

Rosemount™ 644 Temperature Transmitter with FOUNDATION™ Fieldbus Protocol



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Rosemount™ 644 Temperature Transmitter

NOTICE

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

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

Customer Central

Technical support, quoting, and order-related questions.
1-800-999-9307 (7:00 am to 7:00 pm CST)

North American Response Center

Equipment service needs.
1-800-654-7768 (24 hours)

International

(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 your local Emerson™ Sales Representative.

Section 1 Introduction

1.1 Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Rosemount™ 644 Pressure Transmitter. The sections are organized as follows:

[Section 2: Configuration](#) provides instruction on commissioning and operating transmitters. Information on software functions, configuration parameters, and online variables is also included.

[Section 3: Installation](#) contains mechanical and electrical installation instructions, and field upgrade options.

[Appendix A: Specifications and Reference Data](#) supplies reference and specification data, as well as ordering information and contains intrinsic safety approval information, European ATEX directive information, and approval drawings.

[Appendix B: Foundation™ Fieldbus Block Information](#) provides information regarding the function blocks

1.1.1 Transmitter

Features of the Rosemount 644 include:

- Accepts inputs from a wide variety of sensors
- Configuration using FOUNDATION Fieldbus Protocol
- Electronics that are completely encapsulated in epoxy and enclosed in a metal housing, making the transmitter extremely durable and ensuring long-term reliability
- A compact size and two 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.

- Temperature Sensors and Assemblies [Product Data Sheet](#), Volume 1
- Temperature Sensors and Assemblies [Product Data Sheet](#), Volume 2

1.2 Considerations

1.2.1 General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to their sensed temperature. The Rosemount 644 converts the low-level sensor signal to a standard 4–20 mA dc, or digital FOUNDATION Fieldbus signal that is relatively insensitive to lead length and electrical noise. This signal is then transmitted to the control room via two wires.

1.2.2 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.

1.2.3 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 Rosemount 644 head mount transmitter to a DIN rail or assembling a new Rosemount 644 head mount to an existing threaded sensor connection head (former option code L1).

1.2.4 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.

1.2.5 Environmental

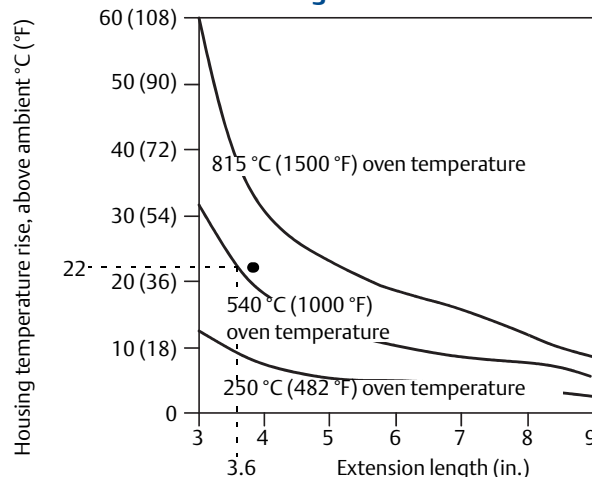
The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

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. Rosemount 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.

1.3 Return of materials

To expedite the return process in North America, call the Emerson 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 a 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.

1.4 Product recycling/disposal

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

Section 2 Configuration

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2.1 Overview

This section provides information on configuring, troubleshooting, operating, and maintaining the Rosemount™ 644 Temperature transmitter using FOUNDATION™ Fieldbus Protocol.

2.2 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.

⚠ 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 a FOUNDATION Fieldbus 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.

2.3 General block information

2.3.1 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 Emerson.com/Rosemount. The initial release of the Rosemount 644 with FOUNDATION Fieldbus is device revision 1.

2.3.2 Node address

The transmitter is shipped at a temporary (248) address. This will enable FOUNDATION Fieldbus host systems to automatically recognize the device and move it to a permanent address.

2.3.3 Modes

The resource, transducer, and all function blocks in the device have modes of operation. These modes govern the operation of the block. Every block supports both automatic (AUTO) and out of service (OOS) modes. Other modes may also be supported.



Changing modes

To change the operating mode, set the MODE_BLK.TARGET to the desired mode. After a short delay, the parameter MODE_BLOCK.ACTUAL should reflect the mode change if the block is operating properly.

Permitted modes

It is possible to prevent unauthorized changes to the operating mode of a block. To do this, configure MODE_BLOCK.PERMITTED to allow only the desired operating modes. It is recommended to always select OOS as one of the permitted modes.

Types of modes

For the procedures described in this manual, it will be helpful to understand the following modes:

AUTO

The functions performed by the block will execute. If the block has any outputs, these will continue to update. This is typically the normal operating mode.

Out of service (OOS)

The functions performed by the block will not execute. If the block has any outputs, these will typically not update and the status of any values passed to downstream blocks will be "BAD." To make some changes to the configuration of the block, change the mode of the block to OOS. When the changes are complete, change the mode back to AUTO.

MAN

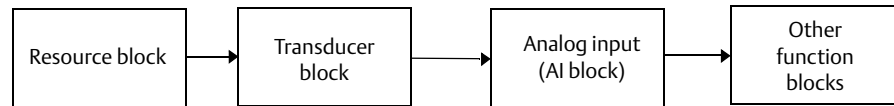
In this mode, variables that are passed out of the block can be manually set for testing or override purposes.

Other types of modes

Other types of modes are Cas, RCas, ROut, IMan, and LO. Some of these may be supported by different function blocks in the 644. For more information, see the Function Block [Reference Manual](#).

Note

When an upstream block is set to OOS, this will impact the output status of all downstream blocks. The figure below depicts the hierarchy of blocks:



2.3.4 Link Active Scheduler (LAS)

The Rosemount 644 can be designated to act as the backup LAS in the event that the designated LAS is disconnected from the segment. As the backup LAS, the Rosemount 644 will take over the management of communications until the host is restored.

The host system may provide a configuration tool specifically designed to designate a particular device as a backup LAS. Otherwise, this can be configured manually as follows:



1. Access the Management Information Base (MIB) for the Rosemount 644.
To activate the LAS capability, write 0x02 to the BOOT_OPERAT_FUNCTIONAL_CLASS object (Index 605). To deactivate, write 0x01.
2. Restart the device.

2.3.5 Block installation

Rosemount devices are pre-configured with function blocks at the factory, the default permanent configuration for the Rosemount 644 is listed below. The Rosemount 644 can have up to 10 additional instantiated function blocks.

- Two AI blocks (tag names AI 1300, AI 1400)
- One proportional/integral/derivative block (tag name PID 1500)

The Rosemount 644 supports the use of function block Instantiation. When a device supports block instantiation, the number of blocks and block types can be defined to match specific application needs. The number of blocks that can be instantiated is only limited by the amount of memory within the device and the block types that are supported by the device. Instantiation does not apply to standard device blocks like the resource, sensor transducer, LCD transducer, and advanced diagnostics blocks.

By reading the parameter “FREE_SPACE” in the Resource block you can determine how many blocks you can instantiate. Each block that you instantiate takes up 4.5 percent of the “FREE_SPACE.”

Block instantiation is done by the host control system or configuration tool, but not all hosts are required to implement this functionality. Please refer to your specific host or configuration tool manual for more information.

2.3.6 Capabilities

Virtual Communication Relationship (VCR)

There are a total of 12 VCR's. One is permanent and 11 are fully configurable by the host system. 16 link objects are available.

Network parameter	Value
Slot Time	8
Maximum Response Delay	2
Maximum Inactivity to Claim LAS Delay	32
Minimum Inter DLPDU Delay	8
Time Sync class	4 (1ms)
Maximum Scheduling Overhead	21
Per CLPDU PhL Overhead	4
Maximum Inter-channel Signal Skew	0
Required Number of Post-transmission-gab-ext Units	0
Required Number of Preamble-extension Units	1

Block execution times

Analog input = 45 ms
PID = 60 ms

2.3.7 Surges/transients

The transmitter will withstand electrical transients of the energy level encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, welding, heavy electrical equipment, or switching gears, can damage both the transmitter and the sensor. To protect against high-energy transients, install the transmitter into a suitable connection head with the integral transient protector, option T1. Refer to the Rosemount 644 Product Data Sheet for more information.

2.4 FOUNDATION Fieldbus function blocks

For reference information on the Resource, Sensor Transducer, AI, LCD Transducer blocks refer to FOUNDATION Fieldbus Block Information on [page 41](#). Reference information on the PID block can be found in the Function Block [Reference Manual](#).

Resource block (index number 1000)

The Resource Function Block (RB) contains diagnostic, hardware, and electronics information. There are no linkable inputs or outputs to the Resource Block.

Sensor transducer block (index number 1100)

The Sensor Transducer Function Block (STB) temperature measurement data includes sensor and terminal temperature. The STB also includes information about sensor type, engineering units, linearization, reranging, damping, temperature compensation, and diagnostics.

LCD transducer block (index number 1200)

The LCD Transducer Block is used to configure the LCD display meter.

Analog input block (index number 1300 and 1400)

The Analog input function block processes the measurements from the sensor and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The AI block is widely used for scaling functionality.

PID block (index number 1500)

The PID function block combines all of the necessary logic to perform proportional/integral/derivative control. The block supports mode control, signal scaling and limiting, feed forward control, override tracking, alarm limit detection, and signal status propagation.

The block supports two forms of the PID equation: Standard and series. You can choose the appropriate equation using the MATHFORM parameter. The standard ISA PID equation is the default selection.

2.4.1 Resource block

FEATURES and FEATURES_SEL

The parameters FEATURES and FEATURE_SEL determine optional behavior of the Rosemount 644.

FEATURES

The FEATURES parameter is read only and defines which features are supported by the Rosemount 644. Below is a list of the FEATURES the Rosemount 644 supports.

UNICODE

All configurable string variables in the Rosemount 644, except tag names, are octet strings. Either ASCII or Unicode may be used. If the configuration device is generating Unicode octet strings, you must set the Unicode option bit.

REPORTS

The Rosemount 644 supports alert reports. The Reports option bit must be set in the features bit string to use this feature. If it is not set, the host must poll for alerts.

SOFT W LOCK

Inputs to the security and write lock functions include the software write lock bits of the FEATURE_SEL parameter, the WRITE_LOCK parameter, and the DEFINE_WRITE_LOCK parameter.

The WRITE_LOCK parameter prevents modification of parameters within the device except to clear the WRITE_LOCK parameter. During this time, the block will function normally updating inputs and outputs and executing algorithms. When the WRITE_LOCK condition is cleared, a WRITE_ALM alert is generated with a priority that corresponds to the WRITE_PRI parameter.

The FEATURE_SEL parameter enables the user to select the software write lock or no write lock capability. In order to enable the software write lock, the SOFT_W_LOCK bit must be set in the FEATURE_SEL parameter. Once this bit is set, the WRITE_LOCK parameter may be set to "Locked" or "Unlocked." Once the WRITE_LOCK parameter is set to "Locked" by the software, all user requested writes as determined by the DEFINE_WRITE_LOCK parameter shall be rejected.

The DEFINE_WRITE_LOCK parameter allows the user to configure whether the write lock function will control writing to all blocks, or only to the resource and transducer blocks. Internally updated data such as process variables and diagnostics will not be restricted.

N/A = No blocks are blocked

Physical = Locks resource and transducer block

Everything = Locks every block.

The following table displays all possible configurations of the WRITE_LOCK parameter.

