Standard**
A01	Regulatory Control Suite – 1 PID Block	–	●	–	–	★
Assembly						
Standard						**Standard**
XA	Sensor specified separately and assembled to transmitter	●	●	●	–	★

Table A-2. Rosemount 644 Smart Temperature Transmitter Ordering Information

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

● = Available
– = Not Available

		Head			Rail	
		A	F	W	A	
Enclosure						
Standard						**Standard**
J5[4][5]	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) SST pipe bracket (M20 entries)	●	●	●	–	★
J6[3]	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) SST pipe bracket (1/2–14 NPT entries)	●	●	●	–	★
J7[3][5]	Universal Head (junction box), cast SST with 50.8 mm (2-in.) SST pipe bracket (M20 entries)	●	●	●	–	★
J8[3]	Universal Head (junction box), cast SST with 50.8 mm (2-in.) SST pipe bracket (1/2–14 NPT entries)	●	●	●	–	★
Expanded						
S1	Connection Head, Polished Stainless Steel (1/2–14 NPT entries)	●	●	●	–	
S2	Connection Head, Polished Stainless Steel (1/2–14 NPSM entries)	●	●	●	–	
S3	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit and entries)	●	●	●	–	
S4	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit entries, M24 x 1.5 head entry)	●	●	●	–	
Local Display (644H only)						
Standard						**Standard**
M5	LCD Display	●	●	●	–	★
Expanded						
M6	LCD Display with Polycarbonate Meter Face	●	●	●	–	
Configuration						
Standard						**Standard**
C1	Factory configuration date, descriptor, and message fields (CDS, document number 00806-0100-4728 required).	●	●	●	●	★
Analog Output						
Standard						**Standard**
A1	Analog output levels compliant with NAMUR-recommendations NE 43: June 1997: high alarm configuration	●	–	–	●	★
CN	Analog output levels compliant with NAMUR-recommendations NE 43: June 1997: low alarm configuration	●	–	–	●	★
C8	Low Alarm (standard Rosemount alarm and saturation values)	●	–	–	●	★
Filter						
Standard						**Standard**
F6	60 Hz line voltage filter	●	●	●	●	★
Trim						
Standard						**Standard**
C2	Transmitter-sensor matching, trim to specific Rosemount RTD calibration schedule (CVD constants)	●	●	●	●	★
Calibration Option						
Standard						**Standard**
C4	5-point calibration. *Use option code Q4 to generate a calibration certificate*	●	●	●	●	★
Q4	Calibration certificate. *3-Point calibration with certificate*	●	●	●	●	★
		Head			**Rail**	
		A	**F**	**W**	**A**	

Table A-2. Rosemount 644 Smart Temperature Transmitter Ordering Information

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

		● = Available – = Not Available				
Accessory Options						
Standard						**Standard**
G1	External ground lug assembly(6) (see "External Ground Screw Assembly" on page A-12)	●	●	●	–	★
G2	Cable gland(7), EEx d, Brass, 7.5 mm - 11.99 mm	●	●	●	–	★
G7	Cable gland, M20x1.5, EEx e, Blue, Polyamide, Diam 5-9mm	●	●	●	–	★
G3	Cover chain. *Only available with enclosure option codes J5 or J6. Not available with LCD Display option code M5.*	●	●	●	–	★
G5	*WAGO* spring clamp terminals	●	●	●	–	★
Interlinkbt Connector						
Standard						**Standard**
GE(8)	Eurofast® Interlinkbt Connector	●	●	●	–	★
GM(8)	Minifast® Interlinkbt Connector	●	●	●	–	★
External Label						
Standard						**Standard**
EL	External label for ATEX Intrinsic Safety	●	●	●	–	★
Typical Rail Mount Model Number: 644 R A I5 **Typical Head Mount Model Number: 644 H F I5 M5 J5 C1**						

(1) Requires enclosure option J5, J6, J7, or J8.
(2) When IS approval is ordered on a Profibus PA, both standard IS and FISCO IS approvals apply. The device label is marked appropriately.
(3) Consult factory for availability.
(4) Suitable for remote mount configuration.
(5) When ordered with XA, 1/2" NPT enclosure will come equipped with an M20 adapter with the sensor installed as process ready.
(6) Only available with Enclosure option code J5 or J6. For ATEX approved units the Ground Lug Assembly is included. It is not necessary to include code G1 for units with ATEX approvals.
(7) Only available with Enclosure option code J5.
(8) Available with Intrinsically Safe approvals only. For FM Intrinsically Safe or non-incendive approval (option code I5), install in accordance with Rosemount drawing 03151-1009 to maintain NEMA 4X rating.

NOTE
For additional options (e.g. "K" codes), please contact your local Emerson Process Management representative.

Tagging

Hardware

- 13 characters total
- Tags are adhesive labels
- Permanently attached to transmitter
- Character height is $^{1}/_{16}$-in (1.6 mm)

Software

- Order with C1 option
- The transmitter can store up to 13 characters for Profibus PA. If no characters are specified, the first 8 characters of the hardware tag are the default.

Considerations

Special Mounting Considerations

See “Mounting Kits for 644H” on page A-8 for the special hardware that is available to:

- Mount a 644H to a DIN rail. (see Table A-3 on page A-12)
- Retrofit a new 644H to replace an existing 644H transmitter in an existing threaded sensor connection head.(see Table A-3 on page A-12)

External Ground Screw Assembly

The external ground screw assembly can be ordered by specifying code G1 when an enclosure is specified. However, some approvals include the ground screw assembly in the transmitter shipment, hence it is not necessary to order code G1. The table below identifies which approval options include the external ground screw assembly and which do not.

Approval Type	External Ground Screw Assembly Included?
E5, I1, I2, I5, I6, I7, K5, K6, NA, I4	No–Order option code G1
E1, E2, E3, E4, E7, K7, N1, N7, ND	Yes

Table A-3. Transmitter Accessories

Part Description	Part Number
Aluminum alloy Universal Head, standard cover—M20 entries	00644-4420-0002
Aluminum alloy Universal Head, meter cover—M20 entries	00644-4420-0102
Aluminum alloy Universal Head, standard cover—$^{1}/_{2}$-14 NPT entries	00644-4420-0001
Aluminum alloy Universal Head, meter cover—$^{1}/_{2}$-14 NPT entries	00644-4420-0101
LCD Display (includes meter and meter spacer assembly)	00644-4430-0002
LCD Display kit (includes meter and meter spacer assembly, and meter cover)	00644-4430-0001
Ground screw assembly kit	00644-4431-0001
Kit, Hardware for mounting a 644H to a DIN rail (includes clips for symmetrical and asymmetrical rails)	00644-5301-0010
Kit, Hardware for retrofitting a 644H in an existing threaded sensor connection head (former option code L1)	00644-5321-0010
Kit, 316 U-Bolt for Universal Housing	00644-4423-0001
Universal clip for rail or wall mount	03044-4103-0001
24 Inches of symmetric (top hat) rail	03044-4200-0001
24 Inches of asymmetric (G) rail	03044-4201-0001
Ground clamp for symmetric or asymmetric rail	03044-4202-0001
End clamp for symmetric or asymmetric rail	03044-4203-0001
Snap rings kit (used for assembly to a DIN sensor – quantity 12)	00644-4432-0001
SST Universal Head, standard cover—M20 entries	00644-4433-0002

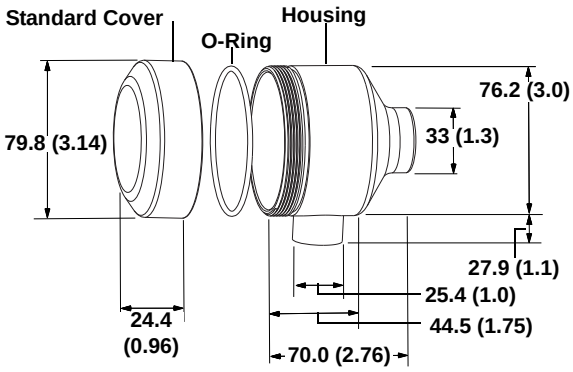
Table A-3. Transmitter Accessories

Part Description	Part Number
SST Universal Head, meter cover—M20 entries	00644-4433-0102
SST Universal Head, standard cover—1/2-14 NPT entries	00644-4433-0001
SST Universal Head, meter cover—1/2-14 NPT entries	00644-4433-0101
Polished SST Connection Head, standard cover—1/2-14 NPT entries	00079-0312-0011
Polished SST Connection Head, meter cover—1/2-14 NPT entries	00079-0312-0111
Polished SST Connection Head, standard cover—1/2-14 NPSM entries	00079-0312-0022
Polished SST Connection Head, meter cover—1/2-14 NPSM entries	00079-0312-0122
Polished SST Connection Head, standard cover—M20 x 1.5 entries	00079-0312-0033
Polished SST Connection Head, meter cover—M20 x 1.5 entries	00079-0312-0133
Polished SST Connection Head, standard cover—M20 x 1.5 / M24 x 1.5 entries	00079-0312-0034
Polished SST Connection Head, meter cover—M20 x 1.5 / M24 x 1.5 entries	00079-0312-0134

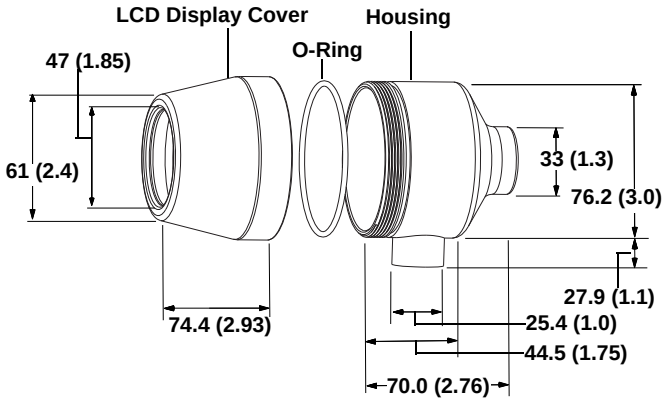
Dimensional Drawings

Sanitary Housing Covers

Standard Cover



LCD Display Cover



Dimensions are in millimeters (inches)

Configuration

Transmitter Configuration

The transmitter is available with standard configuration setting for Profibus PA (see “Standard Profibus PA Configuration”). The configuration settings and block configuration may be changed in the field with Emerson’s DeltaV®, AMS™ Suite, Handheld Field Communicator or other host or configuration tool.

Standard Profibus PA Configuration

Unless specified, the transmitter will be shipped as follows:

Device Address: 126
Sensor Type: RTD, Pt 100 (α=0.00385, 4-wire)
Damping: 5 sec.
Units of Measurement: °C
Line Voltage Filter: 50 Hz
Software Tag:
Alarm Limits: • HI-HI: Infinity • HI: Infinity • LO: - Infinity • LO-LO: Infinity
Local Display (when installed): Engineering Units of Temperature

Appendix B Product Certifications

APPROVED MANUFACTURING LOCATIONS

Emerson Process Management Rosemount Division. – Chanhassen, Minnesota, USA

Rosemount Temperature GmbH – Germany

Emerson Process Management Asia Pacific – Singapore

EUROPEAN UNION DIRECTIVE INFORMATION

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

ATEX Directive (94/9/EC)

Rosemount Inc. complies with the ATEX Directive.

