Reference Manual
00809-0400-4728, Rev CB
May 2024

Rosemount™ 644 Temperature Transmitter

with FOUNDATION™ Fieldbus Protocol

ROSEMOUNT™

EMERSON™

Safety messages

⚠ WARNING

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

Ensure 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 handheld communicator in an explosive atmosphere, ensure that 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.

Before applying pressure, install and tighten thermowells and sensors.

Electrical shock could cause death or serious injury.

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

⚠ WARNING

Physical access

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

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

NOTICE

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 Emerson.com/global.

NOTICE

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

For more information, contact Emerson.com/global.

Contents

1 Introduction

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. This ensures that the transmitter will have extreme durablity and 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.

Related information

Rosemount 214C Temperature Sensors Product Data Sheet

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 644 converts the low-level sensor signal to a standard 4–20 mA dc or digital HART® 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 transmitted 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.

⚠ WARNING

Ensure the instruments in the loop are installed in accordance with intrinsically safe 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 644 Head Mount Transmitter to a DIN rail or assembling a new 644 Head Mount to an existing threaded sensor connection head (former option code L1).

1.2.4 Electrical

NOTICE

Proper electrical installation is necessary to prevent errors due to sensor lead resistance and electrical noise. For best results, Emerson recommends using a shielded cable in electrically noisy environments.

NOTICE

Make wiring connections through the cable entry in the side of the connection head. Ensure that adequate clearance is provided for cover removal.

1.2.5 Environmental

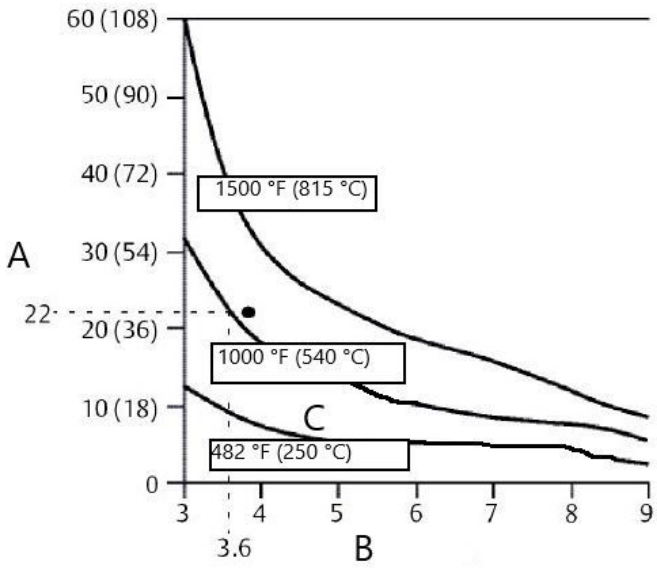
⚠ WARNING

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: 644 Head Mount Transmitter connection head temperature rise vs. extension length



A. Housing temperature rise, above ambient: °C (°F)
B. Extension length (in.)
C. Oven temperature

Example

The transmitter specification limit is 185 °F (85 °C). If the ambient temperature is 131 °F (55 °C) and the process temperature to be measured is 1472 °F (800 °C), the maximum permissible connection head temperature rise is the transmitter specification limit minus the ambient temperature moves 185 °F - 131 °F (85 - 55 °C), or 86 °F (30 °C).

In this case, an extension of 0.3 feet (100 mm) meets this requirement, but 0.4 feet (125 mm) provides a margin of 46 °F (8 °C), thereby reducing any temperature effects in the transmitter.

1.2.6 Product recycling/disposal

Consider recycling equipment and packaging.

Dispose of the product and packaging in accordance with local and national legislation.

2 Configuration

2.1 General block information

2.1.1 Device descriptor

Before configuring the device, ensure the host has the appropriate Device Descriptor file revision for this device. The device descriptor can be found on Emerson.com/global. The initial release of the Rosemount 644 is Device Revision 1.

2.1.2 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 into a permanent address.

2.1.3 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** will 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. Emerson recommends always selecting **OOS** as one of the permitted modes.

Mode types

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

Automatic (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.

Manual (MAN)

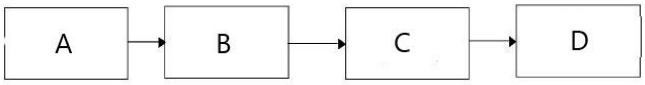
In this mode, variables that are passed out of the block can be manually set for testing or override purposes.