FEATURE_SEL SW_SEL bit	WRITE_LOCK	WRITE_LOCK Read/Write	DEFINE_WRITE_LOCK	Write access to blocks
0 (off)	1 (unlocked)	Read only	NA	All
1 (on)	1 (unlocked)	Read/Write	NA	All
1 (on)	2 (locked)	Read/Write	Physical	Function Blocks only
1 (on)	2 (locked)	Read/Write	Everything	None

FEATURES_SEL

FEATURES_SEL is used to turn on any of the supported features. The default setting of the Rosemount 644 does not select any of these features. Choose one of the supported features if any.

MAX_NOTIFY

The MAX_NOTIFY parameter value is the maximum number of alert reports that the resource can have sent without getting a confirmation, corresponding to the amount of buffer space available for alert messages. The number can be set lower, to control alert flooding, by adjusting the LIM_NOTIFY parameter value. If LIM_NOTIFY is set to zero, then no alerts are reported.

Plantweb™ Alerts

The alerts and recommended actions should be used in conjunction with [“Operation and maintenance” on page 19](#).

The resource block will act as a coordinator for Plantweb alerts. There will be three alarm parameters (FAILED_ALARM, MAINT_ALARM, and ADVISE_ALARM) which will contain information regarding some of the device errors which are detected by the transmitter software. There will be a RECOMMENDED_ACTION parameter which will be used to display the recommended action text for the highest priority alarm and a HEALTH_INDEX parameters (0–100) indicating the overall health of the transmitter. FAILED_ALARM will have the highest priority followed by MAINT_ALARM and ADVISE_ALARM will be the lowest priority.

FAILED_ALARMS

A failure alarm indicates a failure within a device that will make the device or some part of the device non-operational. This implies that the device is in need of repair and must be fixed immediately. There are five parameters associated with FAILED_ALARMS specifically, they are described below.

FAILED_ENABLED

This parameter contains a list of failures in the device which makes the device non-operational that will cause an alert to be sent. Below is a list of the failures with the highest priority first.

1. Electronics
2. NV memory
3. HW/SW incompatible
4. Primary value
5. Secondary value

FAILED_MASK

This parameter will mask any of the failed conditions listed in FAILED_ENABLED. A bit on means that the condition is masked out from alarming and will not be reported.

FAILED_PRI

Designates the alerting priority of the FAILED_ALM, see [“Alarm priority” on page 17](#). The default is 0 and the recommended value are between 8 and 15.

FAILED_ACTIVE

This parameter displays which of the alarms is active. Only the alarm with the highest priority will be displayed. This priority is not the same as the FAILED_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

FAILED_ALM

Alarm indicating a failure within a device which makes the device non-operational.

MAINT_ALARMS

A maintenance alarm indicates the device or some part of the device needs maintenance soon. If the condition is ignored, the device will eventually fail. There are five parameters associated with MAINT_ALARMS, they are described below.

MAINT_ENABLED

The MAINT_ENABLED parameter contains a list of conditions indicating the device or some part of the device needs maintenance soon.

Below is a list of the conditions with the highest priority first.

1. Primary value degraded
2. Secondary value degraded
3. Diagnostic
4. Configuration error
5. Calibration error

MAINT_MASK

The MAINT_MASK parameter will mask any of the failed conditions listed in MAINT_ENABLED. A bit on means that the condition is masked out from alarming and will not be reported.

MAINT_PRI

MAINT_PRI designates the alarming priority of the MAINT_ALM, “Process alarms” on page 16. The default is 0 and the recommended values is 3 to 7.

MAINT_ACTIVE

The MAINT_ACTIVE parameter displays which of the alarms is active. Only the condition with the highest priority will be displayed. This priority is not the same as the MAINT_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

MAINT_ALM

An alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.

Advisory alarms

An advisory alarm indicates informative conditions that do not have a direct impact on the device's primary functions. There are five parameters associated with ADVISE_ALARMS. They are described below.

ADVISE_ENABLED

The ADVISE_ENABLED parameter contains a list of informative conditions that do not have a direct impact on the device's primary functions. Below is a list of the advisories with the highest priority first.

1. NV writes deferred
2. SPM process anomaly detected

ADVISE_MASK

The ADVISE_MASK parameter will mask any of the failed conditions listed in ADVISE_ENABLED. A bit on means the condition is masked out from alarming and will not be reported.

ADVISE_PRI

ADVISE_PRI designates the alarming priority of the ADVISE_ALM, see “Process alarms” on page 16. The default is 0 and the recommended values are 1 or 2.

ADVISE_ACTIVE

The ADVISE_ACTIVE parameter displays which of the advisories is active. Only the advisory with the highest priority will be displayed. This priority is not the same as the ADVISE_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

ADVISE_ALM

ADVISE_ALM is an alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.

Recommended actions for Plantweb alerts

RECOMMENDED_ACTION

The RECOMMENDED_ACTION parameter displays a text string that will give a recommended course of action to take based on which type and which specific event of the Plantweb alerts are active.

Table 2-1. RB.RECOMMENDED_ACTION

	Alarm type	Failed/Maint/Advise Active Event	Recommended action text string
Plantweb alerts	None	None	No action required
	Advisory	NV Writes Deferred	Non-volatile writes have been deferred, leave the device powered until the advisory goes away
	Maintenance	Configuration Error	Re-write the Sensor Configuration
		Primary Value Degraded	Confirm the operating range of the applied sensor and/or verify the sensor connection and device environment
		Calibration Error	Retrim the device
		Secondary Value Degraded	Verify the ambient temperature is within operating limits
	Failed	Electronics Failure	Replace the Device
		HW / SW Incompatible	Verify the Hardware Revision is compatible with the Software Revision
		NV Memory Failure	Reset the device then download the Device Configuration
		Primary Value Failure	Verify the instrument process is within the Sensor range and / or confirm sensor configuration and wiring.
		Secondary Value Failure	Verify the ambient temperature is within operating limits

2.4.2 Sensor transducer block

Note

When the engineering units of the XD_SCALE are selected, the engineering units in the Transducer Block change to the same units. This is the only way to change the engineering units in the sensor transducer block.

Damping



The damping parameter in the Transducer Block may be used to filter measurement noise. By increasing the damping time, the transmitter will have a slower response time, but will decrease the amount of process noise that is translated to the transducer block primary value. Because both the LCD display and AI block get input from the transducer block, adjusting the damping parameter will effect both blocks.

Note

The AI block has it's own filtering parameter called PV_FTME. For simplicity, it is better to do filtering in the transducer block as damping will be applied to primary value on every sensor update. If filtering is done in AI block, damping will be applied to output every macrocycle. The LCD display will display value from transducer block.

2.4.3 Analog Input function block

Configure the AI block



A minimum of four parameters are required to configure the AI block. The parameters are described below with example configurations shown at the end of this section.

CHANNEL

Select the channel that corresponds to the desired sensor measurement. The Rosemount 644 measures both sensor temperature (channel 1) and terminal temperature (channel 2).

L_TYPE

The L_TYPE parameter defines the relationship of the sensor measurement (sensor temperature) to the desired output temperature of the AI Block. The relationship can be direct or indirect.

Direct

Select direct when the desired output will be the same as the sensor measurement (sensor temperature).

Indirect

Select indirect when the desired output is a calculated measurement based on the sensor measurement (e.g. ohm or mV). The relationship between the sensor measurement and the calculated measurement will be linear.

XD_SCALE and OUT_SCALE

The XD_SCALE and OUT_SCALE each include four parameters: 0%, 100%, engineering units, and precision (decimal point). Set these based on the L_TYPE:

L_TYPE is Direct

When the desired output is the measured variable, set the XD_SCALE to represent the operating range of the process. Set OUT_SCALE to match XD_SCALE.

L_TYPE is Indirect

When an inferred measurement is made based on the sensor measurement, set the XD_SCALE to represent the operating range that the sensor will see in the process. Determine the inferred measurement values that correspond to the XD_SCALE 0 and 100% points and set these for the OUT_SCALE.

Note

To avoid configuration errors, only select Engineering Units for XD_SCALE and OUT_SCALE that are supported by the device. The supported units are:

Pressure (channel 1)	Temperature (channel 2)
°C	°C
°F	°F
K	K
R	R
W	W
mV	mV

When the engineering units of the XD_SCALE are selected, this causes the engineering units of the PRIMARY_VALUE_RANGE in the Transducer Block to change to the same units. THIS IS THE ONLY WAY TO CHANGE THE ENGINEERING UNITS IN THE SENSOR TRANSDUCER BLOCK, PRIMARY_VALUE_RANGE parameter.

Configuration examples

4-wire, Pt 100 $\alpha = 385$
AI1 = process temperature
AI2 = terminal temperature

Transducer block

If host system supports methods:

1. Select **Methods**.
2. Select **Sensor Connections**.
3. Follow on-screen instruction.

If host system doesn't not support methods:

1. Put *transducer block* into OOS mode.
 - a. Go to MODE_BLK.TARGET.
 - b. Select **OOS (0x80)**.
2. Go to SENSOR_CONNECTION.
 - a. Select **4-wire (0x4)**.
3. Go to SENSOR_TYPE.
 - a. Select **PT100A385**.
4. Put the *transducer block* back into Auto mode.

AI blocks (basic configuration)⁽¹⁾

AI1 as Process Temperature

1. Put the *AI Block* into OOS mode.
 - a. Go to MODE_BLK.TARGET.
 - b. Select **OOS (0x80)**.
2. Go to CHANNEL, select **Sensor 1**.
3. Go to L_TYPE, select **Direct**.
4. Go to XD_Scale, select **UNITS_INDEX** to be °C.
5. Go to OUT_SCALE.
 - a. Select **UNITS_INDEX** to be °C.
 - b. Set the 0 and 100 scale to be the same as the PRIMARY_VALUE_RANGE.
6. Put the *AI Block* back into Auto mode.
7. Follow host procedure download schedule into block.

1, Configure a minimum of four parameters to get a value out of the AI block.

AI2 as Terminal Temperature

1. Put the *AI Block* into OOS mode.
 - a. Go to MODE_BLK.TARGET, select **OOS (0x80)**.
2. Go to CHANNEL, select **Body Temperature**.
3. Go to L_TYPE. select **Direct**.
4. Go to XD_Scale, select **UNITS_INDEX** to be °C.
5. Go to OUT_SCALE.
 - a. Select **UNITS_INDEX** to be °C.
 - b. Set the 0 and 100 scale to be the same as the SECONDARY_VALUE_RANGE.
6. Put the *AI Block* back into Auto mode.
7. Follow host procedure download schedule into block.

Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. Adjust the filter time constant (in seconds) using the PV_FTIME parameter. Set the filter time constant to zero to disable the filter feature.

Process alarms

Process alarm detection is based on the OUT value. Configure the alarm limits of the following standard alarms:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Low (LO_LIM)
- Low low (LO_LO_LIM)

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI



Alarm priority

Alarms are grouped into five levels of priority:

Priority number	Priority description
0	The alarm condition is not used.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator.
3–7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8–15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status options

Status options (STATUS_OPTS) supported by the AI block are shown below.

Propagate fault forward

If the status from the sensor is Bad, Device failure or Bad, Sensor failure, propagate it to OUT without generating an alarm. The use of these sub-status in OUT is determined by this option. Through this option, the user may determine whether alarming (sending of an alert) will be done by the block or propagated downstream for alarming.

Uncertain if limited

Set the output status of the Analog Input block to uncertain if the measured or calculated value is limited.