CE Electromagnetic Compatibility Compliance Testing

The 644 meets the criteria under IEC 61326:2006

HAZARDOUS LOCATIONS CERTIFICATES

Rosemount 644 with Profibus PA

North American Certifications

Factory Mutual (FM) Approvals

I5 FM Intrinsically Safe
Intrinsically Safe (Entity) / FISCO for use in Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G; when installed per control drawing 00644-2075.
Temperature Code: T4A (T_{amb} = – 50 °C to 60 °C).
Nonincendive for use in Class I, Division 2, Groups A, B, C, and D.
Temperature Code: T6 (T_{amb} = – 50 °C to 70 °C);
T5 (T_{amb} = – 50 °C to 85 °C)

E5 FM Explosion Proof
Explosion Proof for Class I, Division 1, Groups B, C, and D.

Nonincendive for use in Class 1, Division 2, Groups A, B, C, and D.

Temperature Code: T5 (T_{amb} = – 50 °C to 85 °C)
When installed per Rosemount control drawing 00644-1049

Dust Ignition Proof for Class II/III, Division 1, Groups E, F, G.
Temperature Code: T5 (T_a = – 50 °C to 85 °C)

When installed per Rosemount drawing 00644-1049.
(J5, J6, and J8 options only.)

Canadian Standards Association (CSA) Approvals

I6 CSA Intrinsically Safe
Intrinsically Safe and FISCO for Class I, Division 1, groups A, B, C, and D when connected per Rosemount drawing 00644-2076.

Temperature code: T4 (T_{amb} = – 50 °C to 60 °C);

Suitable for Class I, Division 2, groups A, B, C, and D (must be installed in a suitable enclosure)

K6 CSA Intrinsically Safe, Explosion–proof
Includes Intrinsically Safe “I6” and Explosion-Proof for Class I, Division 1, groups 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
Seal not required.
CSA Enclosure Type 4X

Temperature Code: T4 (T_{amb} = – 50 °C to 60 °C);
T5 (T_{amb} = – 50 °C to 85 °C)

NOTE
K6 is only available with 644H option codes J5 and J6.

European Certifications

ATEX Approvals

E1 ATEX Flame Proof
Certificate Number: KEMA99ATEX8715X
ATEX Marking: ⟨Ex⟩ II 2 G
CE 1180
Ex d IIC T6 (–40 °C ≤ T_{amb} ≤ 65 °C)
U_i = 32 Vdc

SPECIAL CONDITIONS FOR SAFE USE (X):

For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

I1 ATEX Intrinsic Safety
Certificate Number: Baseefa03ATEX0499X
ATEX Marking: ⟨Ex⟩ II 1 G
CE 1180
Ex ia IIC T4 (-50 °C ≤ T_{amb} ≤ 60 °C)

Table B-1. Entity Parameters

I.S. Loop/Power Terminals
U_i = 30 V
I_i = 300 mA
P_i = 1.3 W
C_i = 2.1 nF
L_i = 0
FISCO Loop/Power Terminals
U_i = 17.5 V
I_i = 380 mA
P_i = 5.32 W
C_i = 2.1 nF
L_i = 0
Sensor Terminals
U_o = 13.9 V
I_o = 23 mA
P_o = 79 mW
C_i = 7.7 nF
L_i = 0

SPECIAL CONDITIONS FOR SAFE USE (X):

The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20. Non-metallic enclosures must have a surface resistance of less than 1GΩ, light alloy or zirconium enclosures must be protected from impact and friction when installed.

N1 ATEX Type n
Certificate Number: BAS00ATEX3145
ATEX Marking: ⟨Ex⟩ II 3 G
Ex nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)
U_i = 32 V

NC ATEX Type n Component
Certificate Number: BAS99ATEX3084U
ATEX Marking: ⟨Ex⟩ II 3 G
Ex nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)
U_i = 32 V

NOTE
The equipment must be installed in an enclosure meeting the requirements of IP54 and the requirements of the impact tests described in EN50021.

ND ATEX Dust Ignition-Proof
Certificate Number: KEMA99ATEX8715X
ATEX Marking: ⟨Ex⟩ II 1 D
tD A20 T95°C (-40 °C ≤ T_{amb} ≤ 85 °C)
CE 1180
IP66

SPECIAL CONDITIONS FOR SAFE USE (X):

For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

IECEx Certifications

E7 IECEx Flameproof and Dust
Certificate Number: IECEx KEM 09.0015X
Ex d IIC T6 (Flameproof)

Ex tD A20 IP 66 T 95 °C (Dust)

Vmax = 32 V

SPECIAL CONDITIONS FOR SAFE USE (X):

For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

Table B-2. Electrical Data

Transmitter	Sensor
V_{max} = 32 Vdc	U_{max} = 5 Vdc
I_{max} = 12.0 mA	I_{max} = 2.0 mA

I7 IECEx Intrinsic Safety
Certificate Number: IECEx BAS 07.0053X
Ex ia IIC T4/T5/T6

Table B-3. Temperature Classification

$P_{i\ (W)}$	Temperature Class	T_{amb}
1.3	T4	-50 °C to 60 °C
5.32 (FISCO Group IIC)	T4	-60 °C to 80 °C

SPECIAL CONDITIONS FOR SAFE USE (X):

1. The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20.
2. Non-metallic enclosures must have a surface resistance of less than 1 GΩ; light alloy or zirconium enclosures must be protected from impact and friction when installed.

Table B-4. Entity Parameters

Transmitter (I.S.)	Transmitter (FISCO)	Sensor
U_i = 30 Vdc	U_i = 17.5 Vdc	U_o = 13.9 Vdc
I_i = 300 mA	I_i = 380 mA	I_o = 23 mA
P_i = 1.3 W	P_i = 5.32 W	P_o = 79 mW
C_i = 2.1 nF	C_i = 2.1 nF	C_i = 7.7 nF
L_i = 0 mH	L_i = 0 mH	L_i = 0 mH

N7 IECEx Type n
Certificate Number: IECEx BAS 07.0055
Ex nA nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)

Table B-5. Electrical Data

Transmitter	Sensor	
	RTD	Thermocouple
U_i = 32 V	U_i = 5 V	U_i = 0

NG IECEx Type n Component
Certificate Number: IECEx BAS 07.0054U
Ex nA nL IIC T5 (-40 °C ≤ T_{amb} ≤ 75 °C)

Input Parameter: Ui = 32 Vdc

SCHEDULE OF LIMITATIONS:

The component must be housed in a suitably certified enclosure that provides a degree of protection of at least IP54.

Japanese Certifications

Japanese Industrial Standard (JIS) Approvals

I4 JIS Intrinsic Safety

E4 JIS Explosion Proof

Table B-6. Certificate and Description

Certificate	Description	Approval Group	Temp Code
C15744	644H with meter and no sensor	Ex d II C	T6
C15745	644H without meter and no sensor	Ex d II C	T6
C15749	644H without meter and with RTD	Ex d II B	T4
C15750	644H without meter and with thermocouple	Ex d II B	T4

Table B-6. Certificate and Description

Certificate	Description	Approval Group	Temp Code
C15751	644H with meter and thermocouple	Ex d II B	T4
C15752	644H with meter and RTD	Ex d II B	T4
C15910	644H without meter and with thermocouple	Ex d II B + H2	T4
C15911	644H with meter and thermocouple	Ex d II B + H2	T4
C15912	644H without meter and with RTD	Ex d II B + H2	T4
C15913	644H with meter and RTD	Ex d II B + H2	T4

Combination Approvals

K5 Combination of I5 and E5.

Russian GOST Certifications

PPC BA-13006:

0 Ex ia IIC T4/T5/T6

Kazakhstan GOST

Pattern approval Certificate for Measuring Instruments

See Certificate

Ukraine GOST

Pattern Approval for Measuring Instruments

See Certificate

INSTALLATION DRAWINGS

The installation guidelines presented by the drawings must be followed in order to maintain certified ratings for installed transmitters.

Rosemount Drawing 00644-1064, 1 Sheet,
Canadian Standards Association Intrinsic Safety Installation Drawing

Rosemount Drawing 00644-1059, 1 Sheet;
Canadian Standards Association Explosion-Proof Installation Drawing

Rosemount Drawing 00644-2076, 3 Sheets;
Canadian Standards Association 644 Fieldbus Intrinsic Safety/FISCO Installation Drawing

Rosemount Drawing 00644-0009, 2 Sheet
Factory Mutual Intrinsic Safety Installation Drawing

Rosemount Drawing 00644-1049, 1 Sheet;
Factory Mutual Explosion-proof Installation Drawing

Rosemount Drawing 00644-2075, 3 Sheets;
Factory Mutual 644 Fieldbus Intrinsic Safety/FISCO 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).