Other mode types

The other mode types are **Cas**, **RCas**, **ROut**, **IMan**, and **LO**. Some of these may be supported by different function blocks in the Rosemount 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:

Figure 2-1: Block hierarchy



A. Resource block
B. Transducer block
C. Analog input (AI block)
D. Other function blocks

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**.

2.1.4 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.

To configure manually:

Procedure

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

2.1.5 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. For more information, refer to your specific host or configuration tool manual.

2.1.6 Capabilities

Virtual Communication Relationship (VCR)

There are a total of 12 VCR. 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

2.1.7 Surges/transients

NOTICE

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.

Related information

Rosemount 644 Temperature Transmitter Product Data Sheet

2.2 FOUNDATION™ Fieldbus function blocks

For reference information on the Resource, Sensor Transducer, AI, LCD Transducer blocks, refer to FOUNDATION™ Fieldbus Block Information. Reference information on the PID block can be found in the Function Block Reference Manual.

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.

LCD transducer block (index number 1200)

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

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 **MATH FORM** parameter. The standard **ISA PID** equation is the default selection.

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.

2.2.1 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 will 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

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. If needed, choose one of the supported features.

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.

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** is the highest priority, followed by **MAINT_ALARM**. **ADVISE_ALARM** is 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**. For more information, see Process alarms. 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** that 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 degrade**d
2. **Secondary value degrade**d
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. 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**. For more information, see Process alarms. 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: Plantweb alerts (RB.RECOMMENDED_ACTION)

Alarm type	Failed/Maint/Advise Active Event	Recommended action text string
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.

2.2.2 Sensor transducer block

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 its own filtering parameter called **PV_FTIME**. 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.

2.2.3 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 **Channel 1: Sensor Temperature** and **Channel 2: Terminal Temperature**.

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.

Table 2-2: Supported units:

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 α = 385 AI1 = process temperature AI2 = terminal temperature

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**)

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

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

Status options (**STATUS_OPTS**) supported by the AI block:

Propagate fault forward If the status from the sensor is **Bad, Device failure** or **Bad, Sensor failure**, then 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**.

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.

2.2.4 Transducer block (**Methods** supported)

If the host system supports **Methods**:

Procedure

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

2.2.5 Transducer block (**Methods** not supported)

If the host system doesn't support **Methods**:

Procedure

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.

Basic configuration of AI blocks (Process Temperature)

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

AI1 as **Process Temperature**:

Procedure

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.

Basic configuration of AI blocks (Terminal Temperature)

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

AI2 as **Terminal Temperature**:

Procedure

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.

2.2.6 LCD transducer block

The LCD display meter connects directly to the Rosemount 644 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_#

Note
"#" represents the specified parameter number.

Enter the **Block Tag** of the function block that contains the parameter to be displayed. The default function **block tags** from the factory is **TRANSDUCER AI 1300 AI 1400 PID 1500**.

BLK_TYPE_#

Note
"#" represents the specified parameter number.

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_#

Note
"#" represents the specified parameter number.

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_#

Note
"#" represents the specified parameter number.

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.

UNITS_TYPE_#

Note
"#" represents the specified parameter number.

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 ensure to configure the **CUSTOM_UNITS_#** parameter. Select **NONE** if the parameter will be displayed without associated units.

CUSTOM_UNITS_#

Note
"#" represents the specified parameter number.

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**.

2.3 Operation and maintenance

2.3.1 Overview

This section contains information on operation and maintenance procedures.

Each FOUNDATION™ Fieldbus host or configuration tool has different ways of displaying and performing operations. Some hosts will use Device Descriptor (DD) and DD Methods to complete device configuration and will display data consistently across platforms. The DD can found on Emerson.com/global.

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.

2.3.2 Troubleshooting communication problems

The following corrective actions must be only done with consultation of your system integrator. Wiring and installation 31.25 kbit/s, voltage mode, wire medium application guide AG-140 are available from the FOUNDATION™ Fieldbus Protocol.

Device does not show up on segment

Cause

Unknown

Recommended actions

Recycle power to device.

Cause

No power to device

Recommended actions

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 will be approximately 10.5 mA nominal (11 mA max.)

Cause

Segment problems

Recommended actions

Cause

Electronics failing

Recommended actions

No recommended actions. Replace device.