BAD if limited

Set the output status to Bad if the sensor is violating a high or low limit.

Uncertain if Man mode

Set the output status of the analog input block to uncertain if the actual mode of the block is Man.

Note

The instrument must be in Out of Service mode to set the status option.

Advanced features

The AI Function Block provides added capability through the addition of the following parameters:

ALARM_TYPE

ALARM_TYPE allows one or more of the process alarm conditions detected by the AI function block to be used in setting its OUT_D parameter.

OUT_D

OUT_D is the discrete output of the AI function block based on the detection of process alarm condition(s). This parameter may be linked to other function blocks that require a discrete input based on the detected alarm condition.

2.4.4 LCD transducer block

The LCD display meter connects directly to the Rosemount 644 electronics FOUNDATION Fieldbus output board. The meter indicates output and abbreviated diagnostic messages.

The first line of five characters displays the sensor being measured.

If the measurement is in error, “Error” appears on the first line. The second line indicates if the device or the sensor is causing the error.

Each parameter configured for display will appear on the LCD display for a brief period before the next parameter is displayed. If the status of the parameter goes bad, the LCD display will also cycle diagnostics following the displayed variable.

Custom meter configuration

Shipped from the factory, Parameter #1 is configured to display the primary variable (temperature) from the LCD transducer block. Parameters 2–4 are not configured. To change the configuration of Parameter #1 or to configure additional parameters 2–4, use the configuration parameters below.

The LCD transducer block can be configured to sequence four different process variables as long as the parameters are sourced from a function block that is scheduled to execute within the Rosemount 644 temperature transmitter. If a function block is scheduled in the Rosemount 644 that links a process variable from another device on the segment, that process variable can be displayed on the LCD display.

DISPLAY_PARAM_SEL

The DISPLAY_PARAM_SEL parameter specifies how many process variables will be displayed. Select up to four display parameters.

BLK_TAG_#⁽¹⁾

Enter the Block Tag of the function block that contains the parameter to be displayed. The default function block tags from the factory are:

TRANSDUCER
AI 1300
AI 1400
PID 1500

BLK_TYPE_#⁽¹⁾

Enter the block type of the function block that contains the parameter to be displayed. This parameter is generally selected via a drop-down menu with a list of possible function block types. (e.g. Transducer, PID, AI, etc.)

PARAM_INDEX_#⁽¹⁾

The PARAM_INDEX_# parameter is generally selected via a drop-down menu with a list of possible parameter names based upon what is available in the function block type selected. Choose the parameter to be displayed.

CUSTOM_TAG_#⁽¹⁾

The CUSTOM_TAG_# is an optional user-specified tag identifier that can be configured to be displayed with the parameter in place of the block tag. Enter a tag of up to five characters.

1, “#” represents the specified parameter number.

UNITS_TYPE_#⁽¹⁾

The UNITS_TYPE_# parameter is generally selected via a drop-down menu with three options: AUTO, CUSTOM, or NONE. Select AUTO only when the parameter to be displayed is pressure, temperature, or percent. For other parameters, select CUSTOM and be sure to configure the CUSTOM_UNITS_# parameter. Select NONE if the parameter is to be displayed without associated units.

CUSTOM_UNITS_#⁽¹⁾

Specify custom units to be displayed with the parameter. Enter up to six characters. To display Custom Units the UNITS_TYPE_# must be set to CUSTOM.

2.5 Operation and maintenance

2.5.1 Overview

This section contains information on operation and maintenance procedures.

Methods and Manual Operation

Each FOUNDATION Fieldbus host or configuration tool has different ways of displaying and performing operations. Some hosts will use Device Descriptions (DD) and DD Methods to complete device configuration and will display data consistently across platforms. The DD can be found on Emerson.com/Rosemount. There is no requirement that a host or configuration tool support these features.

The information in this section will describe how to use methods in a general fashion. In addition, if your host or configuration tool does not support methods, this section will cover manually configuring the parameters involved with each method operation. For more detailed information on the use of methods, see your host or configuration tool manual.

2.5.2 Troubleshooting guides

Figure 2-1. 644 Troubleshooting Flowchart

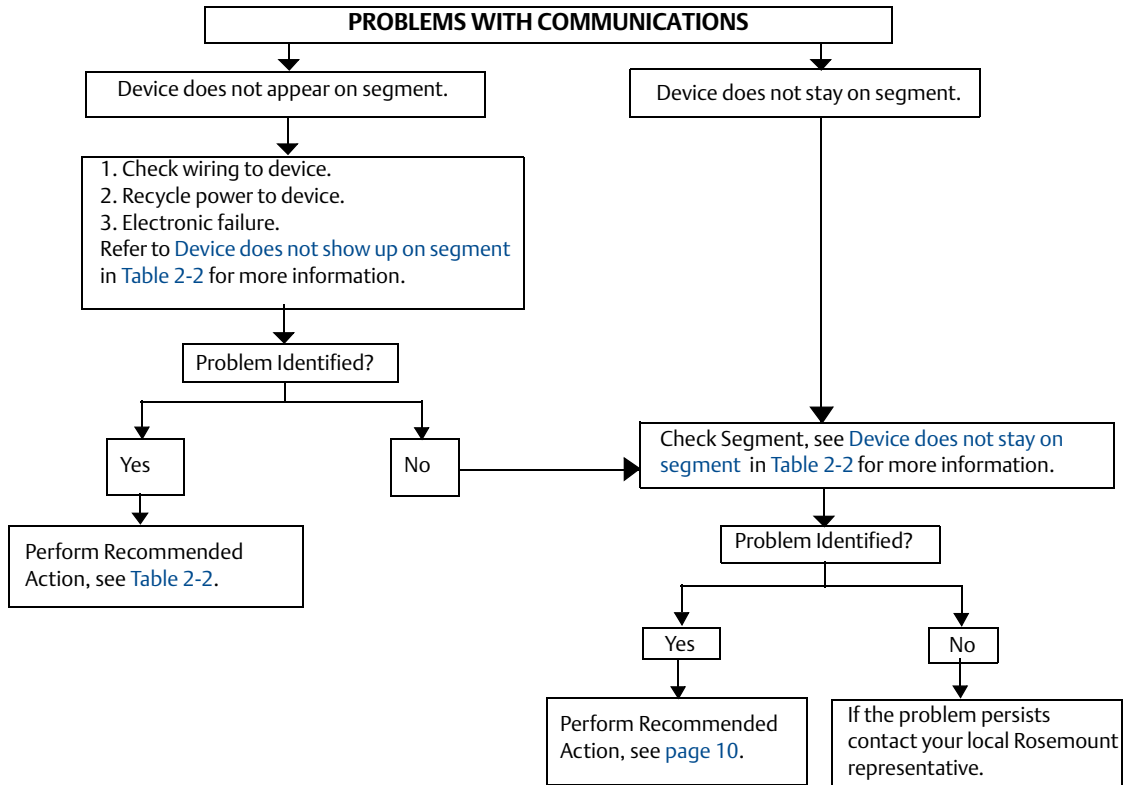


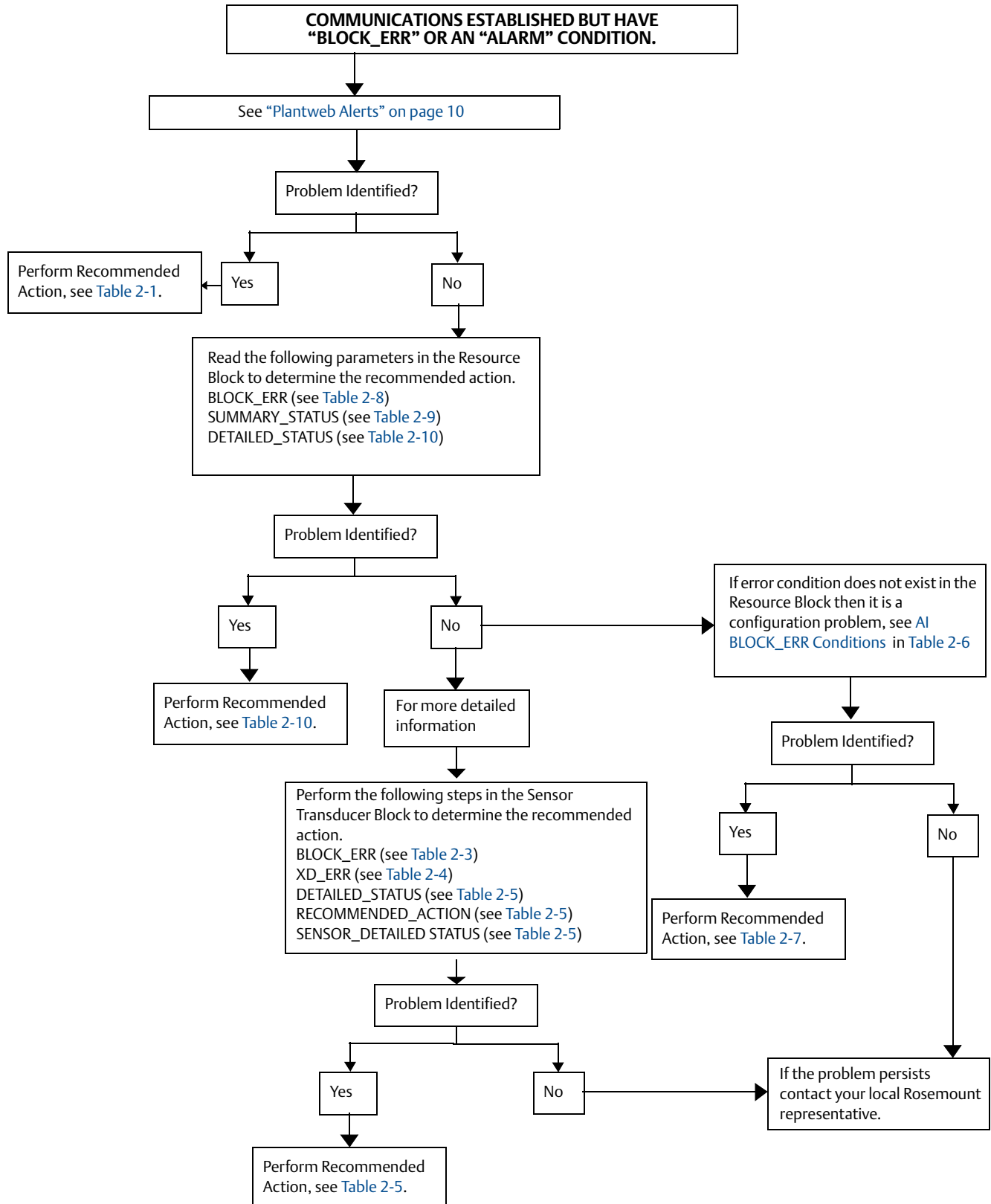
Table 2-2. Troubleshooting Guide

Symptom ⁽¹⁾	Cause	Recommended actions
Device does not show up on segment	Unknown	Recycle power to device.
	No power to device	1. Ensure the device is connected to the segment. 2. Check voltage at terminals. There should be 9–32 Vdc. 3. Check to ensure the device is drawing current. There should be approximately 10.5 mA nominal (11 mA max.)
	Segment problems	
	Electronics failing	Replace device.
	Incompatible network settings	1. Change host network parameters. 2. Refer to host documentation for procedure.
Device does not stay on segment ⁽²⁾	Incorrect signal levels. Refer to host documentation for procedure.	1. Check for two terminators. 2. Excess cable length. 3. Bad power supply or conditioner.
	Excess noise on segment. Refer to host documentation for procedure.	1. Check for incorrect grounding. 2. Check for correct shielded wire. 3. Tighten wire connections. 4. Check for corrosion or moisture on terminals. 5. Check for bad power supply.
	Electronics failing	Replace device.
	Other	Check for water around the transmitter.

