Reference Manual
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October 2011

Rosemount 848T High Density Temperature Transmitter with FOUNDATION™ fieldbus

Device Revision 7

FOUNDATION

ROSEMOUNT®

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Process Management

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Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Rosemount 848T High Density 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 an Emerson Process Management Sales Representative.

LIBERTY EXHIBIT 1031, Page 3
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table of Contents

SECTION 1 Introduction

Safety Messages . . . 1-1
Warnings . . . 1-1
Overview . . . 1-2
Transmitter . . . 1-2
Manual . . . 1-2
Service Support . . . 1-3

SECTION 2 Installation

Safety Messages . . . 2-1
Warnings . . . 2-1
Mounting . . . 2-1
Mounting to a DIN Rail Without an Enclosure . . . 2-2
Mounting to a Panel with a Junction Box . . . 2-2
Mounting to a 2-in. Pipe Stand . . . 2-3
Wiring . . . 2-4
Connections . . . 2-4
Power Supply . . . 2-7
Surges/Transients . . . 2-7
Grounding . . . 2-8
Switches . . . 2-10
Tagging . . . 2-11
Installation . . . 2-12
Using Cable Glands . . . 2-12
Using Conduit Entries . . . 2-12

SECTION 3 Configuration

Safety Messages . . . 3-1
Warnings . . . 3-1
Configuration . . . 3-2
Standard . . . 3-2
Transmitter Configuration . . . 3-2
Custom Configuration . . . 3-2
Methods . . . 3-2
Alarms . . . 3-3
Damping . . . 3-3
Configure the Differential Sensors . . . 3-3
Configure Measurement Validation . . . 3-3
Common Configurations for High Density Applications . . . 3-4
Interfacing Analog Transmitters to Foundation fieldbus . . . 3-6
Block Configuration . . . 3-7
Resource Block . . . 3-7
PlantWeb™ Alerts . . . 3-11
Recommended Actions for PlantWeb Alerts . . . 3-14
Transducer Blocks . . . 3-15
Transducer Block Sub-Parameter Tables . . . 3-20

LIBERTY EXHIBIT 1031, Page 5
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

SECTION 4 Operation and Maintenance

Safety Messages 4-1
Warnings 4-1
Foundation fieldbus Information 4-1
Commissioning (Addressing) 4-2
Hardware Maintenance 4-3
Sensor Check 4-3
Communication/Power Check 4-3
Resetting the Configuration (RESTART) 4-3
Troubleshooting 4-4
Foundation fieldbus 4-4
Resource Block 4-4
Transducer Block Troubleshooting 4-4

APPENDIX A Reference Data

Functional Specifications A-1
Physical Specifications A-3
Function Blocks A-4
Performance Specifications A-4
Dimensional Drawings A-8
Mounting Options A-11
Ordering Information A-12

APPENDIX B Product Certificates

Hazardous Locations Certificates B-1
North American Approvals B-1
European Approvals B-4
Intrinsically Safe and Non-Incendive Installations B-11
Installation Drawings B-12

APPENDIX C Foundation™ fieldbus Technology

Overview C-1
Function Blocks C-1
Device Descriptions C-3
Block Operation C-3
Instrument- Specific Function Blocks C-3
Alerts C-3
Network Communication C-4
Link Active Scheduler (LAS) C-4
Addressing C-6
Scheduled Transfers C-6
Unscheduled Transfers C-7
Function Block Scheduling C-8

APPENDIX D Function Blocks

Analog Input (AI) Function Block D-1
Functionality D-3
AI Block Troubleshooting D-8
Multiple Analog Input (MAI) Function Block D-9
Functionality D-10
MAI Block Troubleshooting D-14
Input Selector Function Block D-15
Functionality D-17
ISEL Block Troubleshooting D-20

LIBERTY EXHIBIT 1031, Page 6
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Section 1 Introduction

Safety Messages . . . . . page 1-1
Overview . . . . . page 1-2
Service Support . . . . . page 1-3

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 sensor 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.

LIBERTY EXHIBIT 1031, Page 7
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

OVERVIEW

Transmitter

The Rosemount 848T is optimal for process temperature measurement 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.

Manual

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

Section 1: Introduction
- Overview
- Considerations
- Return of Materials

Section 2: Installation
- Mounting
- Installation
- Wiring
- Power Supply
- Commissioning

Section 3: Configuration
- FOUNDATION fieldbus Technology
- Configuration
- Function Block Configuration

Section 4: Operation and Maintenance
- Hardware Maintenance
- Troubleshooting

Appendix A: Specification and Reference Data
- Specifications
- Dimensional Drawings
- Ordering Information

Appendix B: Product Certificates
- Hazardous Locations Certificates
- Intrinsically Safe and Non-Incendive Installations
- Installation Drawings

Appendix C: Foundation™ Fieldbus Technology
- Device Descriptions
- Block Operation

Appendix D: Function Blocks
- Analog Input (AI) Function Block
- Multiple Analog Input (MAI) Function Block
- Input Selector Function Block

LIBERTY EXHIBIT 1031, Page 8
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 an Emerson Process Management sales representative.

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

LIBERTY EXHIBIT 1031, Page 9
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

LIBERTY EXHIBIT 1031, Page 10
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Section 2 Installation

Safety Messages . . . . . page 2-1
Mounting . . . . . page 2-1
Wiring . . . . . page 2-4
Grounding . . . . . page 2-8
Switches . . . . . page 2-10
Tagging . . . . . page 2-11
Installation . . . . . page 2-12

SAFETY MESSAGES

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Electrical shock could cause death or serious injury.

- If the sensor 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

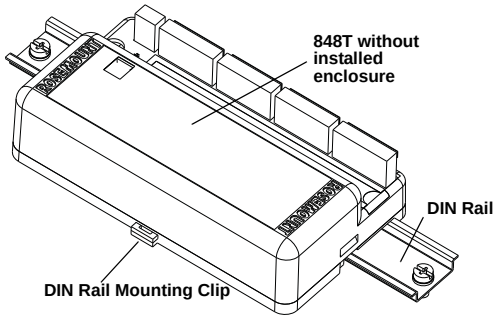
LIBERTY EXHIBIT 1031, Page 11
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

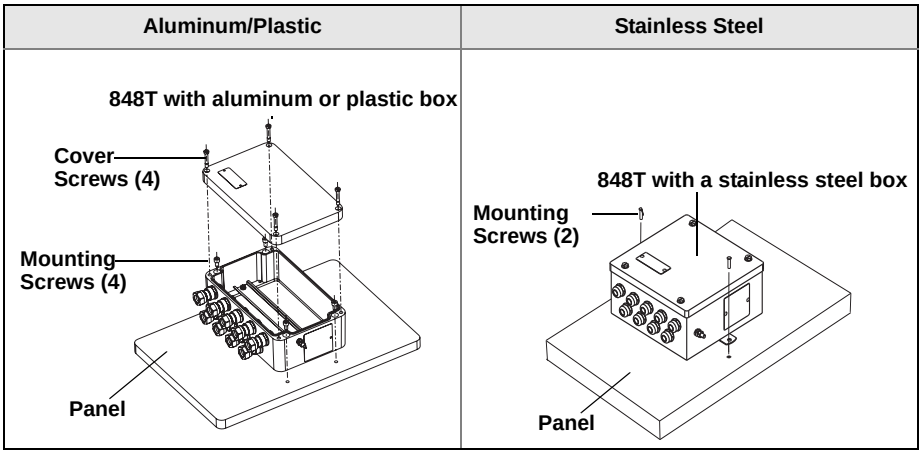


Mounting to a Panel with a Junction Box

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.

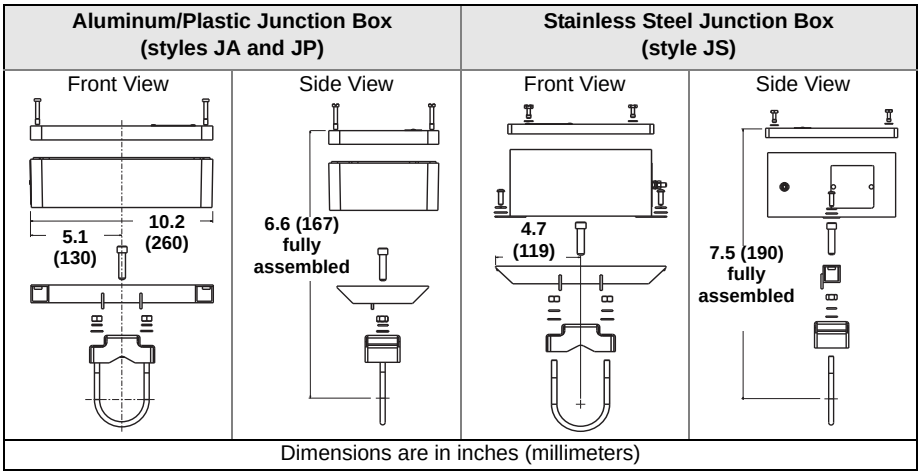
Figure 2-2. Mounting the 848T junction box to a panel

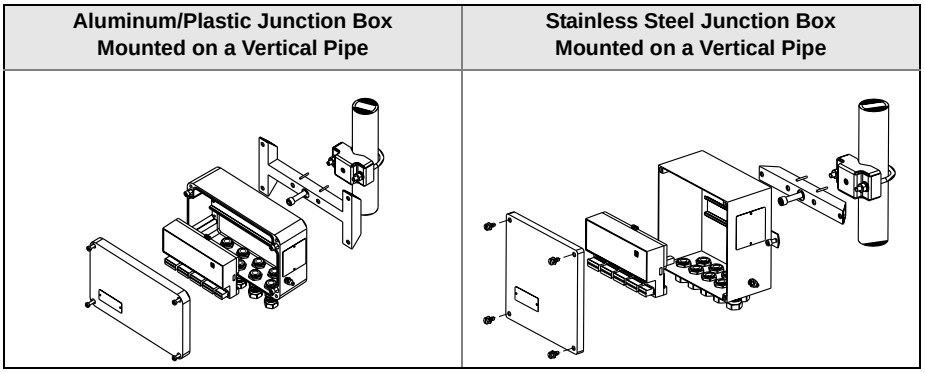


LIBERTY EXHIBIT 1031, Page 12
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Mounting to a 2-in. Pipe Stand

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





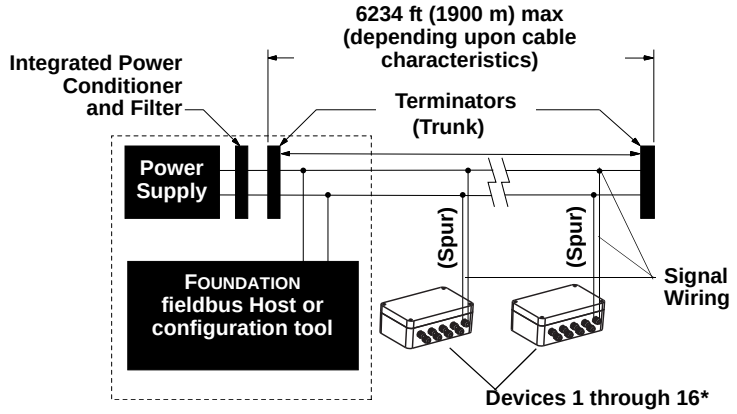
LIBERTY EXHIBIT 1031, Page 13
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

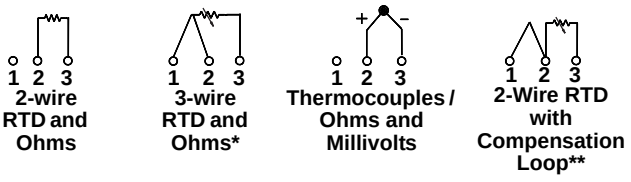


** Intrinsically safe installations may allow fewer devices per I.S. barrier*

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



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

** *The transmitter must be configured for a 3-wire RTD in order to recognize an RTD with a compensation loop.*

LIBERTY EXHIBIT 1031, Page 14
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 that can be read by the 848T and transmitted using 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).

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 Field Communicator for local configuration.

LIBERTY EXHIBIT 1031, Page 15
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Figure 2-5. 848T Analog Input Wiring Diagram

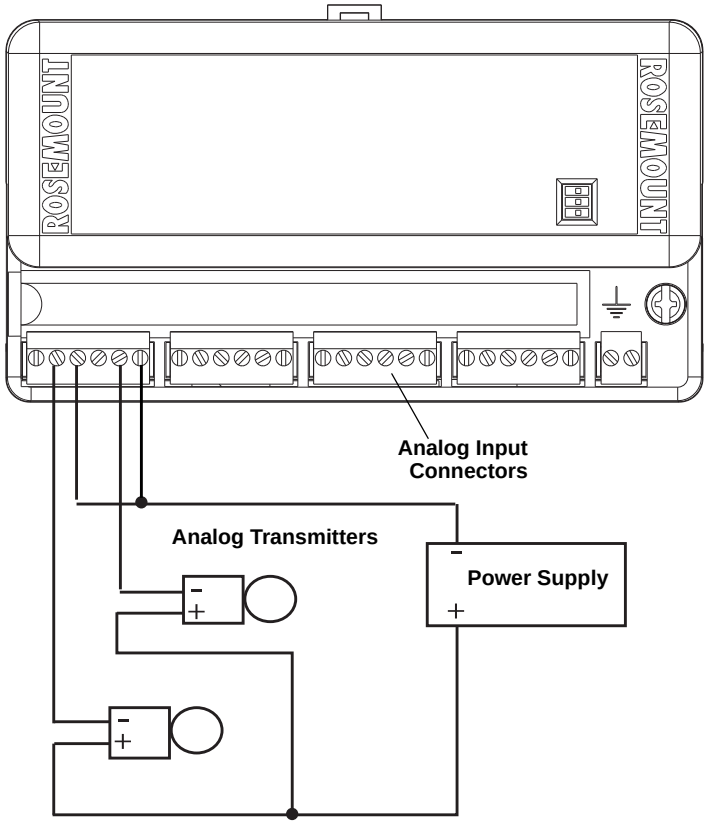
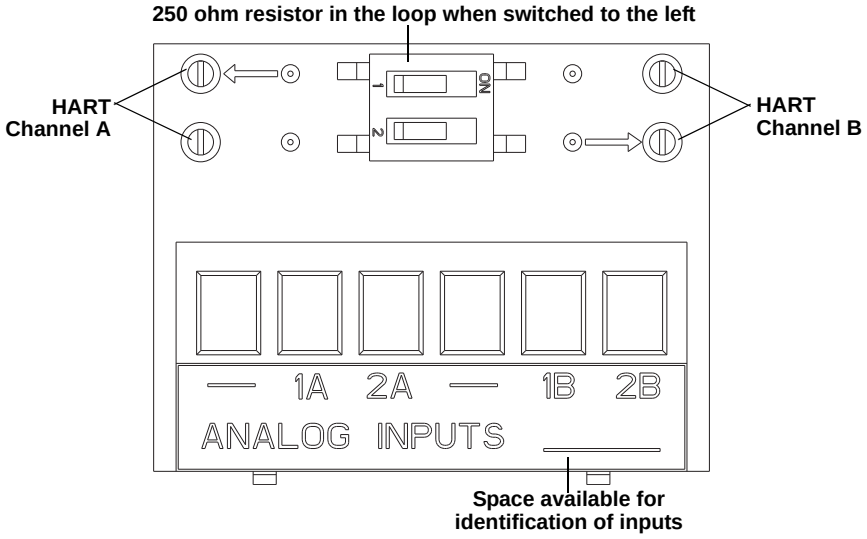