Cause

Incompatible network settings

Recommended actions

1. Change host network parameters.
2. Refer to host documentation for procedure.

Device does not stay on segment

Cause

Incorrect signal levels. Refer to host documentation for procedure.

Recommended actions

1. Check for two terminators.
2. Ensure the cable is not too long.
3. Check for bad power supply or conditioner.

Cause

Excess noise on segment. Refer to host documentation for procedure.

Recommended actions

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.

Cause

Electronics failing

Recommended actions

No recommended actions. Replace device.

Cause

Other

Recommended actions

Check for water around the transmitter.

Communications established but have BLOCK_ERR or an ALARM condition

Recommended actions

1. See Plantweb™ Alerts.

- If problem is identified, then perform the recommended action. See Table 2-1.
- If problem is not identified, then proceed to Step 2.

2. Read the following parameters in the **Resource Block** to determine the recommended action:
   - For **BLOCK_ERR**, see Troubleshooting the AI Block.
   - For **SUMMARY_STATUS**, see Table 2-7.
   - For **DETAILED_STATUS**, see Table 2-8.
   - If problem is identified, then perform recommended action. See Table 2-8.
   - If problem is not identified, then perform the following steps in the **Sensor Transducer Block** to determine the recommended action. If problem is still not identified, then proceed to Step 3.
     — For **BLOCK_ERR**, see Troubleshooting communication problems.
     — For **XD_ERR**, see Table 2-3.
     — For **DETAILED_STATUS**, see Table 2-4.
     — For **RECOMMENDED_ACTION**, see Table 2-4.
     — For **SENSOR_DETAILED STATUS**, see Table 2-4.
   - If the error condition does not exist in the **Resource Block**, then it is a configuration problem. See **AI_BLOCK_ERR Conditions** in Table 2-6. Proceed to Step 3.
3. For further assistance, contact your local Emerson representative.
4. Determine if the problem has been identified.
   - If the problem is identified, then perform the recommended action. See Table 2-6.
   - If the problem is not identified, then contact your local Emerson representative.

2.3.3 Sensor Transducer block Configuration

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.

Procedure

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 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.

Procedure

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**.

Example

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

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 Input/Output (I/O) failure occurred.
Software Error: The software has detected an internal error.
Calibration Error: An error occurred during calibration of the device.

Table 2-4: Sensor Transducer Block XD_ERR Messages *(continued)*

Condition name and description
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 will 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 chksum 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
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 Electromagnetic Frequency (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.

2.3.4 Analog input function block troubleshooting

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

Procedure

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.

   NOTICE

   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, ensure that the **SIMULATE** jumper has been reset after powering up the device.

Example

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.

Troubleshooting the AI Block

Bad or no temperature readings (Read the AI BLOCK_ERR parameter.)

Cause

BLOCK_ERR reads **OUT OF SERVICE (OOS)**

Recommended actions

1. AI Block target mode target mode set to **OOS**.
2. Resource Block is **OUT OF SERVICE**.

Cause

BLOCK_ERR reads **CONFIGURATION ERROR**

Recommended actions

1. Check **CHANNEL** parameter. See CHANNEL.
2. Check **L_TYPE** parameter. See L_TYPE.
3. Check **XD_SCALE** engineering units. See XD_SCALE and OUT_SCALE.

Cause

BLOCK_ERR reads **POWERUP**

Recommended actions

Download **Schedule** into block. Refer to host for downloading procedure.

Cause

BLOCK_ERR reads **BAD INPUT**

Recommended actions

1. Sensor Transducer Block **Out Of Service** (**OOS**)
2. Resource Block **Out of Service** (**OOS**)

Cause

No **BLOCK_ERR** but readings are not correct. If using **Indirect** mode, scaling could be wrong.

Recommended actions

1. Check **XD_SCALE** parameter.
2. Check **OUT_SCALE** parameter. See XD_SCALE and OUT_SCALE.

Cause

No **BLOCK_ERR**. Sensor needs to be calibrated or Zero trimmed.

Recommended actions

See Configuration to determine the appropriate trimming or calibration procedure.

OUT parameter status reads UNCERTAIN and substatus reads EngUnitRangViolation

Cause

Out_ScaleEU_0 and **EU_100** settings are incorrect.

Recommended actions

See XD_SCALE and OUT_SCALE.

2.3.5 Resource block troubleshooting

This section describes error conditions found in the Resource block. Read Table 2-7 through Table 2-9 to determine the appropriate corrective action.