1. The corrective actions should be done with consultation of your system integrator.

2. Wiring and installation 31.25 kbit/s, voltage mode, wire medium application guide AG-140 available from the FOUNDATION Fieldbus Protocol.

Figure 2-2. Problems with Communications Flowchart



2.5.3 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 *MODE_BLK.TARGET* 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 *PRIMARY_VALUE_RANGE*.
5. Set values of *CAL_POINT_LO* to correspond to the temperature applied by the sensor.
6. Apply temperature, temperature corresponding to the upper calibration.
7. Allow temperature to stabilize.
8. Set *CAL_POINT_HI*.

Note

CAL_POINT_HI must be within *PRIMARY_VALUE_RANGE* and greater than *CAL_POINT_LO* + *CAL_MIN_SPAN*

9. Set *SENSOR_CAL_DATE* to the current date.
10. Set *SENSOR_CAL_WHO* to the person responsible for the calibration.
11. Set *SENSOR_CAL_LOC* to the calibration location.
12. Set *MODE_BLK.TARGET* 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 *MODE_BLK.TARGET* to OOS.
2. Set *SENSOR_CAL_METHOD* to Factory Trim.
3. Set *SET_FACTORY_TRIM* to Recall.
4. Set *SENSOR_CAL_DATE* to the current date.
5. Set *SENSOR_CAL_WHO* to the person responsible for the calibration.
6. Set *SENSOR_CAL_LOC* to the calibration location.
7. Set *MODE_BLK.TARGET* to AUTO.

Note

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

Table 2-3. Sensor Transducer Block BLOCK_ERR Messages

Condition name and description
Other
Out of Service: The actual mode is out of service.

Table 2-4. Sensor Transducer Block XD_ERR Messages

Condition name and description
Electronics Failure: An electrical component failed.
I/O Failure: An I/O failure occurred.
Software Error: The software has detected an internal error.
Calibration Error: An error occurred during calibration of the device.
Algorithm Error: The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.

Diagnostics

Table 2-5 lists the potential errors and the possible corrective actions for the given values. The corrective actions are in order of increasing system level compromises. The first step should always be to reset the transmitter and then if the error persists, try the steps in Table 2-5. Start with the first corrective action and then try the second.

Table 2-5. Sensor Transducer Block STB.SENSOR_DETAILED_STATUS Messages

STB.SENSOR_DETAILED_STATUS	Description
Invalid Configuration	Wrong sensor connection with wrong sensor type
ASIC RCV Error	The micro detected a checksum or start/stop bit failure with ASIC communication
ASIC TX Error	The A/D ASIC detected a communication error
ASIC Interrupt Error	ASIC interrupts are too fast or slow
Reference Error	Reference resistors are greater than 25% of known value
ASIC Configuration Error	Citadel registers were not written correctly. (Also CALIBRATION_ERR)
Sensor Open	Open sensor detected
Sensor Shorted	Shorted sensor detected
Terminal Temperature Failure	Open PRT detected
Sensor Out of Operating Range	Sensor readings have gone beyond PRIMARY_VALUE_RANGE values
Sensor beyond operating limits	Sensor readings have gone below 2% of lower range or above 6% of upper range of sensor

Table 2-5. Sensor Transducer Block STB.SENSOR_DETAILED_STATUS Messages

STB.SENSOR_DETAILED_STATUS	Description
Terminal Temperature Out of Operating Range	PRT readings have gone beyond SECONDARY_VALUE_RANGE values
Terminal Temperature Beyond Operating Limits	PRT readings have gone below 2% of lower range or above 6% of upper range of PRT. (These ranges are calculated and are not the actual range of the PRT which is a PT100 A385)
Sensor Degraded	For RTDs, this is excessive EMF detected. This is thermocouple degradation for thermocouples.
Sensor Error	The user trim has failed due to excessive correction or sensor failure during the trim method

2.5.4 Analog input function block

Status

Along with the measured or calculated PV value, every FOUNDATION Fieldbus block passes an additional parameter called STATUS. The PV and STATUS are passed from the Transducer Block to the Analog Input Block. The STATUS can be one of the following: GOOD, BAD, or UNCERTAIN. When there are no problems detected by the self-diagnostics of the block, the STATUS will be GOOD. If a problem occurs with the hardware in the device or the quality of the process variable is compromised for some reason, the STATUS will become either BAD or UNCERTAIN depending upon the nature of the problem. It is important that the Control Strategy that makes use of the Analog Input Block is configured to monitor the STATUS and take action where appropriate when the STATUS is no longer GOOD.

Simulation



Simulate replaces the channel value coming from the sensor transducer block. For testing purposes, it is possible to manually drive the output of the analog input block to a desired value. There are two ways to do this.

Manual mode

To change only the OUT_VALUE and not the OUT_STATUS of the AI Block, place the TARGET MODE of the block to MANUAL. Then, change the OUT_VALUE to the desired value.

Simulate

1. If the SIMULATE switch is in the OFF position, move it to the ON position. If the SIMULATE jumper is already in the ON position, you must move it to off and place it back in the ON position.

Note

As a safety measure, the switch must be reset every time power is interrupted to the device in order to enable SIMULATE. This prevents a device that is tested on the bench from getting installed in the process with SIMULATE still active.

2. To change both the OUT_VALUE and OUT_STATUS of the AI Block, set the TARGET MODE to AUTO.
3. Set SIMULATE_ENABLE_DISABLE to 'Active.'
4. Enter the desired SIMULATE_VALUE to change the OUT_VALUE and SIMULATE_STATUS_QUALITY to change the OUT_STATUS.
If errors occur when performing the above steps, be sure that the SIMULATE jumper has been reset after powering up the device.

Table 2-6. AI BLOCK_ERR Conditions

Condition number	Condition name and description
0	Other
1	Block Configuration Error: The selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
14	Power Up
15	Out of Service: The actual mode is out of service.

Table 2-7. Troubleshooting the AI Block

Symptom	Possible causes	Recommended actions
Bad or no temperature readings (Read the AI "BLOCK_ERR" parameter)	BLOCK_ERR reads OUT OF SERVICE (OOS)	1. AI Block target mode target mode set to OOS. 2. Resource Block OUT OF SERVICE.
	BLOCK_ERR reads CONFIGURATION ERROR	1. Check CHANNEL parameter (see "CHANNEL" on page 14) 2. Check L_TYPE parameter (see "L_TYPE" on page 14) 3. Check XD_SCALE engineering units. (see "XD_SCALE and OUT_SCALE" on page 14)
	BLOCK_ERR reads POWERUP	Download Schedule into block. Refer to host for downloading procedure.
	BLOCK_ERR reads BAD INPUT	1. Sensor Transducer Block Out Of Service (OOS) 2. Resource Block Out of Service (OOS)
	No BLOCK_ERR but readings are not correct. If using Indirect mode, scaling could be wrong.	1. Check XD_SCALE parameter. 2. Check OUT_SCALE parameter. (see "XD_SCALE and OUT_SCALE" on page 14)
	No BLOCK_ERR. Sensor needs to be calibrated or Zero trimmed.	See Section 2: Configuration to determine the appropriate trimming or calibration procedure.
OUT parameter status reads UNCERTAIN and substatus reads EngUnitRangViolation.	Out_ScaleEU_0 and EU_100 settings are incorrect.	See "XD_SCALE and OUT_SCALE" on page 14.

2.5.5 Resource block

This section describes error conditions found in the Resource block. Read Table 2-8 through Table 2-10 to determine the appropriate corrective action.

Block errors

Table 2-8 lists conditions reported in the BLOCK_ERR parameter.

Table 2-8. Resource Block BLOCK_ERR Messages

Condition name and description
Other
Device Needs Maintenance Now
Memory Failure: A memory failure has occurred in FLASH, RAM, or EEPROM memory.
Lost NV Data: Non-volatile data that is stored in non-volatile memory has been lost.
Device Needs Maintenance Now.
Out of Service: The actual mode is out of service.

Table 2-9. Resource Block SUMMARY_STATUS Messages

Condition name
No repair needed
Repairable
Call Service Center

Table 2-10. Resource Block RB.DETAILED_STATUS

RB.DETAILED_STATUS	Description
Sensor Transducer block error	Active when any SENSOR_DETAILED_STAUS bit is on.
Manufacturing Block integrity error	The manufacturing block size, revision, or checksum is wrong.
Hardware/software incompatible	Verify the manufacturing block revision and the hardware revision are correct/compatible with the software revision.
Non-volatile memory integrity error	Invalid checksum on a block of NV data.
ROM integrity error	Invalid application code checksum.
Lost deferred NV data	Device has been power-cycled while non-volatile writes were being deferred to prevent premature memory failure, the write operations have been deferred.
NV Writes Deferred	A high number of writes has been detected to non-volatile memory. To prevent premature failure, the write operations have been deferred.

2.5.6 LCD transducer block

This section describes error conditions found in the LCD Transducer Block. Read [Table 2-11 on page 27](#) and to determine the appropriate corrective action.

Self test procedure for the LCD display

The SELF_TEST parameter in the Resource block will test LCD display segments. When running, the segments of the display should light up for about five seconds.

If your host system supports methods refer to your host documentation on how to run the “Self Test” method. If your host system does not support methods, then you can run this test manually by following the steps below.

1. Put *Resource block* into “OOS” (Out of Service).
2. Go to the parameter called “SELF_TEST” and write the value Self test (0x2).
3. Observe the LCD display screen when you are doing this. All of the segments should light up.
4. Put the *Resource block* back into “AUTO.”

Table 2-11. LCD Transducer Block BLOCK_ERR messages

Condition name and description
Other
Out of Service: The actual mode is out of service.

Symptom	Possible causes	Recommended action
The LCD displays “DSPLY#INVLID.” Read the BLOCK_ERR and if it says “BLOCK CONFIGURATION” perform the Recommended Action	One or more of the display parameters are not configured properly.	See “LCD transducer block” on page 18.
The AI.OUT readings do not match.	The OUT_SCALE of the AI block is not configured properly.	See “Analog input function block” on page 24.
“644” is being displayed or not all of the values are being displayed.	The LCD block parameter “DISPLAY_PARAMETER_SELECT is not properly configured.	See “LCD transducer block (index number 1200)” on page 9.
The display reads OOS.	The resource and or the LCD Transducer block are OOS.	Verify that both blocks are in “AUTO.”
The display is hard to read.	Some of the LCD segments may have gone bad.	See XXXX (Self Test). If some of the segment is bad, replace the LCD display.
	Device is out of the temperature limit for the LCD display. (–20 to 80 °C)	Check ambient temperature of the device.

Section 3 Installation

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Installation	page 32
Wiring	page 35
Power supply	page 38

3.1 Overview

The information in this section covers installation considerations for the Rosemount™ 644 Temperature Transmitter with FOUNDATION Fieldbus™ Protocol. A Quick Start Guide is shipped with every transmitter to describe recommended mounting and wiring procedures for initial installation. Dimensional drawings for Rosemount 644 Transmitter mounting configurations are included in the [Product Data Sheet](#).

3.2 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.