Figure 2-6. 848T Analog Connector



LIBERTY EXHIBIT 1031, Page 16
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Power Supply

Connections

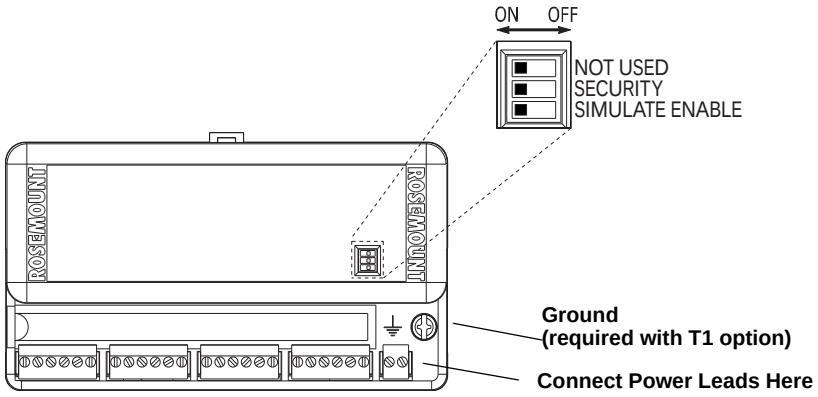
The transmitter requires between 9 and 32 VDC to operate and provide complete functionality. The DC power supply should provide power with less than 2% ripple. A fieldbus segment requires a power conditioner to isolate the power supply filter and decouple the segment from other segments attached to the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

LIBERTY EXHIBIT 1031, Page 17
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

GROUNDING

The 848T transmitter provides input/output isolation up to 620 V 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.

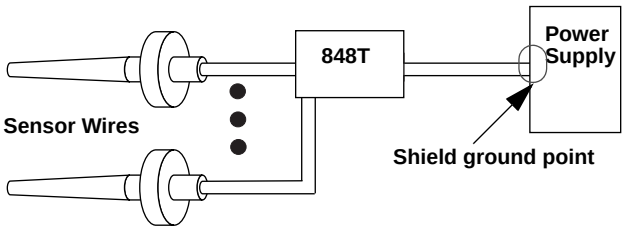
Shielded Wire

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

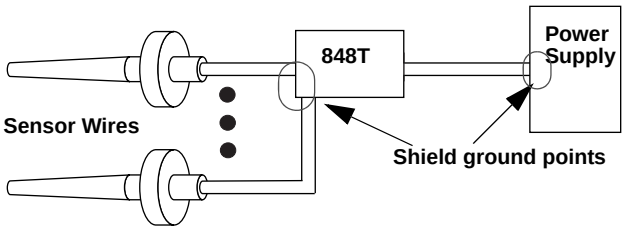
Option 1:

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:

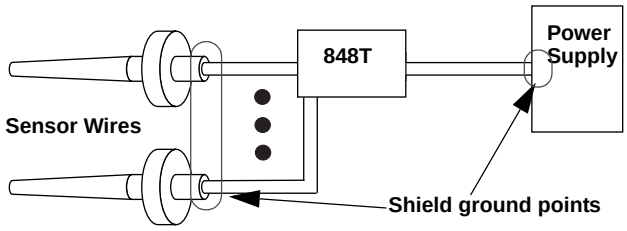
1. Connect sensor wiring shield(s) to the transmitter enclosure (only if the enclosure is grounded).
2. Ensure the sensor shield(s) is electrically isolated from surrounding fixtures that may be grounded.
3. Ground signal wiring shield at the power supply end.



LIBERTY EXHIBIT 1031, Page 18
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

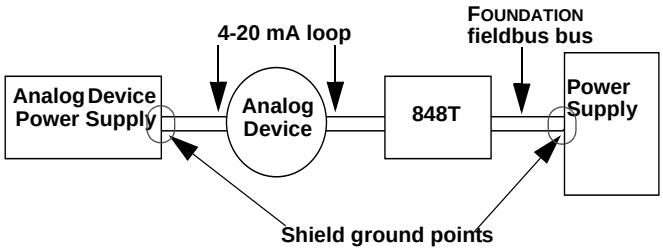
Grounded Thermocouple Inputs

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.



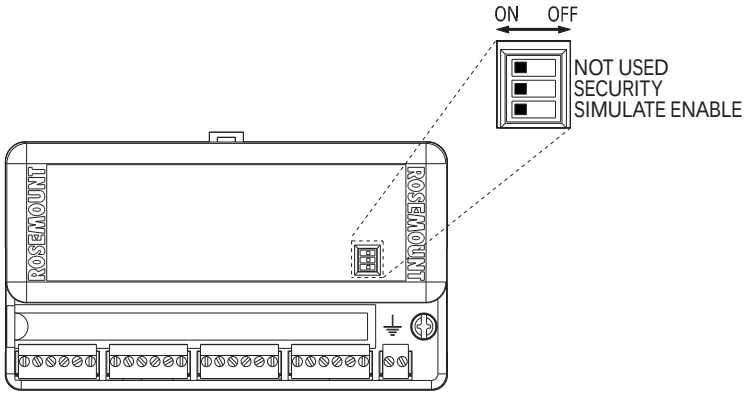
Transmitter Enclosure (optional)

Ground the transmitter in accordance with local electrical requirements.

LIBERTY EXHIBIT 1031, Page 19
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 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.

Not Used

The switch is not functional.

LIBERTY EXHIBIT 1031, Page 20
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

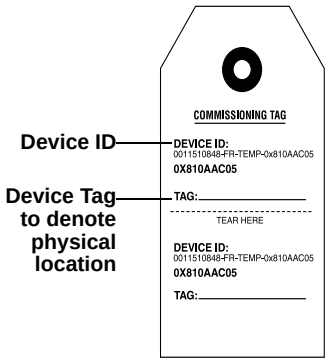
TAGGING

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 32 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 Transducer Block SERIAL_NUMBER parameters will be set at the factory
- The SERIAL_NUMBER parameters can be updated in the field

LIBERTY EXHIBIT 1031, Page 21
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

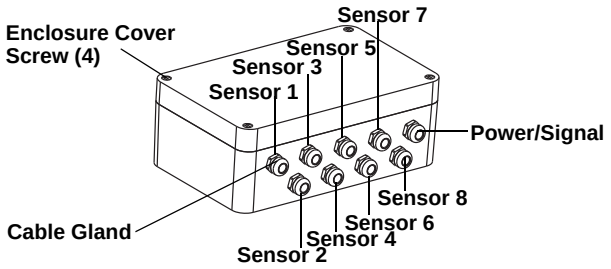
INSTALLATION

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

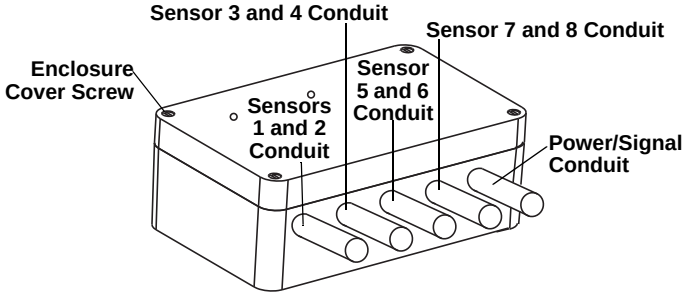


Using Conduit Entries

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



LIBERTY EXHIBIT 1031, Page 22
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Section 3 Configuration

Safety Messages . . . . . page 3-1
Configuration . . . . . page 3-2
Common Configurations for High Density Applications page 3-4
Block Configuration . . . . . page 3-7

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 sensor 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.

LIBERTY EXHIBIT 1031, Page 23
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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	• Transducer Block (1)
FOUNDATION fieldbus Function Blocks	• Analog Input (8) • Multiple Analog Input (2) • 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 Out of Service (OOS) by setting the MODE_BLK.TARGET to OOS, or set the SENSOR_MODE to Configuration.

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.

Methods

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

- Sensor Configuration
- Sensor Input Trim (user input trim)

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.

LIBERTY EXHIBIT 1031, Page 24
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 3-11. 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. (When Multi-bit alerts is enabled, every active alarm is visible for any of the eight sensors, generated by a PlantWeb alert. This is different than only viewing the highest priority alarm.)
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 Transducer Function Block.

1. Set Sensor Mode to Out of Service.
2. Change DAMPING to the desired filter rate (0.0 to 32.0 seconds).
3. Set Sensor Mode to In Service.

Configure the Differential Sensors

Use the following steps to configure the Differential Sensors:

1. Set Dual Sensor Mode to Out of Service.
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 DUAL_SENSOR_CALC to either Not Used, Absolute, or INPUT A minus INPUT B.
4. Set Dual Sensor Mode to In Service.

Configure Measurement Validation

Use the following steps to configure Measurement Validation:

1. Set mode to Disabled for specific sensor.
2. Select sample rate. 1-10 sec/sample is available. 1 second/sample is preferred for sensor degradation. The higher the number of seconds between samples, the more emphasis put on process variation.
3. Select Deviation Limit from 0 to 10 units. If deviation limit is exceeded, a status event will be triggered.
4. Select Increasing Limit. Sets the limit for increasing rate of change. If limit is exceeded, a status event will be triggered.
5. Select Decreasing Limit. Sets the limit for decreasing rate of change. If limit is exceeded, a status event will be triggered.

NOTE:
The decreasing limit selected is required to be a negative value.

LIBERTY EXHIBIT 1031, Page 25
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

6. Set the Deadband from 0 to 90%. This threshold is used to clear the PV status.
7. Set Status Priority. This determines what happens when the specific limit has been exceeded. No Alert - Ignores limit settings. Advisory - Sets Advisory Plant Web Alert, but does not do anything with PV status. Warning - Sets a Maintenance Plant Web Alert and sets PV status to uncertain. Failure - Sets A Failure Plant Web Alert and sets PV status to Bad.
8. Set mode to Enabled for specific sensor.

COMMON CONFIGURATIONS FOR HIGH DENSITY APPLICATIONS

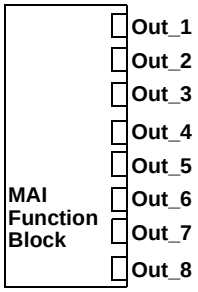
For the application to work properly, configure the links between the function blocks and schedule the order of their execution. The Graphical User Interface (GUI) provided by the FOUNDATION fieldbus host or configuration tool will allow easy configuration.

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 Profiling Application

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

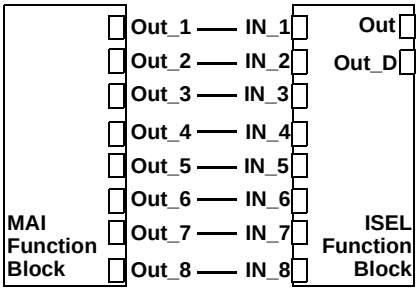


1. Place the Multiple Analog Input (MAI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
2. Set CHANNEL= “channels 1 to 8.” Although the CHANNEL_X parameters remain writable, CHANNEL_X can only be set = X when CHANNEL=1.
3. Set L_TYPE to direct or indirect.
4. Set XD_SCALE (transducer measurement 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.

LIBERTY EXHIBIT 1031, Page 26
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Monitoring Application with a Single Selection

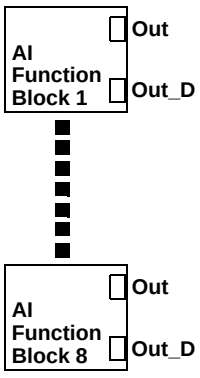
Example: Average exhaust temperature of gas and turbine where there is a single alarm level for all inputs.



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.

Measuring 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 3-11 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.

LIBERTY EXHIBIT 1031, Page 27
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Interfacing Analog Transmitters to FOUNDATION fieldbus

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, or set the SENSOR_MODE to configuration.
2. Set the SENSOR to mV.
3. Set the MODE_BLK.TARGET to AUTO, or set the SENSOR_MODE to operation.

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, or set the SENSOR_MODE to configuration.
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, or set the SENSOR_MODE to operation.

LIBERTY EXHIBIT 1031, Page 28
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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
01	ST_REV	The revision level of the static data associated with the function block.
02	TAG_DESC	The user description of the intended application of the 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: Unicode, Reports, Soft_Write_Lock, Hard_Write_Lock, and Multi-Bit Alarms.
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.
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.

LIBERTY EXHIBIT 1031, Page 29
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-2. Resource Block Parameters

Number	Parameter	Description
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 associated 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.
59	SELF_TEST	Used to self test the device. Tests are device specific.

LIBERTY EXHIBIT 1031, Page 30
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-2. Resource Block Parameters

Number	Parameter	Description
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	Enumerated list of recommended actions displayed with a device alert.
69	FAILED_PRI	Designates the alarming priority of the FAILED_ALM.
70	FAILED_ENABLE	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.
71	FAILED_MASK	Mask of FAILED_ALM. Corresponds bit for bit to FAILED_ACTIVE. A bit on means that the condition is masked out from alarming.
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 for 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 for 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.