Block errors

Table 2-7 lists conditions reported in the **BLOCK_ERR** parameter.

Table 2-7: 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.
Out of Service: The actual mode is out of service.

Table 2-8: Resource Block SUMMARY_STATUS Messages

Condition name
No repair needed
Repairable
Call Service Center

Table 2-9: 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.

2.3.6 LCD transducer block troubleshooting

This section describes error conditions found in the LCD Transducer Block. Read Table 2-10 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 will 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 be following the steps below.

Procedure

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 will light up.
4. Put the Resource block back into **AUTO**.

Table 2-10: LCD Transducer Block BLOCK_ERR messages

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

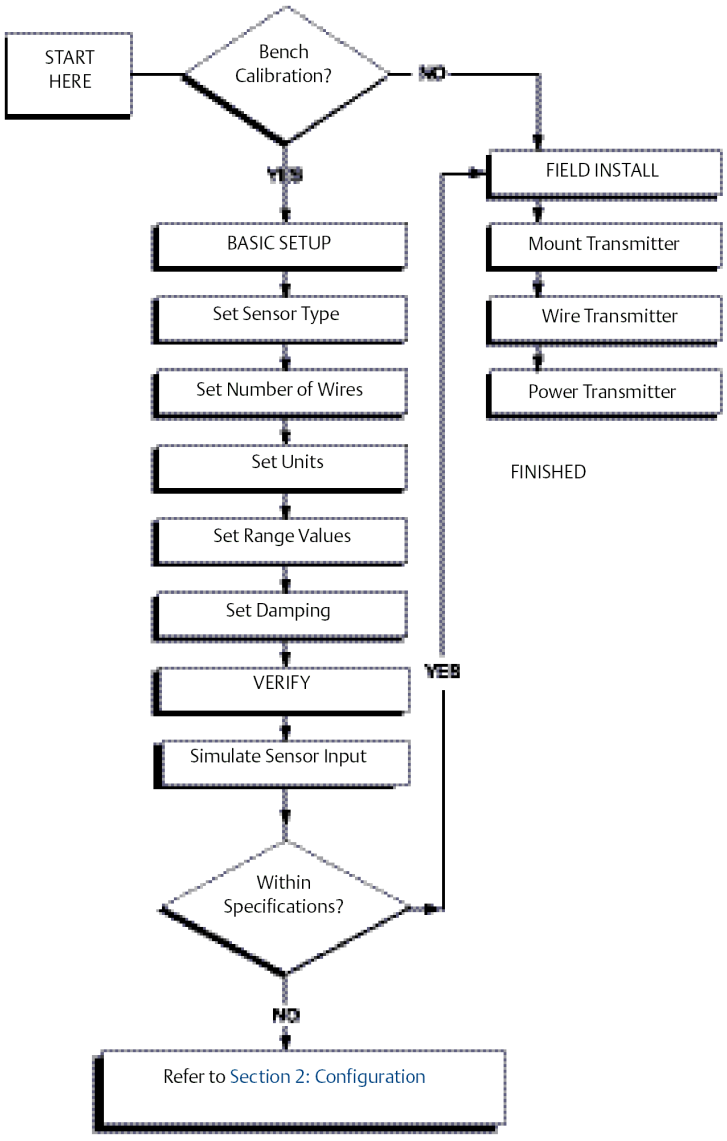
3 Installation

3.1 Overview

The information in this section covers installation considerations for the Rosemount 644. 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 Rosemount 644 Product Data Sheet.

3.2 Installation Flowchart

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:

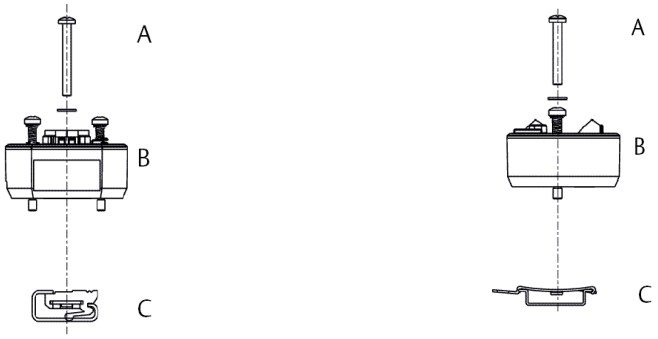
- In a connection head or universal head mounted directly on a sensor assembly.
- Apart from a sensor assembly using a universal head.
- To a DIN rail using an optional mounting clip.

