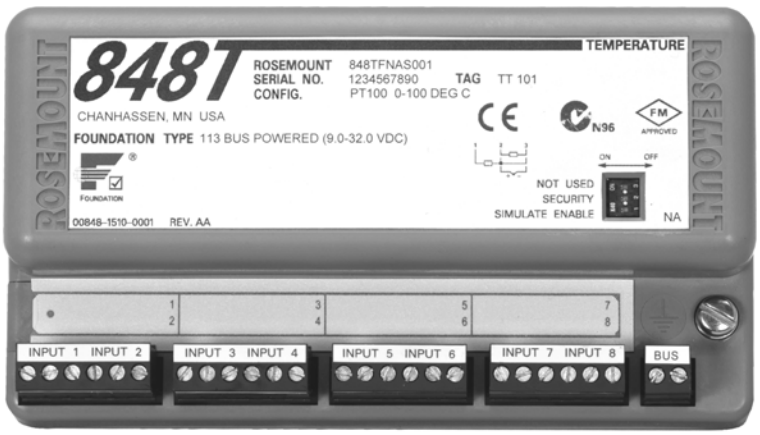
Reference Manual
00809-0100-4697, Rev CB
August 2007

Rosemount 848T Multisensor Transmitter Temperature Inputs with FOUNDATION™ Fieldbus

Device Revision 5



U.S. Patent Number 6,574,515

FOUNDATION

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Rosemount 848T Eight Input Temperature Transmitter with FOUNDATION Fieldbus

NOTICE

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

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

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

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

International
1-(952) 906-8888

⚠CAUTION

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

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

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

Rosemount 848T Eight Input Temperature Transmitter with FOUNDATION™ fieldbus may be protected by one or more U.S. patents pending. Other foreign patents pending.

Cover photo: 848-848C004

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Section 1 Introduction

SAFETY MESSAGES

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

Warnings

⚠WARNING

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

- Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

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

Electrical shock could cause death or serious injury.

- If the senor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

OVERVIEW

Transmitter

The Rosemount 848T is optimal for process temperature monitoring because of its ability to simultaneously measure eight separate and independent temperature points with one transmitter. Multiple temperature sensor types may be connected to each 848T transmitter. In addition, the 848T can accept 4-20 mA inputs. The enhanced measurement capability of the 848T allows it to communicate these variables to any FOUNDATION fieldbus host or configuration tool.

The new Rosemount 3420 Fieldbus Interface Module will interface the 848T outputs to systems without fieldbus capability using the standard interface protocols. Contact a local Emerson Process Management Sales Representative for more information.

Manual

This manual is designed to assist in the installation, operation, and maintenance of the Rosemount 848T Temperature Transmitter.

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- Overview
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SERVICE SUPPORT

To expedite the return process in North America, call the Emerson Process Management National Response Center toll-free at 800-654-7768. This center, available 24 hours a day, will assist with any needed information or materials.

⚠ The center will ask for the following information:

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

The center will provide

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

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

NOTE
If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned materials.

Section 2 Installation

SAFETY MESSAGES

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Electrical shock could cause death or serious injury.

- If the senor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

MOUNTING

The 848T is always mounted remote from the sensor assembly. There are three mounting configurations:

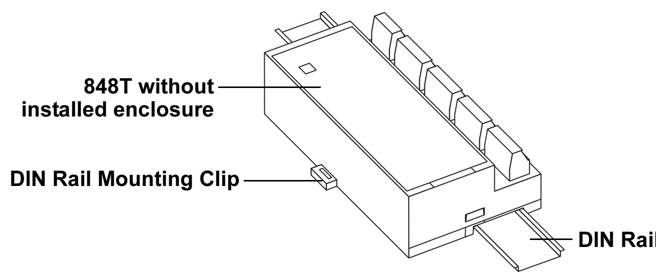
- To a DIN rail without an enclosure
- To a panel with an enclosure
- To a 2-in pipe stand with an enclosure using a pipe mounting kit

Mounting to a DIN Rail Without an Enclosure

To mount the 848T to a DIN rail without an enclosure, follow these steps:

1. Pull up the DIN rail mounting clip located on the top back side of the transmitter.
2. Hinge the DIN rail into the slots on the bottom of the transmitter.
3. Tilt the 848T and place onto the DIN rail. Release the mounting clip. The transmitter should be securely fastened to the DIN rail.

Figure 2-1. Mounting the 848T to a DIN Rail



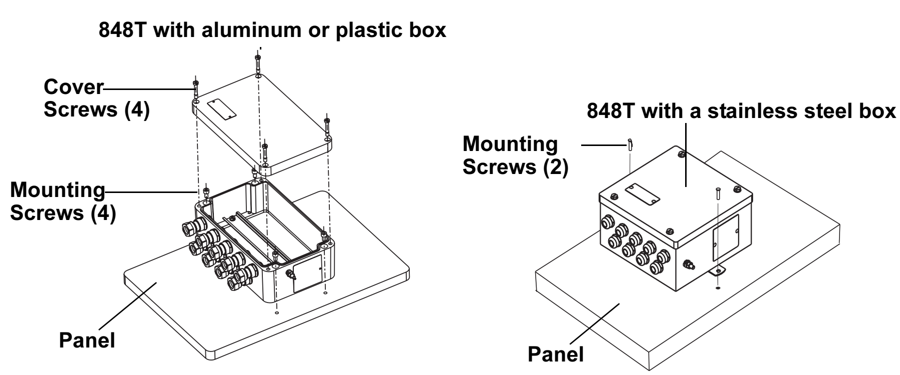
Mounting to a Panel with a Junction Box

When inside of a plastic or aluminum junction box, the 848T mounts to a panel using four 1/4-20 x 1.25-in. screws.

When inside of a stainless steel junction box, the 848T mounts to a panel using two 1/4-20 x 1/2-in. screws.

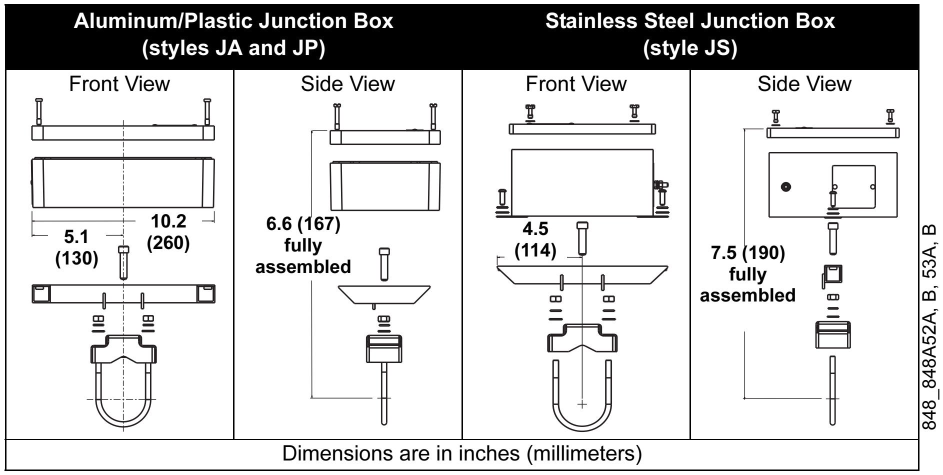
Figure 2-2. Mounting the 848T junction box to a panel

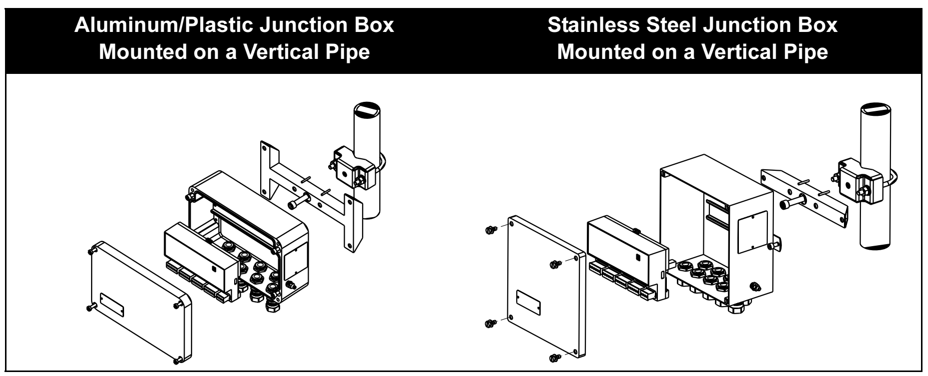
Aluminum/Plastic	Stainless Steel



Mounting to a 2-Inch Pipe Stand

Use the optional mounting bracket (option code B6) to mount the 848T to a 2-inch pipe stand when using a junction box.



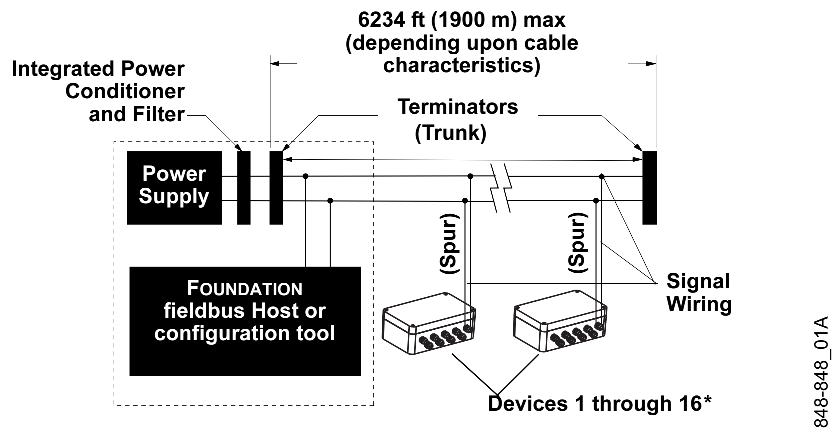


WIRING

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

NOTE
Do not apply high voltage (e.g. AC line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit (bus terminals are rated to 42.4 VDC).

Figure 2-3. 848T Transmitter Field Wiring

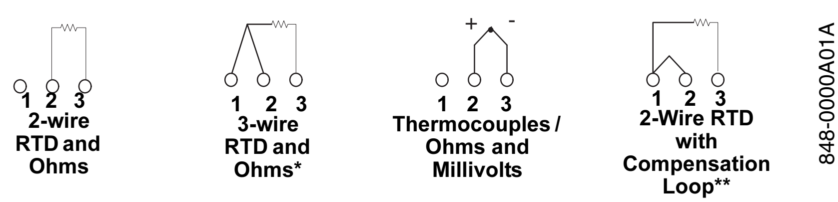


** Intrinsically safe installations may allow fewer devices per I.S. barrier*

Connections

The 848T transmitter is compatible with 2 or 3-wire RTD, thermocouple, Ohm, and millivolt sensor types. Figure 2-4 shows the correct input connections to the sensor terminals on the transmitter. The 848T can also accept inputs from analog devices using the optional analog input connector. Figure 2-5 shows the correct input connections to the analog input connector when installed on the transmitter. Tighten the terminal screws to ensure proper connection.

Figure 2-4. Sensor Wiring Diagram



The wiring of 3-wire RTDs for this unit is different than some earlier models of the 848T. Pay careful attention to the wiring diagram on the label especially if this unit is replacing an older unit.

RTD or Ohm Inputs

Various RTD configurations, including 2-wire and 3-wire are used in industrial applications. If the transmitter is mounted remotely from a 3-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 60 ohms per lead (equivalent to 6,000 feet of 20 AWG wire). If using a 2-wire RTD, both RTD leads are in series with the sensor element, so errors can occur if the lead lengths exceed one foot of 20 AWG wire. Compensation for this error is provided when using 3-wire RTDs.

Thermocouple or Millivolt Inputs

Use appropriate thermocouple extension wire to connect the thermocouple to the transmitter. Make connections for millivolt inputs using copper wire. Use shielding for long runs of wire.

Analog Inputs

The analog connector converts the 4–20 mA signal to a 20–100 mV signal. The 848T transmitter uses a standard mV sensor type to output the scaled 4–20 mA signal onto the FOUNDATION fieldbus.

Use the following steps when installing the 848T with the analog connector:

1. The 848T, when ordered with option code S002, comes with four analog connectors. Replace the standard connector with the analog connector on the desired channels.
2. Wire one or two analog transmitters to the analog connector according to Figure 2-5. There is space available on the analog connector label for identification of the analog inputs.

NOTE
Power supply should be rated to support the connected transmitter(s).

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3. If the analog transmitters can communicate using HART protocol, the analog connectors are supplied with the ability to switch in a 250 ohm resistor for HART communication (see Figure 2-6).

   One switch is supplied for each input (top switch for “A” inputs and bottom switch for “B” inputs). Setting the switch in the “ON” position (to the right) bypasses the 250 ohm resistor. Terminals are provided for each analog input to connect a HART communicator for local configuration.

Figure 2-5. 848T Analog Input Wiring Diagram

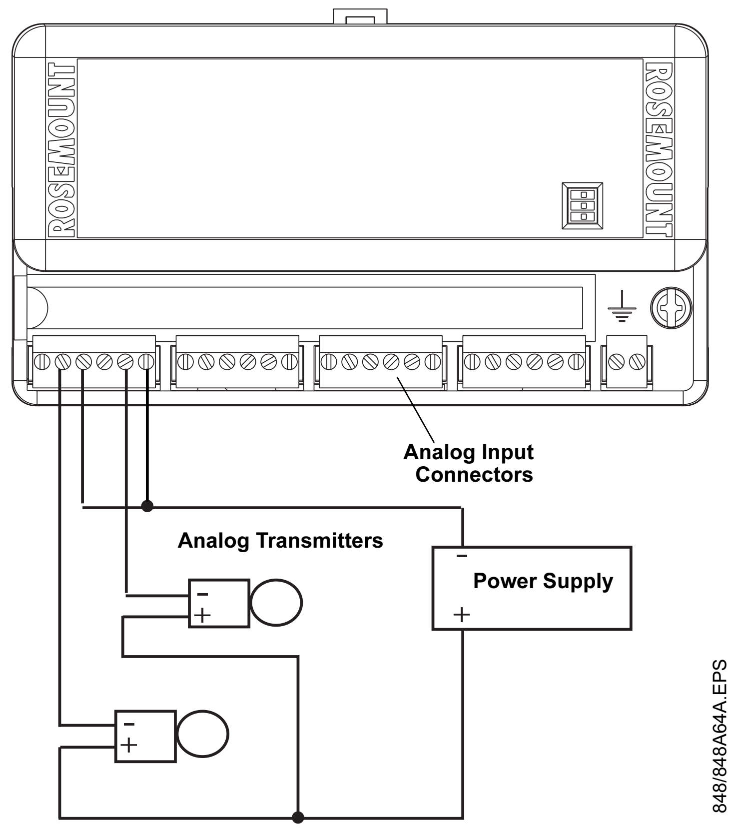
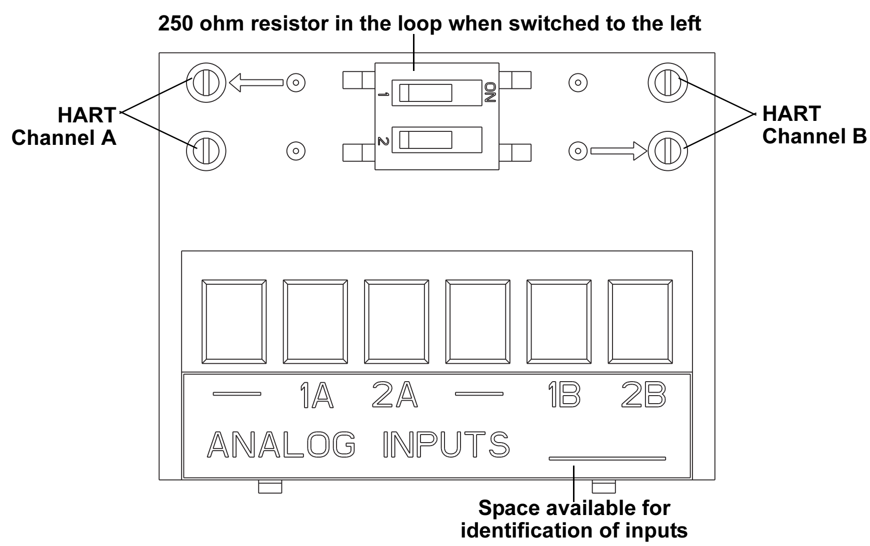


Figure 2-6. 848T Analog Connector



Power Supply

Connections

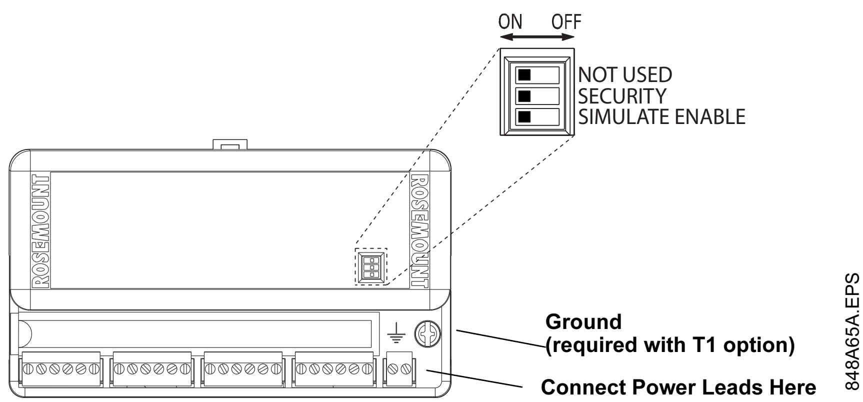
The transmitter requires between 9 and 32 VDC to operate and provide complete functionality. The dc power supply should provide power with less than 2% ripple. A fieldbus segment requires a power conditioner to isolate the power supply filter and decouple the segment from other segments attached to the same power supply.

⚠ All power to the transmitter is supplied over the signal wiring. Signal wiring should be shielded, twisted pair for best results in electrically noisy environments. Do not use unshielded signal wiring in open trays with power wiring or near heavy electrical equipment.

Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not go below 9 VDC. The power terminals are polarity insensitive. To power the transmitter:

1. Connect the power leads to the terminals marked “Bus,” as shown in Figure 2-7.
2. Tighten the terminal screws to ensure adequate contact. No additional power wiring is necessary.

Figure 2-7. Transmitter Label



Surges/Transients

The transmitter will withstand electrical transients encountered through static discharges or induced switching transients. However, a transient protection option (option code T1) is available to protect the 848T against high-energy transients. The device must be properly grounded using the ground terminal (see Figure 2-7 on page 2-7).

GROUNDING

The 848T transmitter provides input/output isolation up to 500 VAC rms.

NOTE
Neither conductor of the fieldbus segment can be grounded. Grounding out one of the signal wires will shut down the entire fieldbus segment.

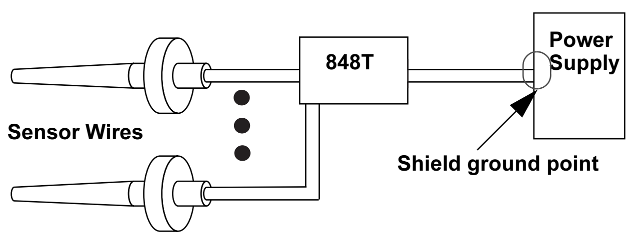
Shielded Wire

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 (most common).

Ungrounded Thermocouple, mV, and RTD/Ohm Inputs

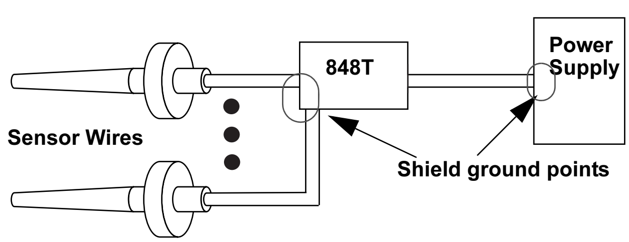
Option 1:

1. Connect signal wiring shield to the sensor wiring shield(s).
2. Ensure the shields are tied together and electrically isolated from the transmitter enclosure.
3. Only ground shield at the power supply end.
4. Ensure that the sensor shield(s) is electrically isolated from the surrounding grounded fixtures.



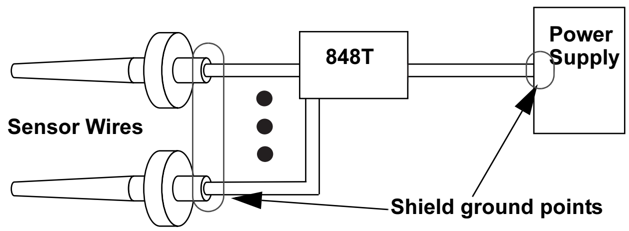
Option 2:

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



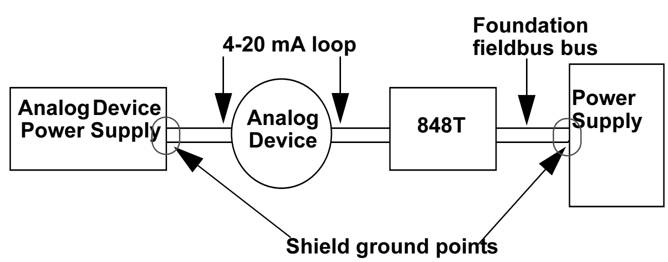
Grounded Thermocouple Inputs

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



Analog Device Inputs

1. Ground analog signal wire at the power supply of the analog devices.
2. Ensure that the analog signal wire and the fieldbus signal wire shields are electrically isolated from the transmitter enclosure.
3. Do not connect the analog signal wire shield to the fieldbus signal wire shield.
4. Ground fieldbus signal wire shield at the power supply end.

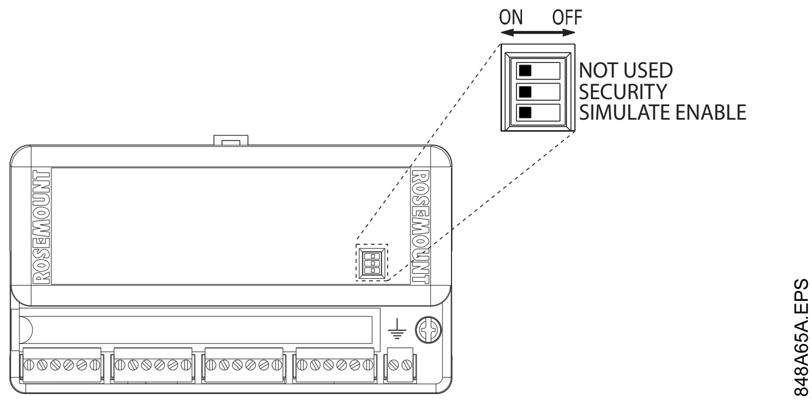


Transmitter Enclosure (optional)

Ground the transmitter in accordance with local electrical requirements.

SWITCHES

Figure 2-8. Switch Location on the Rosemount 848T



Security

After configuring the transmitter, the data can be protected from unwarranted changes. Each 848T is equipped with a security switch that can be positioned “ON” to prevent the accidental or deliberate change of configuration data. This switch is located on the front side of the electronics module and is labeled SECURITY.

See Figure 2-8 on page 2-10 for switch location on the transmitter label.

Simulate Enable

The switch labeled SIMULATE ENABLE is used in conjunction with the Analog Input (AI) and Multiple Analog Input (MAI) function blocks. This switch is used to simulate temperature measurement. As a lock-out feature, the switch must transition from “OFF” to “ON” after power is applied to the transmitter. This feature prevents the transmitter from being left in simulator mode.

Not Used

The switch is not functional.

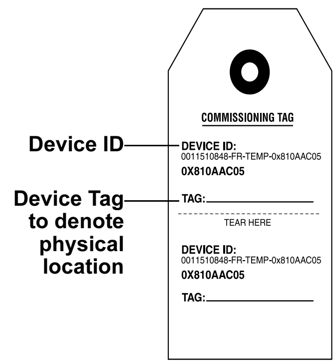
TAGGING

Commissioning Tag

The 848T has been supplied with a removable commissioning tag that contains both the Device ID (the unique code that identifies a particular device in the absence of a device tag) and a space to record the device tag (the operational identification for the device as defined by the Piping and Instrumentation Diagram (P&ID)).

When commissioning more than one device on a fieldbus segment, it can be difficult to identify which device is at a particular location. The removable tag, provided with the transmitter, can aid in this process by linking the Device ID to its physical location. The installer should note the physical location of the transmitter on both the upper and lower location of the commissioning tag. The bottom portion should be torn off for each device on the segment and used for commissioning the segment in the control system.