LIBERTY EXHIBIT 1031, Page 31
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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: 29 to 31 - HEALTH_INDEX = 20 MAINT_ACTIVE: 26 to 28 - HEALTH_INDEX = 30 MAINT_ACTIVE: 19 to 25 - HEALTH_INDEX = 40 MAINT_ACTIVE: 10 to 16 - 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.

Table 3-3. BLOCK_ERR Conditions

.

Number	Name and Description
0	Other
1	Block Configuration Error: A feature in CYCLE_SEL is set that is not supported by CYCLE_TYPE.
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.
7	Input failure/process variable has bad status
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.
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.

LIBERTY EXHIBIT 1031, Page 32
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 33
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-5. Failure Alarms

Alarm	Priority
Electronics Failure	**1**
Memory Failure	**2**
Hardware/Software Incompatible	**3**
Body Temperature Failure	**4**
Sensor 8 Failure	**5**
Sensor 7 Failure	**6**
Sensor 6 Failure	**7**
Sensor 5 Failure	**7**
Sensor 4 Failure	**9**
Sensor 3 Failure	**10**
Sensor 2 Failure	**11**
Sensor 1 Failure	**12**

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 3-11. 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.

LIBERTY EXHIBIT 1031, Page 34
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-6. Maintenance Alarms/Priority Alarm

Alarm	Priority
Sensor 8 Degraded	**1**
Sensor 7 Degraded	**2**
Sensor 6 Degraded	**3**
Sensor 5 Degraded	**4**
Sensor 4 Degraded	**5**
Sensor 3 Degraded	**6**
Sensor 2 Degraded	**7**
Sensor 1 Degraded	**8**
Body Temperature Out of Range	**9**
CJC Degraded	**10**

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 3-11. 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.

Alarm	Priority
PWA Simulate Active	**1**
Excessive Deviation	**2**
Excessive Rate of Change	**3**

NOTE
Alarms are only prioritized if Multi-Bit Alerts are disabled. If MBA is enabled, all alerts are visible.

LIBERTY EXHIBIT 1031, Page 35
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 3-11. 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 3-7. RB.RECOMMENDED_ACTION

Alarm Type	Active Event	Recommended Action
None	None	No action is required.
Advisory	PWA Simulate Active	Disable simulation to return to process monitoring.
Advisory	Excessive Deviation	
Advisory	Excessive Rate of Change	
Maintenance	CJC Degraded	If T/C sensors are being used, restart the device. If condition persists, replace the device.
Maintenance	Body Temperature Out of Range	Verify the ambient temperature is within operating limits.
Maintenance	Sensor 1 Degraded	Confirm the operating range of Sensor 1 and/or verify the sensor connection and device environment.
Maintenance	Sensor 2 Degraded	Confirm the operating range of Sensor 2 and/or verify the sensor connection and device environment.
Maintenance	Sensor 3 Degraded	Confirm the operating range of Sensor 3 and/or verify the sensor connection and device environment.
Maintenance	Sensor 4 Degraded	Confirm the operating range of Sensor 4 and/or verify the sensor connection and device environment.
Maintenance	Sensor 5 Degraded	Confirm the operating range of Sensor 5 and/or verify the sensor connection and device environment.
Maintenance	Sensor 6 Degraded	Confirm the operating range of Sensor 6 and/or verify the sensor connection and device environment.
Maintenance	Sensor 7 Degraded	Conform the operating range of Sensor 7 and/or verify the sensor connection and device environment.

LIBERTY EXHIBIT 1031, Page 36
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Alarm Type	Active Event	Recommended Action
Maintenance	Sensor 8 Degraded	Confirm the operating range of Sensor 8 and/or verify the sensor connection and device environment.
Failed	Sensor 1 Failure	Verify the Sensor 1 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 2 Failure	Verify the Sensor 2 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 3 Failure	Verify the Sensor 3 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 4 Failure	Verify the Sensor 4 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 5 Failure	Verify the Sensor 5 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 6 Failure	Verify the Sensor 6 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 7 Failure	Verify the Sensor 7 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 8 Failure	Verify the Sensor 8 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Body Temperature Failure	Verify that the body temperature is within the operating limits of this device.
Failed	Hardware/Software Incompatible	Contact Service Center to verify the Device Information (RESOURCE.HARDWARE_REV, AND RESOURCE.RB_SFTWR_REV_ALL).
Failed	Memory Error	Restart the device. If the problem persists, replace the device.
Failed	Electronics Failure	Restart the device. If the problem persists, replace the device.

NOTE
If status is set up to flag failure/warning you will see associated sensor degraded or failure alert.

Transducer Blocks

The transducer block allows the user to view and manage the channel information. There is one Transducer Block for the eight sensors that contains specific temperature measurement data, including:

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

LIBERTY EXHIBIT 1031, Page 37
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

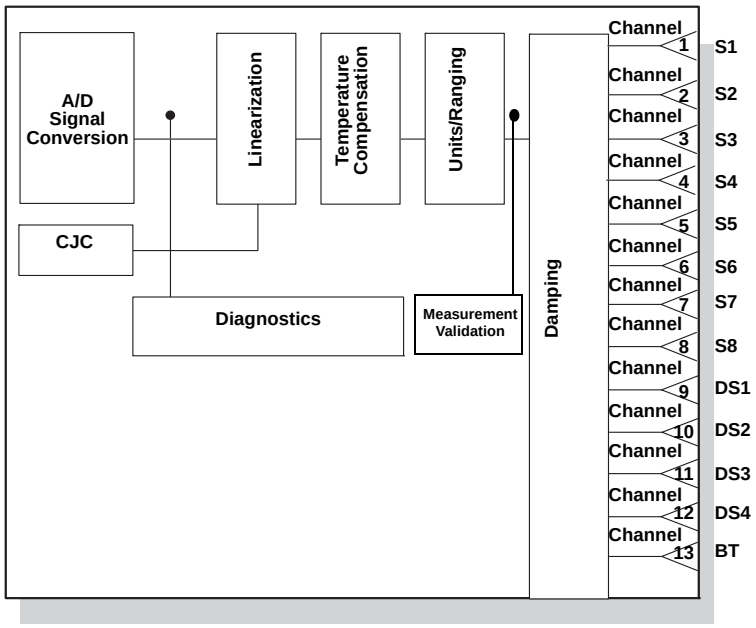
Transducer Block Channel Definitions

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 3-8. Channel Definitions for the 848T

Channel	Description		Channel	Description
1	Sensor One		16	Sensor 3 Deviation
2	Sensor Two		17	Sensor 4 Deviation
3	Sensor Three		18	Sensor 5 Deviation
4	Sensor Four		19	Sensor 6 Deviation
5	Sensor Five		20	Sensor 7 Deviation
6	Sensor Six		21	Sensor 8 Deviation
7	Sensor Seven		22	Sensor 1 Rate Change
8	Sensor Eight		23	Sensor 2 Rate Change
9	Differential Sensor 1		24	Sensor 3 Rate Change
10	Differential Sensor 2		25	Sensor 4 Rate Change
11	Differential Sensor 3		26	Sensor 5 Rate Change
12	Differential Sensor 4		27	Sensor 6 Rate Change
13	Body Temperature		28	Sensor 7 Rate Change
14	Sensor 1 Deviation		29	Sensor 8 Rate Change
15	Sensor 2 Deviation			

Figure 3-1. Transducer Block Data Flow



Transducer Block Errors

The following conditions are reported in the BLOCK_ERR and XD_ERROR parameters.

LIBERTY EXHIBIT 1031, Page 38
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-9. Block/Transducer Error

	Condition Number, Name, and Description	
BLOCK_ERR	0	Other(1)
	7	Input failure/process variable has bad status
	15	Out of service: The actual mode is out of service

(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.

Table 3-10. 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.
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	UPDATE_EVENT	This alert is generated by any change to the static data.
8	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.
9	TRANSDUCER_DIRECTORY	A directory that specified the number and stating indices of the transducers in the transducer block.
10	TRANSDUCER_TYPE	Identifies the transducer that follows 101 – Standard Temperature with Calibration.
11	XD_ERROR	Provides additional error codes related to transducer blocks. *For a list of enumeration values, see FF-902*. Please see tables below for a list of sub-parameters that pertain to XD_ERROR messages.

LIBERTY EXHIBIT 1031, Page 39
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-10. Transducer Block Parameters

Number	Parameter	Description
12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer block.
13	SENSOR_1_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
14	PRIMARY_VALUE_1	The measured value and status available to the function block.
15	SENSOR_2_CONFIG	Sensor Configuration parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
16	PRIMARY_VALUE_2	The measured value and status available to the function block.
17	SENSOR_3_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
18	PRIMARY_VALUE_3	The measured value and status available to the function block
19	SENSOR_4_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
20	PRIMARY_VALUE_4	The measured value and status available to the function block.
21	SENSOR_5_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
22	PRIMARY_VALUE_5	The measured value and status available to the function block.
23	SENSOR_6_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
24	PRIMARY_VALUE_6	The measured value and status available to the function block.
25	SENSOR_7_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
26	PRIMARY_VALUE_7	The measured value and status available to the function block.
27	SENSOR_8_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
28	PRIMARY_VALUE_8	The measured value and status available to the function block
29	SENSOR_STATUS	Status of each individual sensor. Please see tables below for a list of possible status messages.
30	SENSOR_CAL	Parameter structure to allow for calibration of each sensor. Please see tables below for a list of sub-parameters that pertain to Sensor Calibration functions.
31	CAL_STATUS	Status of the calibration that was previously performed. Please see tables below for a list of possible Calibration Statuses.
32	ASIC_REJECTION	A configurable power line noise rejection setting.
33	BODY_TEMP	Body Temperature of the device.
34	BODY_TEMP_RANGE	The range of the body temperature including the units index.
35	TB_SUMMARY_STATUS	Overall summary status of the sensor transducer. Please see tables below for a list of possible transducer statuses.
36	DUAL_SENSOR_1_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
37	DUAL_SENSOR_VALUE_1	The measured value and status available to the function block.
38	DUAL_SENSOR_2_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
39	DUAL_SENSOR_VALUE_2	The measured value and status available to the function block.
40	DUAL_SENSOR_3_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
41	DUAL_SENSOR_VALUE_3	The measured value and status available to the function block.
42	DUAL_SENSOR_4_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
43	DUAL_SENSOR_VALUE_4	The measured value and status available to the function block.
44	DUAL_SENSOR_STATUS	Status of each individual differential measurement. Please see tables below for a list of possible Dual Sensor statuses.
45	VALIDATION_SNSR1_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
46	VALIDATION_SNSR1_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
47	VALIDATION_SNSR2_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.

LIBERTY EXHIBIT 1031, Page 40
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-10. Transducer Block Parameters

Number	Parameter	Description
48	VALIDATION_SNSR2_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
49	VALIDATION_SNSR3_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
50	VALIDATION_SNSR3_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
51	VALIDATION_SNSR4_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
52	VALIDATION_SNSR4_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
53	VALIDATION_SNSR5_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
54	VALIDATION_SNSR5_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
55	VALIDATION_SNSR6_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
56	VALIDATION_SNSR6_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
57	VALIDATION_SNSR7_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
58	VALIDATION_SNSR7_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
59	VALIDATION_SNSR8_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
60	VALIDATION_SNSR8_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.

Changing the Sensor Configuration in the 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 transducer block:

1. Set the MODE_BLK.TARGET to OOS, or set the SENSOR_MODE to configuration.
2. Set SENSOR_n_CONFIG.SENSOR to the appropriate sensor type, and then set SENSOR_n_CONFIG.CONNECTION to the appropriate type and connection.
3. In the Transducer Block, set MODE_BLK.TARGET to AUTO, or set the SENSOR_MODE to operation.

LIBERTY EXHIBIT 1031, Page 41
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Transducer Block Sub-Parameter Tables

Table 3-11. XD_ERROR Sub-Parameter Structure

XD ERROR		Description
0	No Error	
17	General Error	An error has occurred that could not be classified as one of the errors listed below.
18	Calibration Error	An error occurred during calibration of the device or a calibration error has been detected during operation of the device.
19	Configuration Error	An error occurred during configuration of the device or a configuration error has been detected during operation of the device.
20	Electronics Failure	An electronic component has failed.
22	I/O Failure	An I/O failure has occurred.
23	Data Integrity Error	Indicates that data stored within the system may no longer be valid due to non-volatile memory checksum failure, data verify after write failure, etc.
24	Software Error	The software has detected an error. This could be caused by an improper interrupt service routine, an arithmetic overflow, a watchdog timer, etc.
25	Algorithm Error	The algorithm used in the transducer block produced an error. This could be due to an overflow, data reasonableness.

Table 3-12. SENSOR_CONFIG Sub-Parameter Structure

SENSOR CONFIG STRUCTURE	
Parameter	**Description**
SENSOR_MODE	Disables or enables a sensor for configuration.
SENSOR_TAG	Sensor description.
SERIAL_NUMBER	Serial number for the attached sensor.
SENSOR	Sensor Type and Connection. MSB is the sensor type and LSB is the connection.
DAMPING	Sampling Interval used to smooth output using a first order linear filter. A value entered between 0 and the Update_Rate, will result in a damping value equal to the Update_Rate.
INPUT_TRANSIENT_FILTER	Enables or Disables the option for reporting fast changing sensor inputs without temporary holdoff. 0 = Disable, 1 = Enabled.
RTD_2_WIRE_OFFSET	User entered value for constant lead-wire resistance correction in a 2-wire RTD and Ohm sensor types.
ENG_UNITS	The engineering units used for reporting measured sensor values.
UPPER_RANGE	The upper sensor limit for the selected sensor is displayed using Units_Index sub parameter.
LOWER_RANGE	The lower sensor limit for the selected sensor is displayed using Units_Index sub parameter.