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

G-rail (asymmetric) Top hat rail (symmetric)



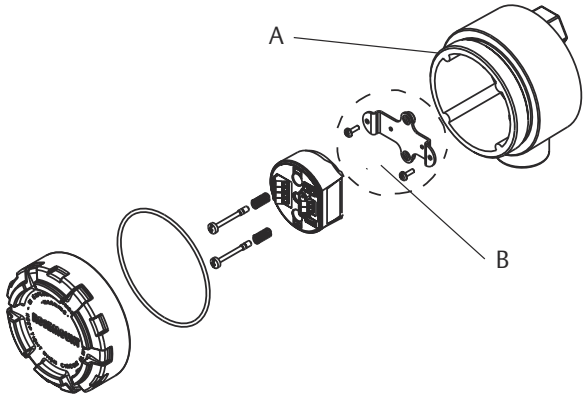
A. Mounting hardware
B. Transmitter
C. Rail clip

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.

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 Installing the transmitter

3.4.1 Head mount transmitter with DIN plate style sensor (Typical European installation)

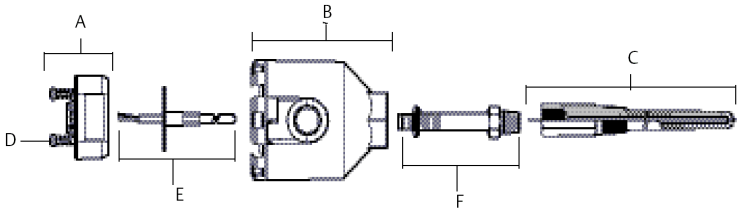
Procedure

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).
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.

⚠ CAUTION

Enclosure covers must be fully engaged to meet explosion-proof requirements.

Example



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 Head mount transmitter with threaded sensor (Typical North American installation)

Procedure

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 (89 mm) in diameter.

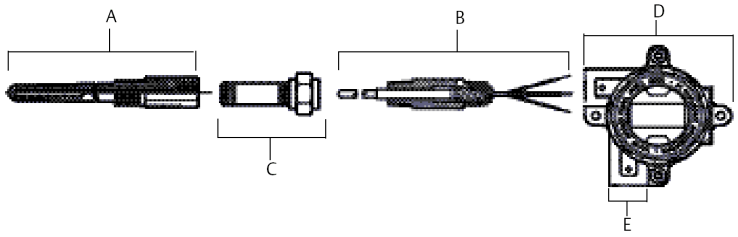
5. Pull the sensor wiring leads through the universal head and transmitter. Mount the transmitter in the universal head by threading the transmitter mounting screws into the universal head mounting holes.
6. Mount the transmitter-sensor assembly into the thermowell. Seal adapter threads with silicone 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.

⚠ WARNING

Enclosure covers must be fully engaged to meet explosion-proof requirements.

Example



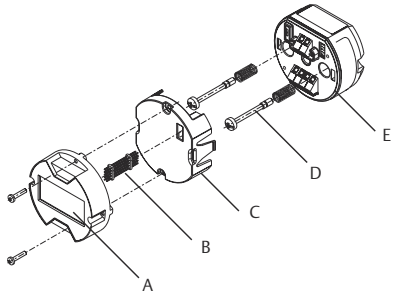
A. Threaded thermowell
B. Threaded style sensor
C. Standard extension
D. Universal head
E. Conduit entry

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

To install the meter:

Procedure

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.

⚠ WARNING

The cover must be fully engaged to meet explosion-proof requirements.

6. Use a communication device, 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.

⚠ WARNING

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.

NOTICE

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 when making sensor connections. Refer to Figure 3-6 for FOUNDATION™ Fieldbus installations.

To wire the power and sensor to the transmitter:

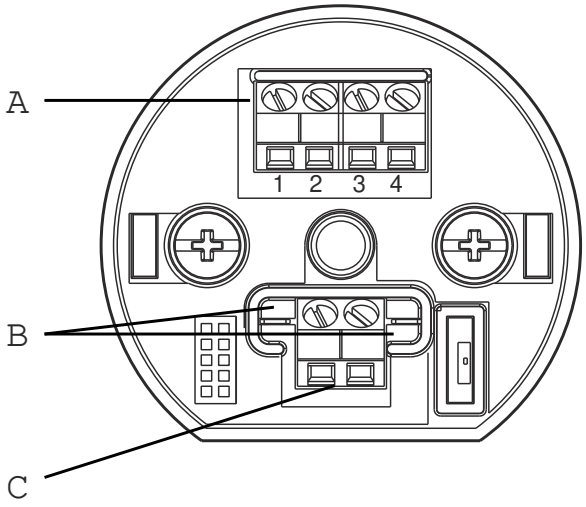
Procedure

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.