Figure 2-9. Commissioning Tag



Transmitter Tag

Hardware

- tagged in accordance with customer requirements
- permanently attached to the transmitter

Software

- the transmitter can store up to 30 characters
- if no characters are specified, the first 30 characters of the hardware tag will be used

Sensor Tag

Hardware

- a plastic tag is provided to record identification of eight sensors
- this information can be printed at the factory upon request
- in the field, the tag can be removed, printed onto, and reattached to the transmitter

Software

- if sensor tagging is requested, the Sensor Transducer Block sensor_sn parameters will be set at the factory
- the sensor_sn parameters can be updated in the field

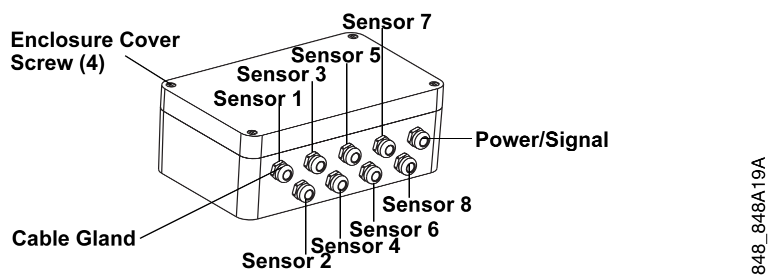
INSTALLATION

Using Cable Glands

Use the following steps to install the 848T with Cable Glands:

1. Remove the junction box cover by unscrewing the four cover screws.
2. Run the sensor and power/signal wires through the appropriate cable glands using the pre-installed cable glands (see Figure 2-10).
3. Install the sensor wires into the correct screw terminals (follow the label on the electronics module).
4. Install the power/signal wires onto the correct screw terminals. Power is polarity insensitive, allowing the user to connect positive (+) or negative (–) to either Fieldbus wiring terminal labeled “Bus.”
5. Replace the enclosure cover and securely tighten all cover screws.

Figure 2-10. Installing the 848T with Cable Glands

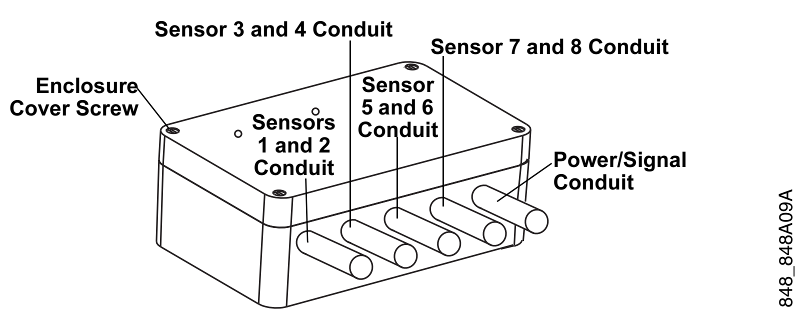


Using Conduit Entries

Use the following steps to install the 848T with Conduit Entries:

1. Remove the junction box cover by unscrewing the four cover screws.
2. Remove the five conduit plugs and install five conduit fittings (supplied by the installer).
3. Run pairs of sensor wires through each conduit fitting.
4. Install the sensor wires into the correct screw terminals (follow the label on the electronics module).
5. Install the power/signal wires into the correct screw terminals. Power is polarity insensitive, allowing the user to connect positive (+) or negative (–) to either Fieldbus wiring terminal labeled “Bus.”
6. Replace the junction box cover and securely tighten all cover screws.

Figure 2-11. Installing the 848T with Conduit Entries



Section 3 Configuration

SAFETY MESSAGES

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Electrical shock could cause death or serious injury.

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

CONFIGURATION

Standard

Each FOUNDATION fieldbus configuration tool or host system has a different way of displaying and performing configurations. Some will use Device Descriptions (DDs) and DD Methods to make configuration and displaying of data consistent across host platforms.

Unless otherwise specified, the 848T will be shipped with the following configuration (default):

Table 3-1. Standard Configuration Settings

Sensor Type(1)	Type J Thermocouple
Damping(1)	5 seconds
Measurement Units(1)	°C
Output(1)	Linear with Temperature
Line Voltage Filter(1)	60 Hz
Temperature Specific Blocks	• Measurement Transducer Block (1) • Sensor Transducer Block (8) • Differential Transducer Block (4)
FOUNDATION fieldbus Function Blocks	• Analog Input (8) • Multiple Analog Input (1) • Input Selector (4)

(1) For all eight sensors

Refer to that systems documentation to perform configuration changes using a FOUNDATION fieldbus host or configuration tool.

NOTE
To make configuration changes, ensure that the block is OOS by setting the MODE_BLK.TARGET to OOS.

Transmitter Configuration

The transmitter is available with the standard configuration setting. The configuration settings and block configuration may be changed in the field with the Emerson Process Management Systems DeltaV®, with AMS*inside*, or other FOUNDATION fieldbus host or configuration tool.

Custom Configuration

Custom configurations are to be specified when ordering. This configuration must be the same for all eight sensors.

Methods

For FOUNDATION fieldbus hosts or configuration tools that support DD methods, there are 3 configuration methods available in each Sensor Transducer block. These methods are included with the device description (DD) software.

- Sensor Connections
- Sensor Input Trim (user input trim)
- Sensor Trim Factory (factory default trim)

Two additional methods are available in the Measurement Transducer Block to provide an easy mechanism to configure the individual sensor from a single location. However using these methods will disable all transducer blocks until the configuration is complete.

- Sensor Configurations
- Response Time Configuration
  (used with the S002 option for the analog adaptors)

See the host system documentation for information on running DD methods from the host system. If the FOUNDATION fieldbus host or configuration tool does not support DD methods, refer to "Block Configuration" on page 3-7 for information on how to modify sensor configuration parameters.

Alarms

Use the following steps to configure the alarms, which are located in the Resource Function Block.

1. Set the resource block to OOS.
2. Set WRITE_PRI to the appropriate alarm level (WRITE_PRI has a selectable range of priorities from 0 to 15, see "Alarm Priority Levels" on page 3-12. Set the other block alarm parameters at this time.
3. Set CONFIRM_TIME to the time, in $^{1}/_{32}$ of a millisecond, that the device will wait for confirmation of receiving a report before trying again (the device does not retry if CONFIRM_TIME is 0).
4. Set LIM_NOTIFY to a value between zero and MAX_NOTIFY. LIM_NOTIFY is the maximum number of alert reports allowed before the operator needs to acknowledge an alarm condition.
5. Enable the reports bit in FEATURES_SEL.
6. Set the resource block to AUTO.

For modifying alarms on individual function blocks (AI or ISEL blocks), refer to Appendix D: Function Blocks.

Damping

Use the following steps to configure the damping, which is located in the Sensor Transducer Function Blocks.

1. Place the Sensor Transducer Block(s) in OOS Mode (change MODE_BLK.TARGET to OOS).
2. Change DAMPING to the desired filter rate (0.0 to 32.0 seconds).
3. Place the Sensor Transducer Block(s) in Auto Mode (change MODE_BLK.TARGET to Auto).

Configure the Differential Sensor Blocks

Use the following steps to configure the Differential Sensor Blocks.

1. Place the Differential Sensor Transducer Block to OOS.
2. Set Input A and Input B to the sensor values that are to be used in the differential equation diff = A–B. (NOTE: Unit types must be the same.)
3. Set the DIFFERENTIAL_CALC to either Not Used, Absolute, or INPUT A minus INPUT B.
4. Place the Differential Sensor Transducer Block in auto mode.

COMMON CONFIGURATIONS FOR MONITORING APPLICATIONS

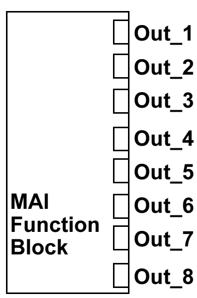
For the application to work properly, configure the links between the function blocks and schedule the order of their execution. The Graphical User Interface (GUI) provided by the FOUNDATION fieldbus host or configuration tool will allow easy configuration.

The measurement strategies shown in this section represent some of the common types of configurations available in the 848T. Although the appearance of the GUI screens will vary from host to host, the configuration logic is the same.

NOTE
Please ensure that the host system or configuration tool is properly configured before downloading the transmitter configuration. If configured improperly, the FOUNDATION fieldbus host or configuration tool could overwrite the default transmitter configuration.

Typical Monitoring/Profiling Application

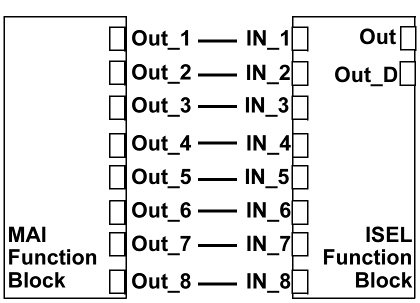
Example: Distillation column temperature profile where all channels have the same sensor units (°C, °F, etc.).



1. Place the Multiple Analog Input (MAI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
2. Set CHANNEL= "channels 1 to 8." Although the CHANNEL_X parameters remain writable, CHANNEL_X can only be set = X when CHANNEL=1.
3. Set L_TYPE to direct or indirect.
4. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
5. Set OUT_SCALE (MAI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
6. Place the MAI Function Block in auto mode.
7. Verify that the function blocks are scheduled.

Monitoring Application with a Single Selection Application

Example: Average exhaust temperature of gas and turbine where there is a single alarm level for all inputs.

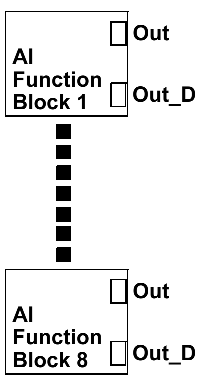


1. Link the MAI outputs to the ISEL inputs.
2. Place the Multiple Analog Input (MAI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
3. Set CHANNEL= "channels 1 to 8." Although the CHANNEL_X parameters remain writable, CHANNEL_X can only be set = X when CHANNEL=1.
4. Set L_TYPE to direct or indirect.
5. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.

6. Set OUT_SCALE (MAI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
7. Place the MAI function block in auto mode.
8. Place the Input Selector (ISEL) function block in OOS mode by setting MODE_BLK.TARGET to OOS.
9. Set OUT_RANGE to match the OUT_SCALE in the MAI block.
10. Set SELECT_TYPE to the desired function (Maximum Value, Minimum Value, First Good Value, Midpoint Value, or Average Value).
11. Set the alarm limits and parameters if necessary.
12. Place the ISEL function block in auto mode.
13. Verify that the function blocks are scheduled.

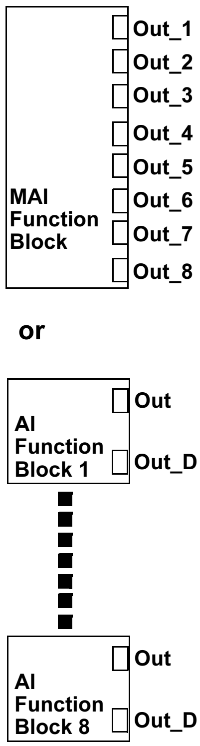
Monitoring Temperature Points Individually

Example: Miscellaneous monitoring of temperature in a "close proximity" where each channel can have different sensor inputs with different units and there are independent alarm levels for each input.



1. Place the first Analog Input (AI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
2. Set CHANNEL to the appropriate channel value. Refer to "Alarm Priority Levels" on page 3-12 for a listing of channel definitions.
3. Set L_TYPE to direct.
4. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
5. Set OUT_SCALE (AI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
6. Set the alarm limits and parameters if necessary.
7. Place the AI function block in auto mode.
8. Repeat steps 1 through 7 for each AI function block.
9. Verify that the function blocks are scheduled.

Interfacing Analog Transmitters to FOUNDATION fieldbus



Sensor Transducer Block Configuration

Use the sensor configuration method to set the sensor type to mV – 2-wire for the applicable transducer block or follow these steps.

1. Set the MODE_BLK.TARGET to OOS mode.
2. Set the SENSOR_TYPE to mV.
3. Set the MODE_BLK.TARGET to AUTO.

Multiple Analog Input or Analog Input Block Configuration

Follow these steps to configure the applicable block.

1. Set the MODE_BLK.TARGET to OOS mode.
2. Set CHANNEL to the transducer block configured for the analog input.
3. Set XD_SCALE.EU_0 to 20
   Set XD_SCALE.EU_100 to 100
   Set XD_SCALE.ENGUNITS to mV
4. SET OUT_SCALE to match the desired scale and units for the connected analog transmitter.
   Flow Example: 0 – 200 gpm
   OUT_SCALE.EU_0 = 0
   OUT_SCALE.EU_100 = 200
   OUT_SCALE.ENGUNITS = gpm
5. Set L_TYPE to INDIRECT.
6. Set the MODE_BLK.TARGET to AUTO.

BLOCK CONFIGURATION

Resource Block

The resource block defines the physical resources of the device including type of measurement, memory, etc. The resource block also defines functionality, such as shed times, that is common across multiple blocks. The block has no linkable inputs or outputs and it performs memory-level diagnostics.

Table 3-2. Resource Block Parameters

Number	Parameter	Description
00	BLOCK	
01	ST_REV	
02	TAG_DESC	The revision level of the static data associated with the function block.
03	STRATEGY	The strategy field can be used to identify grouping of blocks.
04	ALERT_KEY	The identification number of the plant unit.
05	MODE_BLK	The actual, target, permitted, and normal modes of the block. For further description, see the Mode parameter formal model in FF-890.
06	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. For a list of enumeration values, see FF-890, Block_Err formal model.
07	RS_STATE	State of the function block application state machine. For a list of enumeration values, see FF-890.
08	TEST_RW	Read/write test parameter - used only for conformance testing.
09	DD_RESOURCE	String identifying the tag of the resource which contains the Device Description for the resource.
10	MANUFAC_ID	Manufacturer identification number - used by an interface device to locate the DD file for the resource.
11	DEV_TYPE	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.
12	DEV_REV	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
13	DD_REV	Revision of the DD associated with the resource - used by the interface device to locate the DD file for the resource.
14	GRANT_DENY	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
15	HARD_TYPES	The types of hardware available as channel numbers. The supported hardware type is: SCALAR_INPUT
16	RESTART	Allows a manual restart to be initiated.
17	FEATURES	Used to show supported resource block options. The supported features are: SOFT_WRITE_LOCK_SUPPORT, HARD_WRITE_LOCK_SUPPORT, REPORTS, and UNICODE
18	FEATURE_SEL	Used to select resource block options.
19	CYCLE_TYPE	Identifies the block execution methods available for this resource. The supported cycle types are: SCHEDULED, and COMPLETION_OF_BLOCK_EXECUTION
20	CYCLE_SEL	Used to select the block execution method for this resource.
21	MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.
22	MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download.
23	NV_CYCLE_T	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.
24	FREE_SPACE	Percent of memory available for further configuration. Zero in preconfigured resource.
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks.
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas will never happen when SHED_RCAS = 0.

Table 3-2. Resource Block Parameters

Number	Parameter	Description
27	SHED_ROUT	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.
28	FAULT_STATE	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.
29	SET_FSTATE	Allows the FAIL_SAFE condition to be manually initiated by selecting Set.
30	CLR_FSTATE	Writing a Clear to this parameter will clear the device FAIL_SAFE if the field condition has cleared.
31	MAX_NOTIFY	Maximum number of unconfirmed notify messages possible.
32	LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed.
33	CONFIRM_TIME	The time the resource will wait for confirmation of receipt of a report before trying again. Retry will not happen when CONFIRM_TIME=0.
34	WRITE_LOCK	If set, all writes to static and non-volatile parameters are prohibited, except to clear WRITE_LOCK. Block inputs will continue to be updated.
35	UPDATE_EVT	This alert is generated by any change to the static data.
36	BLOCK_ALM	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.
37	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	ACK_OPTION	Selection of whether alarms oscillated with the block will be automatically acknowledged.
39	WRITE_PRI	Priority of the alarm generated by clearing the write lock.
40	WRITE_ALM	This alert is generated if the write lock parameter is cleared.
41	ITK_VER	Major revision number of the interoperability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus Foundation.
42	DISTRIBUTOR	Reserved for use as distributor ID. No Foundation enumerations defined at this time.
43	DEV_STRING	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.
44	XD_OPTIONS	Indicates which transducer block licensing options are enabled.
45	FB_OPTIONS	Indicates which function block licensing options are enabled.
46	DIAG_OPTIONS	Indicates which diagnostics licensing options are enabled.
47	MISC_OPTIONS	Indicates which miscellaneous licensing options are enabled.
48	RB_SFTWR_REV_MAJOR	Major revision of software that the resource block was created with.
49	RB_SFTWR_REV_MINOR	Minor revision of software that the resource block was created with.
50	RB_SFTWR_REV_BUILD	Build of software that the resource block was created with.
51	RB_SFTWR_REV_ALL	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
52	HARDWARE_REV	Hardware revision of that hardware that has the resource block in it.
53	OUTPUT_BOARD_SN	Output board serial number.
54	FINAL_ASSY_NUM	The same final assembly number placed on the label.
55	DETAILED_STATUS	Indicates the state of the transmitter. NOTE: Will be writable when PWA_SIMULATE is On during simulation mode.
56	SUMMARY_STATUS	An enumerated value of repair analysis.
57	MESSAGE_DATE	Date associated with the MESSAGE_TEXT parameter
58	MESSAGE_TEXT	Used to indicate changes made by the user to the device’s installation, configuration, or calibration.

Table 3-2. Resource Block Parameters

Number	Parameter	Description
59	SELF_TEST	Used to self test the device. Tests are device specific.
60	DEFINE_WRITE_LOCK	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.
61	SAVE_CONFIG_NOW	Allows the user to optionally save all non-volatile information immediately.
62	SAVE_CONFIG_BLOCKS	Number of EEPROM blocks that have been modified since last burn. This value will count down to zero when the configuration is saved.
63	START_WITH_DEFAULTS	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)
64	SIMULATE_IO	Status of Simulate jumper/switch
65	SECURITY_IO	Status of Security jumper/switch
66	SIMULATE_STATE	The state of the simulate jumper 0 = Uninitialized 1 = Jumper/switch off, simulation not allowed 2 = Jumper/switch on, simulation not allowed (need to cycle jumper/switch) 3 = Jumper/switch on, simulation allowed
67	DOWNLOAD_MODE	Gives access to the boot block code for over the wire downloads 0 = Uninitialized 1 = Run Mode 2 = Download Mode
68	RECOMMENDED_ACTION	Mask of FAILED_ALM. Corresponds bit of bit to FAILED_ACTIVE. A bit on means that the condition is masked out from alarming.
69	FAILED_PRI	Enumerated list of recommended actions displayed with a device alert.
70	FAILED_ENABLE	Designates the alarming priority of the FAILED_ALM.
71	FAILED_MASK	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.
72	FAILED_ACTIVE	Enumerated list of failure conditions within a device.
73	FAILED_ALM	Alarm indicating a failure within a device which makes the device non-operational.
74	MAINT_PRI	Designates the alarming priority of the MAINT_ALM
75	MAINT_ENABLE	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.
76	MAINT_MASK	Mask of MAINT_ALM. Corresponds bit of bit to MAINT_ACTIVE. A bit on means that the condition is masked out from alarming.
77	MAINT_ACTIVE	Enumerated list of maintenance conditions within a device.
78	MAINT_ALM	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
79	ADVISE_PRI	Designates the alarming priority of the ADVISE_ALM
80	ADVISE_ENABLE	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.
81	ADVISE_MASK	Mask of ADVISE_ALM. Corresponds bit of bit to ADVISE_ACTIVE. A bit on means that the condition is masked out from alarming.
82	ADVISE_ACTIVE	Enumerated list of advisory conditions within a device.

Table 3-2. Resource Block Parameters

Number	Parameter	Description
83	ADVISE_ALM	Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.
84	HEALTH_INDEX	Parameter representing the overall health of the device, 100 being perfect and 1 being non-functioning. The value will be set based on the active PWA alarms in accordance with the requirements stated in “Device Alerts and Health Index PlantWeb Implementation Rules”. Each device may implement its own unique mapping between the PWA parameters and HEALTH_INDEX although a default mapping will be available based on the following rules. HEALTH_INDEX will be set based on the highest priority PWA *_ACTIVE bit as follows: FAILED_ACTIVE: 0 to 31 - HEALTH_INDEX = 10 MAINT_ACTIVE: 27 to 31 - HEALTH_INDEX = 20 MAINT_ACTIVE: 22 to 26 - HEALTH_INDEX = 30 MAINT_ACTIVE: 16 to 21 - HEALTH_INDEX = 40 MAINT_ACTIVE: 10 to 15 - HEALTH_INDEX = 50 MAINT_ACTIVE: 5 to 9 - HEALTH_INDEX = 60 MAINT_ACTIVE: 0 to 4 - HEALTH_INDEX = 70 ADVISE_ACTIVE: 16 to 31 - HEALTH_INDEX = 80 ADVISE_ACTIVE: 0 to 15 - HEALTH_INDEX = 90 NONE - HEALTH_INDEX = 100
85	PWA_SIMULATE	Allows direct writes to the PlantWeb Alert "ACTIVE" parameters and RB.DETAILED_STATUS. The simulate jumper must be "ON' and the SIMULATE_STATE must be "Jumper on, simulation allowed" before PWA_SIMULATE can be active.

Block Errors

Table 3-3 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the Resource block and are given for reference.

Table 3-3. BLOCK_ERR Conditions

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Number	Name and Description
0	Other
1	Block Configuration Error: A feature in CYCLE_SEL is set that is not supported by CYCLE_TYPE.
2	Link Configuration Error: A link used in one of the function blocks is improperly configured.
3	Simulate Active: This indicates that the simulation jumper is in place. This is not an indication that the I/O blocks are using simulated data.
4	**Local Override**
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input failure/process variable has bad status
8	Output Failure: The output is bad based primarily upon a bad input.
9	Memory Failure: A memory failure has occurred in FLASH, RAM, or EEPROM memory.
10	Lost Static Data: Static data that is stored in non-volatile memory has been lost.
11	Lost NV Data: Non-volatile data that is stored in non-volatile memory has been lost.
12	Readback Check Failed
13	Device Needs Maintenance Now
14	Power Up: The device was just powered-up.
15	OOS: The actual mode is out of service.

Modes

The resource block supports two modes of operation as defined by the MODE_BLK parameter:

Automatic (Auto)
The block is processing its normal background memory checks.

Out of Service (OOS)
The block is not processing its tasks. When the resource block is in OOS, all blocks within the resource (device) are forced into OOS. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the resource block are defined above. A write alarm is generated whenever the WRITE_LOCK parameter is cleared. The priority of the write alarm is set in the following parameter:

- WRITE_PRI

Table 3-4. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
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, but does not require operator attention (such as diagnostics and system alerts).
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 Handling

There are no status parameters associated with the resource block.

PlantWeb™ Alerts

The alerts and recommended actions should be used in conjunction with “Operation and Maintenance” on page 4-1.

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

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

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

1. Electronics
2. NV Memory
3. HW / SW Incompatible
4. Primary Value Failure
5. Secondary Value Failure

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

FAILED_PRI
Designates the alerting priority of the FAILED_ALM, see Table 3-4 on page 3-12. The default is 0 and the recommended value are between 8 and 15.

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

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

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

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

Below is a list of the conditions:

1. Primary Value Degraded

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, Table 3-4 on page 3-12. 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. Body Temperature Degraded
3. PlantWeb Alert Simulate is Active

ADVISE_MASK

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

ADVISE_PRI

ADVISE_PRI designates the alarming priority of the ADVISE_ALM, see Table 3-4 on page 3-12. 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 3-5. RB.RECOMMENDED_ACTION

	Alarm Type	Failed/Maint/Advise Active Event	Recommended Action Text String
PlantWeb Alerts	None	None	No action required
	Advisory	Body Temperature Degraded	One of the two body temperature sensors has failed, device remains operational.