LIBERTY EXHIBIT 1031, Page 42
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-13. SENSOR_STATUS Sub-Parameter Structure

Sensor Status Table	
0x00	Active
0x01	Out of Service
0x02	Inactive
0x04	Open
0x08	Short
0x10	Out of Range
0x20	Beyond Limits
0x40	Excess EMF Detected
0x80	Other

Table 3-14. SENSOR_CAL Sub-Parameter Structure

SENSOR CALIBRATION STRUCTURE	
Parameter	**Description**
SENSOR_NUMBER	The sensor number to calibrate
CALIB_POINT_HI	The High calibration point for the selected sensor
CALIB_POINT_LO	The Low calibration point for the selected sensor
CALIB_UNIT	The engineering units used for calibrating the sensor
CALIB_METHOD	The method of the last calibration for sensor 103 - factory trim standard calibration 104 - user trim standard calibration
CALIB_INFO	Information regarding the calibration
CALIB_DATE	Date that the calibration was completed
CALIB_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
CALIB_PT_HI_LIMIT	The High calibration unit
CALIB_PT_LO_LIMIT	The Low calibration unit

Table 3-15. CAL_STATUS Structure

	Cal Status
0	No Command Active
1	Command Executing
2	Command Done
3	Command Done: Errors

Table 3-16. Transducer Status Sub-Parameter Structure

	Transducer Status Table
0x01	A/D Failure
0x02	Sensor Failure
0x04	Dual Sensor Failure
0x08	CJC Degraded
0x10	CJC Failure
0x20	Body Temp Failure
0x40	Sensor Degraded
0x80	Body Temperature Degraded

LIBERTY EXHIBIT 1031, Page 43
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-17. DUAL_SENSOR CONFIG Sub-Parameter Structure

DUAL SENSOR CONFIG STRUCTURE	
Parameter	**Description**
DUAL_SENSOR_MODE	Disables or enables a sensor for configuration
DUAL_SENSOR_TAG	Differential description
INPUT_A	Sensor to be used in DUAL_SENSOR_CALC
INPUT_B	Sensor to be used in DUAL_SENSOR_CALC
DUAL_SENSOR_CALC	Equation used for the dual sensor measurement including: Not Used, Difference (Input A - Input B), and Absolute Difference (Input A - Input B)
ENG_UNITS	Units used to display sensor parameter
UPPER_RANGE	Upper Differential Limit (Input A High - Input B Low)
LOWER_RANGE	Lower Differential Limit (Input A Low - Input B High)

Table 3-18. DUAL_SENSOR_ STATUS Sub-Parameter Structure

	Dual Sensor Status Table
0x00	Active
0x01	Out of Service
0x02	Inactive
0x04	Component Sensor Open
0x08	Component Sensor Short
0x10	Component Sensor Out of Range or Degraded
0x20	Component Sensor Out of Limits
0x40	Component Sensor Inactive
0x80	Configuration Error

Table 3-19. Validation Value Sub-Parameter Structure

Validation Value Sub-Parameter Structure	
Parameter	**Description**
VALIDATION_STATUS	State of the channel specific measurement validation measurement
DEVIATION_VALUE	Deviation output value
DEVIATION_STATUS	Status of the deviation output
RATE_OF_CHANGE_VALUE	Rate of change value output
RATE_OF_CHANGE_STATUS	Status of Rate of change output

LIBERTY EXHIBIT 1031, Page 44
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 3-20. Validation Config Sub-Parameter Structure

Validation Value Sub-Parameter Structure	
Parameter	**Description**
VALIDATION_MODE	Activates the measurement validation data gathering process 0 = Disable 1 = Enable
SAMPLE_RATE	Number of seconds per sample used for measurement validation data collection. This shouldn't exceed 10 seconds per sample, but currently there are no upper limits.
DEVIATION_LIMIT	Sets the limit for the deviation diagnostic. DD limits the upper range to 10.
DEVIATION_ENG_UNITS	Units tied to the deviation output value
DEVIATION_ALERT_SEVERITY	Advisory, Maintenance, Failure 0 = Disabled = Does not use the limits, but provides an output 1 = Advisory = No effect on sensor status, sets advisory PWA 2 = Maint = Sets sensor status to uncertain, sets advisory PWA 3 = Failure = Sets sensor status to Bad, sets advisory PWA
DEVIATION_PCNT_LIM_HYST	Deviation Hysteresis Limit = (1 - DEVIATION_PCNT_LIM_HYST/100) * DEVIATION_LIMIT
RATE_INCREASING_LIMIT	Increasing Rate of Change limit set point
RATE_DECREASING_LIMIT	Decreasing Rate of Change limit set point
RATE_ENG_UNITS	Units tied to the rate of change output value
RATE_ALERT_SEVERITY	Advisory, Maintenance, Failure 0 = Disabled = Does not use the limits, but provides an output 1 = Advisory = No effect on sensor status, sets advisory PWA 2 = Maint = Sets sensor status to uncertain, sets advisory PWA 3 = Failure = Sets sensor status to Bad, sets advisory PWA
RATE_PCNT_LIM_HYST	Rate of Change Increasing Hysteresis Limit = (1 - RATE_PCNT_LIM_HYST/100) * RATE_INCREASING_LIMIT

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:

NOTE:
Active calibrators should not be used in conduction with RTDs on any multiple input temperature transmitter such as the 848T.

LIBERTY EXHIBIT 1031, Page 45
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

1. Under SENSOR_CALIB, the SENSOR_NUMBER to the number of the sensor to calibrate.
2. Set CALIB_UNIT to calibration unit.
3. Set CALIB_METHOD to User Trim (seeTable 3-8 on page 3-16 for valid values).
4. Set the input value of the sensor simulator to be within the range defined by CALIB_LO_LIMIT and CALIB_HI_LIMIT.
5. Set CALIB_POINT_LO (CALIB_POINT_HI) to the value set at the sensor simulator.
6. Read CALIB_STATUS and wait until it reads “Command Done”
7. Repeat steps 3 to 5 if performing a two-point trim. Note that the difference in values between CALIB_POINT_LO and CALIB_POINT_HI must be greater than CALIB_MIN_SPAN.

LIBERTY EXHIBIT 1031, Page 46
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Section 4 Operation and Maintenance

Safety Messages . . . . . page 4-1
Foundation fieldbus Information . . . . . page 4-1
Hardware Maintenance . . . . . page 4-3
Troubleshooting . . . . . page 4-4

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.

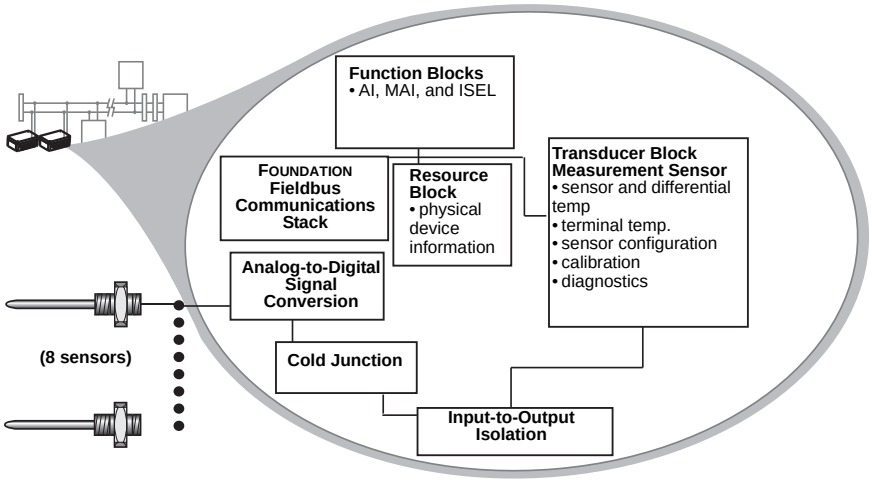
- If the senor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

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 enable 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.

LIBERTY EXHIBIT 1031, Page 47
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table 4-1. Block Diagram for the Rosemount 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.

LIBERTY EXHIBIT 1031, Page 48
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 49
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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: 4
		DLPDU PhLO: 4
		MID: 7
		TSC: 4 (1 ms)
		T1: 96000 (3 seconds)
		T2: 9600000 (300 seconds)
		T3: 480000 (15 seconds)
	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.

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.
	Resource block	The actual mode of the Resource block is in OOS. See Resource Block Diagnostics for corrective action.
	Transducer Block	The actual mode of the Transducer Block is OOS.
The primary value is BAD	Measurement	Look at the SENSOR_STATUS parameter (See Table 3-16 on page 3-21)

LIBERTY EXHIBIT 1031, Page 50
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Appendix A Reference Data

Functional Specifications . . . . . **page A-1**
Physical Specifications . . . . . **page A-3**
Performance Specifications . . . . . **page A-4**
Function Blocks . . . . . **page A-4**
Dimensional Drawings . . . . . **page A-8**
Ordering Information . . . . . **page A-12**

FUNCTIONAL SPECIFICATIONS

Inputs

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

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

Outputs

Manchester-encoded digital signal that conforms to IEC 61158 and ISA 50.02.

Status

- 600 Vdc channel to channel isolation(1)
- 10 Vdc channel to channel isolation for all operating conditions with maximum 150 m. (500 ft) of sensor lead length 18 AWG.

Ambient Temperature Limits

–40 to 185 °F (–40 to 85 °C)

Isolation

Isolation between all sensor channels is rated to 10Vdc over all operating conditions. No damage will occur to the device with up to 600 Vdc between any sensor channel.

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.)

(1) Reference conditions are -40 to 60 °C (-40 to 140 °F) with 30 m. (100 ft) of sensor lead length 18 AWG wire.

LIBERTY EXHIBIT 1031, Page 51
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Transient Protection

The transient protector (option code T1) helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, 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.

Update Time

Approximately 1.5 seconds to read all 8 inputs.

Humidity Limits

0–99% non-condensing relative humidity

Turn-on Time

Performance within specifications is achieved in less than 30 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	20
Links	30
Virtual Communications Relationships (VCR)	20

LIBERTY EXHIBIT 1031, Page 52
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 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 ½-in. NPT fittings.

Materials of Construction for Optional Junction Box

Junction Box Type	Paint
Aluminum	Epoxy Resin
Plastic	NA
Stainless Steel	NA
Aluminum Explosion-proof	NA

Weight

Assembly	Weight		
	oz	lb	kg
Rosemount 848T only	7.5	.47	.208
Aluminum(1)	78.2	4.89	2.22
Plastic (1)	78.2	4.89	2.22
Stainless Steel (1)	77.0	4.81	2.18
Aluminum Explosion-proof	557	34.8	15.5

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

Environmental Ratings

NEMA Type 4X and IP66 with optional junction box. JX3 Explosion-proof enclosure rated to -4 °F (-20 °C).

LIBERTY EXHIBIT 1031, Page 53
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

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 high pipeline vibration specification per IEC 60770-1 1999 with no effect on performance.

Electromagnetic Compatibility Compliance Testing

- Meets the criteria under IEC 61326:2006
- Meets the criteria under European Union Directive 2004/108/EC

LIBERTY EXHIBIT 1031, Page 54
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Accuracy

Table 1. Input Options/Accuracy

Sensor Option	Sensor Reference	Input Ranges		Accuracy Over Range(s)	
		°C	°F	°C	°F
2- and 3-Wire RTDs					
Pt 50 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	± 0.57	± 1.03
Pt 100 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	± 0.28	± 0.50
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 (α = 0.00385)	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.54	± 0.98
Pt 200 (α = 0.003916)	JIS 1604; α = 0.003916, 1981	–200 to 645	–328 to 1193	± 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
Cu 100 (a=428)	GOST 6651-94	-185 to 200	-365 to 392	± 0.48	±0.86
Cu 50 (a=428)	GOST 6651-94	-185 to 200	-365 to 392	± 0.96	±1.73
Cu 100 (a=426)	GOST 6651-94	-50 to 200	-122 to 392	± 0.48	±0.86
Cu 50 (a=426)	GOST 6651-94	-50 to 200	-122 to 392	± 0.96	±1.73
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	–200 to 1000	–328 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 2501	± 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	± 0.70	± 1.26
w5Re26/W26Re	ASTME 988-96	0 to 2000	32 to 3632	± 1.60	± 2.88
GOST Type L	GOST R 8.585-2001	-200 to 800	-392 to 1472	± 0.71	± 1.28
Terminal Temperature		-50 to 85	-58 to 185	±3.50	± 6.30
Ohm Input		0 to 2000 ohms		± 0.90 ohms	
Millivolt Input		-10 to 100 mV		± 0.05 mV	
1000 mV		-10 to 1000 mV		± 1.0 mA	
4–20 mA (Rosemount)(1)		4–20 mA		± 0.01 mA	
4–20 mA (NAMUR)(1)		4–20 mA		± 0.01 mA	
Multipoint Sensors(2)					

(1) Requires the S002 option code.
(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 Emerson representative.

Differential Configuration Notes

Differential capability exists between any two sensor types.

For all differential configurations, the input range is X to Y where X = Sensor A minimum - Sensor B max.
Y = Sensor A maximum - Sensor B 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.

LIBERTY EXHIBIT 1031, Page 55
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Analog Sensors 4–20mA

Two types of 4–20 mA sensors are compatible with the Rosemount 848T. These types must be ordered with the S002 option code complete with an analog connector kit. The alarm levels, accuracy for each type are listed in Table 2.