Figure B-1. CSA Intrinsic Safety Installation Drawing 00644-1064, Rev. AB

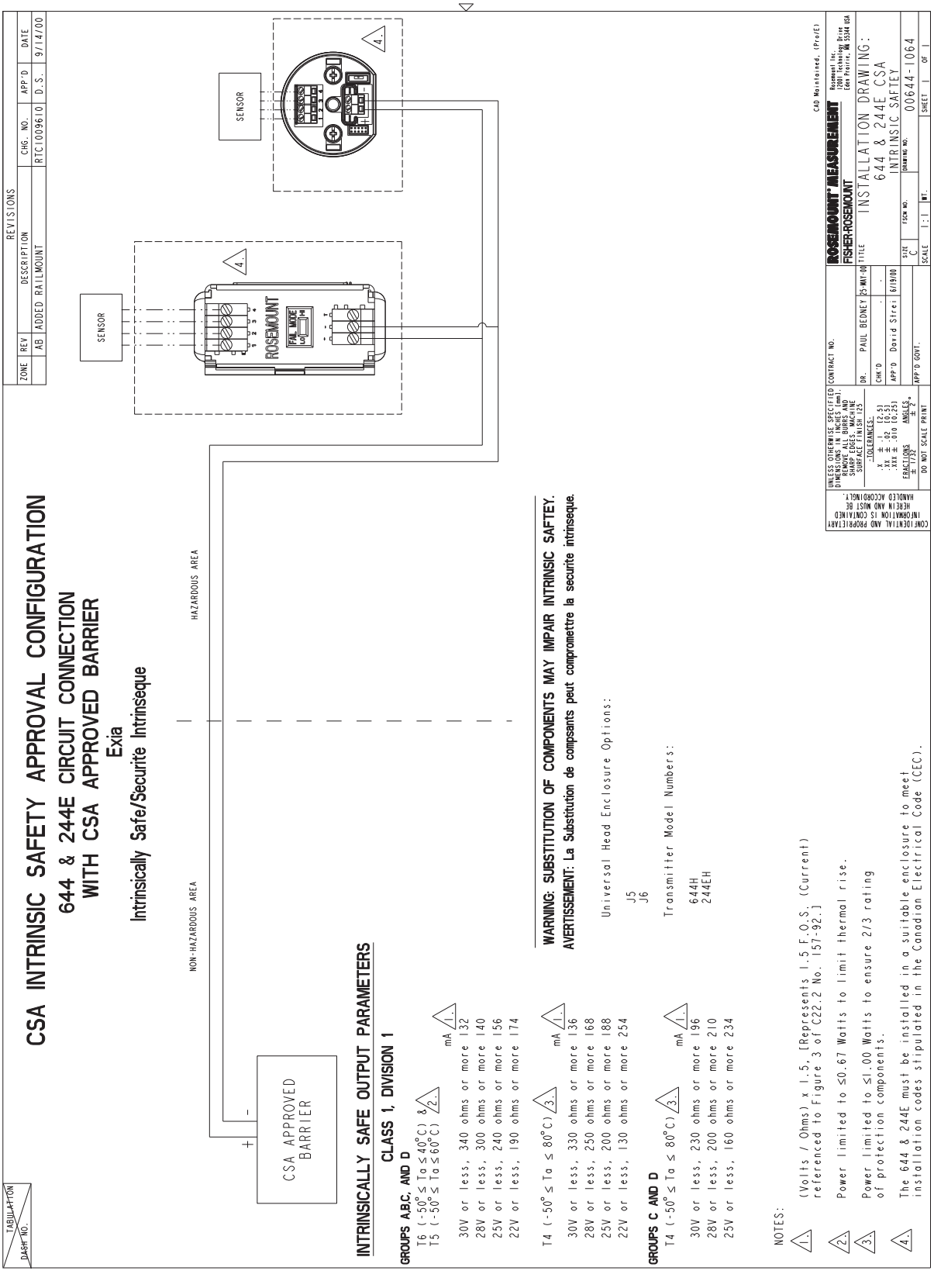


Figure B-2. CSA Explosion-Proof Installation Drawing 00644-1059, Rev. AF

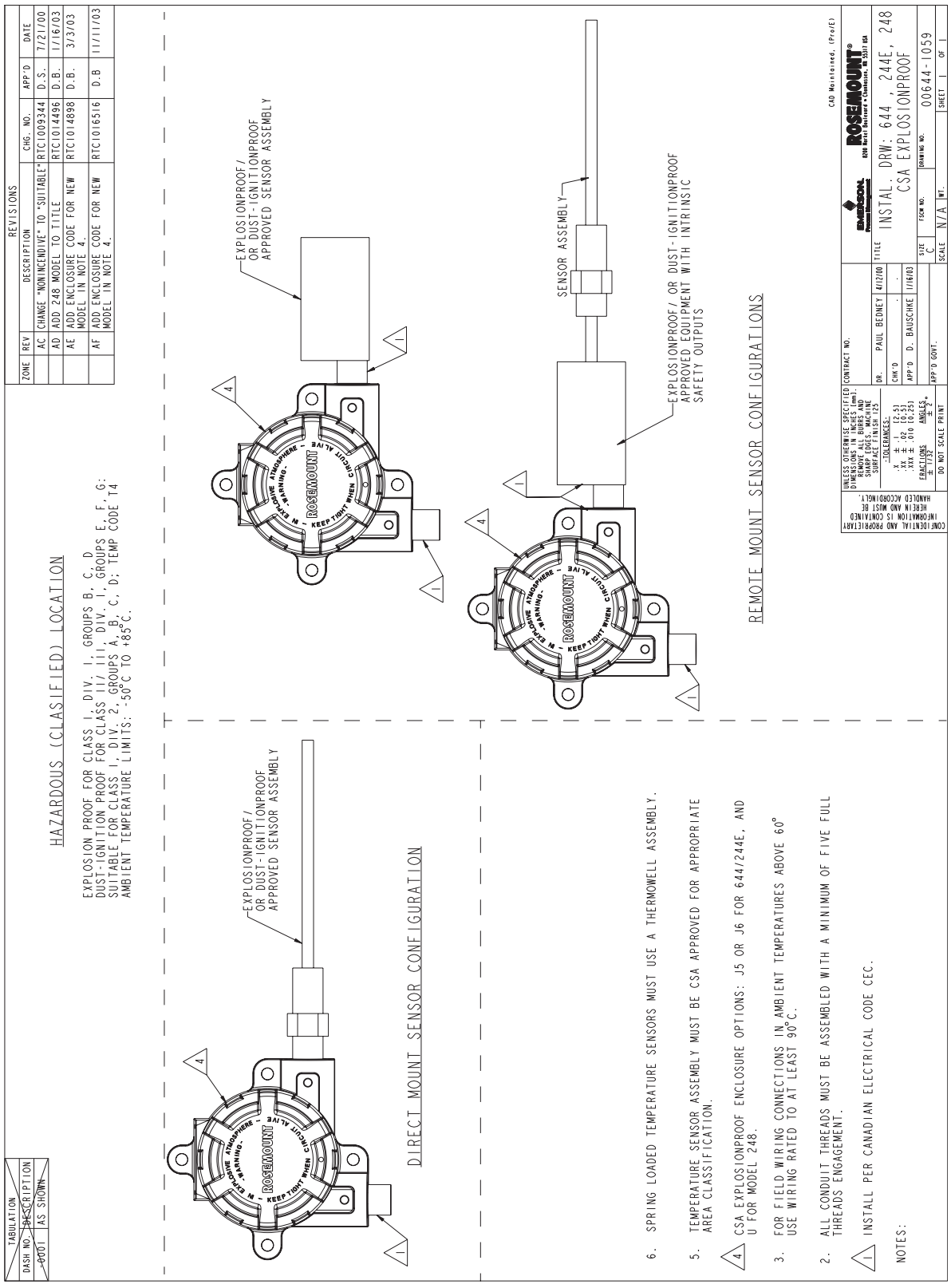
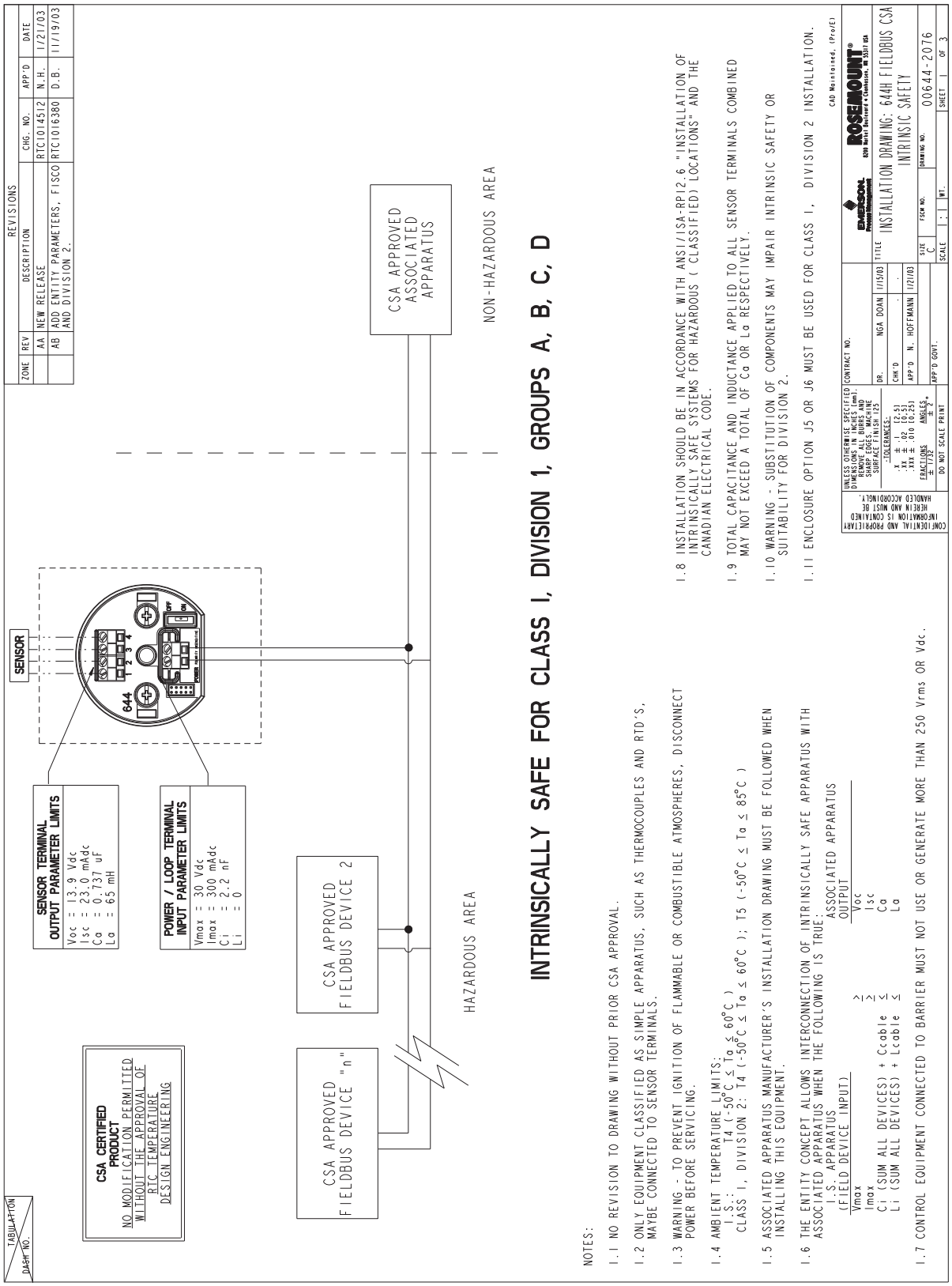
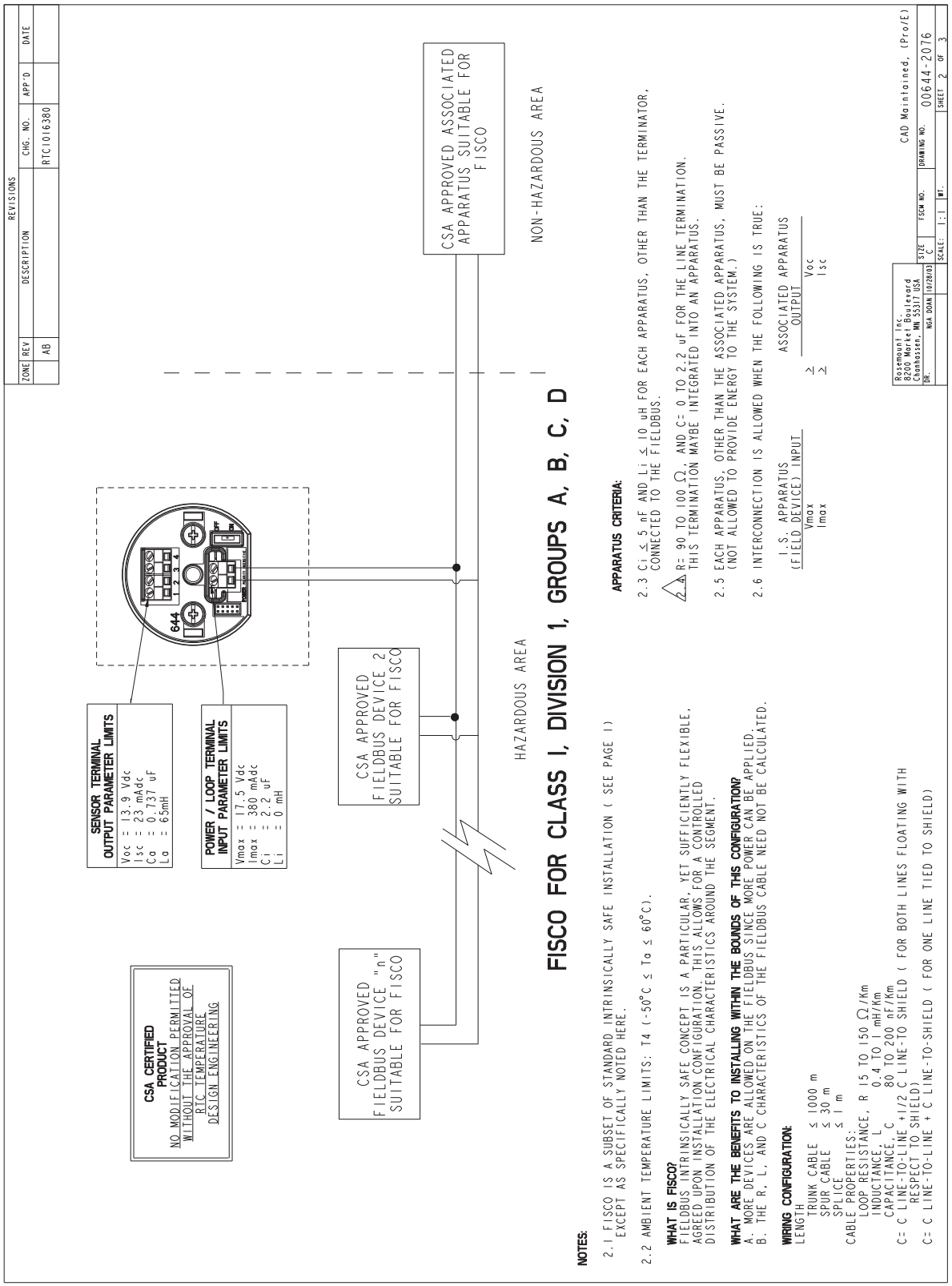