Transducer Blocks

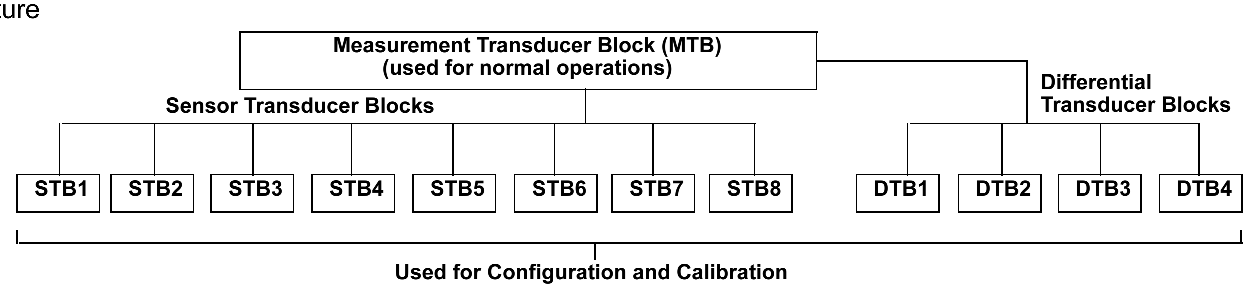
There are three types of transducer blocks that allow the user to view and manage the channel information. These blocks are:

- Measurement Transducer Block (MTB) – see “Measurement Transducer Block (MTB)” on page 3-17.
- Sensor Transducer Block (STB), one for each of the eight sensors – see “Sensor Transducer Block (STB)” on page 3-21.
- Differential Transducer Block (DTB), one for each sensor pair. The DTB can be configured to any pairs of sensors with compatible units – see “Differential Transducer Block (DTB)” on page 3-22.

These Transducer blocks contain specific temperature measurement data, including:

- Sensor Type
- Engineering Units
- Damping
- Temperature Compensation
- Diagnostics

Figure 3-1. Transducer Block Structure



Transducer Block Channel Definitions

The 848T supports multiple sensor inputs. Each input has a channel assigned to it allowing an AI or MAI Function Blocks to be linked to that input. The channels for the 848T are as follows:

Table 3-6. Channel Definitions for the 848T

Channel	Description	Channel	Description
1	Sensor One (STB 1)	7	Sensor Seven (STB 7)
2	Sensor Two (STB 2)	8	Sensor Eight (STB 8)
3	Sensor Three (STB 3)	9	Differential Sensor 1 (DTB 1)
4	Sensor Four (STB 4)	10	Differential Sensor 2 (DTB 2)
5	Sensor Five (STB 5)	11	Differential Sensor 3 (DTB 3)
6	Sensor Six (STB 6)	12	Differential Sensor 4 (DTB 4)
		13	Body Temperature

Transducer Block Errors

The following conditions are reported in the BLOCK_ERR and XD_ERROR parameters. Conditions in **bold** are inactive for the transducer block and are given only for reference.

Table 3-7. Block/Transducer Error

	Condition Number, Name, and Description	
BLOCK_ERR	0	Other[(1)]
	1	**Block configuration error**
	2	**Link configuration error**
	3	**Simulate active**
	4	**Local override**
	5	**Device fault state set**
	6	Device needs maintenance soon
	7	Input failure/process variable has bad status
	8	**Output failure**
	9	**Memory failure**
	10	**Lost static data**
	11	Lost NV data
	12	**Readback check failed**
	13	Device needs maintenance now
	14	Power up: The device was just powered up
	15	Out of service: The actual mode is out of service
	16	Unspecified error: An unidentified error occurred
XD_ERROR	17	General error: A genera error that cannot be specified below occurred
	18	Calibration error: An error occurred during calibration of the device or a calibration error was detected during normal operations.
	19	Configuration error: An error occurred during configuration of the device or a configuration error was detected during normal operations.
	20	Electronics failure: An electrical component failed
	21	Mechanical failure: A mechanical component failed
	22	I/O failure: An I/O failure occurred
	23	Data Integrity Error: Data stored in the device is no longer valid due to a non-volatile memory checksum failure, a data verify after write failure, etc.
	24	Software error: The software has detected an error due to an improper interrupt service routine, an arithmetic overflow, a watchdog time-out, etc.
	25	Algorithm error: The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.

(1) If BLOCK_ERR is "other," then see XD_ERROR.

Transducer Block Modes

The transducer block supports two modes of operation as defined by the MODE_BLK parameter:

Automatic (Auto)
The block outputs reflect the analog input measurement.

Out of Service (OOS)
The block is not processed. Channel outputs are not updated and the status is set to Bad: Out of Service for each channel. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Transducer Block Alarm Detection

Alarms are not generated by the transducer block. By correctly handling the status of the channel values, the down stream block (AI or MAI) will generate the necessary alarms for the measurement. The error that generated this alarm can be determined by looking at BLOCK-ERR and XD_ERROR.

Transducer Block Status Handling

Normally, the status of the output channels reflect the status of the measurement value, the operating condition of the measurement electronics card, and any active alarm conditions. In a transducer, PV reflects the value and status quality of the output channels.

Measurement Transducer Block (MTB)

There is one MTB in the 848T, which allows the user to view all channel information. It provides STB and DTB summary information (primary value and status) and contains the parameters that apply to all STBs and DTBs. The MTB allows configuration of the sensor types and sensor response times.

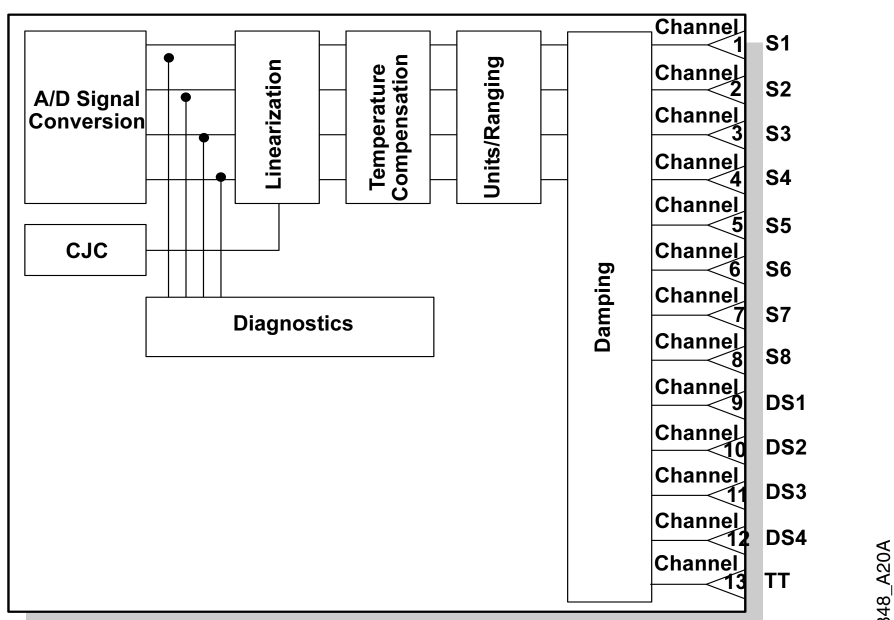


Table 3-8. Measurement Transducer Block Parameters

Number	Parameter	Description
0	BLOCK	
1	ST_REV	The revision level of the static data associated with the function block.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks.
4	ALERT_KEY	The identification number of the plant unit.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. For further description, see the Mode parameter formal model in FF-890.
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. For a list of enumeration values, see FF-890, Block_Err formal model.
7	XD_ERROR	One of the error codes defined in FF-903 XD_ ERROR and Block Alarm Subcodes.
8	PRIMARY_VALUE_1	The measured value and status available from sensor 1.
9	SENSOR_UNIT_1	The Device Description engineering units code index for the calibration values.
10	SENSOR_TAG_1	The user description of the intended application of the block.
11	PRIMARY_VALUE_2	The measured value and status available from sensor 2.
12	SENSOR_UNIT_2	The Device Description engineering units code index for the calibration values.
13	SENSOR_TAG_2	The user description of the intended application of the block.
14	PRIMARY_VALUE_3	The measured value and status available from sensor 3.
15	SENSOR_UNIT_3	The Device Description engineering units code index for the calibration values.
16	SENSOR_TAG_3	The user description of the intended application of the block.
17	PRIMARY_VALUE_4	The measured value and status available from sensor 4.
18	SENSOR_UNIT_4	The Device Description engineering units code index for the calibration values.
19	SENSOR_TAG_4	The user description of the intended application of the block.
20	PRIMARY_VALUE_5	The measured value and status available from sensor 5.
21	SENSOR_UNIT_5	The Device Description engineering units code index for the calibration values.
22	SENSOR_TAG_5	The user description of the intended application of the block.
23	PRIMARY_VALUE_6	The measured value and status available from sensor 6.
24	SENSOR_UNIT_6	The Device Description engineering units code index for the calibration values.
25	SENSOR_TAG_6	The user description of the intended application of the block.
26	PRIMARY_VALUE_7	The measured value and status available from sensor 7.
27	SENSOR_UNIT_7	The Device Description engineering units code index for the calibration values.
28	SENSOR_TAG_7	The user description of the intended application of the block.
29	PRIMARY_VALUE_8	The measured value and status available from sensor 8.
30	SENSOR_UNIT_8	The Device Description engineering units code index for the calibration values.
31	SENSOR_TAG_8	The user description of the intended application of the block.
32	DIFFERENTIAL_VALUE_1	The measured value and status available to the function block from the Differential TB.
33	DIFFERENTIAL_UNIT_1	The Device Description engineering units code index for the calibration values.
34	DIFFERENTIAL_TAG_1	The user description of the intended application of the block.
35	DIFFERENTIAL_VALUE_2	The measured value and status available to the function block from the Differential TB.
36	DIFFERENTIAL_UNIT_2	The Device Description engineering units code index for the calibration values.
37	DIFFERENTIAL_TAG_2	The user description of the intended application of the block.
38	DIFFERENTIAL_VALUE_3	The measured value and status available to the function block from the Differential TB.
39	DIFFERENTIAL_UNIT_3	The Device Description engineering units code index for the calibration values.
40	DIFFERENTIAL_TAG_3	The user description of the intended application of the block.
41	DIFFERENTIAL_VALUE_4	The measured value and status available to the function block from the Differential TB.
42	DIFFERENTIAL_UNIT_4	The Device Description engineering units code index for the calibration values.
43	DIFFERENTIAL_TAG_4	The user description of the intended application of the block.
44	BODY_TEMP	The terminal temperature at the device input terminals.
45	BODY_TEMP_UNIT	The engineering units associated with the BODY_TEMP.
46	MODULE_SN	The Serial Number of the A2D card
47	MODULE_HARDWARE_REV	The hardware revision of the A2D card
48	MODULE_SOFTWARE_REV	Software Revision of the A2D card

Table 3-8. Measurement Transducer Block Parameters

Number	Parameter	Description
49	MODULE_STATUS	A2D card Status
50	ASIC_REJECTION	A configurable power line noise rejection setting
51	TB_COMMAND	A2D Specific Commands
52	TB_SUMMARY_STATUS	Status indicating A2D specific faults
53	SENSOR_SUMMARY_STATUS	Status indicating Sensor specific faults
54	INTERMITTENT_DETECTION_THRESHOLD	Allows the user to configure the amount of change in a sensor reading that causes it to be temporarily at its last value.
55	RESPONSE_TIME	Active: Setting for fast inputs (analog). Accepts reading regardless of the amount of change from the previous reading. Deactivate: Sets the input to reject large transients unless confirmed by subsequent readings (best for temperature measurements).
56	SENSOR_1_CONFIG.SENSOR	Sensor Type setting for the corresponding input
56	SENSOR_1_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
57	SENSOR_2_CONFIG.SENSOR	Sensor Type setting for the corresponding input
57	SENSOR_2_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
58	SENSOR_3_CONFIG.SENSOR	Sensor Type setting for the corresponding input
58	SENSOR_3_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
59	SENSOR_4_CONFIG.SENSOR	Sensor Type setting for the corresponding input
59	SENSOR_4_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
60	SENSOR_5_CONFIG.SENSOR	Sensor Type setting for the corresponding input
60	SENSOR_5_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
61	SENSOR_6_CONFIG.SENSOR	Sensor Type setting for the corresponding input
61	SENSOR_6_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
62	SENSOR_7_CONFIG.SENSOR	Sensor Type setting for the corresponding input
62	SENSOR_7_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input
63	SENSOR_8_CONFIG.SENSOR	Sensor Type setting for the corresponding input
63	SENSOR_8_CONFIG.CONNECTION	Sensor Connection setting for the corresponding input

Changing the Sensor Configuration in the Main Transducer Block

If the FOUNDATION fieldbus configuration tool or host system does not support the use of DD methods for device configuration, the following steps illustrate how to change the sensor configuration in the main transducer block:

1. Set the MODE_BLK.TARGET to OOS.

   For each sensor 'n'
2. Set SENSOR_n_CONFIG.SENSOR to appropriate sensor type.
3. Set SENSOR_n_CONFIG.CONNECTION to appropriate value (2-wire or 3-wire).
4. In the Sensor Transducer Block, set MODE_BLK.TARGET to AUTO.

Measurement Transducer Block Diagnostics

In addition to the BLOCK_ERR and XD_ERROR parameters, more detailed information on the measurement status can be obtained via the TB_SUMMARY_STATUS parameter in the Measurement Transducer Block. Table 3-9 lists the potential errors and the possible corrective actions for the given values. The corrective actions are in the order of increasing system level compromises.

The first step should always be to reset the transmitter. If the error persists, move to the next step as indicated in the table below.

Table 3-9. TB_SUMMARY_STATUS Descriptions and Corrective Actions

Value	Name and Description	Corrective Actions
0x01	Serious A/D error	1. Restart the device(1)
0x02	A/D Communication Error	1. Restart the device
0x04	Terminal Temperature Failure	1. Restart the processor 2. Call service center
0x08	Terminal Temperature Degraded (warning)	1. Monitor for terminal temperature failure
0x10	Sensor/Differential Alert	1. Check wiring for sensor connection (see “Sensor Connections” on page 2-5). 2. Check sensor configuration in transducer block. 3. Replace sensor

(1) Call the service center if the problem reoccurs.

Sensor Transducer Block (STB)

Each temperature input is supported by an STB that provides all the parameters and methods necessary to configure and calibrate each individual sensor. The 848T contains eight identical Sensor Transducer Blocks, one for each available temperature input.

Table 3-10. Sensor Transducer Block Parameters

Number	Parameter	Description
0	BLOCK	
1	ST_REV	The revision level of the static data associated with the function block.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks.
4	ALERT_KEY	The identification number of the plant unit.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.For further description, see the Mode parameter formal model in FF-890.
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. For a list of enumeration values, see FF-890, Block_Err formal model.
7	TRANSDUCER_TYPE	Identifies the transducer that follows.
8	XD_ERROR	One of the error codes defined in FF-903 XD_ ERROR and Block Alarm Subcodes.
9	PRIMARY_VALUE_TYPE	The type of measurement represented by PRIMARY_VALUE.
10	PRIMARY_VALUE	The measured value and status available to the function block.
11	SENSOR_RANGE	The high and low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the final value.
12	DAMPING	Sampling interval used to smooth output using a 1st order linear filter. A value of 0 will disable damping.
13	SENSOR_TYPE	Reflects the type of sensor connected on PRIMARY_VALUE.
14	SENSOR_CONNECTION	The number of wires for the temperature sensor.
15	SENSOR_SN	The sensor serial number.
16	SENSOR_STATUS	Indicates the fail mode of the sensor connected
17	RTD_2_WIRE_OFFSET	User entered value for constant lead-wire resistance correction in 2-wire RTD and Ohm sensor types.
18	CAL_POINT_HI	The highest calibrated value.
19	CAL_POINT_LO	The lowest calibrated value.
20	CAL_MIN_SPAN	The minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points are not too close together.
21	CAL_UNIT	The Device Description engineering units code index for the calibration values.
22	CAL_PT_HI_LIMIT	Calibration Limit High
23	CAL_PT_LO_LIMIT	Calibration Limit Low
24	CAL_MODE	Allows the device to use an Active Calibrator to simulate sensor inputs (Unused)
25	CAL_METHOD	The method of the last calibration.
26	CAL_INFO	Notes from last calibration
27	CAL_DATE	The date of the last calibration
28	CAL_STATUS	Indicates if calibration was successful

Changing the Sensor Configuration in the Sensor Transducer Block

If the FOUNDATION fieldbus configuration tool or host system does not support the use of DD methods for device configuration, the following steps illustrate how to change the sensor configuration in a sensor transducer block:

1. Set the MODE_BLK.TARGET to OOS.
2. Set SENSOR_TYPE to appropriate value.
3. Set SENSOR_CONNECTION to appropriate value (2-wire or 3-wire).
4. In the Sensor Transducer Block, set MODE_BLK.TARGET to AUTO.

Sensor Calibration in the Sensor Transducer Block

If the FOUNDATION fieldbus configuration tool or host system does not support the use of DD methods for device configuration, the following steps illustrate how to calibrate the sensor from the sensor transducer block:

1. Set the MODE_BLK.TARGET to OOS.
2. Set CAL_UNIT to calibration unit.
3. Set CAL_METHOD to User Trim (seeTable 3-6 on page 3-16 for valid values).
4. Set the input value of the sensor simulator to be within the range defined by CAL_PT_LO_LIMIT and CAL_PT_HI_LIMIT.
5. Set CAL_POINT_LO (CAL_POINT_HI) to the value set at the sensor simulator.
6. Read CAL_STATUS and wait until it reads “Trim Complete”
7. Repeat steps 3 to 5 if performing a two-point trim. Note that the difference in values between CAL_POINT_LO and CAL_POINT_HI must be greater than CAL_MIN_SPAN.
8. Set MODE_BLK.TARGET to AUTO.

Differential Transducer Block (DTB)

Each differential temperature measurement is supported by a DTB that provides all the parameters necessary to configure the measurement and select sensors from which the differential measurement is based. The 848T contains four identical Differential Transducer Blocks, one for each available pair of temperature inputs.

Table 3-11. Differential Transducer Block Parameters

Number	Parameter	Description
0	BLOCK	
1	ST_REV	The revision level of the static data associated with the function block.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks.
4	ALERT_KEY	The identification number of the plant unit.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. For further description, see the Mode parameter formal model in FF-890.
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. For a list of enumeration values, see FF-890, Block_Err formal model.
7	TRANSDUCER_TYPE	Identifies the transducer that follows.
8	XD_ERROR	One of the error codes defined in FF-903 XD_ ERROR and Block Alarm Subcodes.
9	DIFFERENTIAL_VALUE	The measured value and status available to the function block.
10	DIFFERENTIAL_RANGE	The high and low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the final value.
11	INPUT_1	Sensor Value to be used in differential calculation
12	INPUT_2	Sensor Value to be used in differential calculation.
13	DIFFERENTIAL_STATUS	Indicates the fail mode of the differential measurement based on the sensors connected
14	DIFFERENTIAL_CALC	Allows the Differential measurement to be absolute, input1 - input2, or None

Section 4 Operation and Maintenance

SAFETY MESSAGES

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

Warnings

⚠WARNING

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

- Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

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

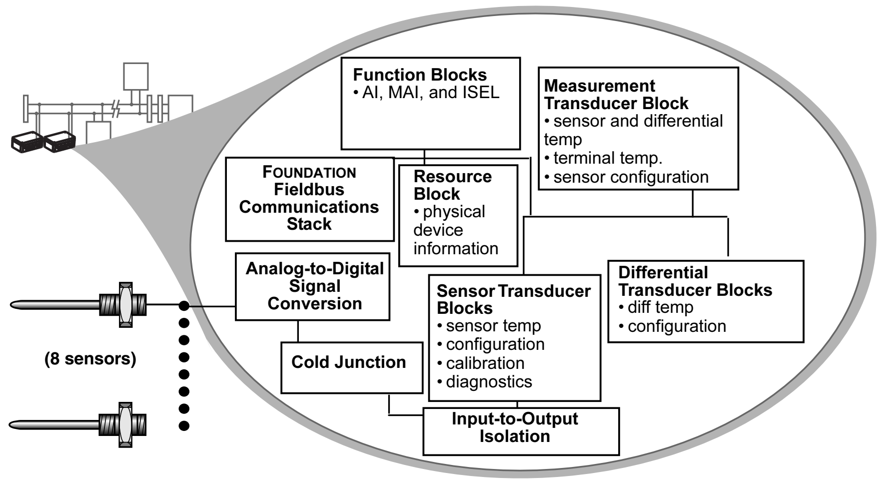
Electrical shock could cause death or serious injury.

- If the senor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

FOUNDATION FIELDBUS INFORMATION

FOUNDATION fieldbus is an all-digital, serial, two-way, multidrop communication protocol that interconnects devices such as transmitters and valve controllers. It is a local area network (LAN) for instruments that enables basic control and I/O to be moved to the field devices. The Model 848T uses FOUNDATION fieldbus technology developed and supported by Emerson Process Management and the other members of the independent Fieldbus Foundation.

Table 4-1. Block Diagram for the Model 848T



Commissioning (Addressing)

To be able to setup, configure, and have it communicate with other devices on a segment, a device must be assigned a permanent address. Unless requested otherwise, it is assigned a temporary address when shipped from the factory.

If there are two or more devices on a segment with the same address, the first device to start up will use the assigned address (ex. Address 20). Each of the other devices will be given one of the four available temporary addresses. If a temporary address is not available, the device will be unavailable until a temporary address becomes available.

Use the host system documentation to commission a device and assign a permanent address.

HARDWARE MAINTENANCE

The 848T has no moving parts and requires a minimal amount of scheduled maintenance. If a malfunction is suspected, check for an external cause before performing the diagnostics presented below.

Sensor Check

⚠ To determine whether the sensor is causing the malfunction, connect a sensor calibrator or simulator locally at the transmitter. Consult an Emerson Process Management representative for additional temperature sensor and accessory assistance.

Communication/Power Check

If the transmitter does not communicate or provides an erratic output, check for adequate voltage to the transmitter. The transmitter requires between 9.0 and 32.0 VDC at the terminals to operate with complete functionality. Check for wire shorts, open circuits, and multiple grounds.

Resetting the Configuration (RESTART)

There are two types of restarts available in the Resource Block. The following section outlines the usage for each of these. For further information, see RESTART in Table 3-2 on page 3-6.

Restart Processor (cycling)

Performing a Restart **Processor** has the same effect as removing power from the device and reapplying power.

Restart with Defaults

Performing a Restart with **Defaults** resets the static parameters for all of the blocks to their initial state. This is commonly used to change the configuration and/or control strategy of the device, including any custom configurations done at the Rosemount factory.

TROUBLESHOOTING

FOUNDATION Fieldbus

Symptom	Possible Cause	Corrective Action
Device does not show up in the live list	Network configuration parameters are incorrect	Set the network parameters of the LAS (host system) according to the FF Communications Profile ST: 8 MRD: 10 DLPDU PhLO: 4 MID: 7 TSC: 4 (1 ms) T1: 1920000 (60 s) T2: 5760000 (180 s) T3: 480000 (15 s)
	Network address is not in polled range	Set first Unpolled Node and Number of UnPolled Nodes so that the device address is within range
	Power to the device is below the 9 VDC minimum	Increase the power to at least 9V
	Noise on the power / communication is too high	Verify terminators and power conditioners are within specification Verify that the shield is properly terminated and not grounded at both ends. It is best to ground the shield at the power conditioner
Device that is acting as a LAS does not send out CD	LAS Scheduler was not downloaded to the Backup LAS device	Ensure that all of the devices that are intended to be a Backup LAS are marked to receive the LAS schedule
All devices go off live list and then return	Live list must be reconstructed by Backup LAS device	Current link setting and configured links settings are different. Set the current link setting equal to the configured settings.

Resource Block

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to something other than OOS.
	Memory Failure	BLOCK_ERR will show the lost NV Data or Lost Static Data bit set. Restart the device by setting RESTART to Processor. If the block error does not clear, call the factory.
Block Alarms Will not work	Features	FEATURES_SEL does not have Alerts enabled. Enable the report bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.

Measurement Transducer Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to AUTO
	A/D board check sum error	The A/D board has a a serious error. See “Measurement Transducer Block Diagnostics” on page 3-14
	Resource block	The actual mode of the Resource block in OOS. See Resource Block Diagnostics for corrective action
One or more of the primary values or differential value statuses are BAD	Measurement	See “Measurement Transducer Block Diagnostics” on page 3-14

Sensor Transducer Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to something other than OOS.
	A/D board check sum error	The A/D board has a checksum error. See Measurement Transducer Block “Measurement Transducer Block Diagnostics” on page 3-14
	Resource block	The actual mode of the Resource block is in OOS. See Resource Block Diagnostics for corrective action.
	Measurement Transducer Block	The actual mode of the Measurement Transducer Block is OOS.
The primary value is BAD	Measurement	Look at the SENSOR_STATUS parameter (See Table 3-9 on page 3-15). See “Measurement Transducer Block Diagnostics” on page 3-14

Differential Transducer Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to something other than OOS.
	A/D board check sum error	The A/D board has a checksum error. See “Measurement Transducer Block Diagnostics” on page 3-14
	Resource block	The actual mode of the Resource block in OOS. See Resource Block Diagnostics for corrective action.
	Measurement Transducer Block	The actual mode of the Measurement Transducer Block is OOS.
The differential value status is BAD	Measurement	Component Sensor is OOS Look at the DIFFERENTIAL_STATUS parameter (See DIFFERENTIAL_STATUS in Table 3-10 on page 3-17). See “Measurement Transducer Block Diagnostics” on page 3-14

Appendix A Reference Data

FUNCTIONAL SPECIFICATIONS

Inputs

Eight independently configurable channels including combinations of 2- and 3-wire RTDs, thermocouples, mV, and Ω inputs.