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

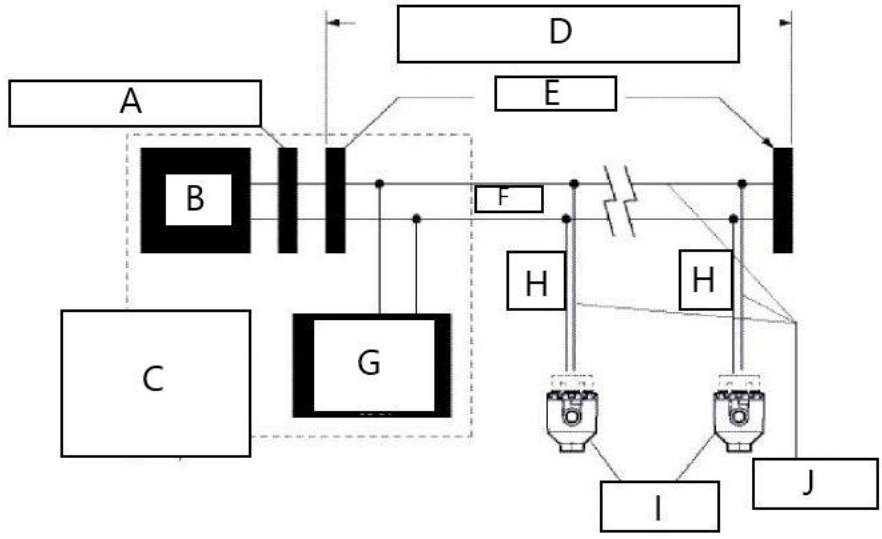
3. Tighten the terminal screws.
   When tightening the sensor and power wires, the max torque is 6 in-lb (0.7 N-m).
4. Reattach and tighten the cover (if applicable).
5. Apply power.
   See Power supply.

Figure 3-5: Rosemount 644H Transmitter Power, Communication, and Sensor Terminals



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

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

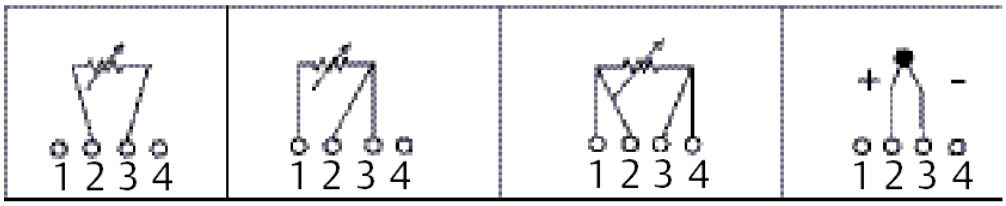


A. Integrated power conditioner and filter
B. Power supply
C. The power supply, filter, first terminator, and configuration tool are typically located in the control room.
D. 6234 ft. (1900 m) max (depending on cable characteristics)
E. Terminators
F. Trunk
G. FOUNDATION™ Fieldbus configuration tool
H. Spur
I. Devices 1 through 16
J. Power/signal wiring

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: Rosemount 644 Sensor Wiring Diagrams



2-wire RTD and Ω	3-wire RTD[1] and Ω	4-wire RTD and Ω	T/C and mV

(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. (914 mm) 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

Table 3-2: Given:

Total cable length:	150 m
Imbalance of the lead wires at 68 °F (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}):	77 °F (25 °C)
RTD resistance at 32 °F (0 °C [R_o]):	100 Ω (for Pt 100 RTD)

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

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

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

Lead wire imbalance seen by the transmitter = 0.5 Ω

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

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

- Pt100 2-wire RTD:

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

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

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

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

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

3.6 Power supply

3.6.1 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.

3.6.2 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.

Note
Emerson recommends that neither side of the loop be grounded on FOUNDATION™ Fieldbus devices. Only the shield wire must be grounded.

Do not ground the signal wire at both ends.