⚠ 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 a Field Communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- All connection head covers must be fully engaged to meet explosion-proof requirements.

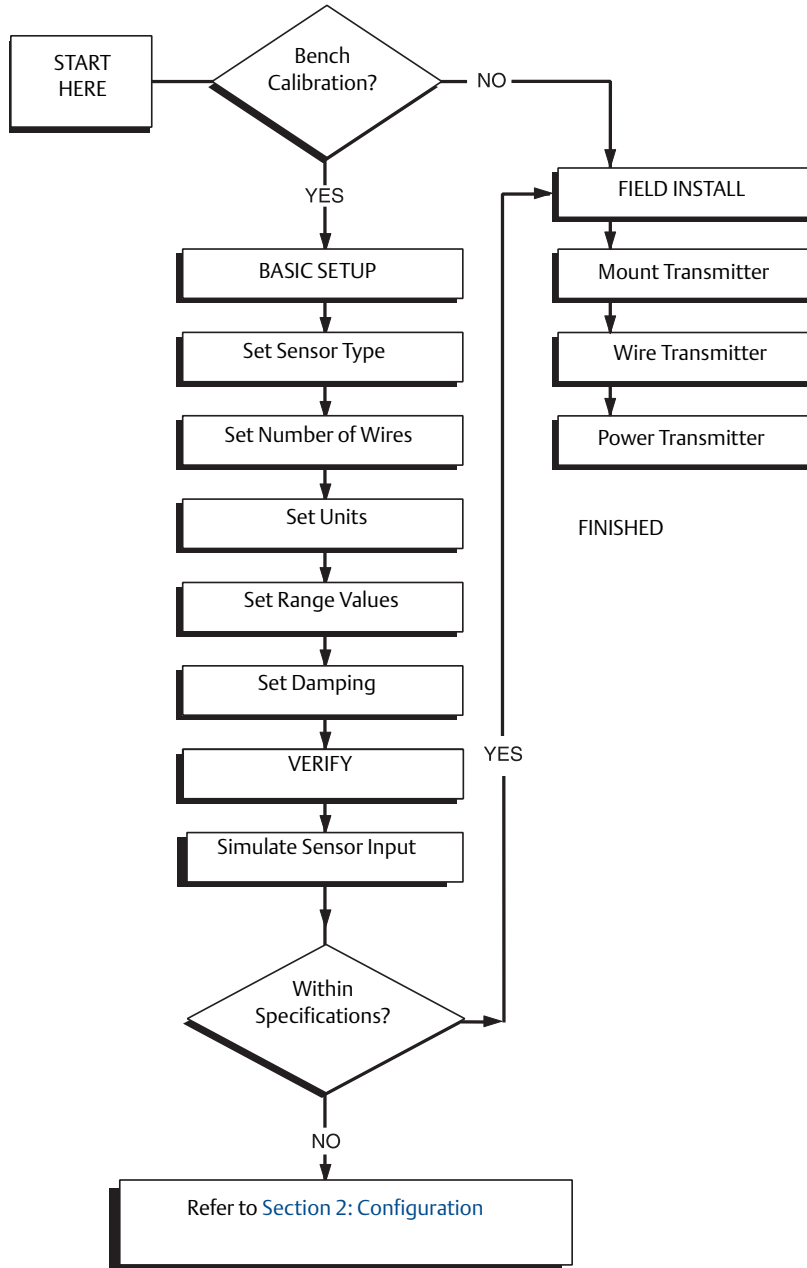
Process leaks could result in death or serious injury.

- 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.

Figure 3-1. Installation Flowchart



3.3 Mounting

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

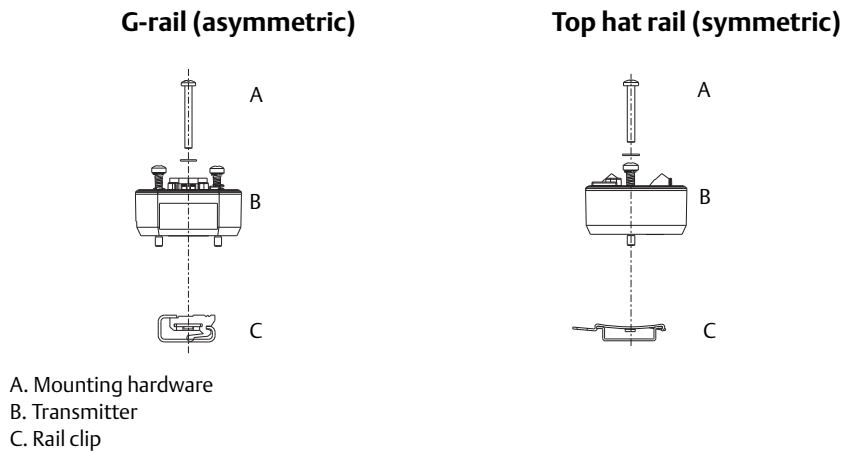
The Rosemount 644 head mount installs:

- 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.

Mounting a Rosemount 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 3-2](#).

Figure 3-2. Assembling Rail Clip Hardware to a 644H



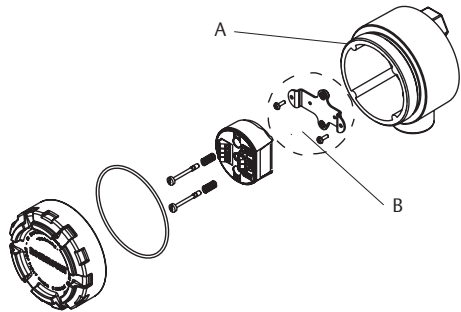
Note

Kit includes mounting hardware and both types of rail kits.

Retrofitting a Rosemount 644H for use in an existing threaded sensor connection head

To mount a Rosemount 644H in an existing threaded sensor connection head (former option code L1), order the Rosemount 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 Rosemount 644H in the existing head. See [Figure 3-3 on page 32](#).

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



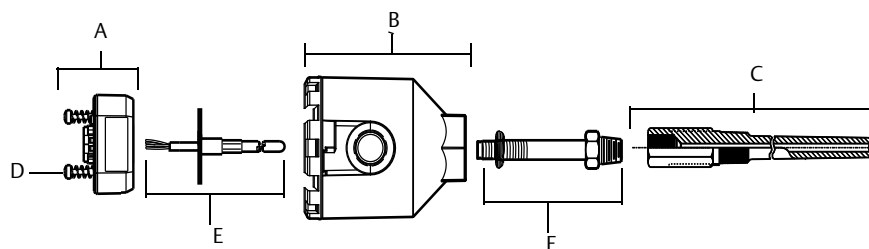
- A. Existing threaded sensor connection head (former option code L1)
- B. Kit includes replacement bracket and screws

3.4 Installation

3.4.1 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 3-7 on page 36](#)).
- 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 a cable gland into the shielded cable.
- ⚠ 6. Insert the shielded cable leads into the connection head through the cable entry. Connect and tighten the cable gland.
- ⚠ 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. Rosemount 644H transmitter
- B. Connection head
- C. Thermowell
- D. Transmitter mounting screws
- E. Integral mount sensor with flying leads
- F. Extension

3.4.2 Typical North American installation

Head mount transmitter with threaded sensor

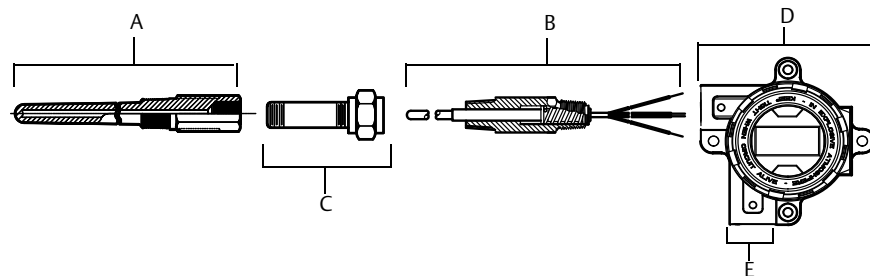


1. Attach the thermowell to the pipe or process container wall. Install and tighten thermowells before applying process pressure.
2. Attach necessary extension nipples and adapters to the thermowell. Seal the nipple and adapter threads with silicone tape.
3. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.
4. To verify the correct installation of integral transient protection (option code T1) on the Rosemount 644 Transmitter, confirm the following steps have been completed:
 - a. Ensure the transient protector unit is firmly connected to the transmitter puck assembly.
 - b. Ensure the transient protector power leads are adequately secured under the transmitter power terminal screws.
 - c. Verify the transient protector's ground wire is secured to the internal ground screw found within the universal head.

Note

The transient protector requires the use of an enclosure of at least 3.5-in (89mm) in diameter.

5. 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.
6. Mount the transmitter-sensor assembly into the thermowell. Seal adapter threads with silicone tape.
7. Install conduit for field wiring to the conduit entry of the universal head. Seal conduit threads with silicone tape.
8. 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.
9. 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

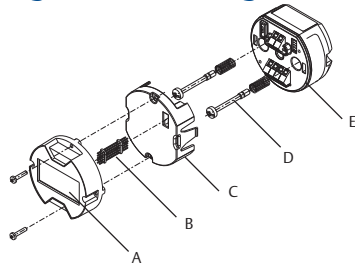
D. Universal head
E. Conduit entry

3.4.3 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 of the meter can be performed if the transmitter has a meter connector (transmitter revision 5.5.2 or later). After-market installation requires the meter kit (part number 00644-4430-0001), which includes:

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

Figure 3-4. Installing the LCD Display



A. LCD display
B. 10-pin connector
C. Meter spacer

D. Captive mounting screws and springs
E. Rosemount 644H

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 8-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 screw's 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 the meter cover; tighten at least one-third turn after the O-ring contacts the transmitter housing. The cover must be fully engaged to meet explosion-proof requirements.
6. Use a Field Communicator, AMS software, or a FOUNDATION Fieldbus Communication tool to configure the meter to the desired display.

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)

3.5 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.
- ⚠ 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 3-5 on page 35](#) when making sensor connections. Refer to [Figure 3-6 on page 36](#) for FOUNDATION Fieldbus installations.

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

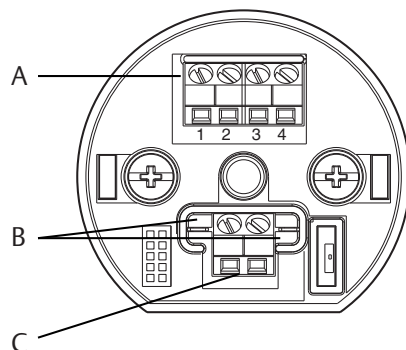
1. Remove the terminal block cover (if applicable).
2. Connect the positive power lead to the “+” terminal. Connect the negative power lead to the “-” terminal (see [Figure 3-7 on page 36](#)).

If a transient protector is being used, the power leads will now be connected to the top of the transient protector unit.

3. Tighten the terminal screws. When tightening the sensor and power wires, the max torque is 6 in-lb (0.7 N-m).
4. Reattach and tighten the cover (if applicable).
5. Apply power (see “Power supply”).