Table 2. Analog Sensors

Sensor Option	Alarm Levels	Accuracy
4–20mA (Rosemount Standard)	3.9 to 20.8 mA	± 0.01mA
4–20mA (NAMUR)	3.8 to 20.5 mA	± 0.01mA

LIBERTY EXHIBIT 1031, Page 56
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Ambient Temperature Effect

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

Table 3. Ambient Temperature Effects

NIST Type	Accuracy per 1.0 °C (1.8 °F) Change in Ambient Temperature[(1)]C	Temperature Range (°C)
RTD		
Pt 50 (α = 0.00391)	• 0.004 °C (0.0072 °F)	NA
Pt 100 (α = 0.00391)	• 0.002 °C (0.0036 °F)	NA
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 200 (α = 0.003916)	• 0.004 °C (0.0072 °F)	NA
Pt 200 (α = 0.00385)	• 0.004 °C (0.0072 °F)	NA
Pt 500	• 0.003 °C (0.0054 °F)	NA
Pt 1000	• 0.003 °C (0.0054 °F)	NA
Cu 10	• 0.03 °C (0.054 °F)	NA
Cu 100 (a=428)	• 0.002 °C (0.0036 °F)	NA
Cu 50 (a=428)	• 0.004 °C (.0072 °F)	NA
Cu 100 (a=426)	• 0.002 °C (0.0036 °F)	NA
Cu 50 (a=426)	• 0.004 °C (.0072 °F)	NA
Ni 120	• 0.003 °C (0.0054 °F)	NA
Thermocouple (R = the value of the reading)		
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
GOST Type L	• 0.007 °C • 0.007 °C + (0.003% of IRI)	• R ≥ 0 • R < 0
Millivolt	• 0.0005 mV	NA
2- and 3-wire Ohm	• 0.0084 ohms	NA
4–20 mA (Rosemount)	• 0.0001 mA	NA
4-20 mA (NAMUR)	• 0.0001 mA	NA

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

LIBERTY EXHIBIT 1031, Page 57
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Ambient Temperature Notes
Examples:

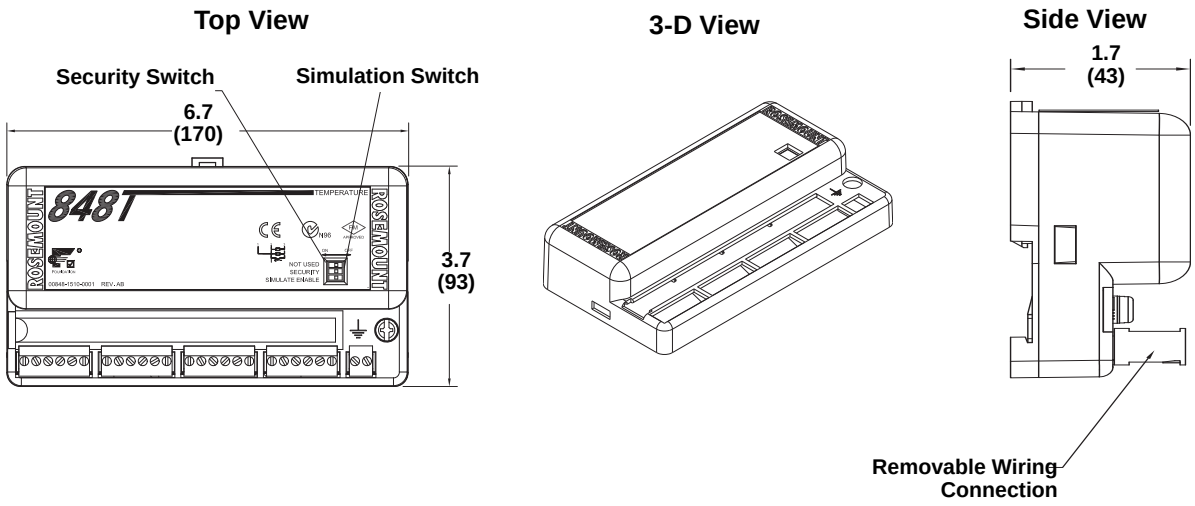
When using a Pt 100 (α = 0.00385) sensor input at 30 °C ambient temperature:

- Digital Temperature Effects: 0.003 °C x (30 - 20) = .03 °C
- Worst Case Error: Digital + Digital Temperature Effects = 0.3 °C + .03 °C = .33 °C
- Total Probable Error $\sqrt{0.30^2 + 0.03^2} = 0.30°C$

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.

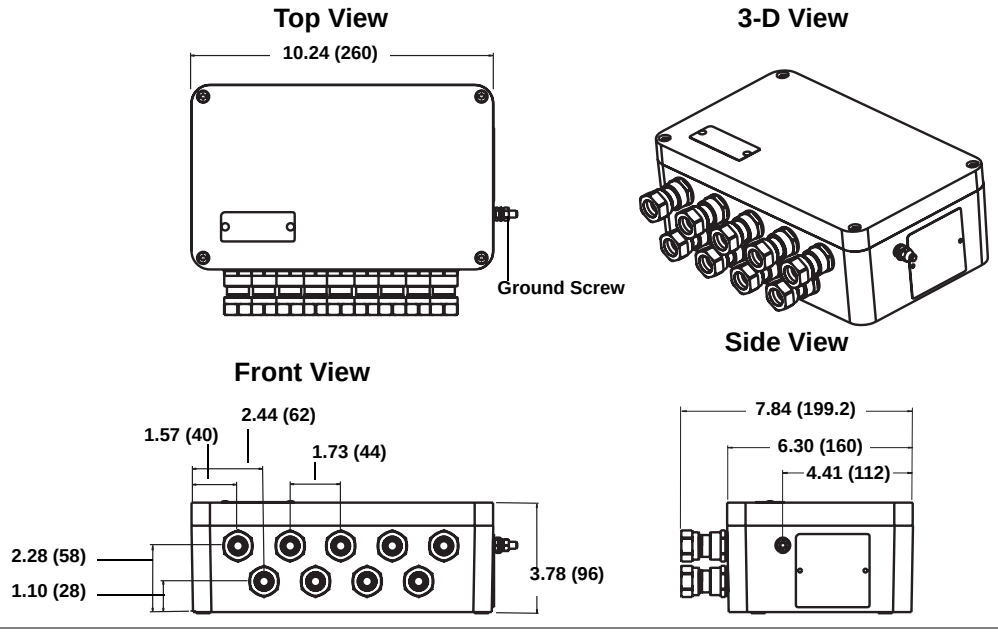
Rosemount 848T



Dimensions are in inches (millimeters)

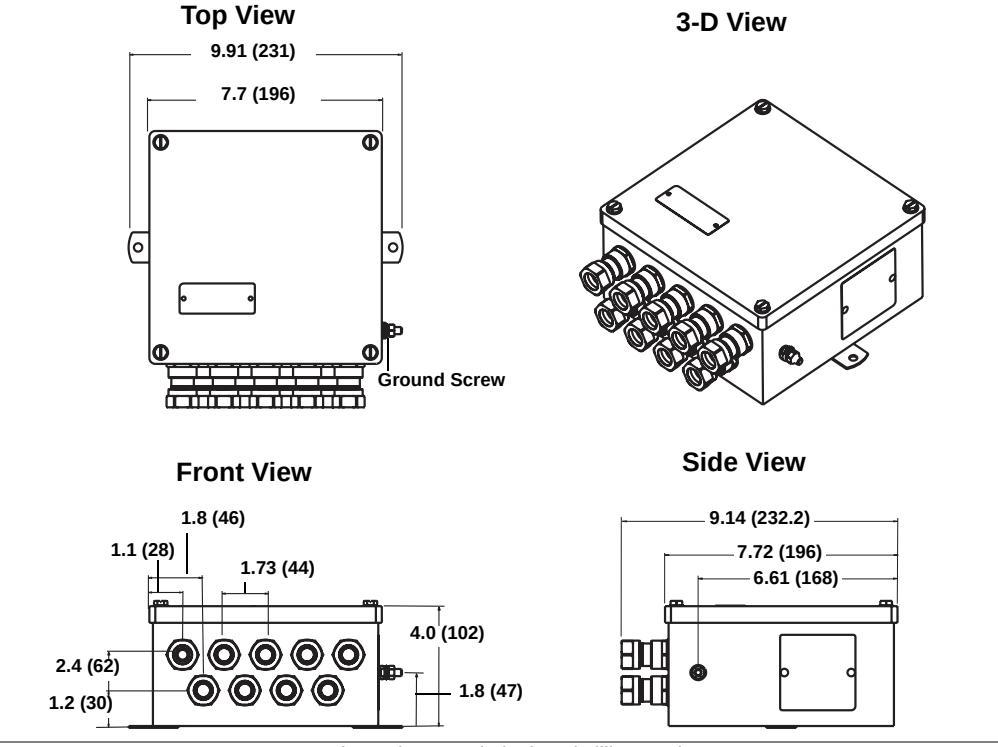
LIBERTY EXHIBIT 1031, Page 58
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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



Dimensions are in inches (millimeters)

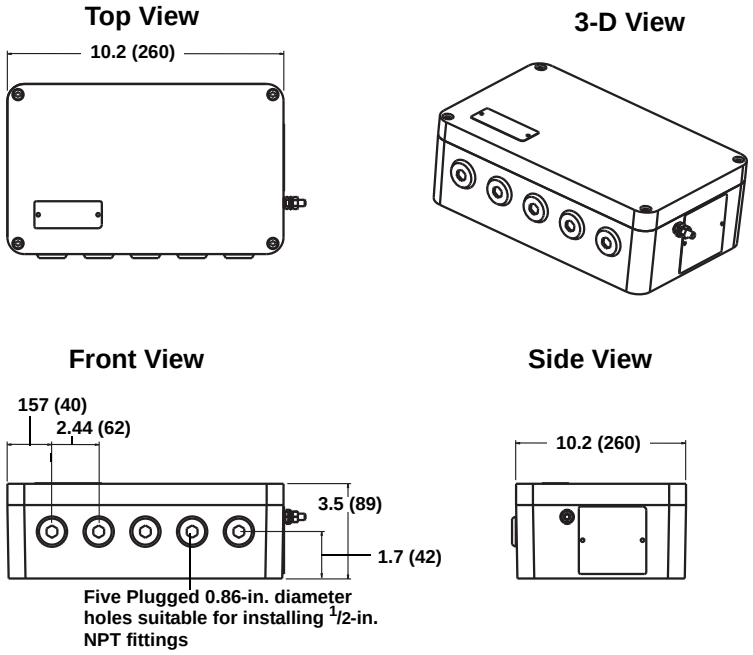
Stainless Steel Junction Box—Cable Gland (option code JS2)



Dimensions are in inches (millimeters)

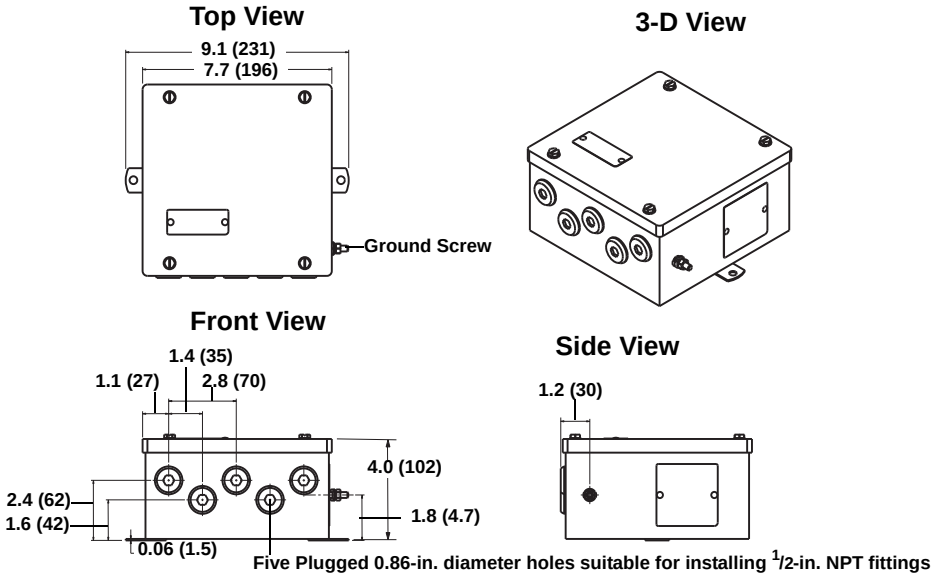
LIBERTY EXHIBIT 1031, Page 59
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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)



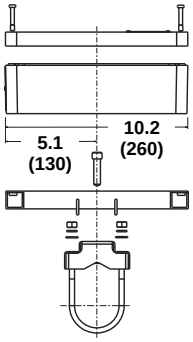
Dimensions are in inches (millimeters)

LIBERTY EXHIBIT 1031, Page 60
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

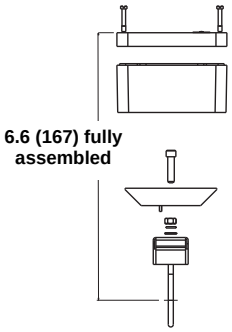
Mounting Options

Aluminum/Plastic Junction Box (styles JA and JP)

Front View

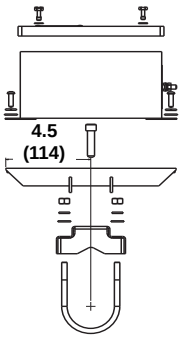


Side View

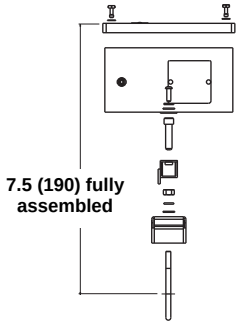


Stainless Steel Junction Box (style JS)

Front View

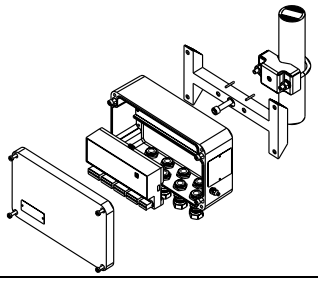


Side View

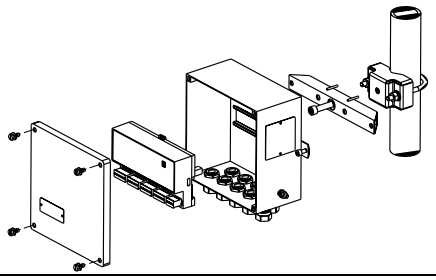


Dimensions are in inches (millimeters)

Aluminum/Plastic Junction Box Mounted on a Vertical Pipe



Stainless Steel Junction Box Mounted on a Vertical Pipe



LIBERTY EXHIBIT 1031, Page 61
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