Figure B-3. CSA 644 Fieldbus Intrinsic Safety, FISCO Installation Drawing 00644-2076, Rev. AB Sheet 1 of 3



Sheet 2 of 3


REVISIONS
ZONE REV DESCRIPTION CHG. NO. APP'D DATE
AB RTC1016380
FISCO FOR CLASS I, DIVISION 1, GROUPS A, B, C, D
HAZARDOUS AREA
NON-HAZARDOUS AREA
CSA APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO
CSA APPROVED FIELDBUS DEVICE 2 SUITABLE FOR FISCO
CSA APPROVED FIELDBUS DEVICE "n" SUITABLE FOR FISCO
644
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Voc = 13.9 Vdc
Isc = 23 mAdc
Ca = 0.737 uF
La = 65mH
POWER / LOOP TERMINAL INPUT PARAMETER LIMITS
Vmax = 17.5 Vdc
Imax = 380 mAdc
Ci = 2.2 uF
Li = 0 mH
CSA CERTIFIED PRODUCT
NO MODIFICATION PERMITTED WITHOUT THE APPROVAL OF RTC TEMPERATURE DESIGN ENGINEERING
NOTES:
2.1 FISCO IS A SUBSET OF STANDARD INTRINSICALLY SAFE INSTALLATION (SEE PAGE 1) EXCEPT AS SPECIFICALLY NOTED HERE.
2.2 AMBIENT TEMPERATURE LIMITS: T4 (-50°C ≤ Ta ≤ 60°C).
WHAT IS FISCO?
FIELDBUS INTRINSICALLY SAFE CONCEPT IS A PARTICULAR, YET SUFFICIENTLY FLEXIBLE, AGREED UPON INSTALLATION CONFIGURATION. THIS ALLOWS FOR A CONTROLLED DISTRIBUTION OF THE ELECTRICAL CHARACTERISTICS AROUND THE SEGMENT.
WHAT ARE THE BENEFITS TO INSTALLING WITHIN THE BOUNDS OF THIS CONFIGURATION?
A. MORE DEVICES ARE ALLOWED ON THE FIELDBUS SINCE MORE POWER CAN BE APPLIED.
B. THE R, L, AND C CHARACTERISTICS OF THE FIELDBUS CABLE NEED NOT BE CALCULATED.
WIRING CONFIGURATION:
LENGTH
TRUNK CABLE ≤ 1000 m
SPUR CABLE ≤ 30 m
SPLICE ≤ 1 m
CABLE PROPERTIES:
LOOP RESISTANCE, R 15 TO 150 Ω/Km
INDUCTANCE, L 0.4 TO 1 mH/Km
CAPACITANCE, C 80 TO 200 nF/Km
C= C LINE-TO-LINE +1/2 C LINE-TO SHIELD (FOR BOTH LINES FLOATING WITH RESPECT TO SHIELD)
C= C LINE-TO-LINE + C LINE-TO-SHIELD (FOR ONE LINE TIED TO SHIELD)
APPARATUS CRITERIA:
2.3 Ci ≤ 5 nF AND Li ≤ 10 uH FOR EACH APPARATUS, OTHER THAN THE TERMINATOR, CONNECTED TO THE FIELDBUS.
2.4 R= 90 TO 100 Ω, AND C= 0 TO 2.2 uF FOR THE LINE TERMINATION. THIS TERMINATION MAYBE INTEGRATED INTO AN APPARATUS.
2.5 EACH APPARATUS, OTHER THAN THE ASSOCIATED APPARATUS, MUST BE PASSIVE. (NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM.)
2.6 INTERCONNECTION IS ALLOWED WHEN THE FOLLOWING IS TRUE:
I.S. APPARATUS (FIELD DEVICE) INPUT ≥ ASSOCIATED APPARATUS OUTPUT
Vmax ≥ Voc
Imax ≥ Isc
Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA
DR. NGA DOAN 10/28/03
SIZE C
SCALE: 1:1
FSCM NO.
DRAWING NO. 00644-2076
WT.
SHEET 2 OF 3
CAD Maintained, (Pro/E)

Sheet 3 of 3

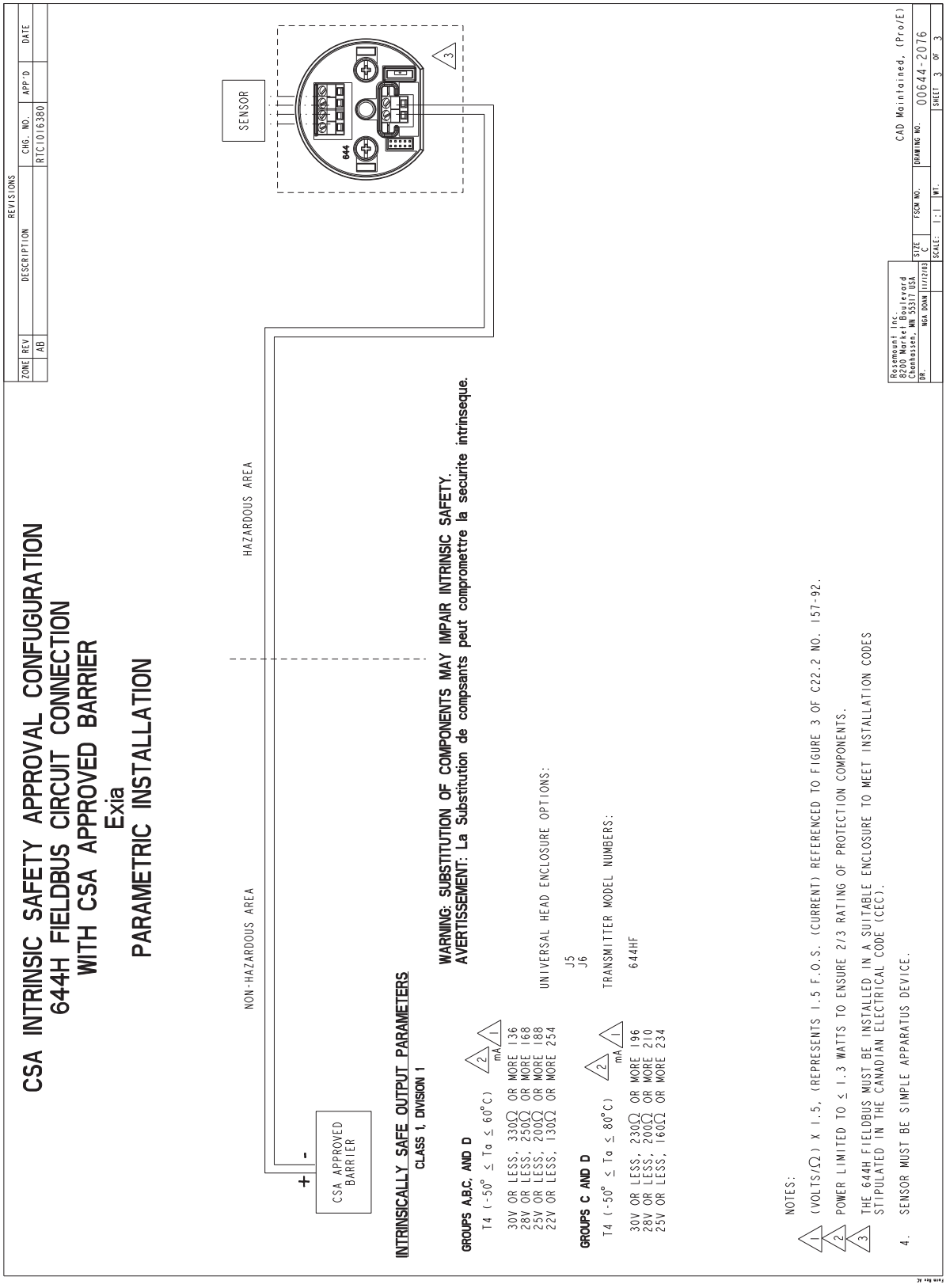
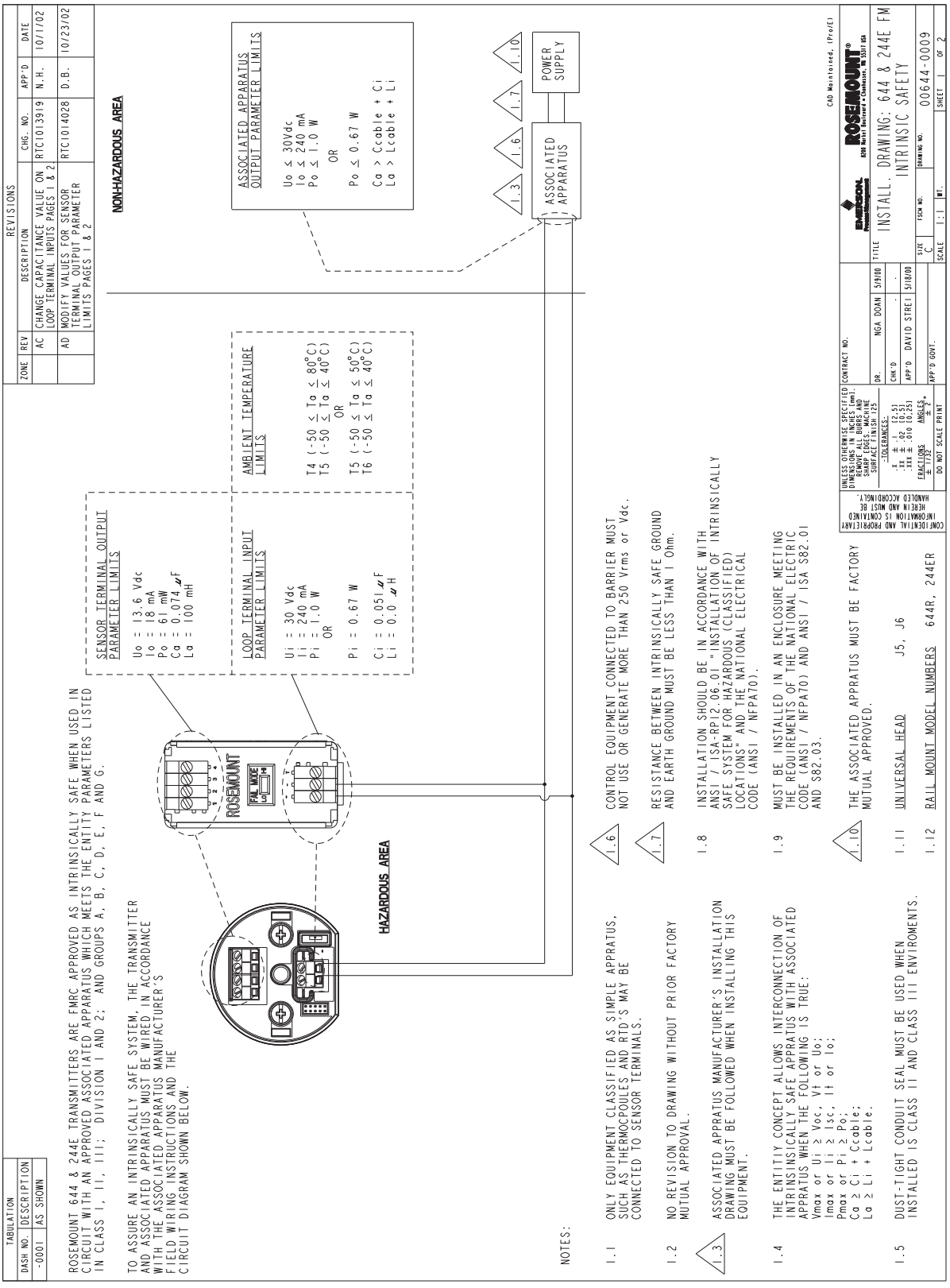