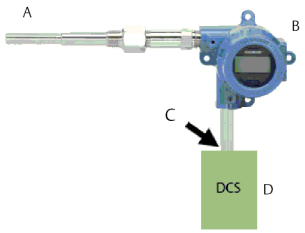
3.6.3 Ungrounded thermocouple, mV, and RTD/Ohm inputs

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).

Grounding option 1

Procedure

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

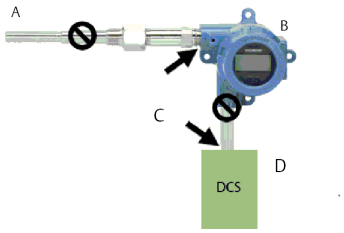
5. Connect shields together, electrically isolated from the transmitter.

Grounding option 2

Procedure

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.

Example



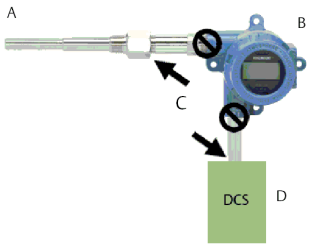
A. Sensor wires
B. Transmitter
C. Shield ground point
D. FOUNDATION™ Fieldbus segment

Grounding option 3

Procedure

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.

Example



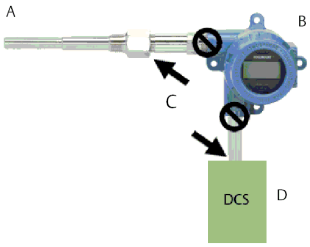
A. Sensor wires
B. Transmitter
C. Shield ground point
D. FOUNDATION™ Fieldbus segment

3.6.4 Grounded thermocouple inputs

Procedure

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.

Example



A. Sensor wires
B. Transmitter
C. Shield ground point
D. FOUNDATION™ Fieldbus segment

A Reference Data

A.1 Product certifications

To view current Rosemount 644 product certifications:

Procedure

1. Go to Rosemount 644 Temperature Transmitter product detail page.
2. Scroll as needed to the green menu bar and select **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 drawingss:

Procedure

1. Go to Rosemount 644 Temperature Transmitter product detail page.
2. Scroll as needed to the green menu bar and select **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics**.
4. Select the appropriate drawing.
5. For ordering information, specifications, and dimensional drawings, select **Data Sheets & Bulletins**.
6. Select the appropriate Product Data Sheet.

A.3 AMS terms

Resistance: This is the existing resistance reading of the thermocouple loop.

Resistance threshold exceeded: The checkbox indicates if the sensor resistance has passed the Trigger Level.

Trigger level: Threshold resistance value for the thermocouple loop. The trigger level may be set for 2, 3, or 4 × Baseline or the default of 5000 ohms. If the resistance of the thermocouple loop surpasses the Trigger Level, a maintenance alert will be generated.

Baseline resistance: The resistance of the thermocouple loop obtained after installation, or after resetting the baseline value. The trigger level may be calculated from the baseline value.

Reset baseline resistance: Launches a method to recalculate the Baseline value (which may take several seconds).

TC diagnostic mode sensor 1or 2: This field will read either enabled or disabled indicating when the thermocouple degradation diagnostic is **On** or **Off** for that sensor.

B FOUNDATION™ Fieldbus Block Information

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. The modes, alarm detection, status handling, and troubleshooting are also 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 Resource Block 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.

Table B-1: Resource Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description
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.
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.

Table B-1: Resource Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description
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.
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. 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 FOUNDATION™ Fieldbus.

Table B-1: Resource Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description
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.
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.

Table B-1: Resource Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description
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 default**s – 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 will never happen when **SHED_ROUT = 0**.
simulate_IO	64	Status of simulate switch.

Table B-1: Resource Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description
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.
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 Sensor transducer block 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 IDs 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.	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.	N/A
INTER_DETECT_THRESH	35	Indicates the type of flange that is attached to the device.	N/A

Table B-2: Sensor Transducer Block Parameters and Descriptions *(continued)*

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.	N/A
CAL_VAN_DUSEN_COEFF	38	Indicates the type of remote seals that are attached to the device.	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.