ORDERING INFORMATION

Table A-1. Rosemount 848T FOUNDATION fieldbus Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product Description		
848T	High Density Temperature Measurement Family		
Transmitter Output			
Standard			**Standard**
F	FOUNDATION fieldbus digital signal (includes AI, MAI, and ISEL function blocks, and Backup Link Active Scheduler)		★
Product Certifications[1]		**Rosemount Junction Box required?**	
Standard			**Standard**
I1	ATEX Intrinsic Safety	No	★
I3	NEPSI Intrinsic Safety	No	★
I4	TIIS Intrinsically Safety (FISCO) Type '1a'	No	★
H4	TIIS Intrinsic Safety (FISCO) Type '1b'	No	★
I5[2]	FM Intrinsically Safe	No	★
I6[2]	CSA Intrinsically Safe	No	★
I7	IECEx Intrinsic Safety	No	★
IA	ATEX FISCO Intrinsic Safety	No	★
IE	FM FISCO Intrinsically Safe	No	★
IF[2]	CSA FISCO Intrinsically Safe, Division 2	No	★
IG	IECEx FISCO (Intrinsic Safety)	No	★
N1	ATEX Type n (enclosure required)	Yes	★
N5	FM Class I, Division 2, and Dust Ignition-proof (enclosure required)	Yes	★
N6	CSA Class I, Division 2	No	★
N7	IECEx Type n (enclosure required)	Yes	★
NC	ATEX Type n Component (Ex nA nL)	No[3]	★
ND	ATEX Dust (enclosure required)	Yes	★
NJ	IECEx Type n Component (Ex nA nL)	No[3]	★
NK	FM Class 1, Division 2	No	★
NA	No Approval	No	★
Expanded			
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2 (JX3 enclosure required)	Yes[4]	

Options (Include with selected model number)

Input Types		
Standard		**Standard**
S001	RTD, Thermocouple, mV, Ohm Inputs	★
S002[5]	RTDs, Thermocouple, mV, Ohm and 4–20 mA Inputs	★
PlantWeb Advanced Diagnostics		
Standard		**Standard**
D04	Measurement Validation Diagnostic	★
Transient Protection		
Standard		**Standard**
T1	Integral Transient Protector	★
Mounting Bracket		
B6	Mounting Bracket for 2-in. pipe mounting – SST bracket and bolts	★

LIBERTY EXHIBIT 1031, Page 62
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Table A-1. Rosemount 848T FOUNDATION fieldbus Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Enclosure Options		
Standard		**Standard**
JP1	Plastic Junction Box; No Entries	★
JP2	Plastic Box, Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JP3	Plastic Box, Conduit Entries (5 Plugged Holes, suitable for installing 1/2-in. NPT fittings)	★
JA1	Aluminum Junction Box; No Entries	★
JA2	Aluminum Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JA3	Aluminum Conduit Entries (5 Plugged Holes, suitable for installing 1/2-in. NPT fittings)	★
JS1	Stainless Steel Junction Box; No Entries	★
JS2	Stainless Steel Box, Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JS3	Stainless Steel Box, Conduit Entries (5 Plugged Holes, suitable for installing 1/2-in. NPT fittings)	★
JX3(6)	Explosion-proof Box, Conduit Entries (4 Plugged Holes, suitable for installing 1/2-in. NPT fittings)	★
Software Configuration		
Standard		**Standard**
C1	Custom Configuration of Date, Descriptor, Message and Wireless Parameters (Requires CDS with Order)	★
Line Filter		
Standard		**Standard**
F5	50 Hz Line Voltage Filter	★
Calibration Certificate		
Standard		**Standard**
Q4	Calibration Certificate (3-Point Calibration)	★
Shipboard Certification		
Standard		**Standard**
SBS	American Bureau of Shipping (ABS) Type Approval	★
SLL	Lloyd's Register (LR) Type Approval	★
Special Temperature Test		
Expanded		
LT	Test to -60 °F (-51.1 °C)	
Conduit Electrical Connector		
Standard		**Standard**
GE(7)	M12, 4-pin, Male Connector (eurofast®)	★
GM(7)	A size Mini, 4-pin, Male Connector (minifast®)	★
Typical Model Number: 848T F I5 S001 T1 B6 JA2		

(1) Consult factory for availability.
(2) Available only with S001 option.
(3) The Rosemount 848T ordered with component approval is not approved as a stand-alone unit. Additional system certification is required.
(4) Enclosure Option JX3 must be ordered with Product Certification Code E6. (O-ring for the JX3 enclosure rated to -20 °C).
(5) S002 is only available with Product Certification N5, N6, N1, NC, NK, and NA.
(6) JX3 Explosion-proof enclosure rated to -4 °F (-20 °C).
(7) Available with no approval or Intrinsically Safe approvals only. For FM Intrinsically Safe (option code I5), install in accordance with Rosemount drawing 00848-4402.

LIBERTY EXHIBIT 1031, Page 63
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

LIBERTY EXHIBIT 1031, Page 64
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Appendix B Product Certificates

Hazardous Locations Certificates . . . . . page B-1
Intrinsically Safe and Non-Incendive Installations . . . . . page B-11
Installation Drawings . . . . . page B-12

HAZARDOUS LOCATIONS CERTIFICATES

North American Approvals

Factory Mutual (FM) Approvals

I5 Intrinsically Safe and Non-Incendive
Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4404.

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 00848-4404.

Temperature Code:
T4A (T_{amb} = -40 to 85 °C)
T5 (T_{amb} = -40 to 70 °C)
Rosemount Enclosure Required.
Indoor Hazardous (Classified) Locations.

Table B-1. FM Approved Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 30 V	V_{OC} = 12.5 V
I_{max} = 300 mA	I_{SC}= 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 2.1 nF	C_A = 1.2 µF
L_i = 0	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

Table B-2. Entity Parameters for Non Incendive Field Wiring

Power/Bus	Sensor(1)
V_{max} = 42.4 V	V_{OC} = 12.5 V
C_i = 2.1nF	I_{SC} = 4.8 mA
L_i = 0	P_o = 15 mW
	C_A = 1.2 µF
	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channel.

LIBERTY EXHIBIT 1031, Page 65
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 00848-4404.

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 00848-4404.

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

Table B-3. Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 17.5 V	V_{OC} = 12.5 V
I_{max} = 380 mA	I_{SC} = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1nF	C_A = 1.2 µF
L_i = 0	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

N5 Dust Ignition-Proof
For use in Class II, III, Division 1, Groups E, F, G. Class I, Division 2, Groups A, B, C, D;
Non-incendive for Class 1, Division 2, Groups A, B, C, D when installed to Rosemount Control Drawing 00848-4404.
Rosemount Enclosure Required.
Valid with both S001 and S002 options.

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

NK 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 00848-4404.

Temperature Code:
T4A (T_{amb} = -40 to 85 °C)
T5 (T_{amb} = -40 to 70 °C)
Rosemount Enclosure Required.
Indoor Hazardous (Classified) Locations.

Table B-4. FM Approved Entity Parameters(1)

Power/Bus	Sensor
V_{max} = 42.4 V	V_{OC} = 12.5 V
C_i = 2.1 µF	I_{SC} = 4.8 mA
L_i = 0 H	P_o = 15 mW
	C_A = 1.2 µF
	L_A = 1 H

(1) Intrinsically safe and non-incendive parameters.

LIBERTY EXHIBIT 1031, Page 66
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Canadian Standards Association (CSA) Certifications

E6 Explosion-Proof and Dust Ignition-Proof
Class I, Division 1, Groups B, C, and D.

Class II, Division 1, Groups E, F, and G.
Class III

Must be installed in enclosure option JX3.
Install per drawing 00848-1041.
Conduit seal not required.

Suitable for use in Class I, Division 2, Groups A, B, C, D. when installed per Rosemount drawing 00848-4405.
Temperature Code:
T3C = ($-50 \leq T_{amb} \leq 60$ °C)
Must be installed in a suitable enclosure as determined acceptable by the local inspection authority.

I6 Intrinsically Safe, Division 2
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4405.

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.
Not valid with S002 option.

Table B-5. CSA Approved Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 30 V	V_{OC} = 12.5 V
I_{max} = 300 mA	I_{SC} = 4.8 mA
C_i = 2.1nF	P_o = 15 mW
L_i = 0	C_A = 1.2 µF
	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

IF FISCO (Intrinsically Safe)
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4405.

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.
Not valid with S002 option.

Table B-6. CSA Approved Entity Parameters

Power/Bus	Sensor(1)
U_i = 17.5 V	V_{OC} = 12.5 V
I_i = 380 mA	I_{SC} = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1nF	C_a = 1.2 µF
L_i = 0	L_a = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

LIBERTY EXHIBIT 1031, Page 67
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

N6 Class I, Division 2
Suitable for use in Class I, Division 2, Groups A, B, C, D. when installed per Rosemount drawing 00848-4405.
Temperature Code:
T3C = ($-50 \leq T_a \leq 60$ °C)
Must be installed in a suitable enclosure as determined acceptable by the local inspection authority.

European Approvals

ATEX Certifications

I1 Intrinsic Safety
Certification Number: Baseefa09ATEX0093X
ATEX Marking ⟨Ex⟩ II 1 G
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-7. ATEX Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.5 V
I_i = 300 mA	I_o = 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 0	C_i = 1.2 µF
L_i = 0	L_i = 1 H

Special Conditions for Safe Use (x):

1. 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 1Gohm. Light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN 60079-11:2007. This must be taken into account when installing the apparatus.

IA FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
Certificate Number: BASEEFA09ATEX0093X
ATEX Marking ⟨Ex⟩ II 1 G
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-8. ATEX Approved Entity Parameters

Power/Bus	Sensor
U_i = 17.5 V	U_o = 12.5 V
I_i = 380 mA	I_o = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 0	C_i = 1.2 µF
L_i = 0	L_i = 1 H

LIBERTY EXHIBIT 1031, Page 68
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Special Conditions for Safe Use (x):

1. 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 1Gohm. Light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN 60079-11:2007. This must be taken into account when installing the apparatus.

NE ATEX TYPE ‘n’ APPROVAL
Certification Number: BASEFFA09ATEX0095X
ATEX Marking ⟨Ex⟩ II 3 G
Ex nA nL IIC T5 (T_{amb} = –40 to 65 °C)

Table B-9. Baseefa Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 5 Vdc
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 Vdc) from 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.

NOTE:
NE is valid with S001 Input Type ONLY

N1 ATEX Type n
Certification Number: Baseefa09ATEX0095X
ATEX Marking ⟨Ex⟩ II 3 G
Ex nL IIC T5 (T_{amb} = –40 to 65 °C)

Table B-10. Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 12.5 Vdc
C_i = 0	I_o = 4.8 mA
L_i = 0	P_o = 15 mW
	C_o = 1.2 µF
	L_o = 1 H

LIBERTY EXHIBIT 1031, Page 69
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Special Conditions for Safe Use (x):

1. Provisions shall be made, external to the apparatus, to prevent the rated voltage of the apparatus supply is not exceeded by transient disturbances of more than 40%
2. The electrical circuit is connected directly to earth; this must be taken into account when installing the apparatus.

NC ATEX Type n Component
Certification Number: Baseefa09ATEX0094U
ATEX Marking ⟨Ex⟩ II 3 G
Ex nA nL IIC T4 (T_{amb} = –50 to 85 °C)
Ex nA nL IIC T5 (T_{amb} = –50 to 70 °C)

Special Conditions for Safe Use (x):

1. The component must be housed in a suitable certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of EN 60079-0, and EN-60079-15.
2. Provisions shall be made, external to the apparatus, to prevent the rated voltage (42.4 VDC) being exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth: this must be taken into account when installing the apparatus.

NOTE
NC is valid with S001 Input Type ONLY

ND ATEX 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 (42.4 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.

Table B-11. Baseefa Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 V	U_o = 5V dc
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 μF
	L_o = 1 H

LIBERTY EXHIBIT 1031, Page 70
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Special Conditions of Safe Use (x):

1. The component must be housed in a suitable certified enclosure.
2. Provisions shall be made, external to the apparatus, to prevent the rated voltage (42.2 V dc) being exceeded by transient disturbances of more than 40%.

IECEx Certifications

I7 IECEx Intrinsic Safety
Certificate No.: IECExBAS09.0030X
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)

Table B-12. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.5 V
I_i = 300 mA	I_o = 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 2.1 μF	C_i = 1.2 μF
L_i = 0	L_i = 1 H

Special Conditions of Safe Use (x):

1. The apparatus must be installed in an enclosure that provides a degree of protection of at least IP20. Non-metallic enclosures must be suitable to prevent electrostatic hazards and light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus is not capable of withstanding the 500V isolation test required by IEC 60079-11: 2006 clause 6.3.12. This must be taken into account when installing the apparatus.

IG IECEx FISCO
Certificate No.: IECExBAS09.0030X
Ex ia IIC T4 (T_{amb} = – 50 to 60 °C)

Table B-13. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i =17.5 Vdc	U_o = 12.5 Vdc
I_i = 380 mA	I_o = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1 μF	C_i = 1.2 μF
L_i = 0	L_i = 1 H

Special Conditions of Safe Use (x):

1. The apparatus must be installed in an enclosure that provides a degree of protection of at least IP20. Non-metallic enclosures must be suitable to prevent electrostatic hazards and light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus is not capable of withstanding the 500V isolation test required by IEC 60079-11: 2006 clause 6.3.12. This must be taken into account when installing the apparatus.

LIBERTY EXHIBIT 1031, Page 71
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

N7 IECEx Type n Approval
Certificate No." IECExBAS09.0032X
Ex Na nL IIC T5 (T_{amb} = – 40 to 65 °C)

NOTE:
N7 is valid with S001 and S002 Input Types

Table B-14. IECEx Approved Entity Parameters

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

Special Conditions of Safe Use:

1. The component must be housed in a suitable component certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of IEC 60079-0: 2004 & IEC 60079-15: 2005.
2. Provision must be made, external to the component, to ensure the rated voltage of the component supply is not exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth; this must be taken into account when installing the component.

NJ IECEx Type n COMPONENT Approval
Certification Number: IECExBAS09.0031U
EEx nA nL IIC T4 (T_{amb} = -50 to 85 °C)
EEx nA nL IIC T5 (T_{amb} = -50 to 70 °C)

NOTE:
NJ is valid with S001 and S002 Input Types

Table B-15. IECEx Approved Entity Parameters

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

Special Conditions of Safe Use:

1. The component must be housed in a suitable component certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of IEC 60079-0: 2004 & IEC 60079-15: 2005.
2. Provision must be made, external to the component, to ensure the rated voltage of the component supply is not exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth; this must be taken into account when installing the component.