4-20 mA inputs using optional connector(s).

All sensor terminals are rated to 42.4 VDC.

Outputs

Manchester-encoded digital signal that conforms to IEC 1158-2 and ISA 50.02.

Status

If self-diagnostics detect a sensor burnout or a transmitter failure, the status of the measurement will be updated accordingly.

Ambient Temperature Limits

–40 to 185 °F (–40 to 85 °C)

Isolation

Input/output isolation is tested to 500 VAC rms (707 VDC). Input/input isolation between each sensor input connector is tested to 500 VAC rms (707 VDC). Input/input isolation between sensors on the same input connector is 3 VAC at 50 – 60 Hz, 1.5 VDC.

Power Supply

Powered over FOUNDATION fieldbus with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 V dc, 22 mA maximum. (Transmitter power terminals are rated to 42.4 V dc.)

Transient Protection

The transient protector (option code T1) helps to prevent damage to the transmitter from transients induced on the loop wiring by lightening, welding, heavy electrical equipment, or switch gears. This option is installed at the factory for the Rosemount 848T and is not intended for field installation.

ASME B 16.5 (ANSI)/IEEE C62.41-1991

(IEEE 587), Location Categories A2, B3.

6 kV / 3 kA peak (1.2 x 50 μS Wave 8 x 20 μS Combination Wave)

6 kV / 0.5 kA peak (100 kHz Ring Wave)

4 kV peak EFT (5 x 50 nS Electrical Fast Transient)

Update Time

Approximately 1.5 seconds to read all eight inputs.

Humidity Limits

0–100% non-condensing relative humidity

Turn-on Time

Performance within specifications is achieved in less than 50 seconds after power is applied to the transmitter.

Alarms

The AI and ISEL function blocks allow the user to configure the alarms to HI-HI, HI, LO, or LO-LO with a variety of priority levels and hysteresis settings.

Backup Link Active Scheduler (LAS)

The transmitter is classified as a device link master, which means it can function as a Link Active Scheduler (LAS) if the current link master device fails or is removed from the segment.

The host or other configuration tool is used to download the schedule for the application to the link master device. In the absence of a primary link master, the transmitter will claim the LAS and provide permanent control for the H1 segment.

FOUNDATION Fieldbus Parameters

Schedule Entries	25
Links	30
Virtual Communications Relationships (VCR)	20

PHYSICAL SPECIFICATIONS

Mounting

The Rosemount 848T can be mounted directly onto a DIN rail or it can be ordered with an optional junction box. When using the optional junction box, the transmitter can be mounted onto a panel or to a 2-in. pipe stand (with option code B6).

Entries for Optional Junction Box

No entry

- Used for custom fittings

Cable Gland

- 9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable

Conduit

- 5 plugged 0.86-in. diameter holes suitable for installing $^1/_2$-in. NPT fittings.

Materials of Construction for Optional Junction Box

Junction Box Type	Paint
Aluminum	Epoxy Resin
Plastic	NA
Stainless Steel	NA

Weight

Assembly	Weight		
	oz	lb	kg
Rosemount 848T only	9.60	0.60	0.27
Aluminum(1)	78.2	4.89	2.22
Plastic (1)	58.1	3.68	1.65
Stainless Steel (1)	77.0	4.81	2.18

(1) Add 35.2 oz (2.2 lb, 0.998 kg) for nickel-plated brass glands

Environmental Ratings

NEMA 4X, CSA Enclosure Type 4X, and IP66 with optional junction box.

FUNCTION BLOCKS

Analog Input (AI)

- Processes the measurement and makes it available on the fieldbus segment.
- Allows filtering, alarming, and engineering unit changes.

Input Selector (ISEL)

- Used to select between inputs and generate an output using specific selection strategies such as minimum, maximum, midpoint, or average temperature.
- Since the temperature value always contains the measurement status, this block allows the selection to be restricted to the first “good” measurement.

Multiple Analog Input Block (MAI)

- The MAI block allows the eight AI blocks to be multiplexed together so they serve as one function block on the H1 segment, resulting in greater network efficiency.

PERFORMANCE SPECIFICATIONS

The transmitter maintains a specification conformance of at least $\pm 3\sigma$.

Stability

- ±0.1% of reading or 0.1 °C (0.18 °F), whichever is greater, for 2 years for RTDs.
- ±0.1% of reading or 0.1 °C (0.18 °F), whichever is greater, for 1 year for thermocouples.

Self Calibration

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

Vibration Effect

Transmitters are tested to the following vibration conditions with no effect on performance:

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

CE Electromagnetic Compatibility Compliance Testing

Meets the criteria under IEC 61326 Amendment 1, 2000:

Emissions
• 30–230 MHz, 30 dB (uV/m) at 10 m
• 230–1000 MHz, 37 dB (uV/m) at 10 m

Susceptibility	
• ESD	• 4 kV contact discharge • 8 kV air discharge
• Radiated	• 80 – 1000 MHz at 10 V/m AM
• Burst	• 1 kV
• Surge	• 1 kV line–to-ground
• Conducted	• 150 kHz to 80 MHz at 3V
• Magnetic	• 50 Hz at 30 A/m

Accuracy

TABLE 1. Input Options/Accuracy

Sensor Option	Sensor Reference	Input Ranges °C	Input Ranges °F	Accuracy Over Range(s) °C	Accuracy Over Range(s) °F
2- and 3-Wire RTDs					
Pt 100 (α = 0.00385)	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.30	± 0.54
Pt 100 (α = 0.003916)	JIS 1604, 1981	–200 to 645	–328 to 1193	± 0.30	± 0.54
Pt 200	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.54	± 0.98
Pt 500	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.38	± 0.68
Pt 1000	IEC 751; α = 0.00385, 1995	–200 to 300	–328 to 572	± 0.40	± 0.72
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	± 0.30	± 0.54
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	± 3.20	± 5.76
Thermocouples—Cold Junction Adds + 0.5 °C to Listed Accuracy					
NIST Type B (Accuracy varies according to input range)	NIST Monograph 175	100 to 300 301 to 1820	212 to 572 573 to 3308	± 6.00 ± 1.54	± 10.80 ± 2.78
NIST Type E	NIST Monograph 175	–50 to 1000	–58 to 1832	± 0.40	± 0.72
NIST Type J	NIST Monograph 175	–180 to 760	–292 to 1400	± 0.70	± 1.26
NIST Type K	NIST Monograph 175	–180 to 1372	–292 to 2502	± 1.00	± 1.80
NIST Type N	NIST Monograph 175	–200 to 1300	–328 to 2372	± 1.00	± 1.80
NIST Type R	NIST Monograph 175	0 to 1768	32 to 3214	± 1.50	± 2.70
NIST Type S	NIST Monograph 175	0 to 1768	32 to 3214	± 1.40	± 2.52
NIST Type T	NIST Monograph 175	–200 to 400	–328 to 752	± 0.70	± 1.26
DIN L	DIN 43710	–200 to 900	–328 to 1652	± 0.70	± 1.26
DIN U	DIN 43710	–200 to 600	–328 to 1112	± 1.70	± 1.26
w5Re26	ASTME 988-96	0 to 2000	32 to 3632	± 1.60	± 2.88
Millivolt Input(1)—Not approved for use with CSA Option Code I6		–10 to 100 mV		± 0.05 mV	
2- and 3-Wire Ohm Input		0 to 2000 ohms		± 0.90 ohm	
Multipoint Sensors(2)					

(1) 4–20 mA inputs are scaled to 20 – 100 mV.
(2) Multipoint (up to 8 points) thermocouples and RTDs are available for purchase with the Rosemount 848T. Input ranges and accuracy for these sensors will depend on the specific multipoint sensor chosen. For more information, contact your local Rosemount representative.

Accuracy Notes

Differential capability exists between any two sensor types:

For all differential configurations, the input range is X to +Y where

X = Sensor 1 minimum - Sensor 2 max.
Y = Sensor 1 maximum - Sensor 2 min.

Accuracy for differential configurations:

If sensor types are similar (for example, both RTDs or both thermocouples), the accuracy = 1.5 times worst case accuracy of either sensor type. If sensor types are dissimilar (for example, one RTD and one thermocouple), the accuracy = Sensor 1 Accuracy + Sensor 2 Accuracy.

Ambient Temperature Effect

Transmitters may be installed in locations where the ambient temperature is between –40 and 85 °C (–40 and 185 °F).

TABLE 2. Ambient Temperature Effects

NIST Type	Accuracy per 1.0 °C (1.8 °F) Change in Ambient Temperature(1)	Temperature Range (°C)
RTD		
Pt 100 (α = 0.00385)	• 0.003 °C (0.0054 °F)	NA
Pt 100 (α = 0.003916)	• 0.003 °C (0.0054 °F)	NA
Pt 500, Pt 1000, Ni 120	• 0.003 °C (0.0054 °F)	NA
Pt 200	• 0.004 °C (0.0072 °F)	NA
Cu 10	• 0.03 °C (0.054 °F)	NA
Thermocouple (R = the value of the reading)		NA
Type B	• 0.014 °C • 0.032 °C - (0.0025% of (R - 300)) • 0.054 °C - (0.011% of (R - 100))	• R ≥ 1000 • 300 ≤ R < 1000 • 100 ≤ R < 300
Type E	• 0.005 °C + (0.00043% of R)	• All
Type J, DIN Type L	• 0.0054 °C + (0.00029% of R) • 0.0054 °C + (0.0025% of |R|)	• R ≥ 0 • R < 0
Type K	• 0.0061 °C + (0.00054% of R) • 0.0061 °C + (0.0025% of |R|)	• R ≥ 0 • R < 0
Type N	• 0.0068 °C + (0.00036% of R)	• All
Type R, Type S	• 0.016 °C • 0.023 °C - (0.0036% of R)	• R ≥ 200 • R < 200
Type T, DIN Type U	• 0.0064 °C • 0.0064 °C - (0.0043% of |R|)	• R ≥ 0 • R < 0
Millivolt	0.0005 mV	NA
2- and 3-wire Ohm	0.0084 ohms	NA

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

Ambient Temperature Notes

Examples:

When using a Pt 100 (a = 0.00385) sensor input and the transmitter is at 40 °C ambient temperature, temperature effects would be:
0.003 °C x (40 - 20) = 0.06 °C.

Worst case error would be:
Sensor Accuracy + Temperature Effects = 0.30 °C + 0.06 = 0.36°C.

Total Probable Error =

$$\sqrt{0.30^2 + 0.06^2} = \quad °C$$

Analog to Fieldbus Performance

4– 20 mA inputs are scaled to 20 – 100 mV.

Accuracy(1):0.0625% of span

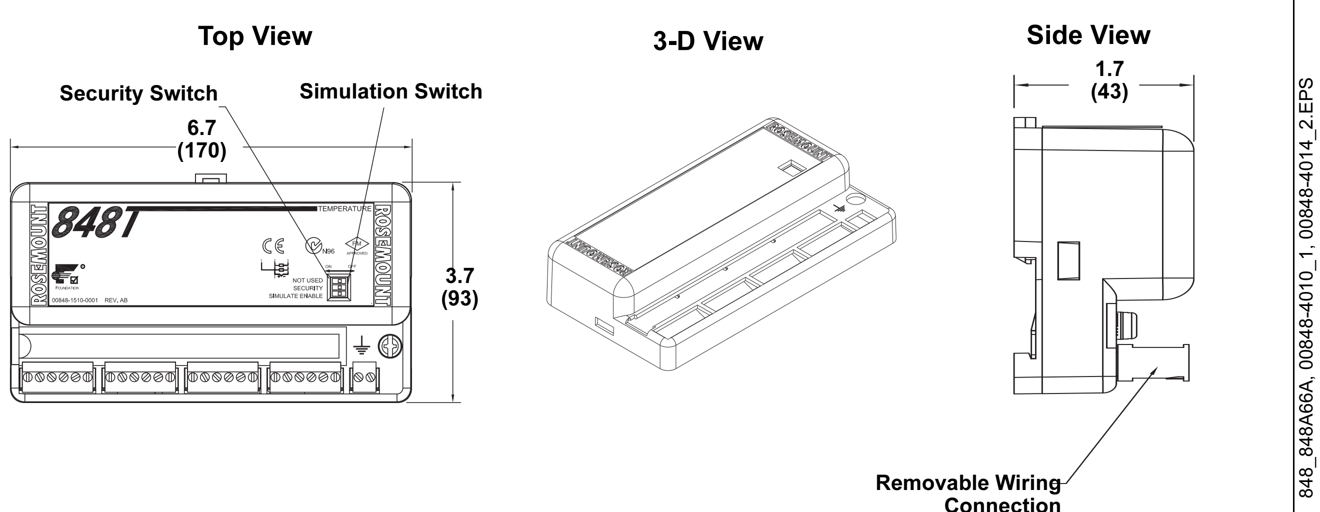
Temperature Effect: [0.002% of reading + 0.000625% of span] per 1.0 °C change in Ambient Temperature.

(1) *To obtain accuracy, the mV input must be calibrated while using the optional analog connector.*

DIMENSIONAL DRAWINGS

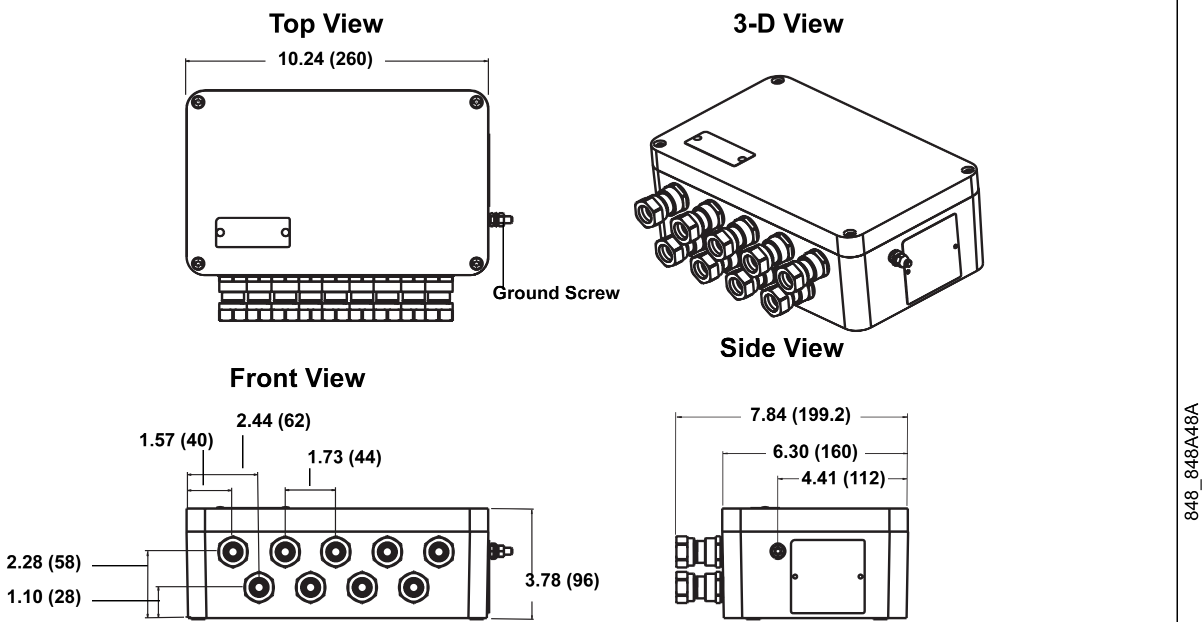
Junction Boxes with no entries (option codes JP1, JA1, and JS1)– external dimensions are the same as those outlined for the other junction box materials in this section.

Rosemount 848T



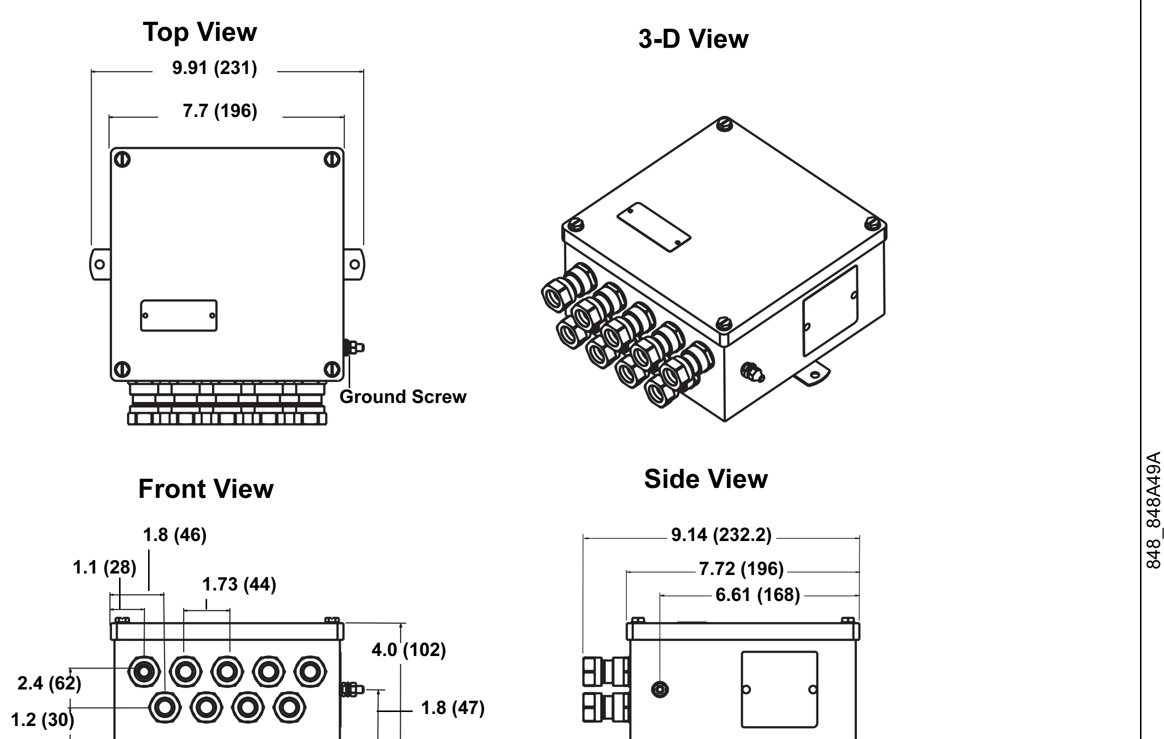
Dimensions are in inches (millimeters)

Aluminum/Plastic Junction Box—Cable Gland (option codes JA2 and JP2)



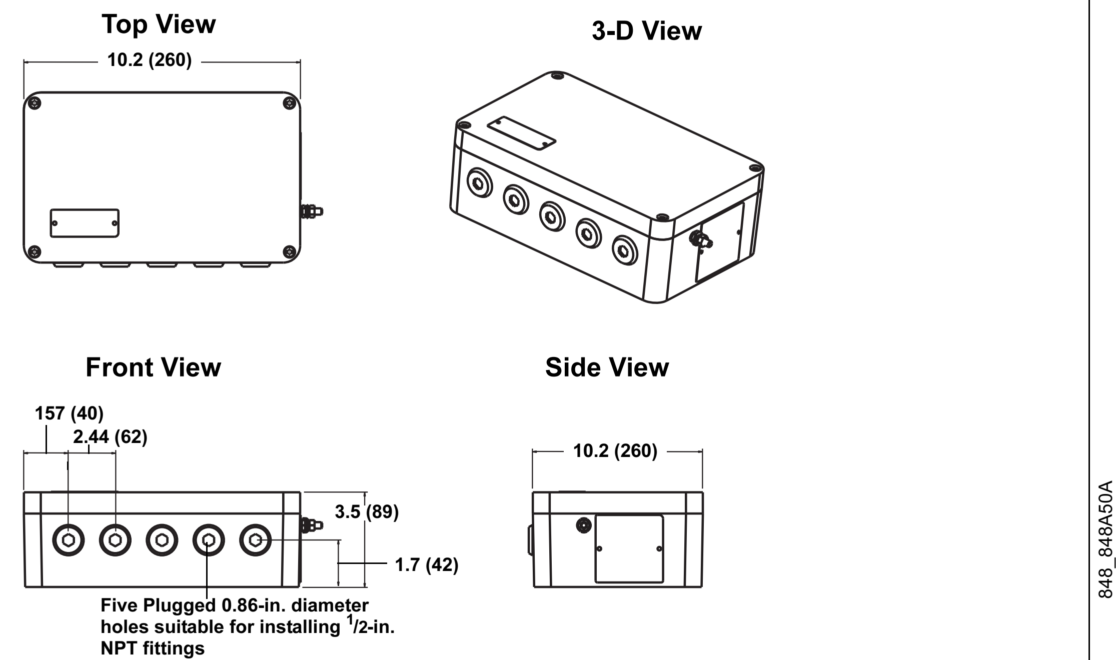
Dimensions are in inches (millimeters)

Stainless Steel Junction Box—Cable Gland (option code JS2)



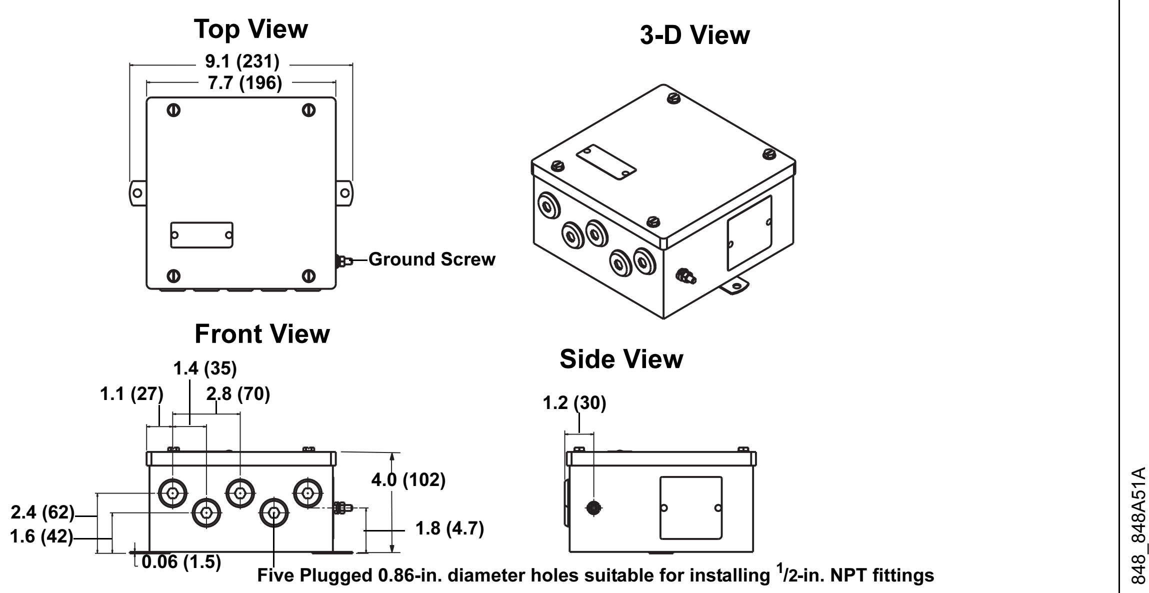
Dimensions are in inches (millimeters)

Aluminum/Plastic Junction Box—Conduit Entry (option codes JA3 and JP3)



Dimensions are in inches (millimeters)

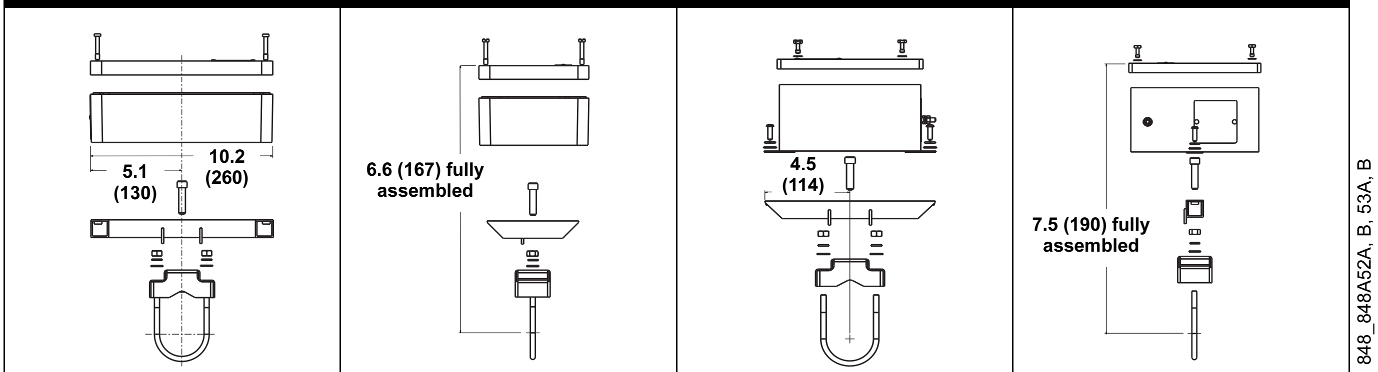
Stainless Steel Junction Box—Conduit Entry (option code JS3)