CSA INTRINSIC SAFETY APPROVAL CONFUGURATION
644H FIELDBUS CIRCUIT CONNECTION
WITH CSA APPROVED BARRIER
Exia
PARAMETRIC INSTALLATION
REVISIONS
ZONE REV DESCRIPTION CHG. NO. APP'D DATE
AB RTC1016380
NON-HAZARDOUS AREA
HAZARDOUS AREA
SENSOR
644
+
-
CSA APPROVED BARRIER
INTRINSICALLY SAFE OUTPUT PARAMETERS
CLASS 1, DIVISION 1
GROUPS A,B,C, AND D
T4 (-50° ≤ Ta ≤ 60°C)
mA
30V OR LESS, 330Ω OR MORE 136
28V OR LESS, 250Ω OR MORE 168
25V OR LESS, 200Ω OR MORE 188
22V OR LESS, 130Ω OR MORE 254
GROUPS C AND D
T4 (-50° ≤ Ta ≤ 80°C)
mA
30V OR LESS, 230Ω OR MORE 196
28V OR LESS, 200Ω OR MORE 210
25V OR LESS, 160Ω OR MORE 234
WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
AVERTISSEMENT: La Substitution de compsants peut compromettre la securite intrinseque.
UNIVERSAL HEAD ENCLOSURE OPTIONS:
J5
J6
TRANSMITTER MODEL NUMBERS:
644HF
NOTES:
1. (VOLTS/Ω) X 1.5, (REPRESENTS 1.5 F.O.S. (CURRENT) REFERENCED TO FIGURE 3 OF C22.2 NO. 157-92.
2. POWER LIMITED TO ≤ 1.3 WATTS TO ENSURE 2/3 RATING OF PROTECTION COMPONENTS.
3. THE 644H FIELDBUS MUST BE INSTALLED IN A SUITABLE ENCLOSURE TO MEET INSTALLATION CODES STIPULATED IN THE CANADIAN ELECTRICAL CODE (CEC).
4. SENSOR MUST BE SIMPLE APPARATUS DEVICE.
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
DR. WCA DCAM 11/12/03
SIZE A2
SCALE: 1:1
FSCM NO.
WT.
CAD Maintained, (Pro/E)
DRAWING NO. 00644-2076
SHEET 3 OF 3

Figure B-4. FM Intrinsic Safety Installation Drawing 00644-0009, Rev. AD Sheet 1 of 2



Sheet 2 of 2

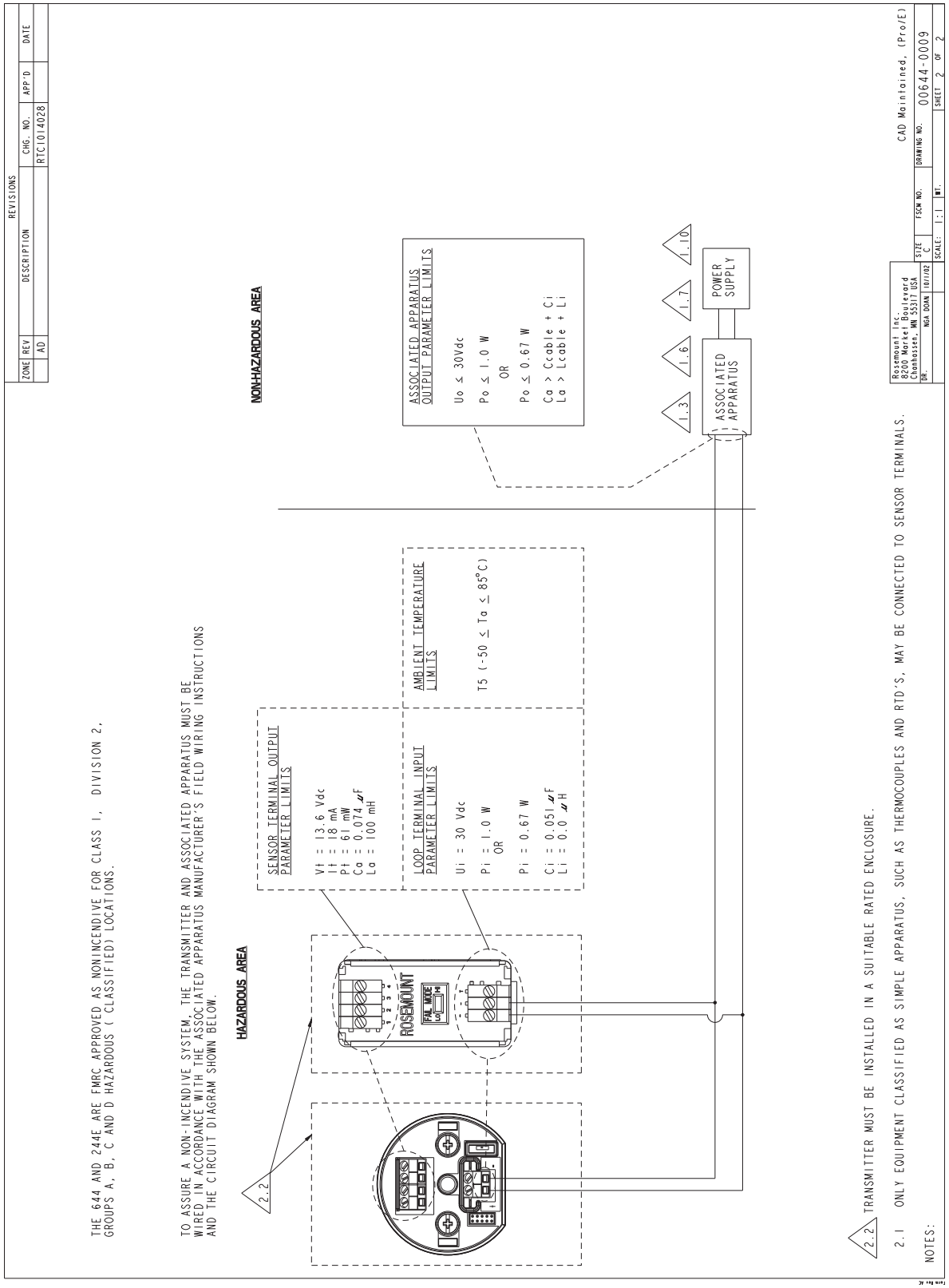

REVISIONS
ZONE REV DESCRIPTION CHG. NO. APP'D DATE
AD RTC101 4028
NONHAZARDOUS AREA
HAZARDOUS AREA
ASSOCIATED APPARATUS OUTPUT PARAMETER LIMITS
Uo ≤ 30Vdc
Po ≤ 1.0 W
OR
Po ≤ 0.67 W
Ca > Ccable + Ci
La > Lcable + Li
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Vt = 13.6 Vdc
It = 18 mA
Pt = 61 mW
Ca = 0.074 µF
La = 100 mH
LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 30 Vdc
Pi = 1.0 W
OR
Pi = 0.67 W
Ci = 0.051 µF
Li = 0.0 µH
AMBIENT TEMPERATURE LIMITS
T5 (-50 ≤ Ta ≤ 85°C)
ASSOCIATED APPARATUS
POWER SUPPLY
ROSEMOUNT
FAIL MODE
1.3
1.6
1.7
1.10
2.2
THE 644 AND 244E ARE FMRC APPROVED AS NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS (CLASSIFIED) LOCATIONS.
TO ASSURE A NON-INCENDIVE SYSTEM, THE TRANSMITTER AND ASSOCIATED APPARATUS MUST BE WIRED IN ACCORDANCE WITH THE ASSOCIATED APPARATUS MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.
NOTES:
2.1 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S, MAY BE CONNECTED TO SENSOR TERMINALS.
2.2 TRANSMITTER MUST BE INSTALLED IN A SUITABLE RATED ENCLOSURE.
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
DR. NGA DOAN 10/1/02
SIZE C
FSCM NO.
SCALE: 1:1 WT.
DRAWING NO. 00644-0009
SHEET 2 OF 2
CAD Maintained, (Pro/E)