LIBERTY EXHIBIT 1031, Page 72
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

China (NEPSI)Certifications

I3 Intrinsic Safety
Ex ia IIC T4
Certification Number: GYJ111365X

Special Conditions for Safe Use (x):

2.1. Only when temperature transmitter is installed in IP 20(GB4208-2008) housing, it could be used in hazardous location. The metallic housing should observe the requirements of GB3836.1-2000 Clause 8. The non-metallic housing should observe the requirements of GB3836.1-2000 Clause 7.3. This apparatus is not capable of withstanding the 500V rms insulation test required by Clause 6.4.12 of GB3836.4-2000.

2.2. The ambient temperature range is:

Output	T code	Ambient temperature
F	**T4**	-50 °C < Ta < + 60 °C

2.3. Parameters:

Terminals of power/loop (1-2):

Output	Maximum Output Voltage: U_o (V)	Maximum Output Current: I_o (mA)	Maximum Output Power: P_o (mW)	Maximum external parameters:	
				C_o (μF)	Lo (H)
F	**30**	300	1.3	2.1	0
F (FISCO)	**17.5**	380	5.32	2.1	0

NOTE
Non-FISCO parameters listed above must be derived from a linear supply with a resistance limited output.

Terminals of sensor:

Output	Terminals	Maximum Output Voltage: U_o (V)	Maximum Output Current: I_o (mA)	Maximum Output Power: P_o (mW)	Maximum external parameters:	
					C_o (μF)	Lo (H)
F	**1-8**	12.5	4.8	15	1.2	1

2.4. The product complies to the requirements for FISCO field devices specified in IEC60079-27: 2008. For the connection of an intrinsically safe circuit in accordance FISCO model, FISCO parameters of this product are as above.

2.5. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.

2.6. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in non-hazardous area.

LIBERTY EXHIBIT 1031, Page 73
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

2.7. End users are not permitted to change any component's insides, but to settle the problem, in conjunction with manufacturer to avoid damage to the product.

2.8. During installation, use and maintenance of this product, observe following standards:

GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres."

GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)."

GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)."

GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering."

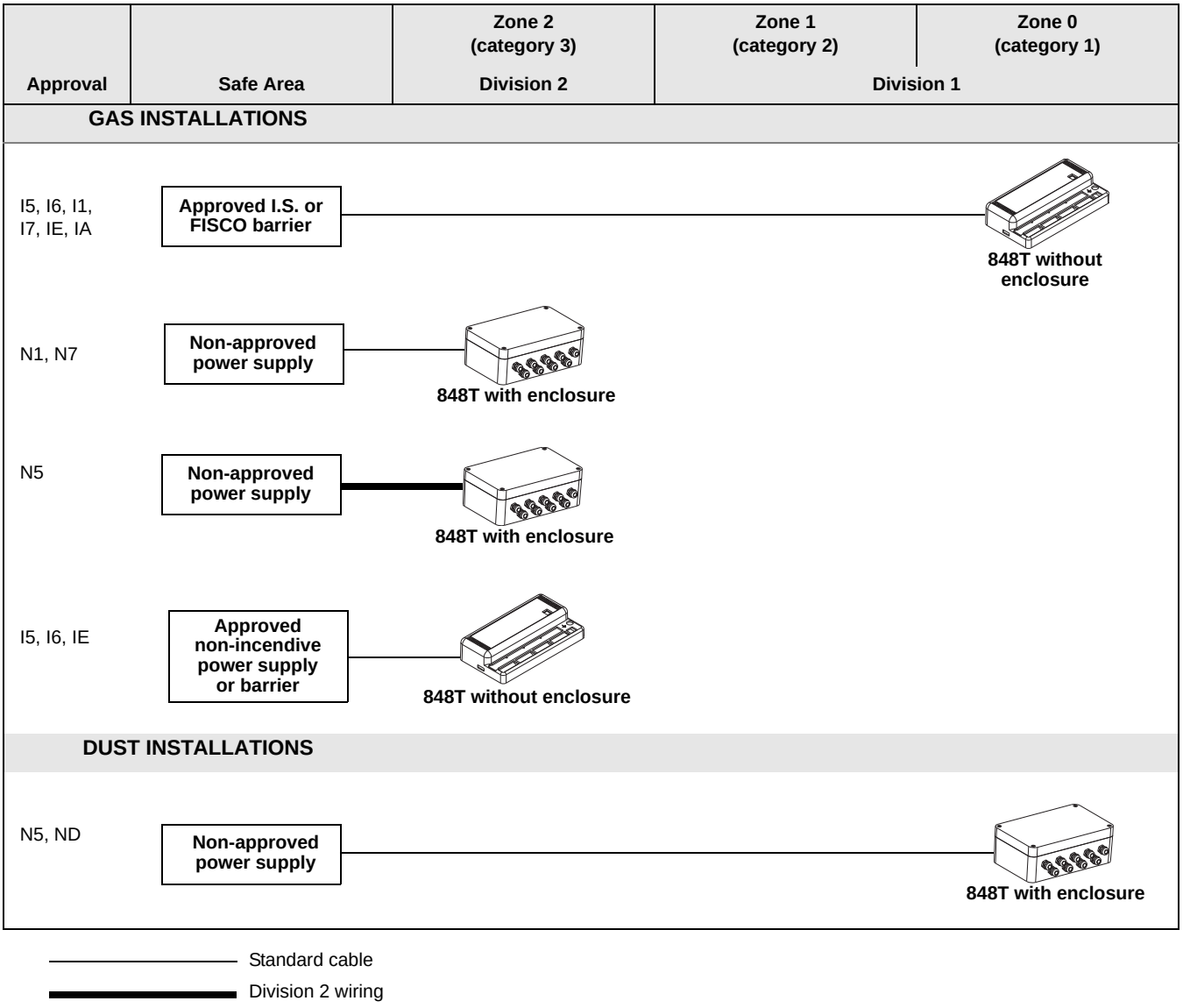
Japanese Certifications

I4 TISS Intrinsic Safety FISCO Type '1a'
Ex ia IIC T4
Certification Number: TC19713

H4 TISS Intrinsic Safety FISCO Type '1b'
Ex ia IIB T4
Certification Number: TC19714

LIBERTY EXHIBIT 1031, Page 74
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

INTRINSICALLY SAFE AND NON-INCENDIVE INSTALLATIONS



Standard cable

Division 2 wiring

LIBERTY EXHIBIT 1031, Page 75
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

INSTALLATION DRAWINGS

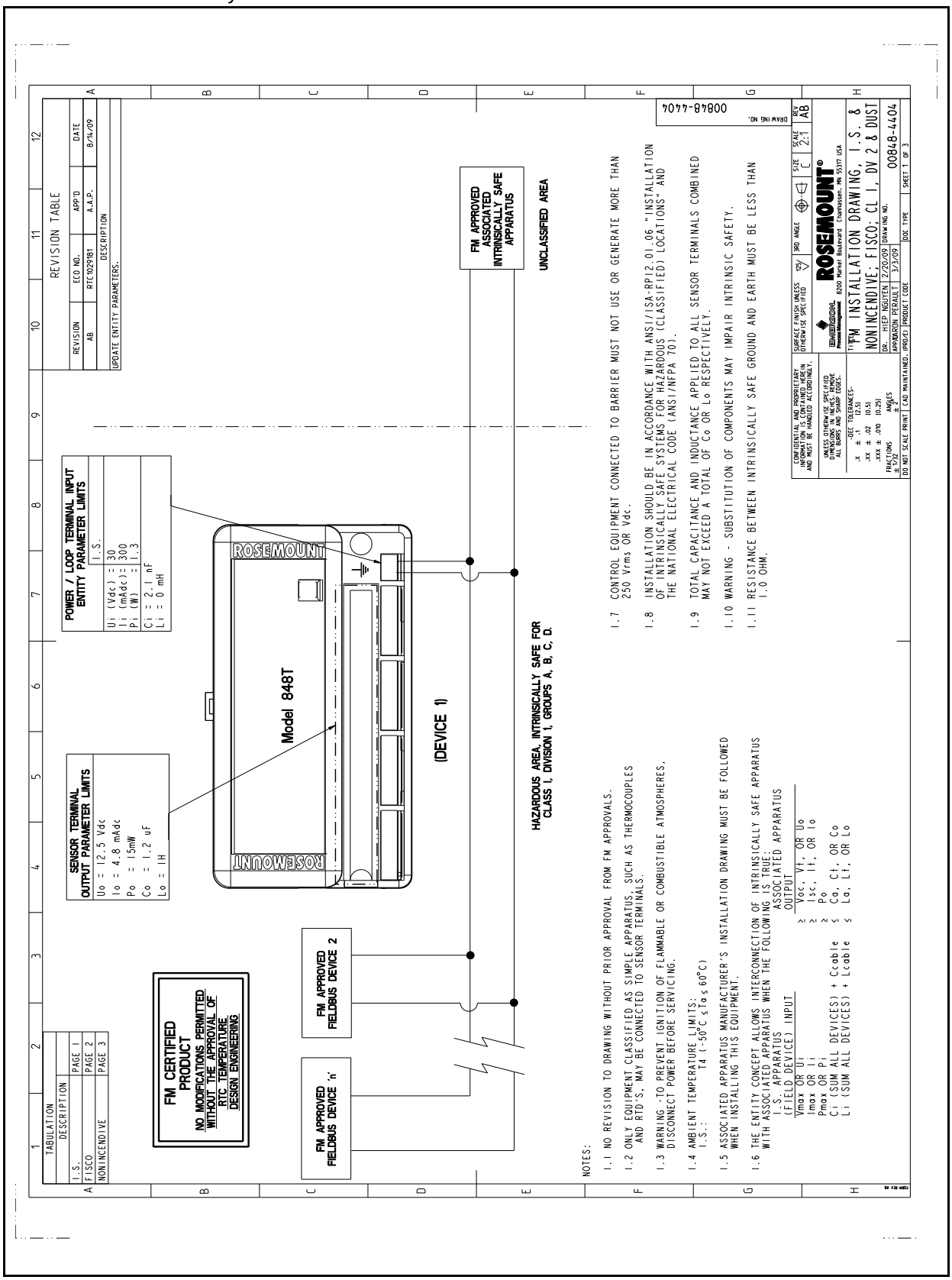
The installation guidelines presented by the drawings must be followed in order to maintain certified ratings for installed transmitters.

Rosemount Drawing 00848-4404, 3 Sheets
Factory Mutual Intrinsic Safety/ FISCO Installation Drawing

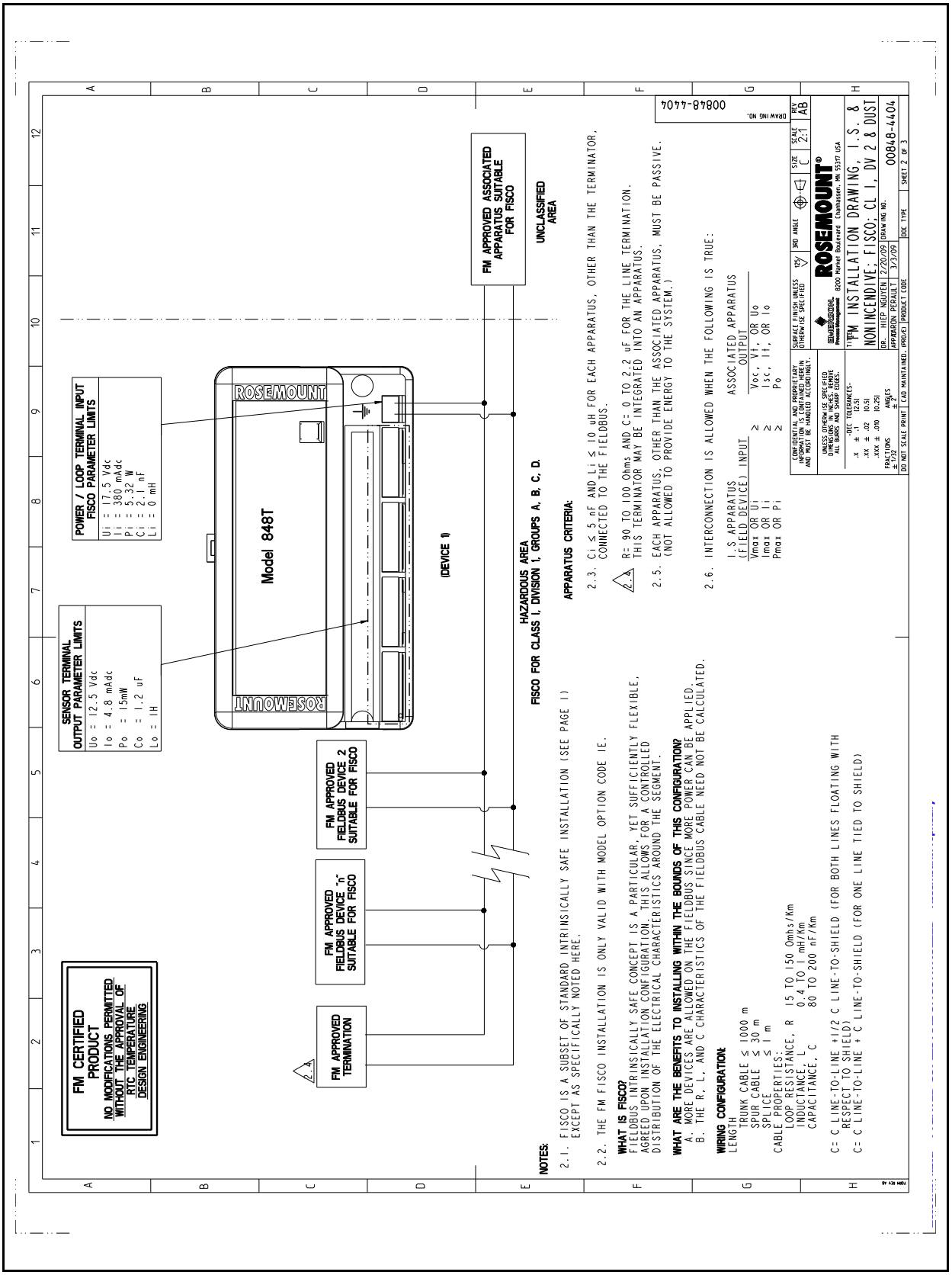
Rosemount Drawing 00848-4405, 2 Sheets
Canadian Standards Association Intrinsic Safety/FISCO Installation Drawing

LIBERTY EXHIBIT 1031, Page 76
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Figure B-1. FM Intrinsic Safety/ FISCO