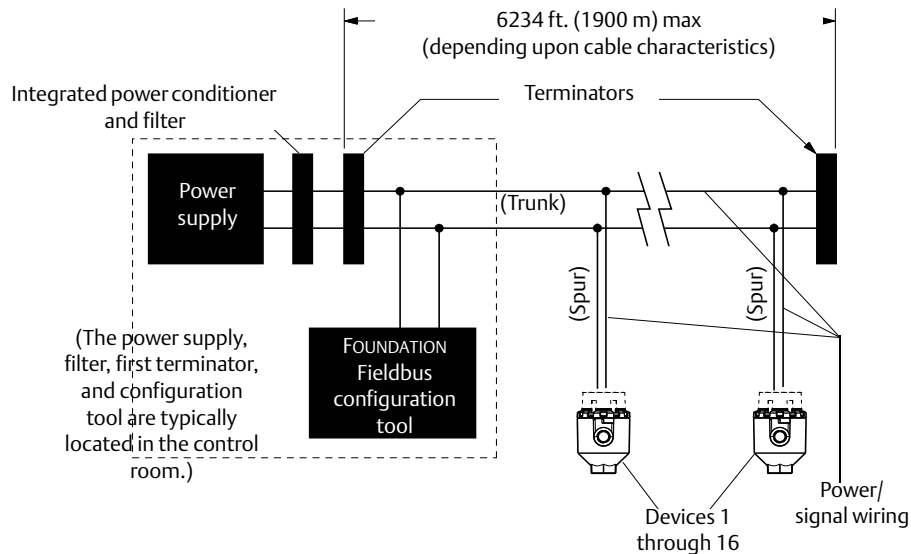
Figure 3-5. Transmitter Power, Communication, and Sensor Terminals

Rosemount 644H



- A. Sensor terminals
- B. Communication terminals
- C. Power terminals

Figure 3-6. Connecting a FOUNDATION Fieldbus Host System to a Transmitter Loop



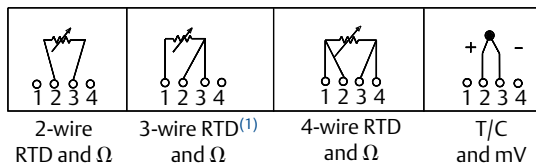
3.5.1 Sensor connections



The Rosemount 644 is compatible with a number of RTD and thermocouple sensor types. [Figure 3-7](#) 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 3-7. Sensor Wiring Diagrams

Rosemount 644 sensor connections diagram



1. Emerson™ 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 inputs 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, or 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 ft. 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 3 ft. 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 3-1. 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_0):	100 Ω (for Pt 100 RTD)

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

$$\text{Basic error} = \frac{\text{Imbalance of lead wires}}{(\alpha_{Pt} \times R_0)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Imbalance of lead wires})}{(\alpha_{Pt}) \times (R_0)}$$

Lead wire imbalance seen by the transmitter = 0.5 Ω

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

$$\frac{(0.0039 \Omega / \Omega \text{ } ^\circ\text{C}) \times (25 \text{ } ^\circ\text{C}) \times (0.5 \Omega)}{(0.00385 \Omega / \Omega \text{ } ^\circ\text{C}) \times (100 \Omega)} = \pm 0.1266 \text{ } ^\circ\text{C} = \text{Error due to amb. temp. var. of } \pm 25 \text{ } ^\circ\text{C}$$

■ Pt100 2-wire RTD:

$$\text{Basic error} = \frac{\text{lead wire resistance}}{(\alpha_{\text{Pt}} \times R_0)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{\text{Cu}}) \times (\Delta T_{\text{amb}}) \times (\text{lead wire resistance})}{(\alpha_{\text{Pt}}) \times (R_0)}$$

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

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

$$\frac{(0.0039 \Omega / \Omega \text{ } ^\circ\text{C}) \times (25 \text{ } ^\circ\text{C}) \times (7.5 \Omega)}{(0.00385 \Omega / \Omega \text{ } ^\circ\text{C}) \times (100 \Omega)} = \pm 1.9 \text{ } ^\circ\text{C} = \text{Error due to amb. temp. var. of } \pm 25 \text{ } ^\circ\text{C}$$

3.6 Power supply

FOUNDATION Fieldbus installation

Powered over FOUNDATION Fieldbus with standard Fieldbus 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 Rosemount 644 with FOUNDATION Fieldbus are polarity insensitive.

3.6.1 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 FOUNDATION Fieldbus devices. Only the shield wire should be grounded.

Note

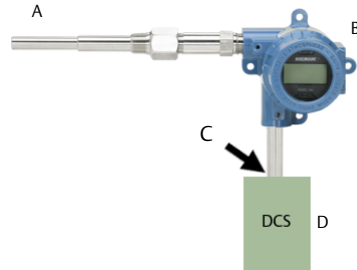
Do not ground the signal wire at both ends.

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.



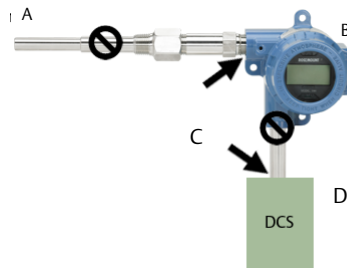
A. Sensor wires
B. Transmitter

C. Shield ground point
D. FOUNDATION Fieldbus segment

5. 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.



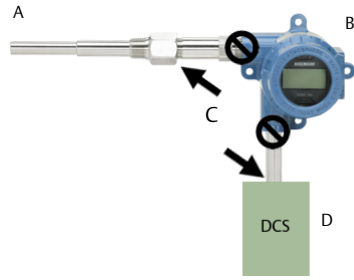
A. Sensor wires
B. Transmitter

C. Shield ground point
D. FOUNDATION Fieldbus segment

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.

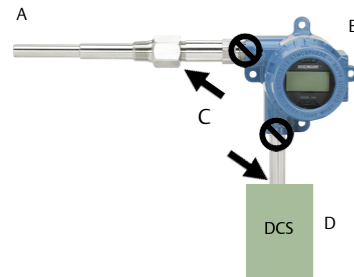


A. Sensor wires
B. Transmitter

C. Shield ground point
D. FOUNDATION Fieldbus segment

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.



A. Sensor wires
B. Transmitter

C. Shield ground point
D. FOUNDATION Fieldbus segment

Appendix A Specifications and Reference Data

Product Certifications	page 41
Ordering Information, Specifications, and Drawings	page 41

A.1 Product Certifications

To view current Rosemount™ 644 Product Certifications, follow these steps:

1. Go to Emerson.com/Rosemount/Rosemount-644.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. Click **Manuals & Guides**.
4. Select the appropriate Quick Start Guide.

A.2 Ordering Information, Specifications, and Drawings

To view current Rosemount 644 Ordering Information, Specifications, and Drawings, follow these steps:

1. Go to Emerson.com/Rosemount/Rosemount-644.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, click **Data Sheets & Bulletins** and select the appropriate Product Data Sheet.

Appendix B FOUNDATION™ Fieldbus Block Information

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LCD transducer block	page 54
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B.1 Resource block

This section contains information on the Rosemount™ 644 Resource Block. Descriptions of all resource block parameters, errors, and diagnostics are included. Also the modes, alarm detection, status handling, and troubleshooting are discussed.

B.1.1 Definition

The resource block defines the physical resources of the device. The resource block also handles functionality that is common across multiple blocks. The block has no linkable inputs or outputs.

B.1.2 Parameters and descriptions

The table below lists all of the configurable parameters of the Resource Block, including the descriptions and index numbers for each.

Table B-1. Resource Block Parameters and Descriptions

Parameter	Index number	Description
ACK_OPTION	38	Selection of whether alarms associated with the function block will be automatically acknowledged.
ADVISE_ACTIVE	82	Enumerated list of advisory conditions within a device.
ADVISE_ALM	83	Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.
ADVISE_ENABLE	80	Enabled ADVISE_ALM alarm conditions. Corresponds bit for bit to the ADVISE_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
ADVISE_MASK	81	Mask of ADVISE_ALM. Corresponds bit of bit to ADVISE_ACTIVE. A bit on means that the condition is masked out from alarming.
ADVISE_PRI	79	Designates the alarming priority of the ADVISE_ALM.
ALARM_SUM	37	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ALERT_KEY	04	The identification number of the plant unit.
BLOCK_ALM	36	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.

Table B-1. Resource Block Parameters and Descriptions

Parameter	Index number	Description
BLOCK_ERR	06	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CLR_FSTATE	30	Writing a Clear to this parameter will clear the device FAIL_SAFE if the field condition has cleared.
CONFIRM_TIME	33	The time the resource will wait for confirmation of receipt of a report before trying again. Retry will not happen when CONFIRM_TIME=0.
CYCLE_SEL	20	Used to select the block execution method for this resource. The 644 supports the following: Scheduled: Blocks are only executed based on the function block schedule. Block Execution: A block may be executed by linking to another blocks completion.
CYCLE_TYPE	19	Identifies the block execution methods available for this resource.
DD_RESOURCE	09	String identifying the tag of the resource which contains the Device Description for this resource.
DD_REV	13	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.
DEFINE_WRITE_LOCK	60	Allows the operator to select how WRITE_LOCK behaves. The initial value is “lock everything”. If the value is set to “lock only physical device” then the resource and transducer blocks of the device will be locked but changes to function blocks will be allowed.
DETAILED_STATUS	55	Indicates the state of the transmitter. See Resource Block detailed status codes.
DEV_REV	12	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
DEV_STRING	43	This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.
DEV_TYPE	11	Manufacturer’s model number associated with the resource - used by interface devices to locate the DD file for the resource.
DIAG_OPTIONS	46	Indicates which diagnostics licensing options are enabled.
DISTRIBUTOR	42	Reserved for use as distributor ID. No Foundation enumerations defined at this time.
DOWNLOAD_MODE	67	Gives access to the boot block code for over-the-wire downloads. 0 = Uninitialized 1 = Run mode 2 = Download mode
FAULT_STATE	28	Condition set by loss of communication to an output block, fault promoted to an output block or physical contact. When FAIL_SAFE condition is set, then output function blocks will perform their FAIL_SAFE actions.
FAILED_ACTIVE	72	Enumerated list of failure conditions within a device.
FAILED_ALM	73	Alarm indicating a failure within a device which makes the device non-operational.
FAILED_ENABLE	70	Enabled FAILED_ALM alarm conditions. Corresponds bit for bit to the FAILED_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
FAILED_MASK	71	Mask of FAILED_ALM. Corresponds bit of bit to FAILED_ACTIVE. A bit on means that the condition is masked out from alarming.