Figure B-5. FM Explosion-Proof Installation Drawing 00644-1049, Rev. AD

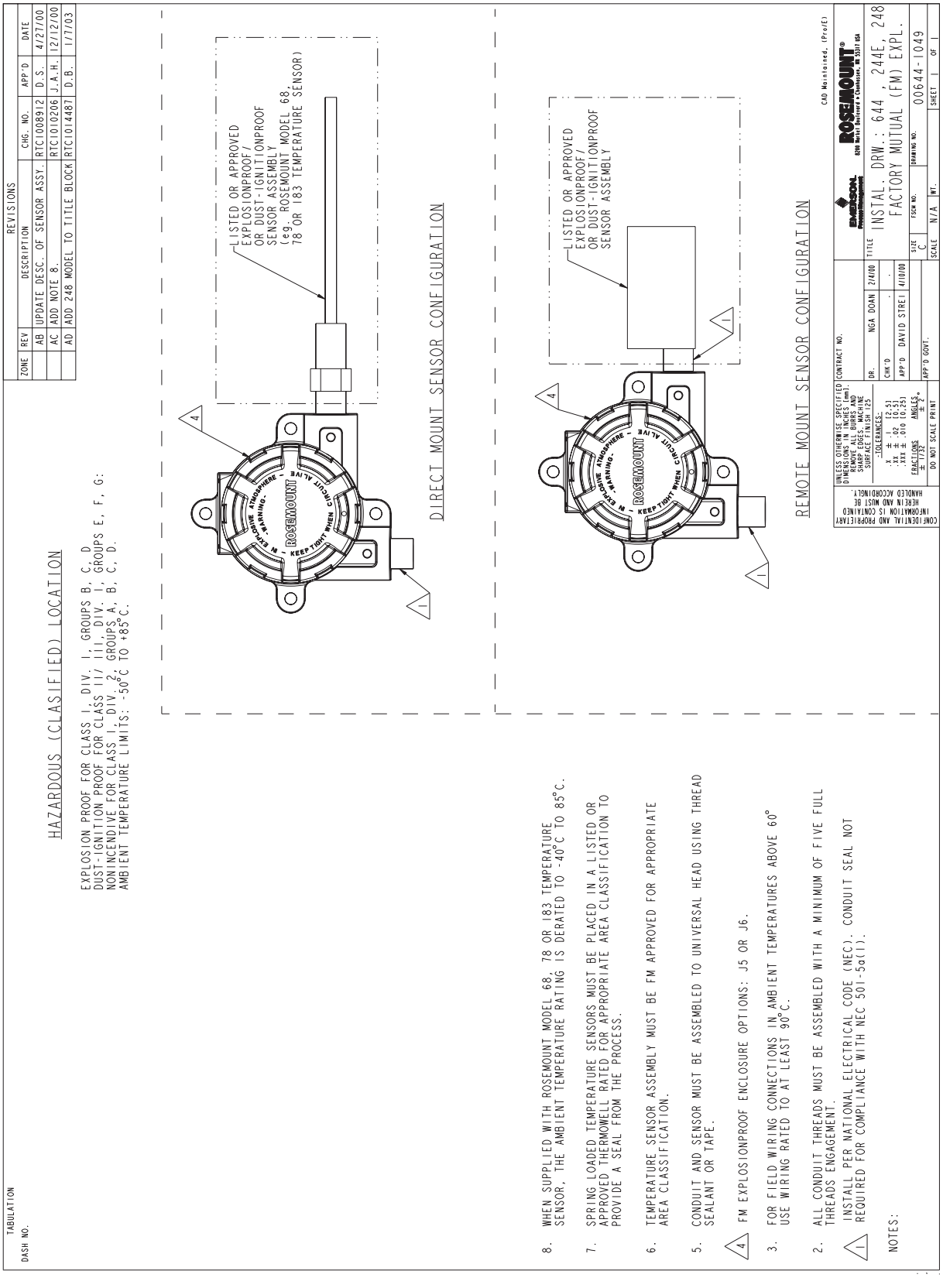
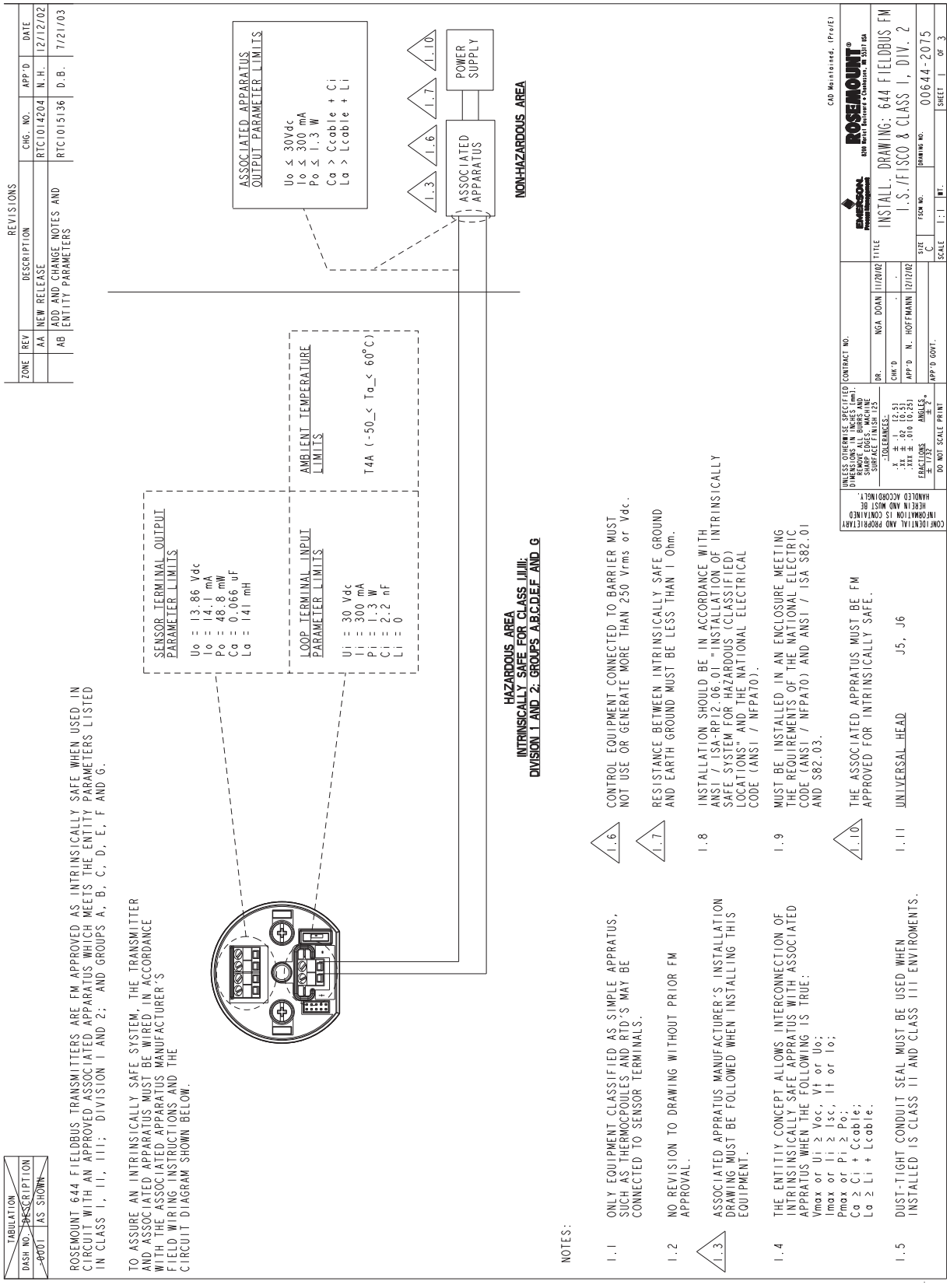
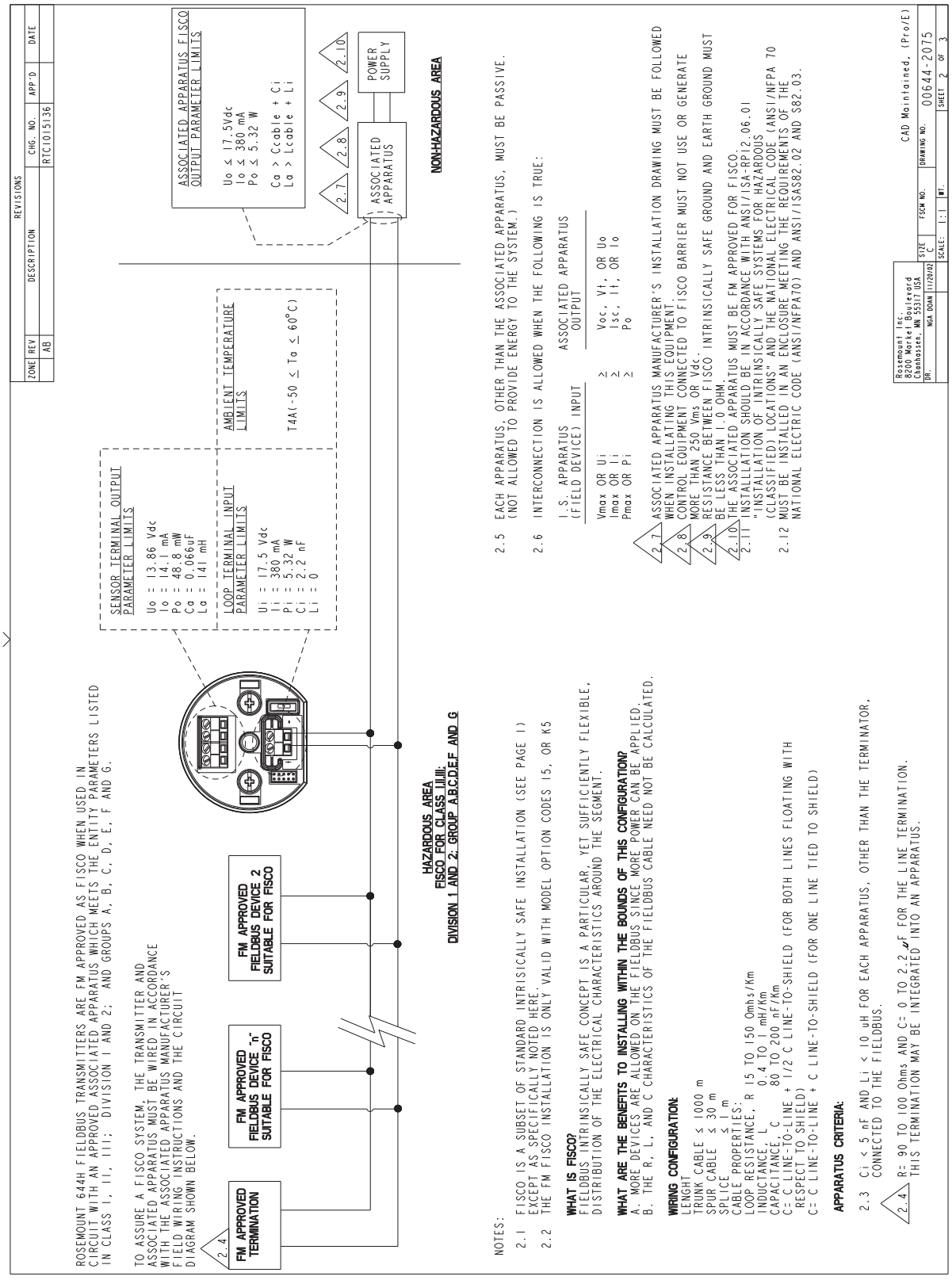


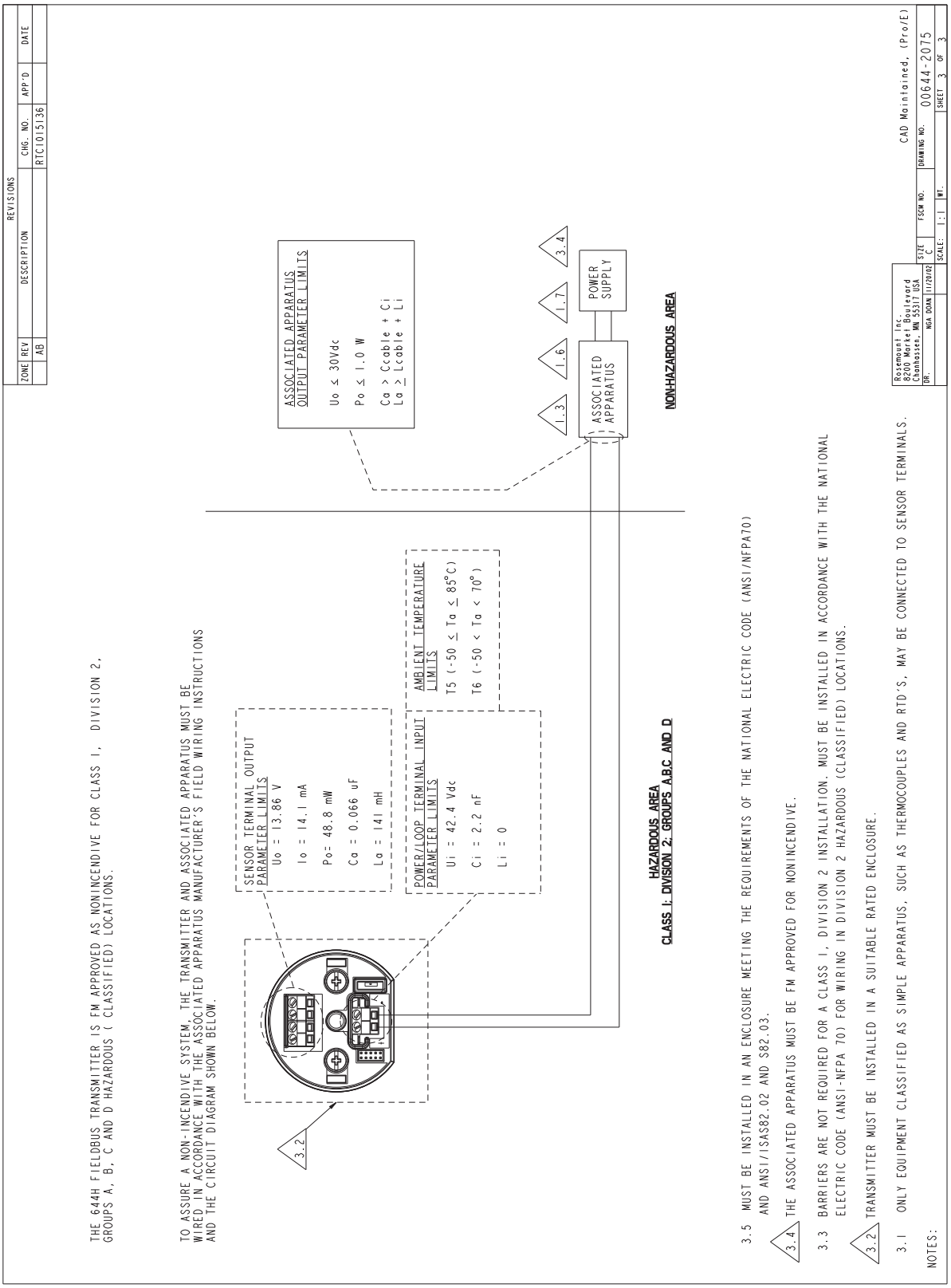
Figure B-6. FM 644 Fieldbus Intrinsic Safety and FISCO Installation Drawing 00644-2075, Rev. AB Sheet 1 of 3



