

Rosemount 3144S Temperature Transmitter

Safety Instrumented Systems (SIS) Requirements



WARNING

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

NOTICE

The content of this document is based on the English language version. Any differences in non-English versions should be resolved in favor of the most current English version.

WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

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

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1 Using this manual

This document provides information about how to install, commission, and proof test a Rosemount 3144S and 3144S with Rosemount X-well™ system to comply with safety instrumented systems (SIS) requirements.

Note

This manual assumes that the following conditions apply:

- Transmitter has been installed correctly and completely according to the instructions in the transmitter Manual and Quick Start Guide.
 - Installation complies with all applicable safety requirements.
 - Operator is trained in local and corporate safety standards.
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1.1 Related documents

All product documentation is available on [Emerson.com](https://www.emerson.com).

For more information, refer to the following documents:

Transmitter	Document
3144S	Manual
3144S	Quick Start Guide
3144S with X-well Technology	Quick Start Guide

2 Safety Instrumented Systems (SIS) certification

The safety-critical outputs of the Rosemount 3144S Temperature Transmitter and 3144S with Rosemount X-well™ Technology are provided through a two-wire, 4–20 mA signal representing temperature. Emerson maintains an SIS-compliant process. Changes made after initial release do not affect overall SIS certification.

The 3144S Transmitter can be equipped with or without a display.

The 3144S Safety Certified Safety Transmitter is certified to: High or Low demand; Type B.

- Safety Instrumented Level (SIL) 2 for random integrity at HFT=0
- SIL 3 for random integrity at HFT=1
- SIL 3 for systematic integrity

3 Safety certified identification

All Rosemount 3144S HART® Transmitters must be identified as safety certified as outlined below before installing them into Safety Instrumented Systems (SIS).

To identify a safety certified 3144S Transmitter, make sure the device satisfies the requirements below:

1. Verify the transmitter was ordered with output option code A and option code QT. This signifies that it is a 4–20mA/HART safety certified device. For example:
MODEL 3144SxxxA.....QT....
2. Devices used in safety applications with ambient temperature below -40 °F (-40 °C) requires option code QT and BR6.
3. Check the **Namur Software Revision** located on the adhesive transmitter tag: *SW Rev_..._*. If the device label software revision is 01.00.00 or higher, the device is safety certified.

4 Installation

Only qualified personnel should install the transmitter. No special installation is required in addition to the standard installation practices outlined in the *Rosemount 3144S Temperature Transmitter Manual*.

Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal.

The loop should be designed to ensure that the voltage across the transmitter power terminals does not go below 11.5 Vdc for Classic Performance and 16.7 Vdc for Ultra Performance when the transmitter output is 23.0 mA.

Environmental limits are available on the [Rosemount 3144S product page](#).

4.1 Safety precautions

Prior to making any changes to any Rosemount 3144S Transmitter, such as changing the configuration or replacing the sensor, take appropriate action to avoid a false trip by electronically bypassing the safety programmable logic controller (PLC).

WARNING

Transmitter output is not safety-rated during the following: configuration changes, multidrop operation, simulation, **Active Calibrator** mode, and loop tests. Ensure alternate means are in place to maintain the process in a safe state.

WARNING

If the transmitter is in a classified area, do not open the wiring compartment unless the power to the transmitter has been removed or unless the area has been declassified. Contact customer support for further information.

Prior to placing the transmitter online and removing the bypass from the safety PLC, verify the transmitter configuration and all safety parameters.

5 Configuration

Use any HART® protocol-capable configuration tool to communicate with and verify the initial configuration or any configuration changes made to the transmitter prior to operating in **Safety** mode.

All configuration methods outlined in the *Rosemount 3144S Manual* are the same for the safety-certified transmitter, with any differences noted.

Use software or hardware lock in order to prevent unwanted changes to the transmitter configuration.

Note

Transmitter output is not safety-rated during the following:

- Configuration changes
- **Multidrop** operation
- When **Sensor Pulsing** is disabled
- Simulation
- Loop tests

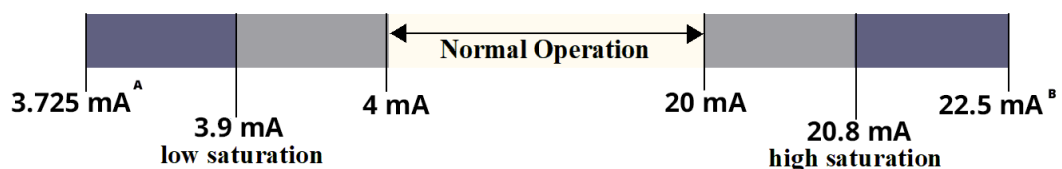
Use alternative means to ensure process safety during transmitter configuration and maintenance activities.

5.1 Alarm and saturation levels

Configure a distributed control system (DCS) or safety logic solver to match transmitter configuration.

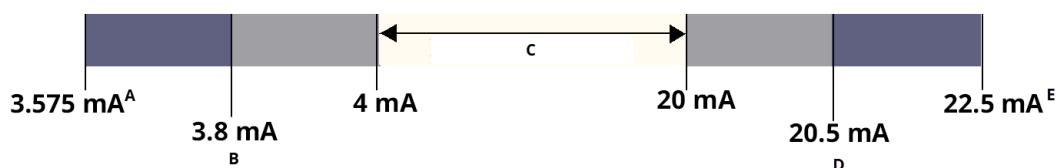
The following three figures identify the various alarm levels available and their operations values.