Table B-1. Resource Block Parameters and Descriptions

Parameter	Index number	Description
FAILED_PRI	69	Designates the alarming priority of the FAILED_ALM.
FB_OPTIONS	45	Indicates which function block licensing options are enabled.
FEATURES	17	Used to show supported resource block options. See Error! Reference source not found. The supported features are: SOFT_WRITE_LOCK_SUPPORT, HARD_WRITE_LOCK_SUPPORT, REPORTS, and UNICODE.
FEATURE_SEL	18	Used to select resource block options.
FINAL_ASSY_NUM	54	The same final assembly number placed on the neck label.
FREE_SPACE	24	Percent of memory available for further configuration. Zero in a preconfigured device.
FREE_TIME	25	Percent of the block processing time that is free to process additional blocks.
GRANT_DENY	14	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
HARD_TYPES	15	The types of hardware available as channel numbers.
HARDWARE_REV	52	Hardware revision of the hardware that has the resource block in it.
ITK_VER	41	Major revision number of the inter operability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus Foundation.
LIM_NOTIFY	32	Maximum number of unconfirmed alert notify messages allowed.
MAINT_ACTIVE	77	Enumerated list of maintenance conditions within a device.
MAINT_ALM	78	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
MAINT_ENABLE	75	Enabled MAINT_ALM alarm conditions. Corresponds bit for bit to the MAINT_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
MAINT_MASK	76	Mask of MAINT_ALM. Corresponds bit of bit to MAINT_ACTIVE. A bit on means that the condition is masked out from alarming.
MAINT_PRI	74	Designates the alarming priority of the MAINT_ALM
MANUFAC_ID	10	Manufacturer identification number – used by an interface device to locate the DD file for the resource.
MAX_NOTIFY	31	Maximum number of unconfirmed notify messages possible.
MEMORY_SIZE	22	Available configuration memory in the empty resource. To be checked before attempting a download.
MESSAGE_DATE	57	Date associated with the MESSAGE_TEXT parameter.
MESSAGE_TEXT	58	Used to indicate changes made by the user to the device's installation, configuration, or calibration.
MIN_CYCLE_T	21	Time duration of the shortest cycle interval of which the resource is capable.
MISC_OPTIONS	47	Indicates which miscellaneous licensing options are enabled.
MODE_BLK	05	The actual, target, permitted, and normal modes of the block: Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for actual

Table B-1. Resource Block Parameters and Descriptions

Parameter	Index number	Description
NV_CYCLE_T	23	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. Zero means it will never be automatically copied. At the end of NV_CYCLE_T, only those parameters which have changed need to be updated in NVRAM.
OUTPUT_BOARD_SN	53	Output board serial number.
RB_SFTWR_REV_ALL	51	The string will contains the following fields: Major rev: 1-3 characters, decimal number 0-255 Minor rev: 1-3 characters, decimal number 0-255 Build rev: 1-5 characters, decimal number 0-255 Time of build: 8 characters, xx:xx:xx, military time Day of week of build: 3 characters, Sun, Mon,... Month of build: 3 characters, Jan, Feb. Day of month of build: 1-2 characters, decimal number 1-31 Year of build: 4 characters, decimal Builder: 7 characters, login name of builder
RB_SFTWR_REV_BUILD	50	Build of software that the resource block was created with.
RB_SFTWR_REV_MAJOR	48	Major revision of software that the resource block was created with.
RB_SFTWR_REV_MINOR	49	Minor revision of software that the resource block was created with.
RECOMMENDED_ACTION	68	Enumerated list of recommended actions displayed with a device alert.
RESTART	16	Allows a manual restart to be initiated. Several degrees of restart are possible. They are the following: 1 Run – nominal state when not restarting. 2 Restart resource – not used. 3 Restart with defaults – set parameters to default values. See START_WITH_DEFAULTS below for which parameters are set. 4 Restart processor – does a warm start of CPU.
RS_STATE	07	State of the function block application state machine.
SAVE_CONFIG_BLOCKS	62	Number of EEPROM blocks that have been modified since last burn. This value will count down to zero when the configuration is saved.
SAVE_CONFIG_NOW	61	Allows the user to optionally save all non-volatile information immediately.
SECURITY_IO	65	Status of security switch.
SELF_TEST	59	Instructs resource block to perform self-test. Tests are device specific.
SET_FSTATE	29	Allows the FAIL_SAFE condition to be manually initiated by selecting Set.
SHED_RCAS	26	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas shall never happen when SHED_ROUT = 0
SHED_ROUT	27	Time duration at which to give up on computer writes to function block ROut locations. Shed from ROut shall never happen when SHED_ROUT = 0
SIMULATE_IO	64	Status of simulate switch.
SIMULATE_STATE	66	The state of the simulate switch: 0 = Uninitialized 1 = Switch off, simulation not allowed 2 = Switch on, simulation not allowed (need to cycle jumper/switch) 3 = Switch on, simulation allowed
ST_REV	01	The revision level of the static data associated with the function block.

Table B-1. Resource Block Parameters and Descriptions

Parameter	Index number	Description
START_WITH_DEFAULTS	63	0 = Uninitialized 1 = do not power-up with NV defaults 2 = power-up with default node address 3 = power-up with default pd_tag and node address 4 = power-up with default data for the entire communications stack (no application data)
STRATEGY	03	The strategy field can be used to identify grouping of blocks.
SUMMARY_STATUS	56	An enumerated value of repair analysis.
TAG_DESC	02	The user description of the intended application of the block.
TEST_RW	08	Read/write test parameter - used only for conformance testing.
UPDATE_EVT	35	This alert is generated by any change to the static data.
WRITE_ALM	40	This alert is generated if the write lock parameter is cleared.
WRITE_LOCK	34	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.
WRITE_PRI	39	Priority of the alarm generated by clearing the write lock.
XD_OPTIONS	44	Indicates which transducer block licensing options are enabled.

B.2 Sensor transducer block

The transducer block contains the actual measurement data, including a pressure and temperature reading. The transducer block includes information about sensor type, engineering units, linearization, reranging, temperature compensation, and diagnostics.

B.2.1 Parameters and descriptions

Table B-2. Sensor Transducer Block Parameters and Descriptions

Parameter	Index number	Description	Notes on how changing this parameter effects transmitter operation
ALERT_KEY	04	The identification number of the plant unit.	No effect on operation of transmitter but may affect the way alerts are sorted on the host end.
BLOCK_ALM	08	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	No effect.
BLOCK_ERR	06	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	No effect.
CAL_MIN_SPAN	18	The minimum calibration span value allowed. This minimum span information is necessary to ensure when calibration is done, the two calibrated points are not too close together.	No effect.
CAL_POINT_HI	16	The highest calibrated value.	Assigns a value to the calibration high point.
CAL_POINT_LO	17	The lowest calibrated value.	Assigns a value to the calibration low point.
CAL_UNIT	19	The device description engineering units code index for the calibration values.	Device must be calibrated using the appropriate engineering units.
COLLECTION_DIRECTORY	12	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer.	No effect.
ASIC_REJECTION	42	Indicates the type of material that the drain vents on the flange are made of. See Drain Vent Material Codes.	N/A
FACTORY_CAL_RECALL	32	Recalls the sensor calibration set at the factory.	N/A
USER_2W_OFFSET	36	Indicates the type of material that the flange is made of. See Flange Material Codes.	N/A
INTER_DETECT_THRESH	35	Indicates the type of flange that is attached to the device. See Flange Type Codes.	N/A

Table B-2. Sensor Transducer Block Parameters and Descriptions

Parameter	Index number	Description	Notes on how changing this parameter effects transmitter operation
MODE_BLK	05	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target	Assigns the device mode.
CALIBRATOR_MODE	33	Indicates the type of sensor module.	N/A
PRIMARY_VALUE	14	The measured value and status available to the function block.	No effect.
PRIMARY_VALUE_RANGE	15	The high and low range limit values, the engineering unit code, and the number of digits to the right of the decimal point to be used to display the final value. Valid engineering units are the following: 1000 = deg K 1001 = deg C 1002 = deg F 1003 = deg R 1243 = millivolt 1281 = ohm	No effect.
PRIMARY_VALUE_TYPE	13	Type of measurement represented by the primary value. 104 = Process Temperature	No effect.
SENSR_DETAILED_STATUS	37	Indicates the number of remote seals that are attached to the device. See Remote Seal Number Codes.	N/A
CAL_VAN_DUSEN_COEFF	38	Indicates the type of remote seals that are attached to the device. See Remote Seal Type Codes.	N/A
SECONDARY_VALUE_RANG	30	The secondary value, related to the sensor.	No effect.
SECONDARY_VALUE_UNIT	29	Engineering units to be used with SECONDARY_VALUE. 1001 °C 1002 °F	No effect.
SENSOR_CAL_DATE	25	The last date on which the calibration was performed. This is intended to reflect the calibration of that part of the sensor that is usually wetted by the process.	No effect.
SENSOR_CAL_LOC	24	The last location of the sensor calibration. This describes the physical location at which the calibration was performed.	No effect.
SENSOR_CAL_METHOD	23	The method of last sensor calibration.	No effect.
OPEN_SNSR_HOLDOFF	34	The type of last sensor calibration.	No effect.
SENSOR_CAL_WHO	26	The name of the person responsible for the last sensor calibration.	No effect.

Table B-2. Sensor Transducer Block Parameters and Descriptions

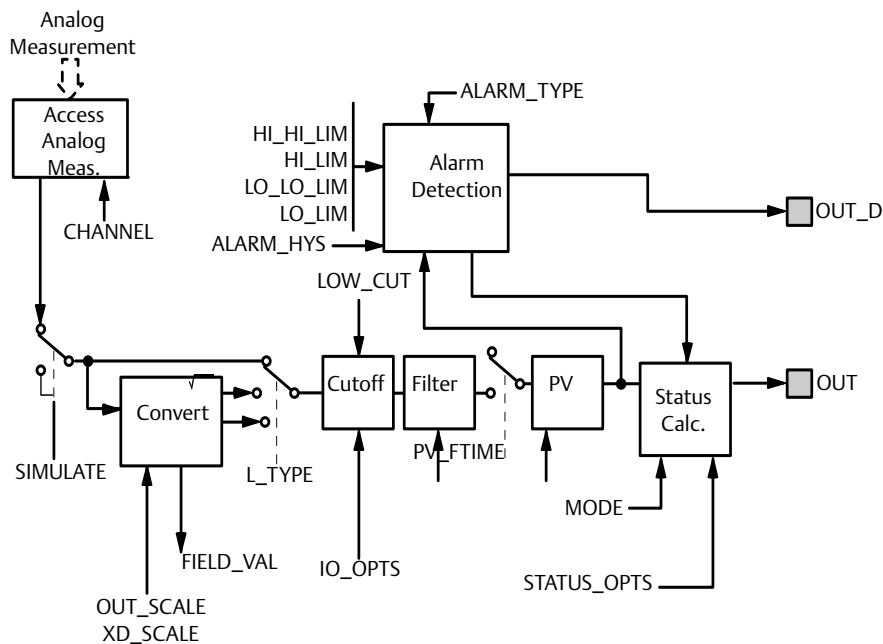
Parameter	Index number	Description	Notes on how changing this parameter effects transmitter operation
SECONDARY_VALUE	28	Defines the type of fill fluid used in the sensor.	No effect.
SENSOR_CONNECTION	27	Defines the construction material of the isolating diaphragms.	No effect.
SENSOR_RANGE	21	The high and low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the sensor.	No effect.
SENSOR_SN	22	Serial number of the sensor.	No effect.
SENSOR_TYPE	20	Type of sensor connected with the transducer block.	No effect.
ST_REV	01	The revision level of the static data associated with the function block.	No effect.
STRATEGY	03	The strategy field can be used to identify grouping of blocks.	No effect.
TAG_DESC	02	The user description of the intended application of the block.	No effect.
SESNOR_1_DAMPING	31	Indicates the state of the transmitter. The parameter contains specific codes relating to the transducer block and the pressure sensor specifically.	No effect.
TRANSDUCER_DIRECTORY	09	Directory that specifies the number and starting indices of the transducers in the transducer block.	No effect.
TRANSDUCER_TYPE	10	Identifies the transducer that follows.	No effect.
UPDATE_EVT	07	This alert is generated by any change to the static data.	No effect.
XD_ERROR	11	Provides additional error codes related to transducer blocks.	No effect.

B.3 Analog Input (AI) function block

The Analog Input (AI) function block processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel number to define the variable that the AI block processes.

The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (OUT) reflects the process variable (PV) value and status. In Manual mode, OUT may be set manually. The Manual mode is reflected on the output status. A discrete output (OUT_D) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the OUT value and user specified alarm limits. [Figure B-1](#) illustrates the internal components of the AI function block, and [Table B-3 on page 52](#) lists the AI block parameters and their units of measure, descriptions, and index numbers.