Sheet 2 of 3


REVISIONS
ZONE REV | DESCRIPTION | CHG. NO. | APP'D | DATE
AB | RTC0105136
ROSEMOUNT 644H FIELDBUS TRANSMITTERS ARE FM APPROVED AS FISCO WHEN USED IN CIRCUIT WITH AN APPROVED ASSOCIATED APPARATUS WHICH MEETS THE ENTITY PARAMETERS LISTED IN CLASS I, II, III; DIVISION 1 AND 2; AND GROUPS A, B, C, D, E, F AND G.
TO ASSURE A FISCO SYSTEM, THE TRANSMITTER AND ASSOCIATED APPARATUS MUST BE WIRED IN ACCORDANCE WITH THE ASSOCIATED APPARATUS MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Uo = 13.86 Vdc
Io = 14.1 mA
Po = 48.8 mW
Ca = 0.066uF
La = 141 mH
LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 17.5 Vdc
Ii = 380 mA
Pi = 5.32 W
Ci = 2.2 nF
Li = 0
AMBIENT TEMPERATURE LIMITS
T4A(-50 ≤ Ta ≤ 60°C)
ASSOCIATED APPARATUS FISCO OUTPUT PARAMETER LIMITS
Uo ≤ 17.5Vdc
Io ≤ 380 mA
Po ≤ 5.32 W
Ca > Ccable + Ci
La > Lcable + Li
2.4 FM APPROVED TERMINATION
FM APPROVED FIELDBUS DEVICE "n" SUITABLE FOR FISCO
FM APPROVED FIELDBUS DEVICE 2 SUITABLE FOR FISCO
HAZARDOUS AREA
FISCO FOR CLASS I,II,III;
DIVISION 1 AND 2, GROUP A,B,C,D,E,F AND G
2.7 2.8 2.9 2.10
ASSOCIATED APPARATUS
POWER SUPPLY
NON-HAZARDOUS AREA
NOTES:
2.1 FISCO IS A SUBSET OF STANDARD INTRISICALLY SAFE INSTALLATION (SEE PAGE 1) EXCEPT AS SPECIFICALLY NOTED HERE.
2.2 THE FM FISCO INSTALLATION IS ONLY VALID WITH MODEL OPTION CODES I5, OR K5
WHAT IS FISCO?
FIELDBUS INTRINSICALLY SAFE CONCEPT IS A PARTICULAR, YET SUFFICIENTLY FLEXIBLE, DISTRIBUTION OF THE ELECTRICAL CHARACTERISTICS AROUND THE SEGMENT.
WHAT ARE THE BENEFITS TO INSTALLING WITHIN THE BOUNDS OF THIS CONFIGURATION?
A. MORE DEVICES ARE ALLOWED ON THE FIELDBUS SINCE MORE POWER CAN BE APPLIED.
B. THE R, L, AND C CHARACTERISTICS OF THE FIELDBUS CABLE NEED NOT BE CALCULATED.
WIRING CONFIGURATION:
LENGHT
TRUNK CABLE ≤ 1000 m
SPUR CABLE ≤ 30 m
SPLICE ≤ 1 m
CABLE PROPERTIES:
LOOP RESISTANCE, R 15 TO 150 Ohms/Km
INDUCTANCE, L 0.4 TO 1 mH/Km
CAPACITANCE, C 80 TO 200 nF/Km
C= C LINE-TO-LINE + 1/2 C LINE-TO-SHIELD (FOR BOTH LINES FLOATING WITH RESPECT TO SHIELD)
C= C LINE-TO-LINE + C LINE-TO-SHIELD (FOR ONE LINE TIED TO SHIELD)
APPARATUS CRITERIA:
2.3 Ci < 5 nF AND Li < 10 uH FOR EACH APPARATUS, OTHER THAN THE TERMINATOR, CONNECTED TO THE FIELDBUS.
2.4 R= 90 TO 100 Ohms AND C= 0 TO 2.2 µF FOR THE LINE TERMINATION. THIS TERMINATION MAY BE INTEGRATED INTO AN APPARATUS.
2.5 EACH APPARATUS, OTHER THAN THE ASSOCIATED APPARATUS, MUST BE PASSIVE. (NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM.)
2.6 INTERCONNECTION IS ALLOWED WHEN THE FOLLOWING IS TRUE:
I.S. APPARATUS (FIELD DEVICE) INPUT
ASSOCIATED APPARATUS OUTPUT
Vmax OR Ui ≥ Voc, Vt, OR Uo
Imax OR Ii ≥ Isc, It, OR Io
Pmax OR Pi ≥ Po
2.7 ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLATING THIS EQUIPMENT.
2.8 CONTROL EQUIPMENT CONNECTED TO FISCO BARRIER MUST NOT USE OR GENERATE MORE THAN 250 Vms OR Vdc.
2.9 RESISTANCE BETWEEN FISCO INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN 1.0 OHM.
2.10 THE ASSOCIATED APPARATUS MUST BE FM APPROVED FOR FISCO.
2.11 "INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA-RP12.06.01 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70
2.12 MUST BE INSTALLED IN AN ENCLOSURE MEETING THE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE (ANSI/NFPA70) AND ANSI//ISAS82.02 AND S82.03.
Rosemount Inc.
12001 Technology Drive
Chanhassen, MN 55317 USA
CAD Maintained, (Pro/E)
DR: MGA DCMA 11/20/02
SCALE: 1:1 WT.
SIZE FSCM NO.
DRAWING NO. 00644-2075
SHEET 2 OF 3

Sheet 3 of 3


REVISIONS
ZONE REV DESCRIPTION CHG. NO. APP'D DATE
AB RTC105136
THE 644H FIELDBUS TRANSMITTER IS FM APPROVED AS NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS (CLASSIFIED) LOCATIONS.
TO ASSURE A NON-INCENDIVE SYSTEM, THE TRANSMITTER AND ASSOCIATED APPARATUS MUST BE WIRED IN ACCORDANCE WITH THE ASSOCIATED APPARATUS MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Uo = 13.86 V
Io = 14.1 mA
Po= 48.8 mW
Ca = 0.066 uF
La = 141 mH
POWER/LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 42.4 Vdc
Ci = 2.2 nF
Li = 0
AMBIENT TEMPERATURE LIMITS
T5 (-50 ≤ Ta ≤ 85°C)
T6 (-50 < Ta < 70°)
ASSOCIATED APPARATUS OUTPUT PARAMETER LIMITS
Uo ≤ 30Vdc
Po ≤ 1.0 W
Ca > Ccable + Ci
La ≥ Lcable + Li
ASSOCIATED APPARATUS
POWER SUPPLY
HAZARDOUS AREA
CLASS I, DIVISION 2, GROUPS A,B,C AND D
NON-HAZARDOUS AREA
3.5 MUST BE INSTALLED IN AN ENCLOSURE MEETING THE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE (ANSI/NFPA70) AND ANSI/ISA82.02 AND S82.03.
3.4 THE ASSOCIATED APPARATUS MUST BE FM APPROVED FOR NONINCENDIVE.
3.3 BARRIERS ARE NOT REQUIRED FOR A CLASS I, DIVISION 2 INSTALLATION. MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (ANSI-NFPA 70) FOR WIRING IN DIVISION 2 HAZARDOUS (CLASSIFIED) LOCATIONS.
3.2 TRANSMITTER MUST BE INSTALLED IN A SUITABLE RATED ENCLOSURE.
3.1 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S, MAY BE CONNECTED TO SENSOR TERMINALS.
NOTES:
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8200 Market Boulevard
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CAD Maintained, (Pro/E)
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SIZE C
FSCM NO.
SCALE: 1:1
WT.
DRAWING NO. 00644-2075
SHEET 3 OF 3

Appendix C Profibus Block Information

OVERVIEW

This Appendix contains Profibus block and parameter 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 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.

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.

Please review the approval sections of the 644 Profibus reference manual for any restrictions associated with a safe installation.

- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks could result in death or serious injury.

- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

RESOURCE BLOCK

Table C-1 through Table C-3 can be used to cross reference parameters from the Profibus specification, class 2 master, DD, or DTM

Table C-1. Physical Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
0	16	BLOCK_OBJECT	This object contains the characteristics of the blocks.	The BLOCK_OBJECT parameter is the first parameter of every block. It contains the characteristics of the block e.g. block type and profile number.
0	17	ST_REV	Static Revision	Parameter that changes by 1 when the corresponding block has been modified.
0	18	TAG_DESC	Tag	A user-supplied description of the block.
0	19	STRATEGY	Strategy	The STRATEGY parameter has a user-specified value. This assigned value can be used in configuration or diagnostics as a key in sorting block information.
0	20	ALERT_KEY	Alert Key	The ALERT_KEY parameter has a user assigned value which may be used in sorting alarms or events generated by a block.
0	21	TARGET_MODE	Target Mode	The TARGET_MODE parameter indicates which mode is desired for the block. It is normally set by a control application or by an operator through a human interface application.
0	22	MODE_BLK	N/A	The MODE_BLK parameter is a structured parameter composed of the actual mode, the normal mode, and the permitted mode.
0	23	ALARM_SUM	N/A	The parameter ALARM_SUM summarizes the status of up to 16 block alarms.
0	24	SOFTWARE_REVISION	Software Revision	Revision-number of the software of the field device.
0	25	HARDWARE_REV	Hardware Revision	Revision-number of the hardware of the field device.
0	26	DEVICE_MAN_ID	Manufacturer ID	Identification code of the manufacturer of the field device.
0	27	DEVICE_ID	Model	Manufacturer specific identification of the device.
0	28	DEVICE_SER_NUM	Permanent Tag	Serial number of the field device.
0	29	DIAGNOSIS	Diagnosis	Detailed information of the device, bitwise coded.
0	30	DIAGNOSIS_EXTENSION	Diagnosis Extension	Additional manufacturer-specific information of the device, bitwise coded. More than one message possible at once.
0	31	DIAGNOSIS_MASK	Diagnosis Mask	Definition of supported DIAGNOSIS information-bits. 0: not supported 1: supported
0	32	DIAGNOSIS_MASK_EXTENSION	Diagnosis Mask Extension	Definition of supported DIAGNOSIS_EXTENSION information-bits. 0: not supported 1: supported
0	34	WRITE_LOCKING	Write Lock	Software write protection.
0	35	FACTORY_RESET	Factory Reset	The command for resetting a device to default values. The setting of the bus address is not affected.
0	36	DESCRIPTOR	Descriptor	User-definable text (a string) to describe the device within the application.