Dimensions are in inches (millimeters)

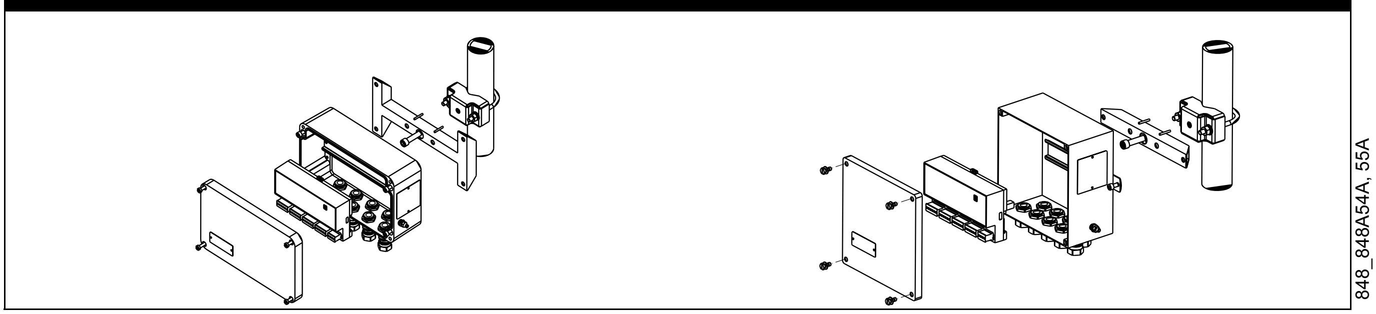
Mounting Options

Aluminum/Plastic Junction Box (styles JA and JP)		Stainless Steel Junction Box (style JS)	
Front View	Side View	Front View	Side View



Dimensions are in inches (millimeters)

Aluminum/Plastic Junction Box Mounted on a Vertical Pipe	Stainless Steel Junction Box Mounted on a Vertical Pipe



ORDERING INFORMATION

Model	Product Description	
848T	Eight Input Temperature Transmitter	
Code	**Communications Protocol**	
F	FOUNDATION™ fieldbus digital signal (includes 8 AI and 4 ISEL function blocks, and Backup Link Active Scheduler)	
Code	**Product Certifications(1)**	**Rosemount Junction Box required?**
I5	FM Intrinsic Safety and Non-Incendive	No
IE	FM FISCO (Fieldbus Intrinsically Safe Concept) and Non-incendive Class I, Division 2	No
N5	FM Class I, Division 2 Dust Ignition Proof	Yes
I6	CSA Intrinsic Safety and Non-Incendive	No
IF	CSA FISCO (Fieldbus Intrinsically Safe Concept) and Suitable for Class I, Division 2	No
I1	ATEX Intrinsic Safety	No
IA	ATEX FISCO (Fieldbus Intrinsically Safe Concept)	No
N1	ATEX Type n	Yes
NC	ATEX Type n Component	No(2)
ND	ATEX Dust Ignition Proof	Yes
I7	IEXEx Intrinsic Safety (Consult Factory)	No
N7	IEXEx Type n (Consult Factory)	No(3)
IG	IECEx FISCO (Fieldbus Intrinsically Safe Concept)	No
I2	CEPEL Intrinsic Safety	No
NA	No Approval	No
Code	**Input Types**	
S001	RTDs and Thermocouples	
S002(4)	RTDs, Thermocouples, and 4–20 mA	
Code	**Options**	
	Transient Protection	
T1	Transient Protection	
	Mounting Kit Options	
B6	Universal Mounting Bracket for 2-in. pipe mounting and for panel mounting – SST bracket and bolts	
	Non Explosion-Proof Junction Box	
	Plastic Junction Box	
JP1	No Entries	
JP2	Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	
JP3	Conduit Entries (5 plugged holes, suitable for installing $^1/_2$-in. NPT fittings)	
	Aluminum Junction Box	
JA1	No Entries	
JA2	Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	
JA3	Conduit Entries (5 plugged holes, suitable for installing $^1/_2$-in. NPT fittings)	
	Stainless Steel Junction Box	
JS1	No Entries	
JS2	Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	
JS3	Conduit Entries (5 plugged holes, suitable for installing $^1/_2$-in. NPT fittings)	

Model	Product Description
	Custom Software Configuration Request
C1	Factory configuration of date, descriptor, and message fields (CDS required)
	Configuration(5) Options
F5	50 Hz Line Voltage Filter
	Special Temperature Test
LT	Test to -60°F (-51.1°C)
Typical Model Number: 848T F I5 S001 T1 B6 JA2	

(1) Consult factory for availability.
(2) The Rosemount 848T ordered with option code NC is not approved as a stand-alone unit. Additional system certification is required.
(3) The Rosemount 848T must be installed so it is protected to at least the requirements of IP54; All listed Junction Boxes fulfill this requirement.
(4) Not available with product certifications.
(5) Configuration is the same for all eight inputs.

Appendix B Product Certificates

HAZARDOUS LOCATIONS CERTIFICATES

North American Approvals

Factory Mutual (FM) Approvals

I5 Intrinsically Safety and Non-Incendive
Intrinsically Safe for use in Class I, Division 1, Groups A, B,C, D; when installed per Rosemount drawing 00848-4402.

Temperature Code:
T4(T_{amb} = – 40 to 60 °C)

Non-incendive for use in Class I, Division 2, Groups A, B, C, D (suitable for use with non-incendive field wiring) when installed in accordance with Rosemount Drawing 00848-4402.

Temperature Code:
T4A (T_{amb} = –40 to 85 °C)
T5 (T_{amb} = –40 to 70 °C)

Table B-1. FM Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.02 V
I_i = 300 mA	I_o = 13.6 mA
P_i = 1.3 W	P_o = 0.04 W
C_i = 2.1nF	C_a = 1.36 μF
L_i = 0	L_a = 160 mH

IE FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
Intrinsically safe for use in Class I, Division 1, Groups A, B,C, D; when installed in accordance with Rosemount Drawing 00848-4402.

Temperature Code:
T4(T_{amb} = – 40 to 60 °C)

Non-incendive for use in Class I, Division 2, Groups A, B, C, D (suitable for use with non-incendive field wiring); when installed in accordance with Rosemount Drawing 00848-4402.

Temperature Code:
T4A (T_{amb} = –40 to 85 °C)
T5 (T_{amb} = –40 to 70 °C)

Table B-2. Entity Parameters

Power/Bus	Sensor
U_i = 17.5 V	U_o = 12.02 V
I_i = 380 mA	I_o = 13.6 mA
P_i = 5.32 W	P_o = 0.04W
C_i = 2.1nF	C_a = 1.36 μF
L_i = 0	L_a = 160 mH

N5 Dust Ignition-Proof Dust Ignition Proof
For use in Class II, III, Division 1, Groups E, F, G. Class I, Division 2, Groups A, B, C, D; when installed in accordance with Rosemount Drawing 00848-4402.

Temperature Code:
T4A (T_{amb} = –40 to 85 °C)
T5 (T_{amb} = –40 to 70 °C)

Canadian Standards Association (CSA) Approvals

I6 Intrinsic Safety and Non-Incendive
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4403.

Temperature Code:
T3C (T_{amb} = –50 to 60 °C)

Suitable for Class I, Division 2, Groups A, B, C, D. Rated 42.4 VDC max.

Table B-3. CSA Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.02 V
I_i = 300 mA	I_o = 11.8 mA
C_i = 2.1nF	C_a = 1.36 μF
L_i = 0	L_a = 225 mH

IF FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4403.

Temperature Code:
T3C (T_{amb} = –50 to 60 °C)

Suitable for Class I, Division 2, Groups A, B, C, D.Rated 42.4 VDC max.

Table B-4. CSA Approved Entity Parameters

Power/Bus	Sensor
U_i = 17.5 V	U_o = 12.02 V
I_i = 380 mA	I_o = 11.8 mA
C_i = 2.1nF	C_a = 1.36 μF
L_i = 0	L_a = 225 mH

European Approvals

CENELEC Approvals

I1 Intrinsic Safety
Certification Number: Baseefa02ATEX0010X
ATEX Marking Ⓔx II 1 G
EEx ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-5. CENELEC Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.5 V
I_i = 300 mA	I_o = 66 mA
P_i = 1.3 W	P_o = 40 mW
C_i = 0	C_i = 0
L_i = 0	L_i = 0

Special Conditions for Safe Use (x):

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

The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN50 020:1994 when the optional transient protection (FISCO) board is fitted and this must be taken into account when installing the apparatus.

IA FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
Certification Number: Baseefa02ATEX0010X
ATEX Marking Ⓔx II 1 G
EEx ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-6. CENELEC Approved Entity Parameters

Power/Bus	Sensor
U_i = 17.5 V	U_o = 12.5 V
I_i = 380 mA	I_o = 66 mA
P_i = 5.32 W	P_o = 40 mW
C_i = 0	C_i = 0
L_i = 0	L_i = 0

Special Conditions for Safe Use (x):

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

The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN50 020:1994 when the optional transient protection (FISCO) board is fitted and this must be taken into account when installing the apparatus.

N1 CENELEC Type n
Certification Number: BAS01ATEX3199X
ATEX Marking Ex II 3 G
EEx nL IIC T5 (T_{amb} = –40 to 65 °C)

Table B-7. Entity Parameters

Power/Bus	Sensor
U_i = 42.4 V	U_o = 5 V
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 µF
	L_o = 1000 mH

Special Conditions for Safe Use (x):

1. Provisions shall be made, external to the apparatus, to prevent the rated voltage (42.4 V dc) being exceeded by transient disturbances of more than 40%.

2. The ambient temperature range of use shall be the most restrictive of the apparatus, cable gland, or blanking plug.

NC CENELEC Type n Component
Certification Number: BAS01ATEX3198U
ATEX Marking Ex II 3 G
EEx nL IIC T4 (T_{amb} = –50 to 85 °C)
EEx nL IIC T5 (T_{amb} = –50 to 70 °C)

Special Conditions for Safe Use (x):

1. The component must be housed in a suitably certified enclosure.

2. Provision shall be made, external to the component, to prevent the rated voltage (42.4V d.c.) being exceeded by transient disturbances of more than 40%.TBD

ND CENELEC Dust Ignition Proof
Certification Number: BAS01ATEX1315X
ATEX Marking Ex II 1 D
T90C (T_{amb} = – 40 to 65 °C) IP66

Special Conditions for Safe Use (x):

1. The user must ensure that the maximum rated voltage and current (42.2 volts, 22 mA, DC) are not exceeded. All connections to other apparatus or associated apparatus shall have control over this voltage and current equivalent to a category “ib” circuit according to EN50020.

2. Component approved EEx e cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.

3. Any unused cable entry holes must be filled with component approved EEx e blanking plugs.

4. The ambient temperature range of use shall be the most restrictive of the apparatus, cable gland, or blanking plug.

Australian Approvals

Standard Australia Quality Assurance Service (SAA)

NOTE
Consult factory for SAA availability.

I7 Intrinsic Safety
Ex ia IIC

N7 Type n
Ex n IIC

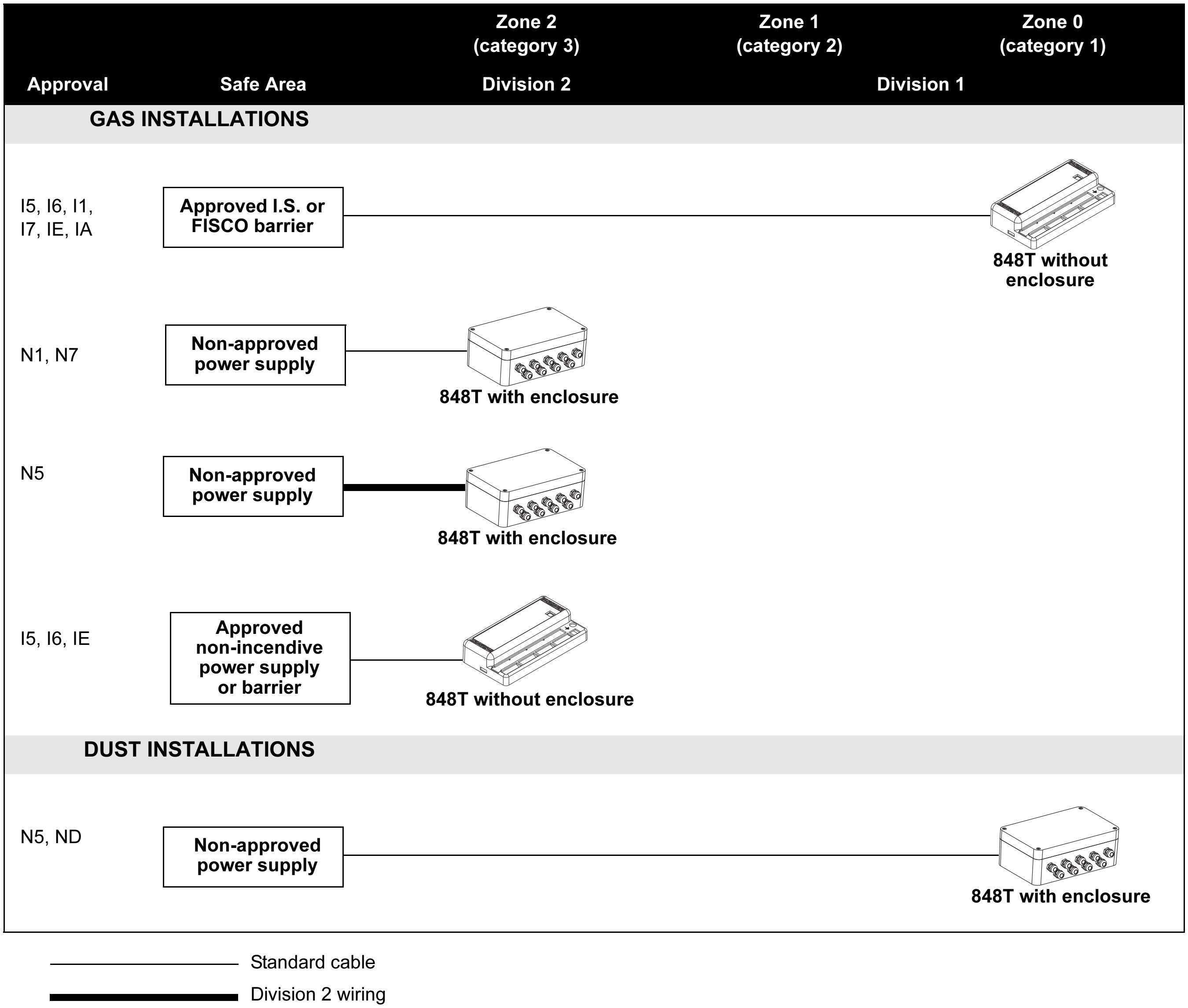
Brazilian Approval

Centro de Pesquisas de Energia Eletrica (CEPEL) Approval

NOTE
Consult factory for CEPEL availability.

I2 Intrinsic Safety
BR-Ex ia IIC T4

INTRINSICALLY SAFE AND NON-INCENDIVE INSTALLATIONS



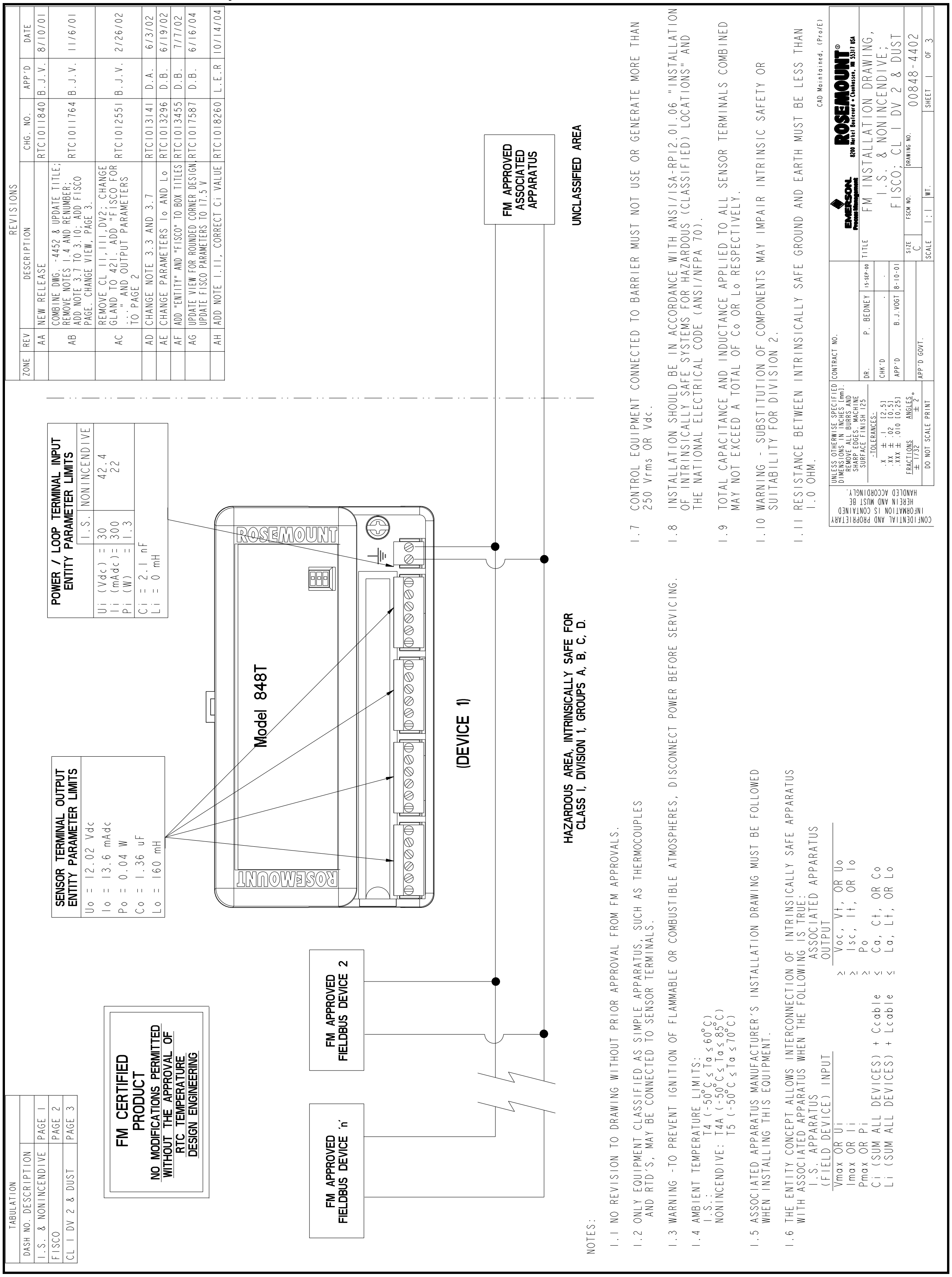
INSTALLATION DRAWINGS

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

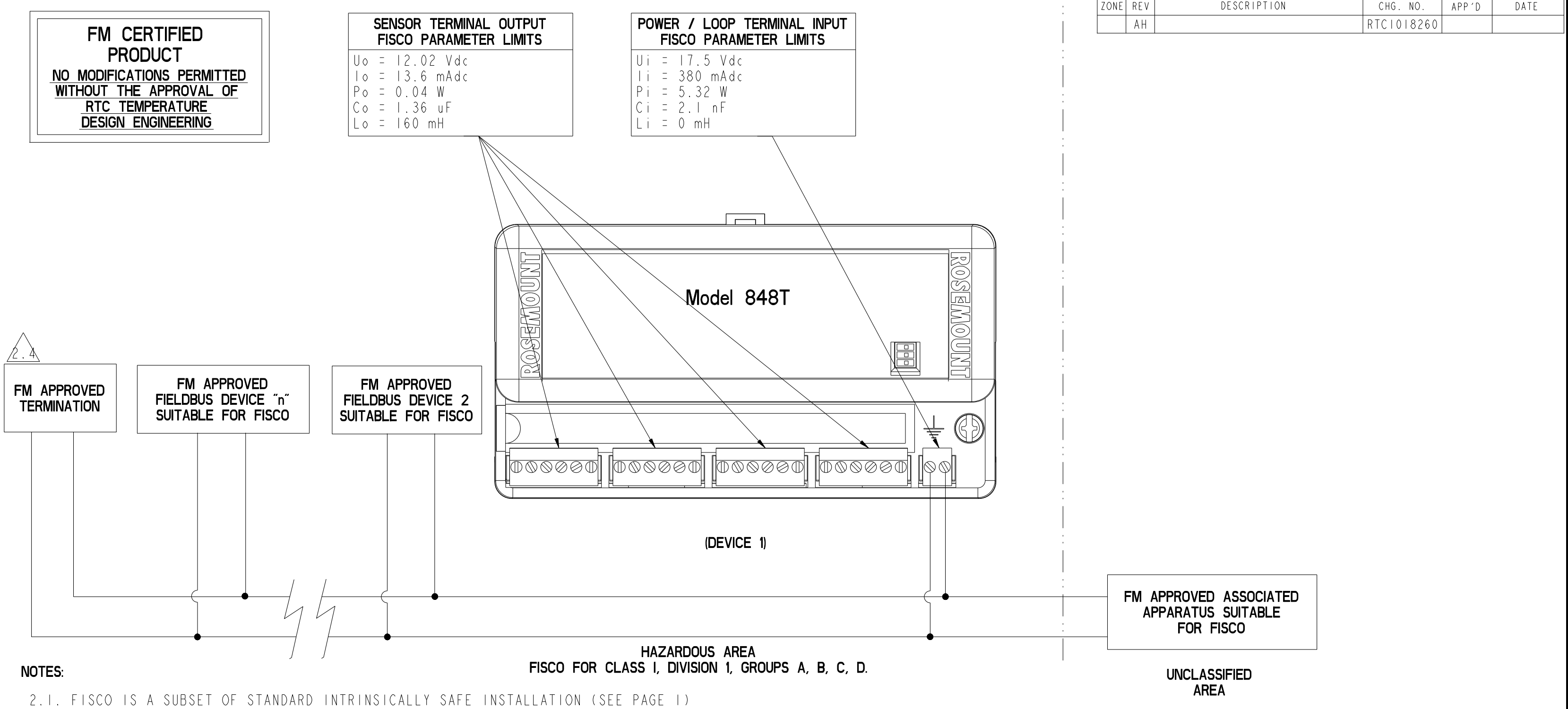
Rosemount Drawing 00848-4402, 3 Sheets
Factory Mutual Intrinsic Safety/ FISCO Installation Drawing

Rosemount Drawing 00848-4403, 2 Sheets
Canadian Standards Association Intrinsic Safety/FISCO Installation Drawing

Figure B-1. FM Intrinsic Safety/ FISCO



REVISIONS					
ZONE	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AH		RTC1018260		



NOTES:

2.1. FISCO IS A SUBSET OF STANDARD INTRINSICALLY SAFE INSTALLATION (SEE PAGE 1) EXCEPT AS SPECIFICALLY NOTED HERE.

2.2. THE FM FISCO INSTALLATION IS ONLY VALID WITH MODEL OPTION CODE IE.

WHAT IS FISCO?
FIELDBUS INTRINSICALLY SAFE CONCEPT IS A PARTICULAR, YET SUFFICIENTLY FLEXIBLE, AGREED UPON INSTALLATION CONFIGURATION. THIS ALLOWS FOR A CONTROLLED DISTRIBUTION OF THE ELECTRICAL CHARACTERISTICS AROUND THE SEGMENT.

WHAT ARE THE BENEFITS TO INSTALLING WITHIN THE BOUNDS OF THIS CONFIGURATION?
A. MORE DEVICES ARE ALLOWED ON THE FIELDBUS SINCE MORE POWER CAN BE APPLIED.
B. THE R, L, AND C CHARACTERISTICS OF THE FIELDBUS CABLE NEED NOT BE CALCULATED.