Table B-2: Sensor Transducer Block Parameters and Descriptions *(continued)*

Parameter	Index number	Description	Notes on how changing this parameter effects transmitter operation
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.
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.
SENSOR_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

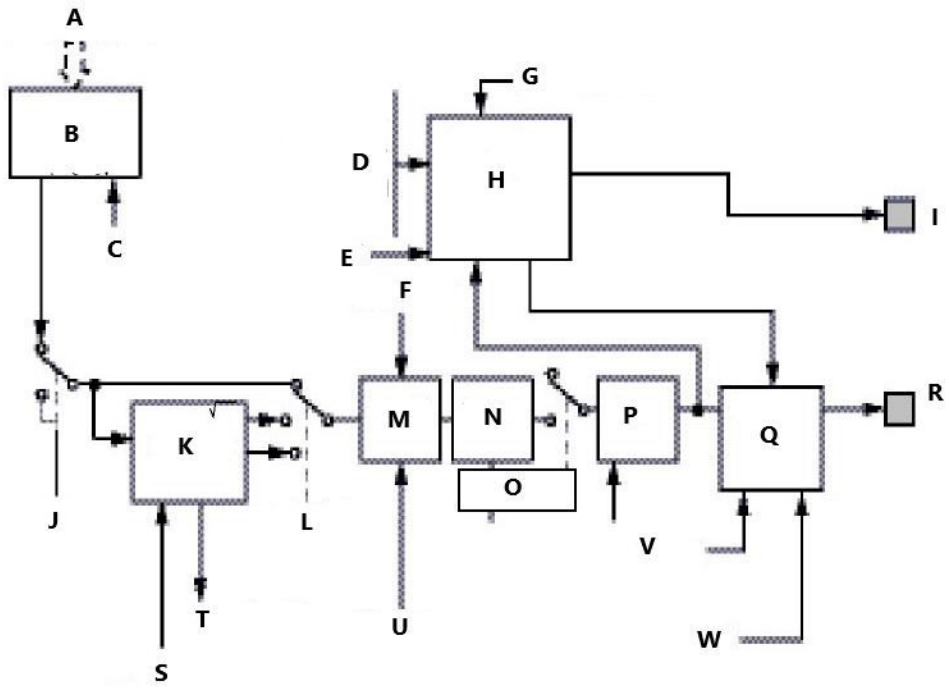
The Analog Input (AI) function block processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or 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 lists the AI block parameters and their units of measure, descriptions, and index numbers.

Figure B-1: AI Function Block



A. ***Analog measurement***
B. ***Access Analog measurement***
C. ***CHANNEL***
D. ***HI_HI_LIM, HI_LIM, LO_LO_LIM, LO_LIM***
E. ***ALARM_HYS***
F. ***LOW_CUT***
G. ***ALARM_TYPE***
H. ***Alarm detection***
I. ***OUT_D***
J. ***SIMULATE***
K. ***Convert***
L. ***L_TYPE***
M. ***Cutoff***
N. ***Filter***
O. ***PV_FTIME***
P. ***PV***
Q. ***Status Calc.***
R. ***OUT***
S. ***OUT_SCALE, XD_SCALE***
T. ***FIELD_VAL***
U. ***IO_OPTS***
V. ***MODE***
W. ***STATUS_OPTS***

Note
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.

Table B-3: Definitions of AI Function Block System Parameters *(continued)*

Parameter	Index no.	Available values	Units	Default	Read/ Write	Description
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.
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.

Table B-3: Definitions of AI Function Block System Parameters *(continued)*

Parameter	Index no.	Available values	Units	Default	Read/ Write	Description
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.

Table B-3: Definitions of AI Function Block System Parameters *(continued)*

Parameter	Index no.	Available values	Units	Default	Read/ Write	Description
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_2O (68 °F) inHg (0 °C) ftH_2O (68 °F) mmH_2O (68 °F) mmHg (0 °C) psi bar mbar g/cm^2 kg/cm^2 Pa kPa torr atm deg C deg F	AI1(1) = deg C AI2 = 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.

Table B-4: LCD Transducer Block Parameters and Descriptions *(continued)*

Parameter	Index	Description
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 indicies, and DD Item IDs 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.

Table B-4: LCD Transducer Block Parameters and Descriptions *(continued)*

Parameter	Index	Description
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_DIRCTORY	9	A directory that specifies the number and starting indicies of the transducers in the transducer block.
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 static 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

Table B-5: PID Block Parameters and Descriptions *(continued)*

Parameter	Index		Parameter	Index		Parameter	Index
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_TARGETOP	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			

00809-0400-4728
Rev. CB
2024

For more information: **Emerson.com/global**

ROSEMOUNT™

EMERSON™