Table C-1. Physical Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
0	37	DEVICE_MESSAGE	Message	User-definable MESSAGE to describe the device within the application or in the plant. Date of installation of the device.
0	38	DEVICE_INSTALL_DATE	Installation Date	Date of installation of the device.
0	40	IDENT_NUMBER_SELECTOR	GSD Type	The Profibus Ident Number.
0	42	FEATURE	Features	Indicates optional features implemented in the device and the status of these features which indicates if the feature is supported or not supported.
0	43	COND_STATUS_DIAG	Current Status and Diagnostic	Indicates the mode of a device that can be configured for status and diagnostic behavior.
0	49	DEVICE_ADDRESS	Address	The address of the device.
0	50	STACK_LIB_VERSION	Stack Revision	The version of the registered stack in the device.
0	51	OUTPUT_BOARD_SN	Output Board Serial Number	The serial number given to the electronics output board.
0	52	FINAL_ASSY_NUM	Final Assembly Number	An identifying number given to the device at Final Assembly
0	53	CONFIGURE_LCD	Configure LCD	Selection of what parameters to be displayed on the LCD.
0	54	IDENT_VALUE	PROFIBUS Ident Number	Each PROFIBUS device shall have an Ident Number provided by PI. The Ident Number specifies the cyclic behavior of a device which is described in the corresponding GSD file. A PROFIBUS PA device shall support at least one profile specific Ident Number.

Table C-2. Transducer Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
2	16	BLOCK_OBJECT	This object contains the characteristics of the blocks.	The BLOCK_OBJECT parameter is the first parameter of every block. It contains the characteristics of the block e.g. block type and profile number.
2	17	ST_REV	Static Revision	Parameter that changes by 1 when the corresponding block has been modified.
2	18	TAG_DESC	Tag	A user-supplied description of the block.
2	19	STRATEGY	Strategy	The STRATEGY parameter has a user-specified value. This assigned value can be used in configuration or diagnostics as a key in sorting block information.
2	20	ALERT_KEY	Alert Key	The ALERT_KEY parameter has a user assigned value which may be used in sorting alarms or events generated by a block.
2	21	TARGET_MODE	Target Mode	The TARGET_MODE parameter indicates which mode is desired for the block. It is normally set by a control application or by an operator through a human interface application.
2	22	MODE_BLK	Mode	The MODE_BLK parameter is a structured parameter composed of the actual mode, the normal mode and the permitted mode.
2	23	ALARM_SUM	Alarm Summary	The parameter ALARM_SUM summarizes the status of up to 16 block alarms.

Table C-2. Transducer Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
2	24	PRIMARY_VALUE	Primary Value	Process value
2	25	PRIMARY_VALUE_UNIT	Primary Value Unit	Selects the unit code of the PRIMARY_VALUE and other values.
2	26	SECONDARY_VALUE_1	Secondary Value	Process value connected to channel 1 and corrected by BIAS_1.
2	28	SENSOR_MEAS_TYPE	Sensor Measurement Type	Mathematical function to calculate PRIMARY_VALUE (PV).
2	29	INPUT_RANGE	Electrical Input Range and Mode	Electrical input range and mode.
2	30	LIN_TYPE	Sensor Type	Selects the type of sensor (Code) for Thermocouples, Rtd, Pyrometers or linear.
2	35	BIAS_1	Bias	Bias that can be algebraically added to the process value of channel 1.
2	37	UPPER_SENSOR_LIMIT	Upper Sensor Limit	Physical upper limit function of the sensor (e.g. Pt 100 = 850 °C) and input range.
2	38	LOWER_SENSOR_LIMIT	Lower Sensor Limit	Physical lower limit function of the sensor (e.g. Pt 100 = -200 °C) and input range.
2	40	INPUT_FAULT_GEN	Input Malfunction	Input malfunction: Diagnosis object for errors that concerns all values.
2	41	INPUT_FAULT_1	SV Input Malfunction	Input malfunction: Diagnosis object for errors that concern SV_1.
2	43	SENSOR_WIRE_CHECK_1	Check Open/Short Sensor	Enables lead breakage and short circuit detection for Sensor 1.
2	49	RJ_TEMP	Terminal Temperature	Reference junction temperature.
2	50	RJ_TYPE	Reference Junction	Selects reference junction from internal to fixed value.
2	52	SENSOR_CONNECTION	Sensor Connection	Connection to the sensor, selected for 2, 3, and 4 wires connection.
2	53	COMP_WIRE1	2-Wire Offset	Value in Ω to compensate line resistance when the thermo resistance is connected with 2 wires.
2	79	CAL_POINT_HI	Upper Cal Point	This parameter contains the highest calibrated value. For calibration of the high limit point give the high measurement value (pressure) to the sensor and transfer this point as HIGH to the transmitter.
2	80	CAL_POINT_LO	Lower Cal Point	This parameter contains the lowest calibrated value. For calibration of the low limit point give the low measurement value (pressure) to the sensor and transfer this point as LOW to the transmitter.
2	81	CAL_MIN_SPAN	Calibration Minimum Span	This parameter contains the minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points (high and low) are not too close together.
2	82	CAL_UNIT	Calibration Unit	The units used for Calibration.
2	83	SENSOR_CAL_METHOD	Method	Method used to calibrate the temperature sensor.
2	84	SENSOR_CAL_LOC	Location	The location the calibration was performed.
2	85	SENSOR_CAL_DATE	Date	The date the calibration was performed.
2	86	SENSOR_CAL_WHO	Performed By	The name of the person performing the calibration.
2	87	SENSOR_SN	Sensor Serial Number	The serial number associated with the sensor reading the temperature.

Table C-2. Transducer Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
2	89	TERMINAL_TEMP_RANGE	Terminal Temperature Range	The temperature range associated with the terminal temperature of the device.
2	90	ASIC_REJECTION	AC Power Filter	Should be configured to the frequency of AC Power (50Hz/60Hz) currently running in the facility.
2	91	CALIBRATOR_MODE	Active Calibrator Mode	Select ‘Active Calibrator On’ if using a calibration device. This is critical if the calibrator requires constant current for calibration. If using a sensor or a calibration device that can accept pulsed current, select ‘Active Calibrator Off’.
2	92	OPEN_SNSR_HOLDOFF	Open Sensor Holdoff	A software feature that has the transmitter perform additional verification of the open sensor status prior to activating the transmitter alarm. If the additional verification shows that the open sensor condition is not valid, the transmitter will not go into alarm.
2	93	INTER_DETECT_THRESH	Transient Filter	The Intermittent Sensor Detect feature is designed to guard against process temperature readings caused by intermittent open sensor conditions (and open sensor condition lasting less than one update). Default is set to 0.2% of the sensor limits. The feature can be switched on or off and can be adjusted from 0 to 100% of the sensor limits.
2	94	CAL_VAN_DUSEN_COEFF	Callendar-Van Dusen	The calculated coefficients used in the Callendar Van dusen equation to characterize the sensor curve with Transmitter-Sensor matching.

Table C-3. Analog Input Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
1	16	BLOCK_OBJECT	This object contains the characteristics of the blocks.	The BLOCK_OBJECT parameter is the first parameter of every block. It contains the characteristics of the block e.g. block type and profile number.
1	17	ST_REV	Static Revision	Parameter that changes by 1 when the corresponding block has been modified.
1	18	TAG_DESC	Tag Description	A user-supplied description of the block.
1	19	STRATEGY	Strategy	The STRATEGY parameter has a user-specified value. This assigned value can be used in configuration or diagnostics as a key in sorting block information.
1	20	ALERT_KEY	Alert Key	The ALERT_KEY parameter has a user assigned value which may be used in sorting alarms or events generated by a block.
1	21	TARGET_MODE	Target Mode	The TARGET_MODE parameter indicates which mode is desired for the block. It is normally set by a control application or by an operator through a human interface application.
1	22	MODE_BLK	N/A	The MODE_BLK parameter is a structured parameter composed of the actual mode, the normal mode and the permitted mode.
1	23	ALARM_SUM	N/A	The parameter ALARM_SUM summarizes the status of up to 16 block alarms.

Table C-3. Analog Input Block Parameters

Slot	Index	Parameter Name	DD Label	Help Text
1	24	BATCH	Batch	The Batch parameter is necessary in a distributed fieldbus system to identify used and available channels, in addition to identify the current batch in case of alerts.
1	26	OUT	Out	The Function Block parameter OUT contains the current measurement value in a vendor specific or configuration adjusted engineering unit and the belonging status in AUTO MODE.
1	27	PV_SCALE	PV Scale - Upper Value PV Scale - Lower Value	Conversion of the Process Variable into percent using the high and low scale values.
1	28	OUT_SCALE	Out Scale	The Function Block parameter OUT_SCALE contains the values of the lower limit and upper limit effective range.
1	29	LIN_TYPE	Linearization Type	Type of linearization.
1	30	CHANNEL	Channel	Reference to the active Transducer Block which provides the measurement value to the Function Block.
1	32	PV_FTIME	Damping Value	Filter time of the Process Variable.
1	33	FSAFE_TYPE	Fail Safe Type	Defines the reaction of the device, if a fault is detected.
1	34	FSAFE_VALUE	Fail Safe Value	Default value for the OUT parameter, if a sensor or sensor electronic fault is detected.
1	35	ALARM_HYS	Alarm Hysteresis	Hysteresis. The hysteresis is expressed as value below high limit and above low limit in the engineering unit of expressed as value below high limit and above low limit in the engineering unit of xx_LIM.
1	37	HI_HI_LIM	Hi Hi	Value for upper limit of alarms.
1	39	HI_LIM	Hi	Value for upper limit of warnings.
1	41	LO_LIM	Lo	Value for lower limit of warnings.
1	43	LO_LO_LIM	Lo Lo	Value for the lower limit of alarms.
1	50	SIMULATE	Simulate	For commissioning and test purposes the input value from the Transducer Block in the Analog Input Function Block AI-FB can be modified.

CONDENSED STATUS

The Rosemount 644 device utilizes condensed status as recommended by the Profile 3.02 specification and NE 107. Condensed status has some additional bits and changed bit assignments from classic status. Confirm bit assignment using Table C-4 and Table C-5.

Table C-4. Diagnostic Descriptions

Device Related Diagnosis		
Byte-Bit	**Unit_Diag_Bit (1)**	**Diagnostic Description**
2-3	35	Restart
2-4	36	Cold Start
2-5	37	Maintenance Required
2-7	39	Ident_Number violation
3-0	40	Failure of the device
3-1	41	Maintenance demanded
3-2	42	Function Check
3-3	43	Process not returning valid values
4-7	55	Extension Available

(1) Unit_Diag_Bit located in GSD file

Table C-5. Output Status Bit Definition

Condensed Status	AI Block OUT Status Parameter	
Description	**HEX**	**DECIMAL**
Bad - passivated	0x23	35
Bad, maintenance alarm, more diagnostics available	0x24	36
Bad, process related - no maintenance	0x28	40
Uncertain, substitute set	0x4B	75
Uncertain, process related, no maintenance	0x78	120
Good, ok	0x80	128
Good, update event	0x84	132
Good, advisory alarm, low limit	0x89	137
Good, advisory alarm, high limit	0x8A	138
Good, critical alarm, low limit	0x8D	141
Good, critical alarm, high limit	0x8E	142
Good, function check	0xBC	188

Reference Manual
00809-0300-4728, Rev AA
January 2011

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00809-0300-4728 Rev AA, 1/11

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