WIRING CONFIGURATION:
LENGTH
TRUNK CABLE ≤ 1000 m
SPUR CABLE ≤ 30 m
SPLICE ≤ 1 m
CABLE PROPERTIES:
LOOP RESISTANCE, R 15 TO 150 Omhs/Km
INDUCTANCE, L 0.4 TO 1 mH/Km
CAPACITANCE, C 80 TO 200 nF/Km

C= C LINE-TO-LINE +1/2 C LINE-TO-SHIELD (FOR BOTH LINES FLOATING WITH RESPECT TO SHIELD)
C= C LINE-TO-LINE + C LINE-TO-SHIELD (FOR ONE LINE TIED TO SHIELD)

APPARATUS CRITERIA:

2.3. Ci ≤ 5 nF AND Li ≤ 10 uH FOR EACH APPARATUS, OTHER THAN THE TERMINATOR, CONNECTED TO THE FIELDBUS.

2.4 R= 90 TO 100 Ohms AND C= 0 TO 2.2 uF FOR THE LINE TERMINATION. THIS TERMINATOR MAY BE INTEGRATED INTO AN APPARATUS.

2.5. EACH APPARATUS, OTHER THAN THE ASSOCIATED APPARATUS, MUST BE PASSIVE. (NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM.)

2.6. INTERCONNECTION IS ALLOWED WHEN THE FOLLOWING IS TRUE:

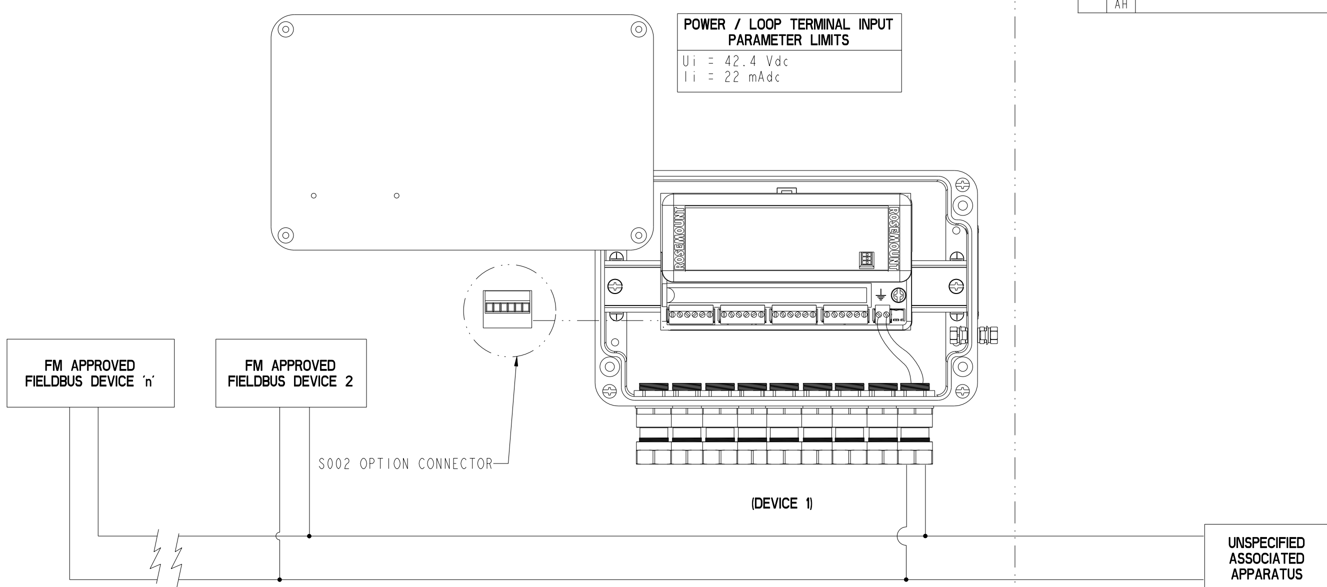
I.S APPARATUS (FIELD DEVICE) INPUT		ASSOCIATED APPARATUS OUTPUT
Vmax OR Ui	≥	Voc, Vt, OR Uo
Imax OR Ii	≥	Isc, It, OR Io
Pmax OR Pi	≥	Po

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD Maintained, (Pro/E)

DR. NGA DOAN	9/19/01	SIZE C	FSCM NO.	DRAWING NO. 00848-4402
		SCALE: 1:1	WT.	SHEET 2 OF 3

REVISIONS					
ZONE	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AH		RTC1018260		



HAZARDOUS AREA
DUST IGNITION PROOF FOR CLASS II, III, DIVISION I, GROUPS E, F, G
SUITABLE FOR CLASS I, DIVISION 2, GROUPS A, B, C, D

UNCLASSIFIED AREA

NOTES:

3.1. NO REVISION TO DRAWING WITHOUT PRIOR FACTORY MUTUAL APPROVAL.

3.2. ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS NOT GENERATING MORE THAN 15V, 100 mA AND 25 mW, SUCH AS THERMOCOUPLES AND RTD'S, MAY BE CONNECTED TO SENSOR TERMINALS.

3.3 WARNING - TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.

3.4. AMBIENT TEMPERATURE LIMITS:
CL I, DV 2: T4A ($-40°C \leq Ta \leq 85°C$)
T5 ($-40°C \leq Ta \leq 70°C$)
DUST: ($-40°C \leq Ta \leq 85°C$)

3.5. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS.

3.6. WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR DIVISION 2.

3.7. APPROVAL OF THE MODEL 848T COVERS OPERATION IN THE CLASS I, DIVISION 2 HAZARDOUS LOCATION WHEN INSTALLED IN A GENERAL PURPOSE ENCLOSURE. CLASS I, DIVISION 2 INSTALLATION WITH UNSPECIFIED ASSOCIATED APPARATUS REQUIRES WIRING FOR CLASS I, DIVISION 2 LOCATIONS.

3.8 CABLE GLANDS ARE TYPE HAWKE # 501/421 WITH CABLE DIAMETER OF 7.5 TO 11.9 mm.

3.9 APPROVAL OF THE MODEL 848T COVERS OPERATION IN THE CLASS II, III, DIVISION I, 2 HAZARDOUS LOCATION ONLY WHEN INSTALLED IN A NATIONALLY RECOGNIZED TEST LABORATORY (NRTL) APPROVED DUST-TIGHT ENCLOSURE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

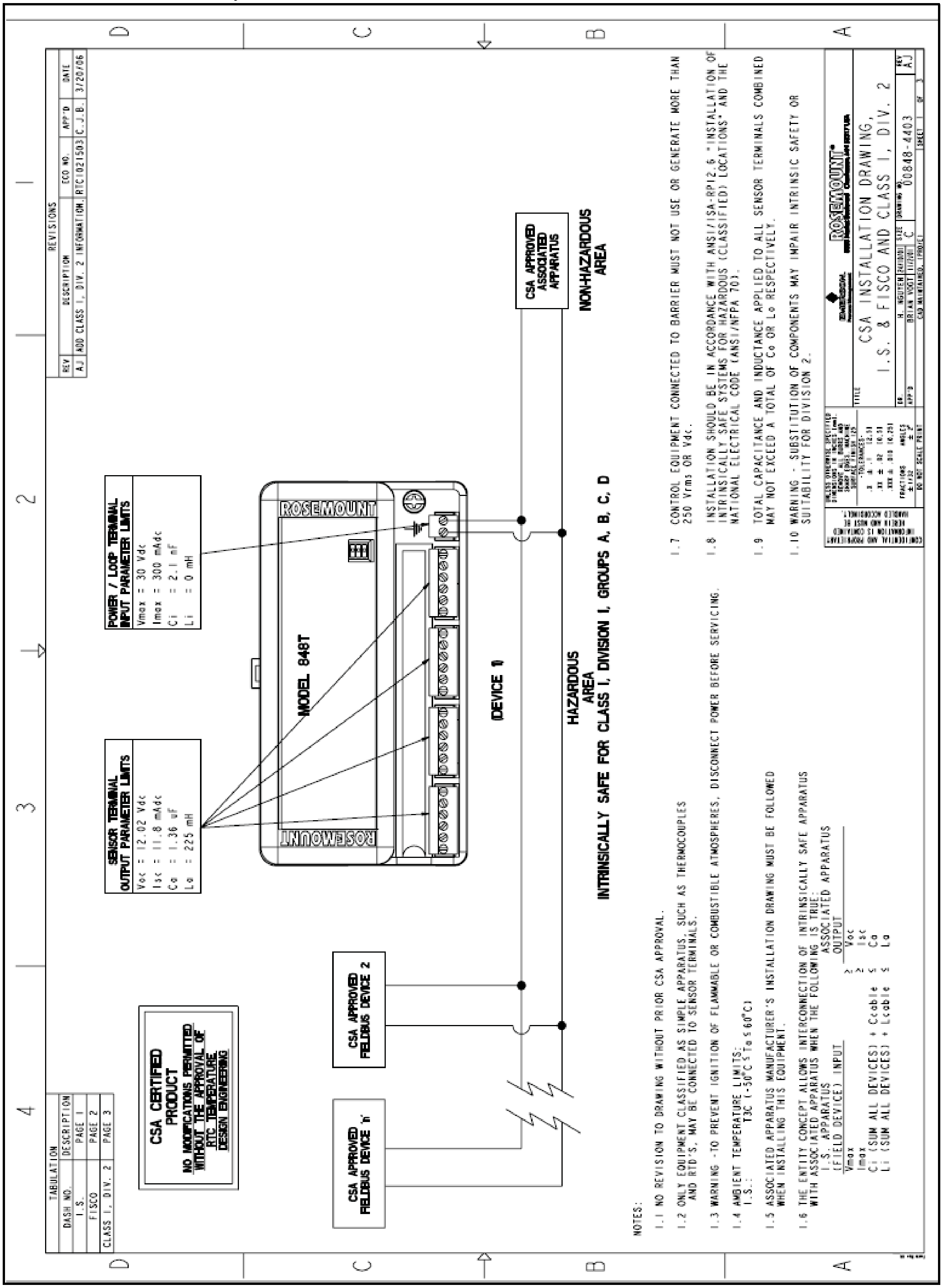
3.10 INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND THE NATIONAL ELECTRICAL CODE (ANSI-NFPA 70).

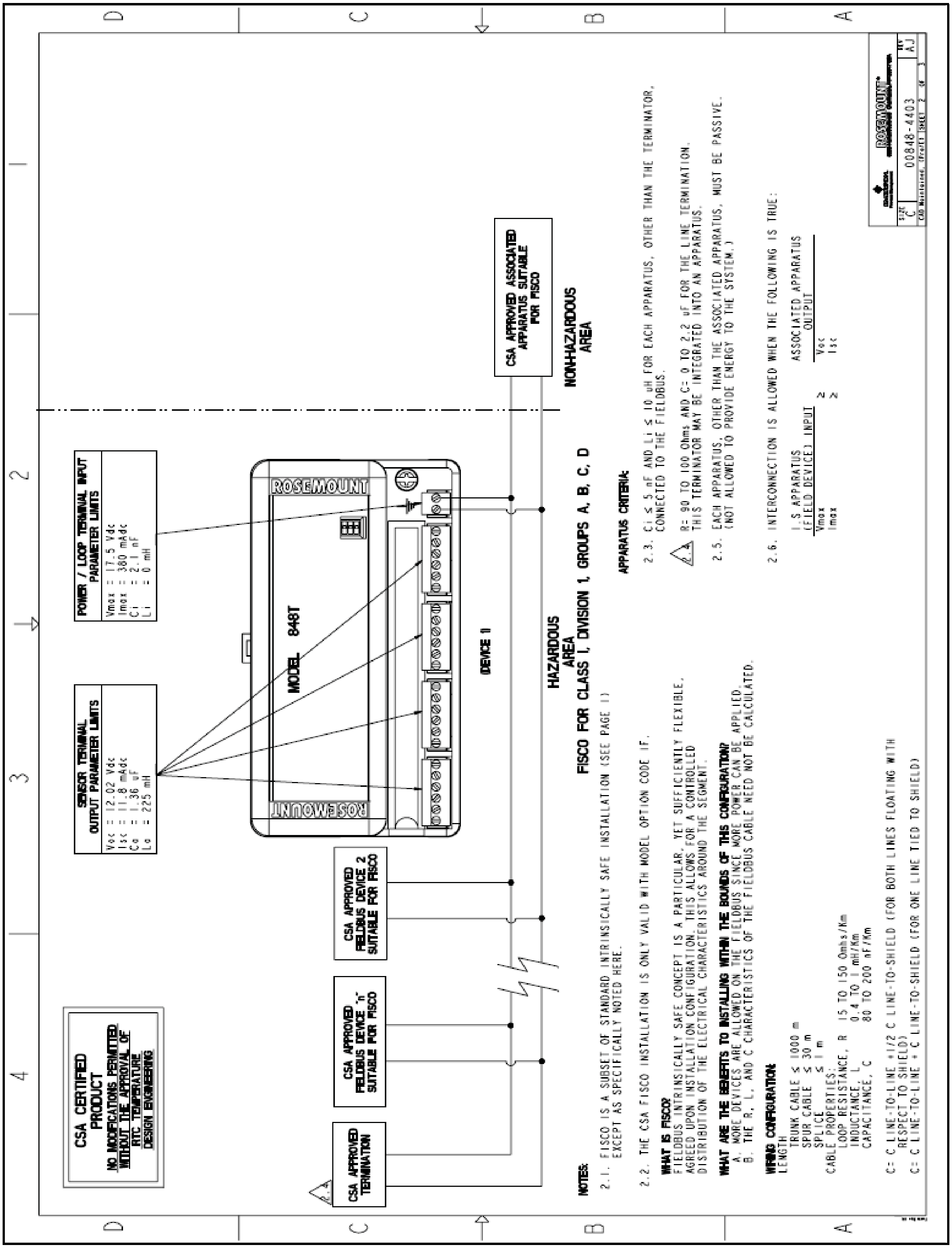
FM CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT THE APPROVAL OF RTC TEMPERATURE DESIGN ENGINEERING

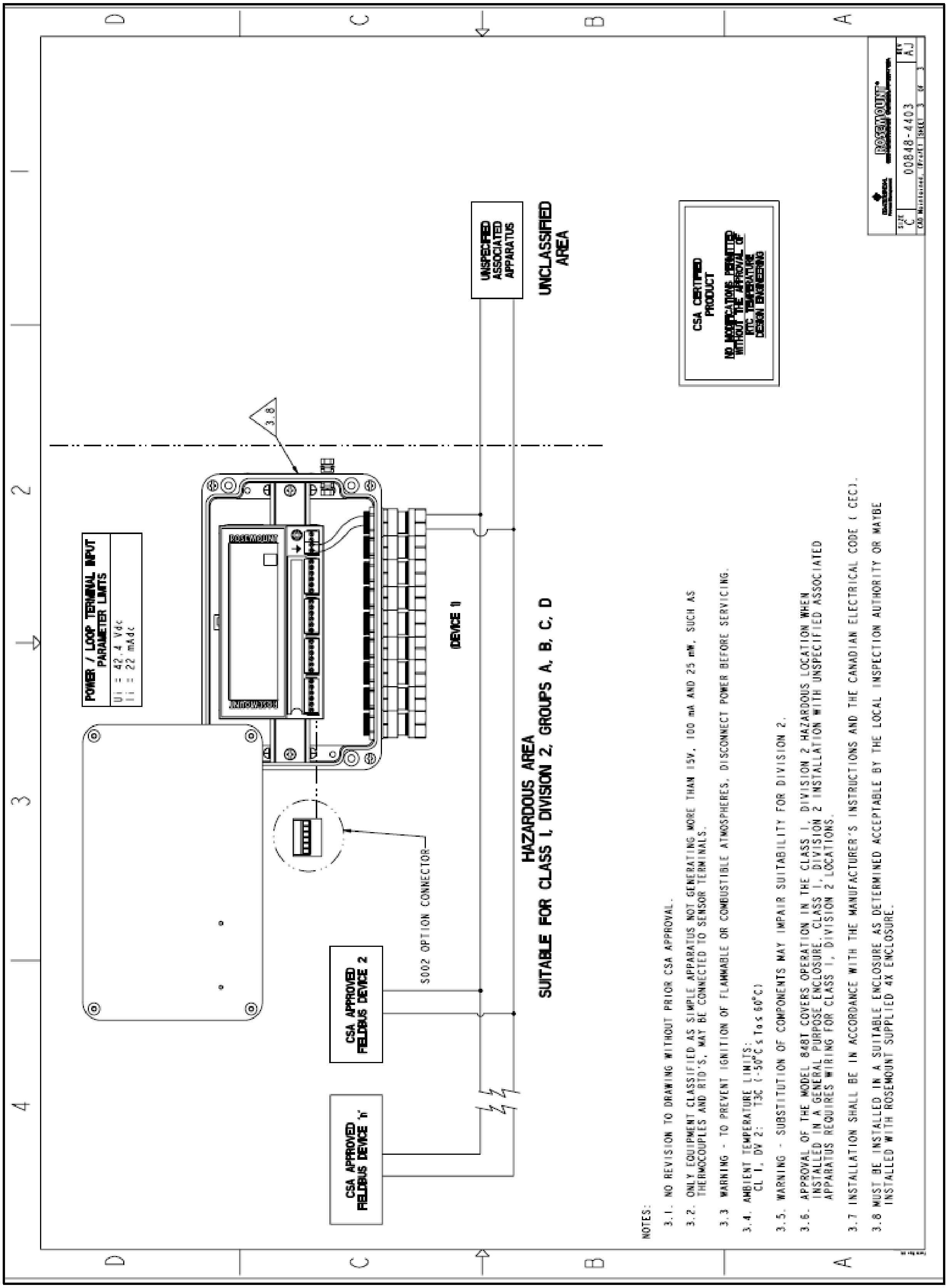
CAD Maintained, (Pro/E)

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA						
DR. NGA DOAN	9/24/01	SIZE C	FSCM NO.	DRAWING NO. 00848-4402		
		SCALE: 1:1	WT.	SHEET 3 OF 3		

Figure B-2. CSA Intrinsic Safety/ FISCO




CSA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT THE APPROVAL OF RTC TEMPERATURE DESIGN ENGINEERING
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Voc = 12.02 Vdc
Isc = 11.8 mAdc
Co = 1.36 uF
Lo = 225 mH
POWER / LOOP TERMINAL INPUT PARAMETER LIMITS
Vmax = 17.5 Vdc
Imax = 380 mAdc
Ci = 2.1 nF
Li = 0 mH
ROSEMOUNT
MODEL 848T
ROSEMOUNT
2.4
CSA APPROVED TERMINATION
CSA APPROVED FIELDBUS DEVICE "n" SUITABLE FOR FISCO
CSA APPROVED FIELDBUS DEVICE 2 SUITABLE FOR FISCO
(DEVICE 1)
CSA APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO
HAZARDOUS AREA
FISCO FOR CLASS I, DIVISION 1, GROUPS A, B, C, D
NON-HAZARDOUS AREA
NOTES:
2.1. FISCO IS A SUBSET OF STANDARD INTRINSICALLY SAFE INSTALLATION (SEE PAGE 1) EXCEPT AS SPECIFICALLY NOTED HERE.
2.2. THE CSA FISCO INSTALLATION IS ONLY VALID WITH MODEL OPTION CODE IF.
WHAT IS FISCO?
FIELDBUS INTRINSICALLY SAFE CONCEPT IS A PARTICULAR, YET SUFFICIENTLY FLEXIBLE, AGREED UPON INSTALLATION CONFIGURATION. THIS ALLOWS FOR A CONTROLLED DISTRIBUTION OF THE ELECTRICAL CHARACTERISTICS AROUND THE SEGMENT.
WHAT ARE THE BENEFITS TO INSTALLING WITHIN THE BOUNDS OF THIS CONFIGURATION?
A. MORE DEVICES ARE ALLOWED ON THE FIELDBUS SINCE MORE POWER CAN BE APPLIED.
B. THE R, L, AND C CHARACTERISTICS OF THE FIELDBUS CABLE NEED NOT BE CALCULATED.
WIRING CONFIGURATION:
LENGTH
TRUNK CABLE ≤ 1000 m
SPUR CABLE ≤ 30 m
SPLICE ≤ 1 m
CABLE PROPERTIES:
LOOP RESISTANCE, R 15 TO 150 Omhs/Km
INDUCTANCE, L 0.4 TO 1 mH/Km
CAPACITANCE, C 80 TO 200 nF/Km
C= C LINE-TO-LINE +1/2 C LINE-TO-SHIELD (FOR BOTH LINES FLOATING WITH RESPECT TO SHIELD)
C= C LINE-TO-LINE + C LINE-TO-SHIELD (FOR ONE LINE TIED TO SHIELD)
APPARATUS CRITERIA:
2.3. Ci ≤ 5 nF AND Li ≤ 10 uH FOR EACH APPARATUS, OTHER THAN THE TERMINATOR, CONNECTED TO THE FIELDBUS.
2.4 R= 90 TO 100 Ohms AND C= 0 TO 2.2 uF FOR THE LINE TERMINATION. THIS TERMINATOR MAY BE INTEGRATED INTO AN APPARATUS.
2.5. EACH APPARATUS, OTHER THAN THE ASSOCIATED APPARATUS, MUST BE PASSIVE. (NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM.)
2.6. INTERCONNECTION IS ALLOWED WHEN THE FOLLOWING IS TRUE:
I.S APPARATUS (FIELD DEVICE) INPUT
ASSOCIATED APPARATUS OUTPUT
Vmax ≥ Voc
Imax ≥ Isc
ROSEMOUNT
SIZE C
00848-4403
REV AJ
SHEET 2 OF 3


POWER / LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 42.4 Vdc
Ii = 22 mAdc
CSA APPROVED FIELDBUS DEVICE 'n'
CSA APPROVED FIELDBUS DEVICE 2
S002 OPTION CONNECTOR
(DEVICE 1)
3.8
UNSPECIFIED ASSOCIATED APPARATUS
HAZARDOUS AREA
SUITABLE FOR CLASS I, DIVISION 2, GROUPS A, B, C, D
UNCLASSIFIED AREA
NOTES:
3.1. NO REVISION TO DRAWING WITHOUT PRIOR CSA APPROVAL.
3.2. ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS NOT GENERATING MORE THAN 15V, 100 mA AND 25 mW, SUCH AS THERMOCOUPLES AND RTD'S, MAY BE CONNECTED TO SENSOR TERMINALS.
3.3 WARNING - TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
3.4. AMBIENT TEMPERATURE LIMITS:
CL I, DV 2: T3C (-50°C ≤ Ta ≤ 60°C)
3.5. WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR DIVISION 2.
3.6. APPROVAL OF THE MODEL 848T COVERS OPERATION IN THE CLASS I, DIVISION 2 HAZARDOUS LOCATION WHEN INSTALLED IN A GENERAL PURPOSE ENCLOSURE. CLASS I, DIVISION 2 INSTALLATION WITH UNSPECIFIED ASSOCIATED APPARATUS REQUIRES WIRING FOR CLASS I, DIVISION 2 LOCATIONS.
3.7 INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND THE CANADIAN ELECTRICAL CODE (CEC).
3.8 MUST BE INSTALLED IN A SUITABLE ENCLOSURE AS DETERMINED ACCEPTABLE BY THE LOCAL INSPECTION AUTHORITY OR MAYBE INSTALLED WITH ROSEMOUNT SUPPLIED 4X ENCLOSURE.
CSA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT THE APPROVAL OF RTC TEMPERATURE DESIGN ENGINEERING
ROSEMOUNT
SIZE C
00848-4403
REV AJ
SHEET 3 OF 3

Appendix C FOUNDATION™ Fieldbus Technology

OVERVIEW

FOUNDATION fieldbus is an all-digital, serial, two-way, multidrop communication protocol that interconnects devices such as transmitters, sensors, actuators, and valve controllers. Fieldbus is a Local Area Network (LAN) for instruments that are used in both process and manufacturing automation, having the built-in capability to distribute the control applications across the network. The fieldbus environment is the base level group of digital networks and the hierarchy of plant networks.

The fieldbus retains the desirable features of the 4–20 mA analog system, including standardized physical interface to the wire, bus-powered devices on a single pair of wires, and intrinsic safety options. It also enables the following capabilities:

- Increased capabilities due to full digital communication.
- Reduced wiring and wire terminations due to multiple devices on one pair of wires.
- Increased supplier selection due to interoperability
- Reduced loading on control room equipment due to the distribution of some control and input/output functions to field devices.

Fieldbus devices work together to provide I/O and control for automated processes and operations. The Fieldbus Foundation provides a framework for describing these systems as a collection of physical devices interconnected by a fieldbus network. One of the ways that the physical devices are used is to perform their portion of the total system operation by implementing one or more function blocks.