Figure B-1. AI Function Block



OUT = block output value and status

OUT_D = discrete output that signals a selected alarm condition

B.3.1 Analog input (AI) parameter table

Table B-3. Definitions of AI Function Block System Parameters

Parameter	Index no.	Available values	Units	Default	Read/Write	Description
ACK_OPTION	23	0 = Auto Ack Disabled 1 = Auto Ack Enabled	None	0 all Disabled	Read and Write	Used to set auto acknowledgment of alarms.
ALARM_HYS	24	0 – 50	Percent	0.5	Read and Write	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.
ALM_SEL	38	HI_HI, HI, LO, LO_LO	None	Non selected	Read and Write	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.
ALARM_SUM	22	Enable/Disable	None	Enable	Read and Write	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
ALERT_KEY	04	1 – 255	None	0	Read and Write	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	21	Not applicable	None	Not applicable	Read only	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	Not applicable	None	Not applicable	Read only	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CAP_STDDEV	40	> = 0	Seconds	0	Read and Write	The time over which the VAR_INDEX is evaluated.
CHANNEL	15	1 = Process Temperature 2 = Terminal Temperature	None	AI ⁽¹⁾ : Channel = 1 AI2: Channel = 2	Read and Write	The CHANNEL value is used to select the measurement value. Refer to the appropriate device manual for information about the specific channels available in each device. You must configure the CHANNEL parameter before you can configure the XD_SCALE parameter.
FIELD_VAL	19	0 – 100	Percent	Not applicable	Read only	The value and status from the transducer block or from the simulated input when simulation is enabled.
GRANT_DENY	12	Program Tune Alarm Local	None	Not applicable	Read and Write	Normally the operator has permission to write to parameter values, but Program or Local remove that permission and give it to the host controller or a local control panel.
HI_ALM	34	Not applicable	None	Not applicable	Read only	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
HI_HI_ALM	33	Not applicable	None	Not applicable	Read only	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
HI_HI_LIM	26	Out_Scale ⁽²⁾	Out_Scale ⁽²⁾	Not applicable	Read and Write	The setting for the alarm limit used to detect the HI HI alarm condition.
HI_HI_PRI	25	0 – 15	None	1	Read and Write	The priority of the HI HI alarm.
HI_LIM	28	Out_Scale ⁽²⁾	Out_Scale ⁽²⁾	Not applicable	Read and Write	The setting for the alarm limit used to detect the HI alarm condition.
HI_PRI	27	0 – 15	None	1	Read and Write	The priority of the HI alarm.
IO_OPTS	13	Low Cutoff Enable/Disable	None	Disable	Read and Write	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
L_TYPE	16	Direct Indirect Indirect Square Root	None	Direct	Read and Write	Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root).
LO_ALM	35	Not applicable	None	Not applicable	Read only	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.

Table B-3. Definitions of AI Function Block System Parameters

Parameter	Index no.	Available values	Units	Default	Read/Write	Description
LO_LIM	30	Out_Scale ⁽²⁾	Out_Scale ⁽²⁾	Not applicable	Read and Write	The setting for the alarm limit used to detect the LO alarm condition.
LO_LO_ALM	36	Not applicable	None	Not applicable	Read only	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
LO_LO_LIM	32	Out_Scale ⁽²⁾	Out_Scale ⁽²⁾	Not applicable	Read and Write	The setting for the alarm limit used to detect the LO LO alarm condition.
LO_LO_PRI	31	0 – 15	None	1	Read and Write	The priority of the LO LO alarm.
LO_PRI	29	0 – 15	None	1	Read and Write	The priority of the LO alarm.
LOW_CUT	17	> = 0	Out_Scale ⁽²⁾	0	Read and Write	If percentage value of transducer input fails below this, PV = 0.
MODE_BLK	05	Auto Manual Out of Service	None	Not applicable	Read and Write	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT	08	Out_Scale ⁽²⁾ ± 10%	Out_Scale ⁽²⁾	Not applicable	Read and Write	The block output value and status.
OUT_D	37	Discrete_State 1 – 16	None	Disabled	Read and Write	Discrete output to indicate a selected alarm condition.
OUT_SCALE	11	Any output range	All available	none	Read and Write	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
PV	07	Not applicable	Out_Scale ⁽²⁾	Not applicable	Read only	The process variable used in block execution.
PV_FTIME	18	> = 0	Seconds	0	Read and Write	The time constant of the first-order PV filter. It is the time required for a 63% change in the IN value.
SIMULATE	09	Not applicable	None	Disable	Read and Write	A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.
ST_REV	01	Not applicable	None	0	Read only	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STATUS_OPTS	14	Propagate fault forward Uncertain if Limited Bad if Limited Uncertain if Man Mode		0	Read and Write	
STDDEV	39	0 – 100	Percent	0	Read and Write	The average absolute error between the PV and its previous mean value over that evaluation time defined by VAR_SCAN.
STRATEGY	03	0 – 65535	None	0	Read and Write	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	02	32 text characters	None	none	Read and Write	The user description of the intended application of the block.
UPDATE_EVT	20	Not applicable	None	Not applicable	Read only	This alert is generated by any change to the static data.
XD_SCALE	10	Any sensor range	inH ₂ O (68 °F) inHg (0 °C) ftH ₂ O (68 °F) mmH ₂ O (68 °F) mmHg (0 °C) psi bar mbar g/cm ² kg/cm ² Pa kPa torr atm deg C deg F	A11 ⁽¹⁾ = deg C A12 = deg C		In all Rosemount devices the units of the transducer block is forced to match the unit code.

1. The host system may write over default values pre-configured by Rosemount.
2. Assume that when L_Type = Direct, the user configures Out_Scale which is equal to XD_Scale.

B.4 LCD transducer block

Table B-4. LCD Transducer Block Parameters and Descriptions

Parameter	Index	Description
ALERT_KEY	4	The identification number of the plant unit.
BLK_TAG_1	15	The tag of the block containing DP1.
BLK_TAG_2	21	The tag of the block containing DP2.
BLK_TAG_3	27	The tag of the block containing DP3.
BLK_TAG_4	33	The tag of the block containing DP4.
BLK_TYPE_1	14	The enumerated block type for DP1's block.
BLK_TYPE_2	20	The enumerated block type for DP2's block.
BLK_TYPE_3	26	The enumerated block type for DP3's block.
BLK_TYPE_4	32	The enumerated block type for DP4's block.
BLOCK_ALM	8	The BLOCK_ALM is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	6	This parameter reflects the error status associated with the hardware or software components associated with a block. it is a bit string, so that multiple errors may be shown.
COLLECTION_DIRECTORY	12	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer block.
CUSTOM_TAG_1	17	The block description that is displayed for DP1.
CUSTOM_TAG_2	23	The block description that is displayed for DP2.
CUSTOM_TAG_3	29	The block description that is displayed for DP3.
CUSTOM_TAG_4	35	The block description that is displayed for DP4.
CUSTOM_UNITS_1	19	This is the user entered units that are displayed when UNITS_TYPE_1=Custom.
CUSTOM_UNITS_2	25	This is the user entered units that are displayed when UNITS_TYPE_2=Custom.
CUSTOM_UNITS_3	31	This is the user entered units that are displayed when UNITS_TYPE_3=Custom.
CUSTOM_UNITS_4	37	This is the user entered units that are displayed when UNITS_TYPE_4=Custom.
DISPLAY_PARAM_SEL	13	This will determine which Display Parameters are active. Bit 0 = DP1 Bit 1 = DP2 Bit 2 = DP3 Bit 3 = DP4 Bit 4 = Bar Graph enable
MODE_BLK	5	The actual, target, permitted, and normal modes of the block.
PARAM_INDEX_1	16	The relative index of DP1 within its block.
PARAM_INDEX_2	22	The relative index of DP2 within its block.
PARAM_INDEX_3	28	The relative index of DP3 within its block.
PARAM_INDEX_4	34	The relative index of DP4 within its block.
ST_REV	1	The revision level of the static data associated with the function block.
STRATEGY	3	The strategy field can be used to identify grouping of blocks.
TAG_DESC	2	The user description of the intended application of the block.
TRANSDUCER_DIRECTORY	9	A directory that specifies the number and starting indices of the transducers in the transducer block.

Table B-4. LCD Transducer Block Parameters and Descriptions

Parameter	Index	Description
TRANSDUCER_TYPE	10	Identifies the transducer that follows.
UNITS_TYPE_1	18	This parameter determines where the units for the display parameter come from.
UNITS_TYPE_2	24	This parameter determines where the units for the display parameter come from.
UNITS_TYPE_3	30	This parameter determines where the units for the display parameter come from.
UNITS_TYPE_4	36	This parameter determines where the units for the display parameter come from.
UPDATE_EVT	7	This alert is generated by any change to the staic data.
XD_ERROR	11	Provides additional error codes related to transducer blocks.




B.5 PID block

Table B-5. PID Block Parameters and Descriptions

Parameter	Index	Parameter	Index	Parameter	Index
ACK_OPTIONS	46	HI_HI_LIM	49	SP_LO_LIM	22
ALARM_HYS	47	HI_HI_PRI	48	SP_RATE_DN	19
ALARM_SUM	45	HI_LIM	51	SP_RATE_UP	20
ALERT_KEY	4	HI_PRI	50	SP_WORK	68
BAL_TIME	25	IDEADBAND	74	ST_REV	1
BETA	73	IN	15	STATUS_OPTS	14
BIAS	66	LO_ALM	62	STDDEV	75
BKCAL_HYS	30	LO_LIM	53	STRATEGY	3
BKCAL_IN	27	LO_LO_ALM	63	STRUCTURECONFIG	71
BKCAL_OUT	31	LO_LO_LIM	55	T_AOPERIODS	92
BLOCK_ALARM	44	LO_LO_PRI	54	T_AUTO_EXTRA_DT	90
BLOCK_ERR	6	LO_PRI	52	T_AUTO_HYSTERESIS	91
BYPASS	17	MATHFORM	70	T_GAIN_MAGNIFIER	89
CAP_STDDEV	76	MODE_BLK	5	T_HYSTER	87
CAS_IN	18	OUT	9	T_IPGAIN	80
CONTROL_OPS	13	OUT_HI_LIM	28	T_PDTIME	85
DV_HI_ALM	64	OUT_LO_LIM	29	T_PSGAIN	83
DV_HI_LIM	57	OUT_SCALE	11	T_PTIMEC	84
DV_HI_PRI	56	PV	7	T_RELAYSS	88
DV_LO_ALM	65	PV_FTIME	16	T_REQUEST	77
DV_LO_LIM	59	PV_SCALE	10	T_STATE	78
DV_LO_PRI	58	RATE	26	T_STATUS	79
ERROR	67	RCAS_IN	32	T_TARGETTOP	86
FF_GAIN	42	RCAS_OUT	35	T_UGAIN	81
FF_SCALE	41	RESET	24	T_UPERIOD	82
FF_VAL	40	ROUT_IN	33	TAG_DESC	2
GAIN	23	ROUT_OUT	36	TRK_IN_D	38
GAMMA	72	SHED_OPT	34	TRK_SCALE	37
GRANT_DENY	12	SP	8	TRK_VAL	39
HI_ALM	61	SP_FTIME	69	UPDATE_EVT	43
HI_HI_ALM	60	SP_HI_LIM	21		




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