Figure 5-1: Rosemount Alarm Level



A. Transmitter failure, hardware or software alarm in Low position.

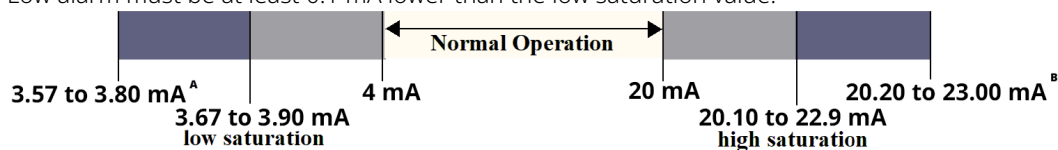
B. Transmitter failure, hardware or software alarm in High position.

Figure 5-2: NAMUR Alarm Level

- A. Transmitter failure, hardware or software alarm in Low position.**
- B. Low saturation**
- C. Normal operation**
- D. High saturation**
- E. Transmitter failure, hardware or software alarm in High position.**

Figure 5-3: Custom Alarm Level

Low alarm must be at least 0.1 mA lower than the low saturation value.



- A. Transmitter failure, hardware or software alarm in Low position.**
- B. Transmitter failure, hardware or software alarm in High position.**

5.1.1 Security switch

Position the **Security** switch to the **ON** position to prevent accidental or deliberate change of configuration data during normal operation. Be sure to take transmitter out of fixed current (loop test) and simulation before setting **Security** switch to **ON**.

5.2 Damping

User-adjustable damping affects the transmitter's ability to respond to changes in the applied process. The sum of the damping value and response time must not exceed the loop requirements.

If using a thermowell assembly, ensure that any additional response time due to thermowell material is accounted for.

6 Operation and maintenance

6.1 Proof tests

Emerson recommends the following proof tests. In the event that an error is found in the safety functionality, send proof results and corrective actions taken to Emerson at [Contact Measurement Instrumentation Solutions Customer Service](#).

The Rosemount 3144S Temperature Transmitter offers guided versions of both the partial and comprehensive proof tests, simplifying each proof test procedure by providing step-by-step instructions. You can access these instructions via HART® host (such as AMS Device Manager), AMS Device Configurator app, or AMS Trex HART communicator.

All proof test procedures must be carried out by qualified personnel.

6.2 Partial proof test

This partial proof test consists of reasonability checks of the transmitter output.

Refer to the *Failure Mode, Effects, and Diagnostic Analysis (FMEDA) Report* for percent of possible DU failures in the device.

The *FMEDA Report* can be found on the Rosemount 3144S Temperature Transmitter product page.

Required tools:

- Field Communicator
 - mA meter
1. Bypass the safety PLC or take other appropriate action to avoid a false trip.
 2. Send a HART® command to the transmitter to go to high alarm current output and verify that the analog current reaches that value.
This tests for compliance voltage problems, such as low loop power supply voltage or increased wiring resistance. This also tests for other possible failures.
 3. Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value.
This tests for possible quiescent current related failures.
 4. Use the HART communicator to view detailed device status to ensure no alarms or warnings are present in the transmitter.
 5. Perform reasonability check on the sensor value(s) versus an independent estimate (such as from direct monitoring of Basic Process Control System [BPCS] value) to show current reading is good.
 6. Restore the loop to full operation.
 7. Remove the bypass from the safety PLC or otherwise restore to normal operation.

6.3 Comprehensive proof test

The comprehensive proof test consists of performing the same steps as the partial proof test, but with a 2-point calibration of the temperature sensor in place of the reasonability check.

Refer to the *Failure Mode, Effects, and Diagnostics Analysis (FMEDA) Report* for percent of possible DU failures in the device.

Prerequisites

Required tools:

- Field Communicator
- Temperature calibration equipment
- mA meter

1. Bypass the safety programmable logic controller (PLC) or take other appropriate action to avoid a false trip.
2. Perform [2](#) through [4](#) of [Partial proof test](#).
3. Perform a two-point verification of the sensor over the full working range and verify the current output at each point.
4. Repeat [3](#) for the second sensor, if present.
5. Restore the loop to full operation.
6. Remove the bypass from the safety PLC or otherwise restore to normal operation.

6.4 Inspection

Visual inspection Not required.

Special tools Not required.

6.4.1 Product repair

The transmitter is repairable by major component replacement.

All failures detected by the transmitter diagnostics or by the proof-test must be reported. Feedback can be submitted electronically at [Emerson.com/Rosemount/Contact-Us](https://emerson.com/rosemount/contact-us).

7 Specifications

Safety-critical 4 - 20 mA analog signal representing temperature

Note

Digital HART[®] only used for setup, calibration, and diagnostic purposes, not for safety critical operation.

Safety deviation ± 2 percent of process variable span

Transmitter 60 seconds

response time See also *Specifications* section of the [Rosemount 3144S Temperature Transmitter Product Data Sheet](#) and [Damping](#) to take into account additional response time due to damping configuration, thermowell, and sensor.

Worst-case < 1 hour

Transmitter accuracy and acceptable sensor types are provided in the Product Data Sheet.

The transmitter must be operated according to the functional and performance specifications provided in the [Rosemount 3144S Temperature Transmitter Product Data Sheet](#).

7.1 Failure rate data

The *Failure Mode, Effects, and Diagnostic Analysis (FMEDA) Report* includes failure rates, assumptions made in the Functional Safety Assessment, and independent information on generic sensor models.

7.2 Product life

50 years – Based on worst case component wear-out mechanisms; not based on wear-out of process sensors.

Report any safety related product information at [Contact Measurement Instrumentation Solutions Customer Service](#).

For more information: [Emerson.com/global](https://emerson.com/global)

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