FUNCTION BLOCKS

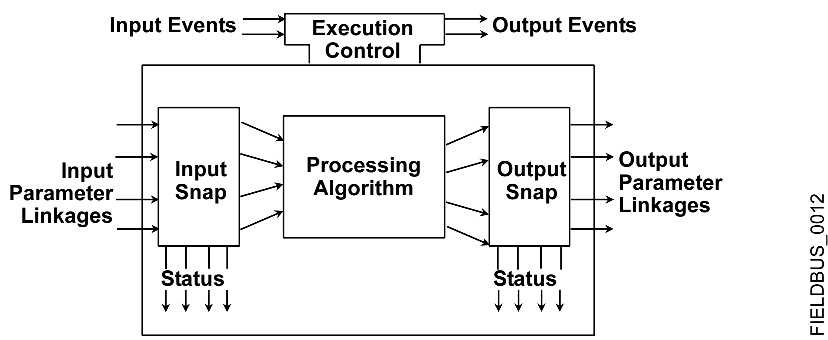
Function blocks perform process control functions, such as analog input (AI) and analog output (AO) functions as well as proportional-integral-derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

The Fieldbus Foundation has established the function blocks by defining a small set of parameters used in all function blocks called universal parameters. The Foundation has also defined a standard set of function block classes, such as input, output, control, and calculation blocks. Each of these classes has a small set of parameters established for it. They have also published definitions for transducer blocks commonly used with standard function blocks. Examples include temperature, pressure, level, and flow transducer blocks.

The Foundation specifications and definitions allow vendors to add their own parameters by importing and subclassing specified classes. This approach permits extending function block definitions as new requirements are discovered and as technology advances.

Figure C-1 illustrates the internal structure of a function block. When execution begins, input parameter values from other blocks are snapped-in by the block. The input snap process ensures that these values do not change during the block execution. New values received for these parameters do not affect the snapped values and will not be used by the function block during the current execution.

Figure C-1. Function Block Internal Structure



Once the inputs are snapped, the algorithm operates on them, generating outputs as it progresses. Algorithm executions are controlled through the setting of contained parameters. Contained parameters are internal to function blocks and do not appear as normal input and output parameters. However, they may be accessed and modified remotely, as specified by the function block.

Input events may affect the operation of the algorithm. An execution control function regulates the receipt of input events and the generation of output events during execution of the algorithm. Upon completion of the algorithm, the data internal to the block is saved for use in the next execution, and the output data is snapped, releasing it for use by other function blocks.

A block is a tagged logical processing unit. The tag is the name of the block. System management services locate a block by its tag. Thus the service personnel need only know the tag of the block to access or change the appropriate block parameters.

Function blocks are also capable of performing short-term data collection and storage for reviewing their behavior.

DEVICE DESCRIPTIONS

Device Descriptions (DD) are specified tool definitions that are associated with the Resource and Transducer Blocks. Device descriptions provide the definition and description of the function blocks and their parameters.

To promote consistency of definition and understanding, descriptive information, such as data type and length, is maintained in the device description. Device Descriptions are written using an open language called the Device Description Language (DDL). Parameter transfers between function blocks can be easily verified because all parameters are described using the same language. Once written, the device description can be stored on an external medium, such as a CD-ROM or diskette. Users can then read the device description from the external medium. The use of an open language in the device description permits interoperability of function blocks within devices from various vendors. Additionally, human interface devices, such as operator consoles and computers, do not have to be programmed specifically for each type of device on the bus. Instead their displays and interactions with devices are driven from the device descriptions.

Device descriptions may also include a set of processing routines called methods. Methods provide a procedure for accessing and manipulating parameters within a device.

BLOCK OPERATION

In addition to function blocks, fieldbus devices contain two other block types to support the function blocks. These are the resource block and the transducer block.

Instrument- Specific Function Blocks

Resource Blocks

Resource blocks contain the hardware–specific characteristics associated with a device; they have no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. The execution of this algorithm is dependent on the characteristics of the physical device, as defined by the manufacturer. As a result, the algorithm may cause the generation of events. There is only one resource block defined for a device. For example, when the mode of a resource block is “Out of Service (OOS),” it impacts all of the other blocks.

Transducer Blocks

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors and ensure proper writes to the actuator without burdening the function blocks that use the data. The transducer block also isolates the function block from the vendor–specific characteristics of the physical I/O.

Alerts

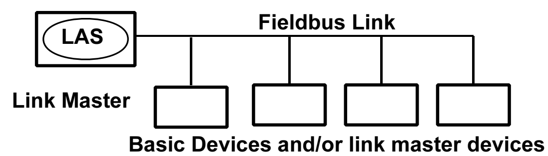
When an alert occurs, execution control sends an event notification and waits a specified period of time for an acknowledgment to be received. This occurs even if the condition that caused the alert no longer exists. If the acknowledgment is not received within the pre-specified time-out period, the event notification is retransmitted, assuring that alert messages are not lost.

Two types of alerts are defined for the block, events and alarms. Events are used to report a status change when a block leaves a particular state, such as when a parameter crosses a threshold. Alarms not only report a status change when a block leaves a particular state, but also report when it returns back to that state.

NETWORK COMMUNICATION

Figure C-2 illustrates a simple fieldbus network consisting of a single segment (link).

Figure C-2. Simple, Single-Link Fieldbus Network



Link Active Scheduler (LAS)

All links have one Link Active Scheduler (LAS). The LAS operates as the bus arbiter for the link. The LAS does the following:

- recognizes and adds new devices to the link.
- removes non-responsive devices from the link.
- distributes Data Link Time (DL) and Link Scheduling Time (LS) on the link. DL is a network-wide time periodically distributed by the LAS to synchronize all device clocks on the bus. LS time is a link-specific time represented as an offset from DL. It is used to indicate when the LAS on each link begins and repeats its schedule. It is used by system management to synchronize function block execution with the data transfers scheduled by the LAS.
- polls devices for process loop data at scheduled transmission times.
- distributes a priority-driven token to devices between scheduled transmissions.

Any device on the link may become the LAS. The devices that are capable of becoming the LAS are called Link Master devices (LM). All other devices are referred to as basic devices. When a segment first starts up, or upon failure of the existing LAS, the link master devices on the segment bid to become the LAS. The link master that wins the bid begins operating as the LAS immediately upon completion of the bidding process. Link masters that do not become the LAS act as basic devices. However, the link masters can act as LAS backups by monitoring the link for failure of the LAS and then bidding to become the LAS when a LAS failure is detected.

Only one device can communicate at a time. Permission to communicate on the bus is controlled by a centralized token passed between devices by the LAS. Only the device with the token can communicate. The LAS maintains a list of all devices that need access to the bus. This list is called the “Live List.”

Two types of tokens are used by the LAS. A time-critical token, Compel Data (CD), is sent by the LAS according to a schedule. A non-time critical token, pass token (PT), is sent by the LAS to each device in ascending numerical order according to address.

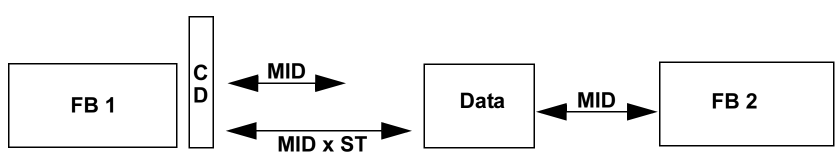
There may be many LM devices on a segment but only the LAS is actively controlling communication traffic. The remaining LM devices on the segment are in a stand-by state, ready to take over if the primary LAS fails. This is achieved by constantly monitoring the communication traffic on the bus and determining if activity is not present. Since there can be multiple LM devices on the segment when the primary LAS fails, the device with the lowest node address will become the primary LAS and take control of the bus. Using this strategy, multiple LAS failures can be handled with no loss of the LAS capability of the communications bus.

LAS Parameters

There are many bus communication parameters but only a few are used. For standard RS-232 communications, the configuration parameters are baud rate, start / stop bits, and parity. The key parameters for H1 Fieldbus are as follows.

- **Slot Time (ST)** – Used during the bus master election process. It is the maximum amount of time permitted for device A to send a message to device B. Slot time is a parameter which defines a worst case delay which includes internal delay in the sending device and the receiving device. Increasing the value of ST slows down bus traffic because a LAS device must wait longer prior to determining that the LM is down.
- **Minimum Inter-PDU Delay (MID)** – The minimum gap between two messages on the fieldbus segment or it is the amount of time between the last byte of one message and the first byte of the next message. The units of the MID are octets. An octet is 256 μs, hence the units for MID are approximately 1/4 ms. This would mean an MID of 16 would specify approximately a minimum of 4 ms between messages on the Fieldbus. Increasing the value of MID slows down bus traffic because a larger “gap” between messages occurs.
- **Maximum Response (MRD)** – Defines the maximum amount of time permitted to respond to an immediate response request, e.g. CD, PT. When a published value is requested using the CD command, the MRD defines how long before the device publishes the data. Increasing this parameter will slow down the bus traffic by decreasing how fast CDs can be put onto the network. The MRD is measured in units of ST.
- **Time Synchronization Class (TSC)** – A variable that defines how long the device can estimate its time before drifting out of specific limits. The LM will periodically send out a time update messages to synchronize devices on the segment. Decreasing the parameter number increases the number of times that time distribution messages must be published, increasing bus traffic and overhead for the LM device. See Figure C-3.

Figure C-3. LAS Parameter diagram



Backup LAS

A LM device is one that has the ability to control the communications on the bus. The LAS is the LM capable device that is currently in control of the bus. While there can be many LM devices acting as backups, there can only be one LAS. The LAS is typically a host system but for stand-alone applications, a device may be providing the role of primary LAS.

Addressing

To setup, configure, and communicate with other devices on a segment, a device must be assigned a permanent address. Unless requested otherwise, it is assigned a temporary address when shipped from the factory.

Fieldbus uses addresses between 0 and 255. Addresses 0 through 15 are reserved for group addressing and for use by the data link layer.

If there are two or more devices on a segment with the same address, the first device to start up will use the assigned address. Each of the other devices will be given one of the four temporary addresses. If a temporary address is not available, the device will be unavailable until a temporary address is available.

Use the host system documentation to commission a device and assign a permanent address.

Scheduled Transfers

Information is transferred between devices over the fieldbus using three different types of reporting.

Publisher/Subscriber

This type of reporting is used to transfer critical process loop data, such as the process variable. The data producers (publishers) post the data in a buffer that is transmitted to the subscriber, when the publisher receives the Compel Data (CD). The buffer contains only one copy of the data. New data completely overwrites previous data. Updates to published data are transferred simultaneously to all subscribers in a single broadcast. Transfers of this type can be scheduled on a precisely periodic basis.

Report Distribution

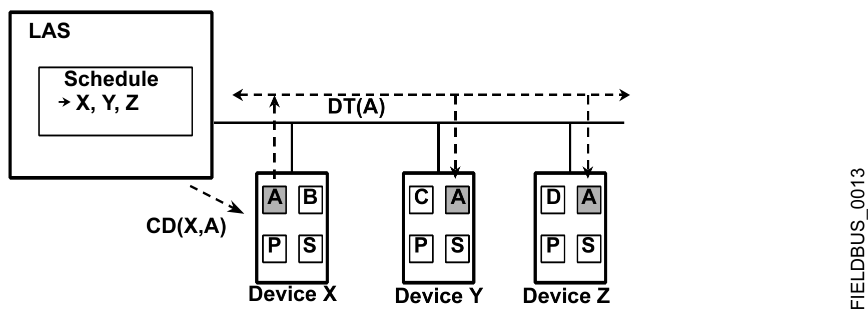
This type of reporting is used to broadcast and multicast event and trend reports. The destination address may be predefined so that all reports are sent to the same address, or it may be provided separately with each report. Transfers of this type are queued. They are delivered to the receivers in the order transmitted, although there may be gaps due to corrupted transfers. These transfers are unscheduled and occur between scheduled transfers at a given priority.

Client/Server

This type of reporting is used for request/response exchanges between pairs of devices. Like Report Distribution reporting, the transfers are queued, unscheduled, and prioritized. Queued means the messages are sent and received in the order submitted for transmission, according to their priority, without overwriting previous messages. However, unlike Report Distribution, these transfers are flow controlled and employ a retransmission procedure to recover from corrupted transfers.

Figure C-4 diagrams the method of scheduled data transfer. Scheduled data transfers are typically used for the regular cyclic transfer of process loop data between devices on the fieldbus. Scheduled transfers use publisher/subscriber type of reporting for data transfer. The LAS maintains a list of transmit times for all publishers in all devices that need to be cyclically transmitted. When it is time for a device to publish data, the LAS issues a CD message to the device. Upon receipt of the CD, the device broadcasts or "publishes" the data to all devices on the fieldbus. Any device that is configured to receive the data is called a "subscriber."

Figure C-4. Scheduled Data Transfer



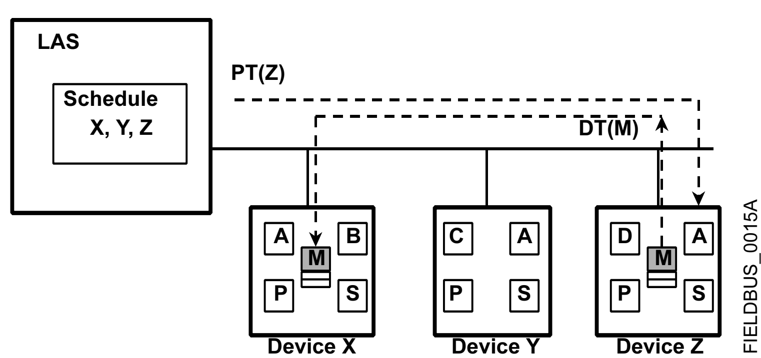
LAS = Link Active Scheduler
P = Publisher
S = Subscriber
CD = Compel Data
DT = Data Transfer Packet

Unscheduled Transfers

Figure C-5 diagrams an unscheduled transfer. Unscheduled transfers are used for things like user-initiated changes, including set point changes, mode changes, tuning changes, and upload/download. Unscheduled transfers use either report distribution or client/server type of reporting for transferring data.

All of the devices on the fieldbus are given a chance to send unscheduled messages between transmissions of scheduled data. The LAS grants permission to a device to use the fieldbus by issuing a pass token (PT) message to the device. When the device receives the PT, it is allowed to send messages until it has finished or until the "maximum token hold time" has expired, whichever is the shorter time. The message may be sent to a single destination or to multiple destinations.

Figure C-5. Unscheduled Data Transfer

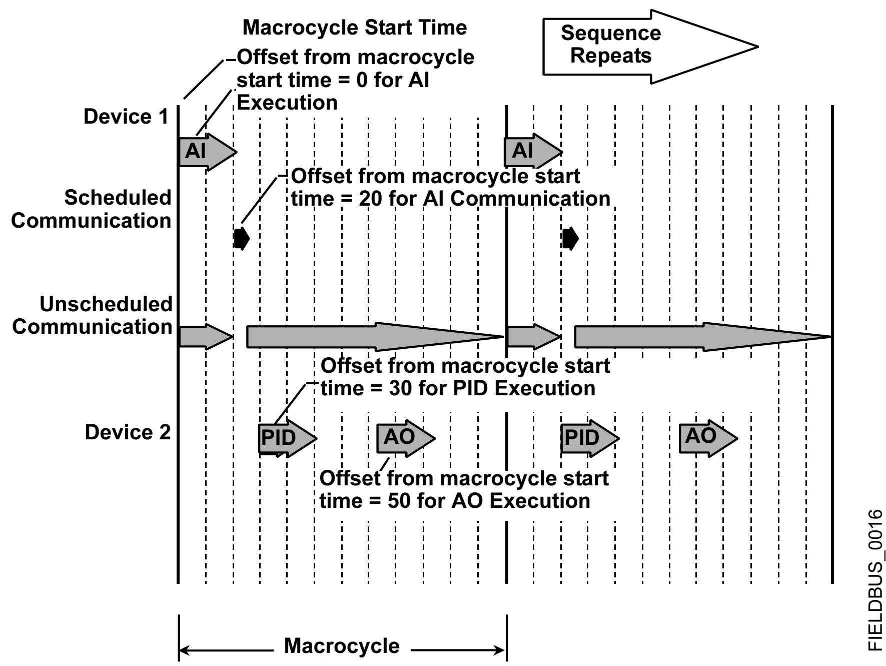


P = Publisher S = Subscriber PT = Pass Token M = Message

Function Block Scheduling

Figure C-6 shows an example of a link schedule. A single iteration of the link-wide schedule is called the macrocycle. When the system is configured and the function blocks are linked, a master link-wide schedule is created for the LAS. Each device maintains its portion of the link-wide schedule, known as the Function Block Schedule. The Function Block Schedule indicates when the function blocks for the device are to be executed. The scheduled execution time for each function block is represented as an offset from the beginning of the macrocycle start time.

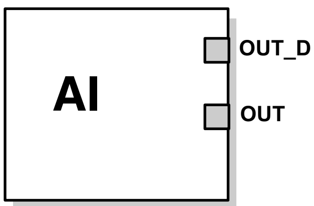
Figure C-6. Example Link Schedule Showing Scheduled and Unscheduled Communication



To support synchronization of schedules, periodically Link Scheduling (LS) time is distributed. The beginning of the macrocycle represents a common starting time for all Function Block schedules on a link and for the LAS link-wide schedule. This permits function block executions and their corresponding data transfers to be synchronized in time.

Appendix D Function Blocks

ANALOG INPUT (AI) FUNCTION BLOCK



Out = The block output value and status
Out_D = Discrete output that signals a selected alarm condition

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.

Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
01	ST_REV	None	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.
02	TAG_DESC	None	The user description of the intended application of the block.
03	STRATEGY	None	The strategy field can be used to identify a grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the "block is currently in" Target: The mode to "go to" Permitted: Allowed modes that target may take on Normal: Most common mode for target
06	BLOCK_ERR	None	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.
07	PV	EU of XD_SCALE	The process variable used in block execution.
08	OUT	EU of OUT_SCALE or XD_SCALE if in direct L_TYPE	The block output value and status.
09	SIMULATE	None	A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.

Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
10	XD_SCALE	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value. The XD_SCALE units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to MAN or AUTO.
11	OUT_SCALE	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT when L_TYPE is not direct.
12	GRANT_DENY	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
13	IO_OPTS	None	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
14	STATUS_OPTS	None	Allows the user to select options for status handling and processing. The options supported in the AI block are the following: Propagate fault forward Uncertain if limited Bad if limited Uncertain if Manual mode.
15	CHANNEL	None	The CHANNEL value is used to select the measurement value. Configure the CHANNEL parameter before configuring the XD_SCALE parameter. Refer to Table 3-5 on page 3-11.
16	L_TYPE	None	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).
17	LOW_CUT	%	If percentage value of transducer input fails below this, PV = 0.
18	PV_FTIME	Seconds	The time constant of the first-order PV filter. It is the time required for a 63% change in the PV or OUT value.
19	FIELD_VAL	Percent	The value and status from the transducer block or from the simulated input when simulation is enabled.
20	UPDATE_EVT	None	This alert is generated by any change to the static data.
21	BLOCK_ALM	None	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.
22	ALARM_SUM	None	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.
23	ACK_OPTION	None	Used to set auto acknowledgment of alarms.
24	ALARM_HYS	Percent	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.
25	HI_HI_PRI	None	The priority of the HI HI alarm.
26	HI_HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI HI alarm condition.
27	HI_PRI	None	The priority of the HI alarm.
28	HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
29	LO_PRI	None	The priority of the LO alarm.
30	LO_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
31	LO_LO_PRI	None	The priority of the LO LO alarm.
32	LO_LO_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the LO LO alarm condition.
33	HI_HI_ALM	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
34	HI_ALM	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
35	LO_ALM	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.

Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
36	LO_LO_ALM	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
37	OUT_D	None	Discrete output to indicate a selected alarm condition.
38	ALM_SEL	None	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.
39	STDDEV	% of OUT Range	Standard deviation of the measurement for 100 macrocycles.
40	CAP_STDDEV	% of OUT Range	Capability standard deviation, the best deviation that can be achieved.

Functionality

Simulation

To support testing, either change the mode of the block to manual and adjust the output value, or enable simulation through the configuration tool and manually enter a value for the measurement value and its status. In simulation, the ENABLE jumper must be set on the field device.

NOTE
All fieldbus instruments have a simulation jumper. As a safety measure, the jumper has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

With simulation enabled, the actual measurement value has no impact on the value or the status.

Figure D-1. Analog Input Function Block Timing Diagram

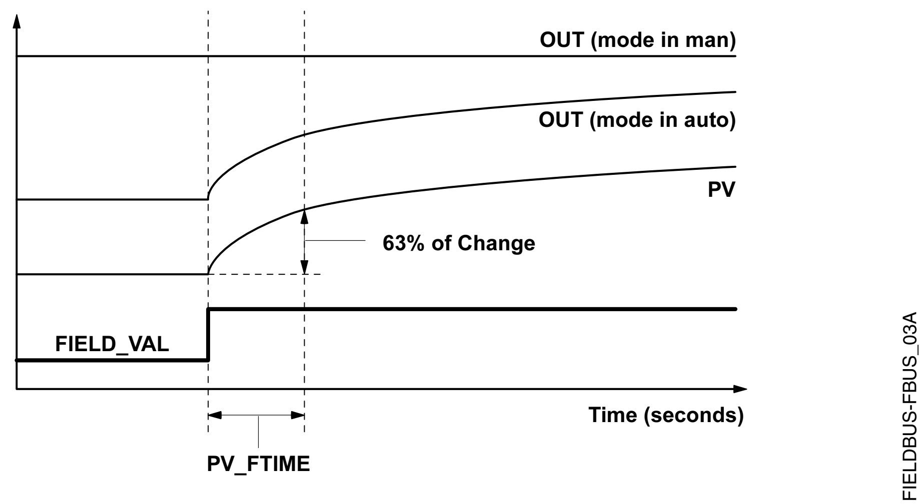
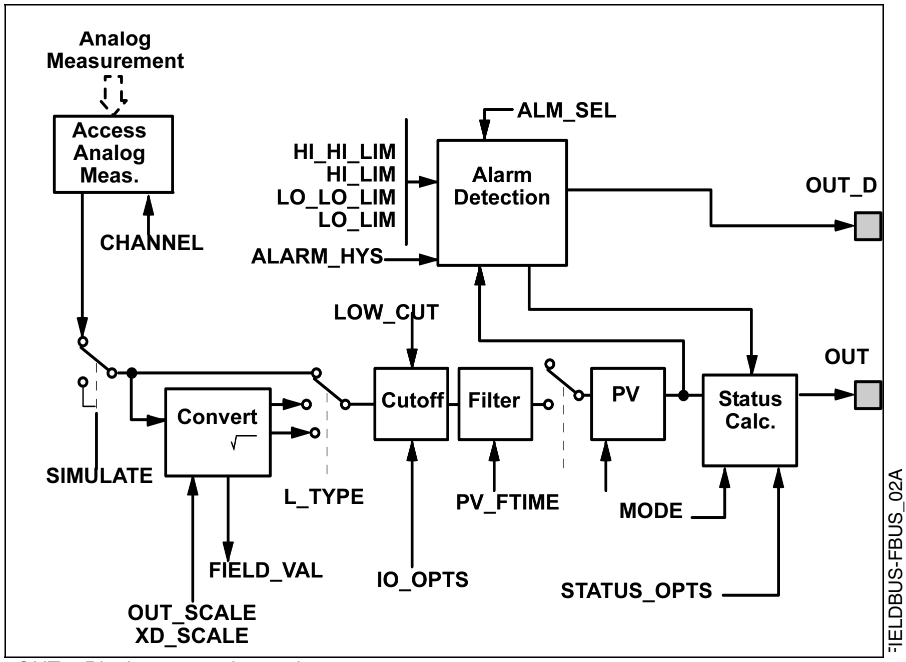


Figure D-2. Analog Input Function Block Schematic



OUT = Block output value and status
OUT_D = Discrete output that signals a selected alarm condition

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.

Signal Conversion

Set the signal conversion type with the Linearization Type (L_TYPE) parameter. View the converted signal (in percent of XD_SCALE) through the FIELD_VAL parameter.

$$\text{FIELD\_VAL} = \frac{100 \times (\text{Channel Value} - \text{EU*@0\%})}{(\qquad - \qquad)}$$

*** XD_SCALE values**

Choose from direct, indirect, or indirect square root signal conversion with the L_TYPE parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

PV   Channel Value

Indirect

Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE) to the range and units of the PV and OUT parameters (OUT_SCALE).

$$\text{PV} = \left(\frac{\text{FIELD\_VAL}}{100}\right) \times (\text{EU**@100\%} \quad \text{EU**@0\%}) + \text{EU**@0\%}$$

**** OUT_SCALE values**

Indirect Square Root

Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV and OUT parameters.

$$PV \quad \sqrt{\left(\frac{FIELD\_VAL}{100}\right)} \times (EU^{**}@100\% \quad EU^{**}@0\%) \quad EU^{**}@0\%$$

When the converted input value is below the limit specified by the LOW_CUT parameter, and the Low Cutoff I/O option (IO_OPTS) is enabled (True), a value of zero is used for the converted value (PV). This option eliminates false readings when the differential pressure measurement is close to zero and it may be useful with zero-based measurement devices such as flowmeters.

NOTE
Low Cutoff is the only I/O option supported by the AI block. Set the I/O option when the block is OOS.

Block Errors

Table D-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the AI block and are given here for reference.

Table D-2. BLOCK_ERR Conditions

Number	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.
2	**Link Configuration Error**
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override**
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up
15	Out of Service: The actual mode is out of service.

Modes

The AI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The value of the block output (OUT) may be set manually

Automatic (Auto)
OUT reflects the analog input measurement or the simulated value when simulation is enabled.

Out of Service (OOS)
The block is not processed. FIELD_VAL and PV are not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the AI block are defined above.

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 chatter 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

Table D-3. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
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, but does not require operator attention (such as diagnostics and system alerts).
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 Handling

Normally, the status of the PV reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the PV. In Man mode, the OUT status constant limit is set to indicate that the value is a constant and the OUT status is *Good*.

If the sensor limit exceeds the high or low range, PV status is set high or low and EU range status is set to uncertain.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

BAD if Limited
Sets the OUT status quality to *Bad* when the value is higher or lower than the sensor limits.

Uncertain if Limited
Sets the OUT status quality to *Uncertain* when the value is higher or lower than the sensor limits.

Uncertain if in Manual mode
The status of the Output is set to *Uncertain* when the mode is set to Manual

NOTES
1. The instrument must be in OOS mode to set the status option.
2. The AI block only supports the BAD if Limited option, uncertain if limited, and uncertain if manual.

Advanced Features

The AI function block provided with Rosemount fieldbus devices provides added capability through the addition of the following parameters:

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
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.

STD_DEV and CAP_STDDEV
Diagnostic parameters that can be used to determine the variability of the process.

Application Information

The configuration of the AI function block and its associated output channels depends on the specific application. A typical configuration for the AI block involves the following parameters:

CHANNEL
The device supports more than one measurement, so verify that the selected channel contains the appropriate measurement or derived value. Refer to Table 3-5 on page 3-11 for a listing of available channels on the 848T.

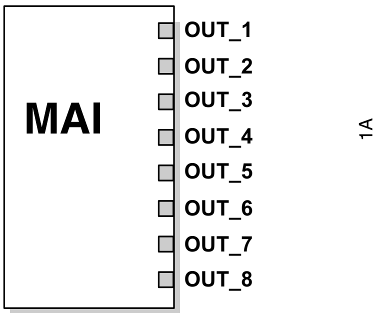
L_TYPE
Select **Direct** when the measurement is in the desired engineering units for the block output. Select **Indirect** when converting the measured variable into another, for example, pressure into level or flow into energy.

SCALING
provides the range and units of the measurement and provides the range and engineering units of the output. OUT_SCALE is only used when in indirect or indirect square root.

AI Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: • CHANNEL must be set to a valid value and cannot be left at initial value of 0. • XD_SCALE.UNITS_INDEX must match the units in the transducer block channel value. Setting the units in the AI block automatically sets them in the XD_BLOCK. • L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Process and/or block alarms will not work.	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY. Alarm not linked to host.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	Linearization Type	L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Scaling	Scaling parameters are set incorrectly: • XD_SCALE.EU0 and EU100 should match that of the transducer block channel value. • OUT_SCALE.EU0 and EU100 are not set properly. • Both STB on each asic used must by in auto.
Cannot set HI_LIMIT, HI_HI_LIMIT, LO_LIMIT, or LO_LO_LIMIT Values	Scaling	Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE or set values within range.

MULTIPLE ANALOG INPUT (MAI) FUNCTION BLOCK



Out1 = The block output value and status for the first channel.

The Multiple Analog Input (MAI) function block has the ability to process up to eight field device measurements and make them available to other function blocks. The output values from the MAI block are in engineering units and contain 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 numbers to define the variables that the MAI block processes.

The MAI block supports signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameters (OUT_1 to OUT_8) reflects the process variable (PV) values and status. In Manual mode, OUT may be set manually. The Manual mode is reflected on the output status. Table lists the MAI block parameters and their units of measure, descriptions, and index numbers.

Table D-4. Multiple Analog Input Function Block Parameters

Number	Parameter	Units	Description
1	ST_REV	None	The revision level of the static data associated with the input selector block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	None	The user description of the intended application of the block.
3	STRATEGY	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the "block is currently in" Target: The mode to "go to" Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	None	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.
7	CHANNEL	None	Allows for custom channel setting. Valid values include: 0: Unitialized 1: Channels 1 to 8 (index values 27 to 34 can only be set to their corresponding channel number, i.e. CHANNEL_X=X) 2: Custom settings (index values 27 to 34 can be configured for any valid channel as defined by the DD)
8, 9, 10, 11, 12, 13, 14, 15	OUT (1, 2, 3, 4, 5, 6, 7, 8)	EU of OUT_SCALE	The block output value and status
16	UPDATE_EVT	None	This alert is generated by any change to the static data
17	BLOCK_ALM	None	The block alarm is used for all configuration, hardware connection feature, 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 may be reported without clearing the Active status, if the subcode has changed.
18	SIMULATE	None	A group of data that contains the current sensor transducer value and status, and the enable/disable bit.

Table D-4. Multiple Analog Input Function Block Parameters

Number	Parameter	Units	Description
19	XD_SCALE	None	The high and low scale values, engineering units code and number of digits to the right of the decimal point associated with the channel input value. The XD_SCALE units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to MAN or AUTO. It will automatically change units in the STB block to the last one written. Multiple blocks reading the same channel may conflict (only one unit type per channel).
20	OUT_SCALE	None	The high and low scale values, engineering unit code and number of digits to the right of the decimal point associated with OUT.
21	GRANT_DENY	None	Options for controlling access of host computers and local control panels for operating, tuning, and alarm parameters of the block. Not used by device.
22	IO_OPTS	None	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
23	STATUS_OPTS	None	Allows the user to select options for status handling and processing. The options supported in the MAI block are the following: • Propagate fault forward • Uncertain if limited • Bad if limited • Uncertain if manual mode
24	L_TYPE	None	Linearization type. Determines whether the field value is uses directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root)
25	LOW_CUT	%	If percentage value of the sensor transducer input falls below this, PV = 0
26	PV_FTIME	Seconds	The time constant of the first-order PV filter. It is the time required for a 63% change in the IN value.
27, 28, 29, 30, 31, 32, 33, 34	CHANNEL_(1, 2, 3,4 5, 6, 7, 8)	None	The CHANNEL (1, 2, 3, 4, 5, 6, 7, 8) value is used to select the measurement value. See Table D-4 on page D-6 for available channels. Configure the CHANNEL parameters to custom (2) before configuring the CHANNEL parameters.
35, 36, 37, 38, 39, 40, 41, 42	STDDEV_(1, 2, 3, 4, 5, 6, 7, 8)	% of OUT Range	Standard deviation of the corresponding measurement.
43, 44, 45, 46, 47, 48, 49, 50	CAP_STDDEV_(1 , 2, 3, 4, 5, 6, 7, 8)	% of OUT Range	Capability standard deviation, the best deviation that can be achieved.

Functionality

Simulation

To support testing, either change the mode of the block to manual and adjust the output value or enable simulation through the configuration tool and manually enter a value for the measurement value and its status (this single value will apply to all outputs). In both cases, first set the ENABLE jumper on the field device.

NOTE
All fieldbus instruments have a simulation jumper. As a safety measure, the jumper has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

With simulation enabled, the actual measurement value has no impact on the OUT value or the status. The OUT values will all have the same value as determined by the simulate value.

Figure D-3. Multiple Analog Input Function Block Timing Diagram

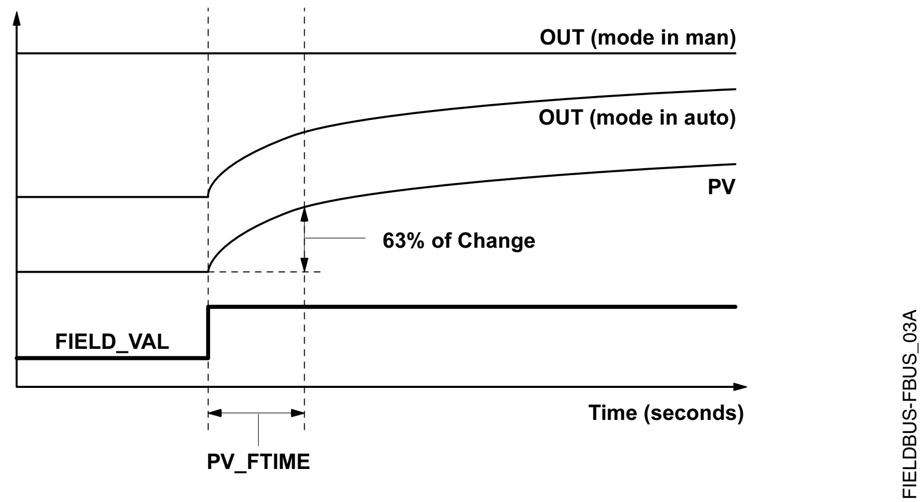
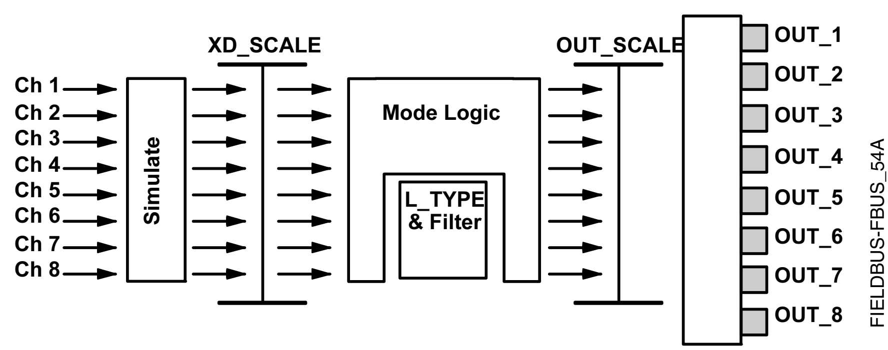


Figure D-4. Multiple Analog Input Function Block Schematic



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 (same value applied to eight channels). Set the filter time constant to zero to disable the filter feature.

Signal Conversion

Set the signal conversion type with the Linearization Type (L_TYPE) parameter. Choose from direct, indirect, or indirect square root signal conversion with the L_TYPE parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

PV Channel Value

Indirect

Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE) to the range and units of the PV and OUT parameters (OUT_SCALE).

$$PV \quad \left(\frac{\text{Channel Value}}{100}\right) \times \left(EU^{**}@100\% \quad EU^{**}@0\%\right) \quad EU^{**}@0\%$$

Indirect Square Root

Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV and OUT parameters.

$$PV \quad \sqrt{\left(\frac{\text{Channel Value}}{100}\right)} \times \left(EU^{**}@100\% \quad EU^{**}@0\%\right) \quad EU^{**}@0\%$$

When the converted input value is below the limit specified by the LOW_CUT parameter, and the Low Cutoff I/O option (IO_OPTS) is enabled (True), a value of zero is used for the converted value (PV). This option is useful to eliminate false readings when the differential temperature measurement is close to zero, and it may also be useful with zero-based measurement devices such as flowmeters.

NOTE

is the only I/O option supported by the MAI block. Set the I/O option in Manual or Out of Service mode only.

Block Errors

Table D-5 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the MAI block and are given for reference.

Table D-5. BLOCK_ERR Conditions

Number	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 WRITE_CHECK = zero.
2	**Link Configuration Error**
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override**
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up
15	Out of Service: The actual mode is out of service.

Modes

The MAI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The block output (OUT) may be set manually

Automatic (Auto)
OUT_1 to OUT_8 reflects the analog input measurement or the simulated value when simulation is enabled.

Out of Service (OOS)
The block is not processed. PV is not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Status Handling

Normally, the status of the PV reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the PV. In Man mode, the OUT status constant limit is set to indicate that the value is a constant and the OUT status is *Good*.

If the sensor limit exceeds the high or low side range, PV status is set high or low and EU range status is set to uncertain.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

BAD if Limited
Sets the OUT status quality to *Bad* when the value is higher or lower than the sensor limits.

Uncertain if Limited
sets the OUT status quality to *Uncertain* when the value is higher or lower than the sensor limits.

Uncertain if in Manual mode
The status of the Output is set to *Uncertain* when the mode is set to Manual

NOTES

1. The instrument must be OOS to set the status option.
2. The MAI block only supports the BAD if Limited option.

Application Information

The intended use for this type of function block is for applications where the sensor types and functionality of each channel (i.e. the simulate, scaling, filtering, alarms type, and options) are the same.

The configuration of the MAI function block and its associated output channels depends on the specific application. A typical configuration for the MAI block involves the following parameters:

CHANNEL
If the device supports more than one measurement, verify that the selected channel contains the appropriate measurement or derived value. Refer to Table D-4 on page D-6 for a listing of available channels on the 848T.

L_TYPE
Select when the measurement is already in the desired engineering units for the block output. Select when converting the measured variable into another, for example, pressure into level or flow into energy. Select **Indirect Square Root** when the block I/O parameter value represents a flow measurement made using differential pressure, and when square root extraction is not performed by the transducer.

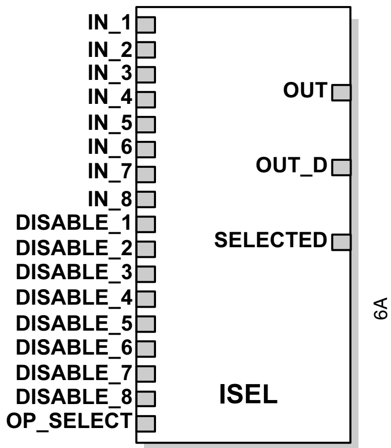
SCALING
provides the range and units of the measurement and provides the range and engineering units of the output.

MAI Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: • Initial value is 1. • XD_SCALE.UNITS_INDEX must match the units in all the corresponding sensor transducer blocks. • L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Process and/or block alarms will not work.	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	Linearization Type	L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Scaling	Scaling parameters are set incorrectly: • XD_SCALE.EU0 and EU100 should match that of the corresponding sensor transducer block. • OUT_SCALE.EU0 and EU100 are not set properly. • Both STBs in an ASIC must be set to auto. Best in 1, 2, 7, 8, ASICs in Auto for thermocouples

INPUT SELECTOR FUNCTION BLOCK

The Input Selector (ISEL) function block can be used to select the first good, Hot Backup, maximum, minimum, or average of as many as eight input values and place it at the output. The block supports signal status propagation. There is process alarm detection in the Input Selector function block. Table D-6 lists the ISEL block parameters and their descriptions, units of measure, and index numbers.



IN (1-8) = Input
DISABLE (1-8) = Discrete input used to disable the associated input channel
SELECTED = The selected channel number
OUT = The block output and status
OUT_D = Discrete output that signals a selected alarm condition

Table D-6. Input Selector Function Block Parameters

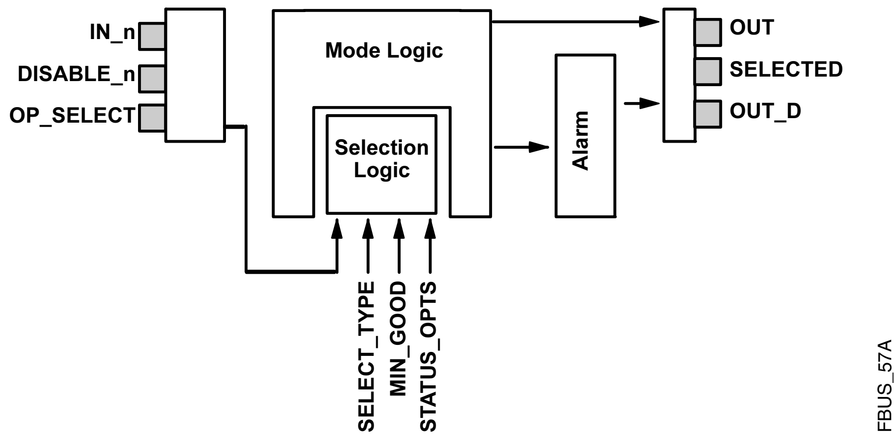
Number	Parameter	Units	Description
1	ST_REV	None	The revision level of the static data associated with the input selector block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	None	The user description of the intended application of the block.
3	STRATEGY	None	The strategy field can be used to identify groupings of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the “block is currently in” Target: The mode to “go to” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	None	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.
7	OUT	OUT_RANGE	The primary analog value calculated as a result of executing the function block.
8	OUT_RANGE	EU of OUT	The engineering units code to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
9	GRANT_DENY	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
10	STATUS_OPTS	None	Allows the user to select options for status handling and processing.
11,1 2, 13, 14, 25, 26, 27, 28	IN_(1, 2, 3, 4, 5, 6, 7, 8)	Determined by source	A connection input from another block

Table D-6. Input Selector Function Block Parameters

Number	Parameter	Units	Description
15, 16, 17, 18, 29, 30, 31, 32	DISABLE_(1, 2, 3, 4, 5, 6, 7, 8)	None	A connection from another block that disables the associated input from the selection.
19	SELECT_TYPE	None	Specifies input selection method. Methods available include: First Good, Minimum, Maximum, Middle, Average, or Hot Backup.
20	MIN_GOOD	None	The minimum number of good inputs.
21	SELECTED	None	The selected input number (1 to 8) or the number of input used for the average output.
22	OP_SELECT	None	Overrides the algorithm to select 1 of the 8 inputs regardless of the selection type.
23	UPDATE_EVT	None	This alert is generated by any change to the static data
24	BLOCK_ALM	None	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 may be reported without clearing the Active status, if the subcode has changed.
33	AVG_USE	None	Number of parameters to use in the averaging calculation. For example, if AVG_USE is 4 and the number of connected inputs is 6, then the highest and lowest values would be dropped prior to calculating the average. If AVG_USE is 2 and the number of connected inputs is 7, then the two highest and lowest values would be dropped prior to calculating the average and the average would be based on the middle three inputs.
34	ALARM_SUM	None	The current alert status, unacknowledged states, and disabled states of the alarms associated with the function block.
35	ACK_OPTION	None	Used to set automatic acknowledgement of alarms.
36	ALARM_HYS	Percent	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears
37	HI_HI-PRI	None	The priority of the HI HI alarm
38	HI_HI_LIM	Percent	The setting for the alarm limit used to detect the HI HI alarm condition.
39	HI_PRI	None	The priority of the HI alarm
40	HI_LIM	EU of IN	The setting for the alarm limit used to detect the HI alarm condition
41	LO_PRI	None	The priority of the LO alarm
42	LO_LIM	EU of IN	The setting of the alarm limit used to detect the LO alarm condition
43	LO_LO_PRI	None	The priority of the LO LO alarm
44	LO_LO_LIM	EU of IN	The setting for the alarm limit sued to detect the LO LO alarm condition
45	HI_HI_ALM	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
46	HI_ALM	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
47	LO_ALM	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
48	LO_LO_ALM	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
49	OUT_D	None	Discrete output to indicate a selected alarm value
50	ALM_SEL	None	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.

Functionality

Figure D-5. Input Selector Function Block Schematic



Block Errors

Table D-7 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the ISEL block and are given for reference.

Table D-7. BLOCK_ERR Conditions

Number	Name and Description
0	Other: The output has a quality of uncertain.
1	**Block Configuration Error: Select type is not configured**
2	**Link Configuration Error**
3	**Simulate Active**
4	Local Override
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: One of the inputs is Bad.
8	Output Failure
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up: The device was just powered-up.
15	Out of Service: The actual mode is out of service.

Modes

The ISEL function block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The block output (OUT) may be set manually.

Automatic (Auto)
OUT reflects the selected value.

Out of Service (OOS)
The block is not processed. The BLOCK_ERR parameter shows Out of Service. The target mode of a block may be restricted to one or more of the supported modes. In this mode, changes can be made to all configurable parameters.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The type of block errors for the ISEL block are defined above.

Process Alarm detection is based on the OUT value. The alarm limits of the following standard alarms can be configured:

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

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

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI

Table D-8. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
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, but does not require operator attention (such as diagnostics and system alerts).
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.

Block Execution

The ISEL function block reads the values and status of up to eight inputs. To specify which of the six available methods (algorithms) is used to select the output, configure the selector type parameter (SELECT_TYPE) as follows:

- **Max** selects the maximum value of the inputs.
- **Min** selects the minimum value of the inputs.
- **Avg** calculates the average value of the inputs.
- **Mid** calculates the update for eight sensors.
- **1st Good** selects the first available good input.

If the DISABLE_N is active, the associated input is not used in the selection algorithm.

If an input is not connected, it is also not used in the algorithm.

If the OP_SELECT is set to a value between 1 and 8, the selection type logic is overridden and the output value and status is set to the value and status of the input selected by .

SELECTED will have the number of selected input unless the SELECT_TYPE is mid, in which case it will take the average of the two middle values. Then SELECTED will be set to “0” if there is an even number of inputs.

Status Handling

In Auto mode, reflects the value and status quality of the selected input. If the number of inputs with Good status is less than MIN_GOOD, the output status will be Bad.

In Man mode, the OUT status high and low limits are set to indicate that the value is a constant and the OUT status is always Good.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

Use Uncertain as Good
Sets the OUT status quality to Good when the selected input status is Uncertain.

Uncertain if in Manual mode
The status of the Output is set to Uncertain when the mode is set to manual.

NOTE
The instrument must be to OOS to set the status option.

Application Information

Use the ISEL function block to:

- Select the maximum temperature input from eight inputs and send it to another function block (see Figure D-6)
- Calculate the average temperature of the eight inputs (see Figure D-7)
- Use only six of the eight inputs to calculate the average temperature.

Figure D-6. Input Selector Function Block Application Example (SEL_TYPE = max)

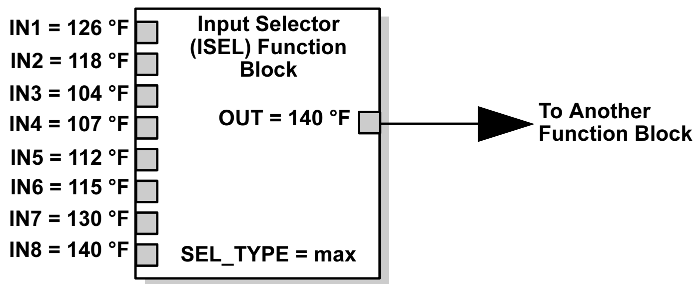


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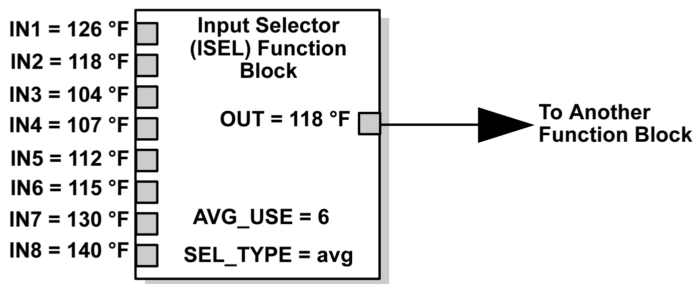
Figure D-7. Input Selector Function Block Application Example (SEL_TYPE = average) AVG_USE = 6



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To determine OUT for a 6-input reading, read all eight, sort in numerical order, drop the highest and lowest values, and calculate the average.

107 112 115 118 126 130
6
118°F

ISEL Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. SELECT_TYPE must be set to a valid value and cannot be left at 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Status of output is BAD	Inputs	All inputs have Bad status
	OP selected	OP_SELECT is not set to 0 (or it is linked to an input that is not 0), and it points to an input that is Bad.
	Min good	The number of Good inputs is less than MIN_GOOD.
	Block is in OOS mode	Change mode to Auto
Block alarms will not work.	Features	FEATURES_SEL in the resource block does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY in the resource block is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Cannot set HI_LIMIT, HI_HI_LIMIT, LO_LIMIT, LO_LO_LIMIT	Scaling	Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE or set values within range.

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