LIBERTY EXHIBIT 1031, Page 77
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274



LIBERTY EXHIBIT 1031, Page 78
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

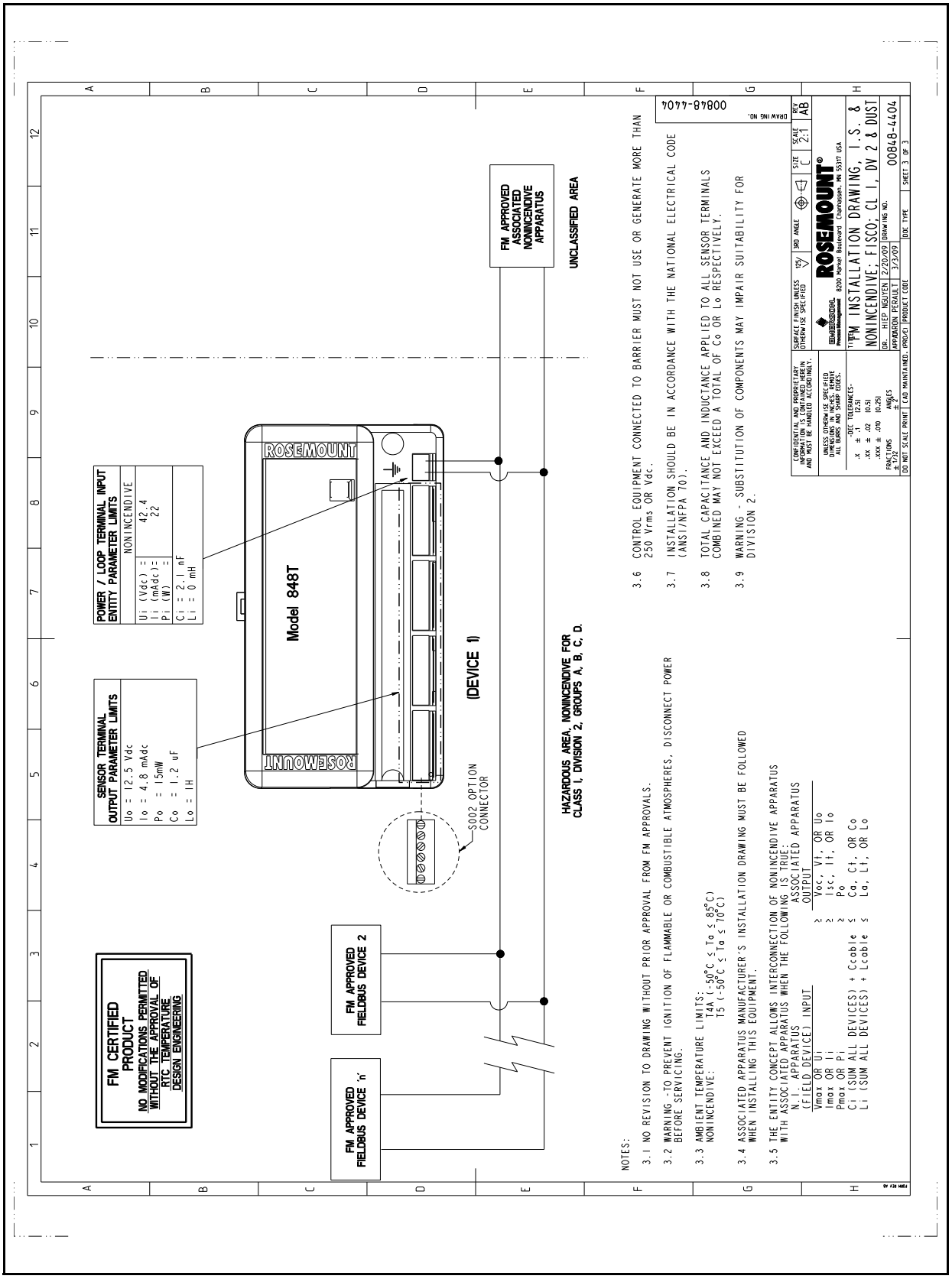
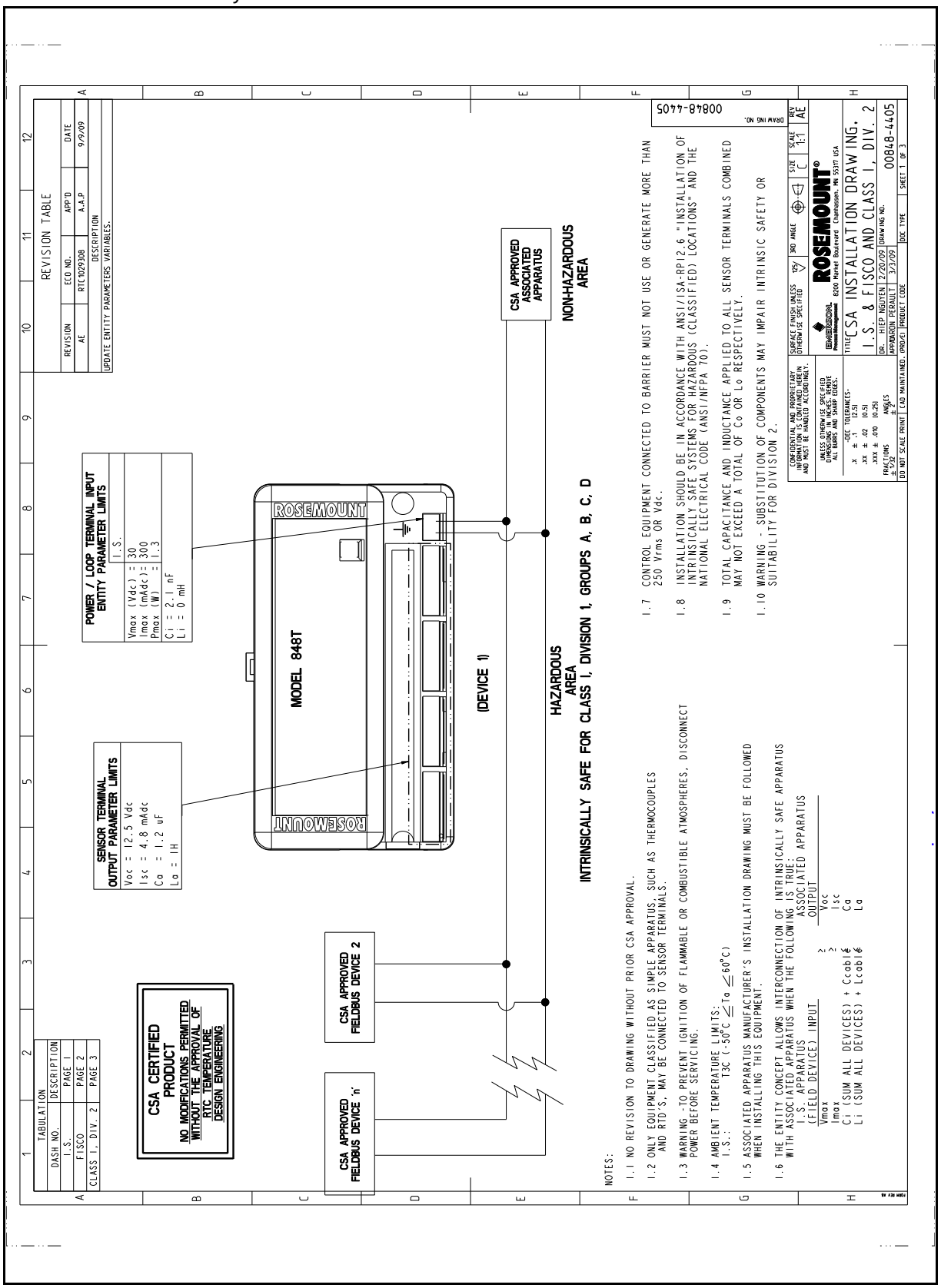
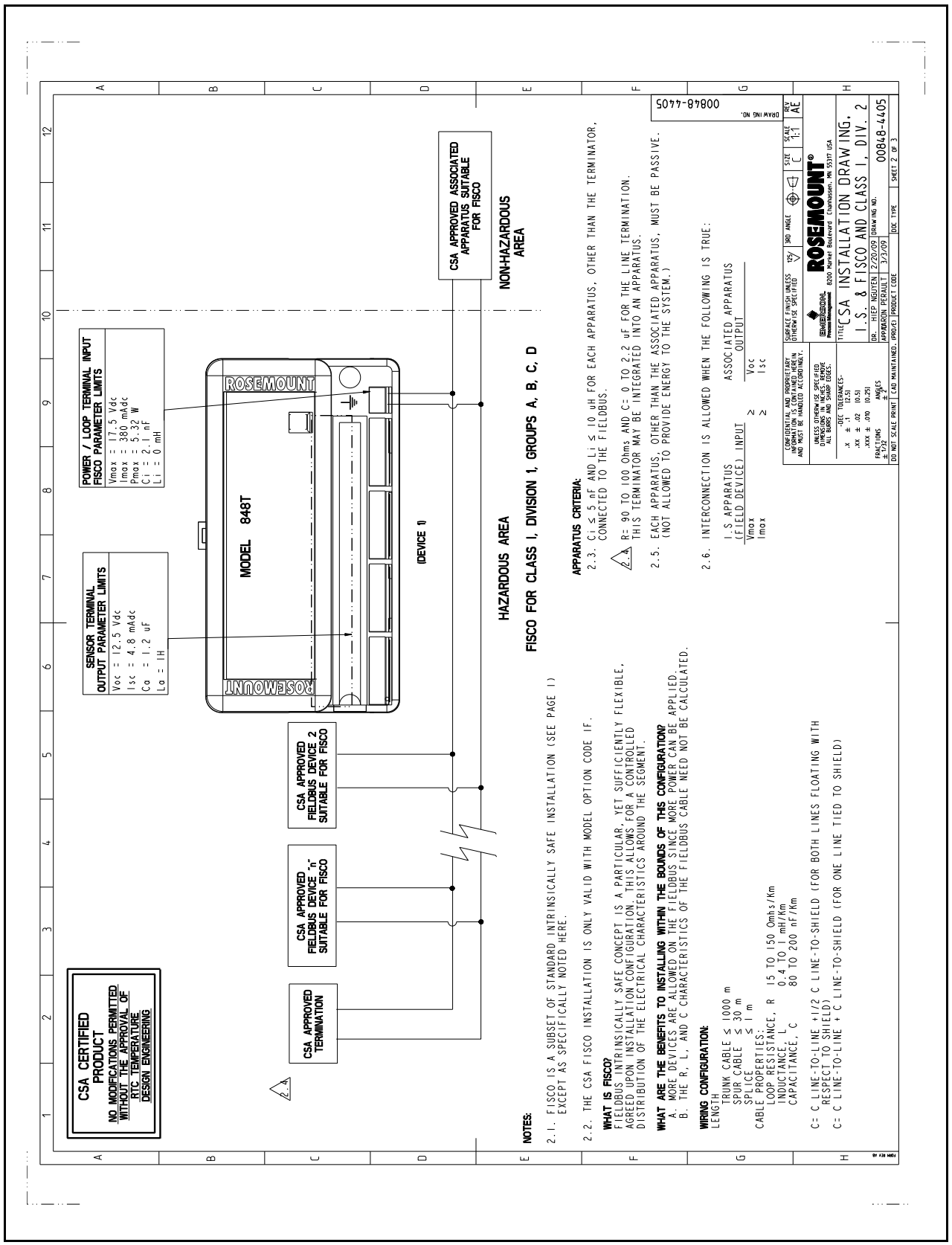

FM CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT THE APPROVAL OF RTC TEMPERATURE DESIGN ENGINEERING
FM APPROVED FIELDBUS DEVICE 'n'
FM APPROVED FIELDBUS DEVICE 2
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Uo = 12.5 Vdc
Io = 4.8 mAdc
Po = 15mW
Co = 1.2 uF
Lo = 1H
POWER / LOOP TERMINAL INPUT ENTITY PARAMETER LIMITS
NONINCENDIVE
Ui (Vdc) = 42.4
Ii (mAdc) = 22
Pi (W) =
Ci = 2.1 nF
Li = 0 mH
ROSEMOUNT
Model 848T
(DEVICE 1)
S002 OPTION CONNECTOR
HAZARDOUS AREA, NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A, B, C, D.
FM APPROVED ASSOCIATED NONINCENDIVE APPARATUS
UNCLASSIFIED AREA
NOTES:
3.1 NO REVISION TO DRAWING WITHOUT PRIOR APPROVAL FROM FM APPROVALS.
3.2 WARNING -TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
3.3 AMBIENT TEMPERATURE LIMITS:
NONINCENDIVE: T4A (-50°C ≤ Ta ≤ 85°C)
T5 (-50°C ≤ Ta ≤ 70°C)
3.4 ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
3.5 THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF NONINCENDIVE APPARATUS WITH ASSOCIATED APPARATUS WHEN THE FOLLOWING IS TRUE:
N.I. APPARATUS (FIELD DEVICE) INPUT
Vmax OR Ui ≥ Voc, Vt, OR Uo
Imax OR Ii ≥ Isc, It, OR Io
Pmax OR Pi ≥ Po
Ci (SUM ALL DEVICES) + Ccable ≤ Ca, Ct, OR Co
Li (SUM ALL DEVICES) + Lcable ≤ La, Lt, OR Lo
ASSOCIATED APPARATUS OUTPUT
3.6 CONTROL EQUIPMENT CONNECTED TO BARRIER MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR Vdc.
3.7 INSTALLATION SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70).
3.8 TOTAL CAPACITANCE AND INDUCTANCE APPLIED TO ALL SENSOR TERMINALS COMBINED MAY NOT EXCEED A TOTAL OF Co OR Lo RESPECTIVELY.
3.9 WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR DIVISION 2.
00848-4404
DRAWING NO.
ROSEMOUNT
8200 Market Boulevard Chanhassen, MN 55317 USA
FM INSTALLATION DRAWING, I.S. & NONINCENDIVE; FISCO; CL I, DV 2 & DUST
DR. HIEP NGUYEN 2/20/09
APPROVED PERAULT 3/3/09
00848-4404
SHEET 3 OF 3

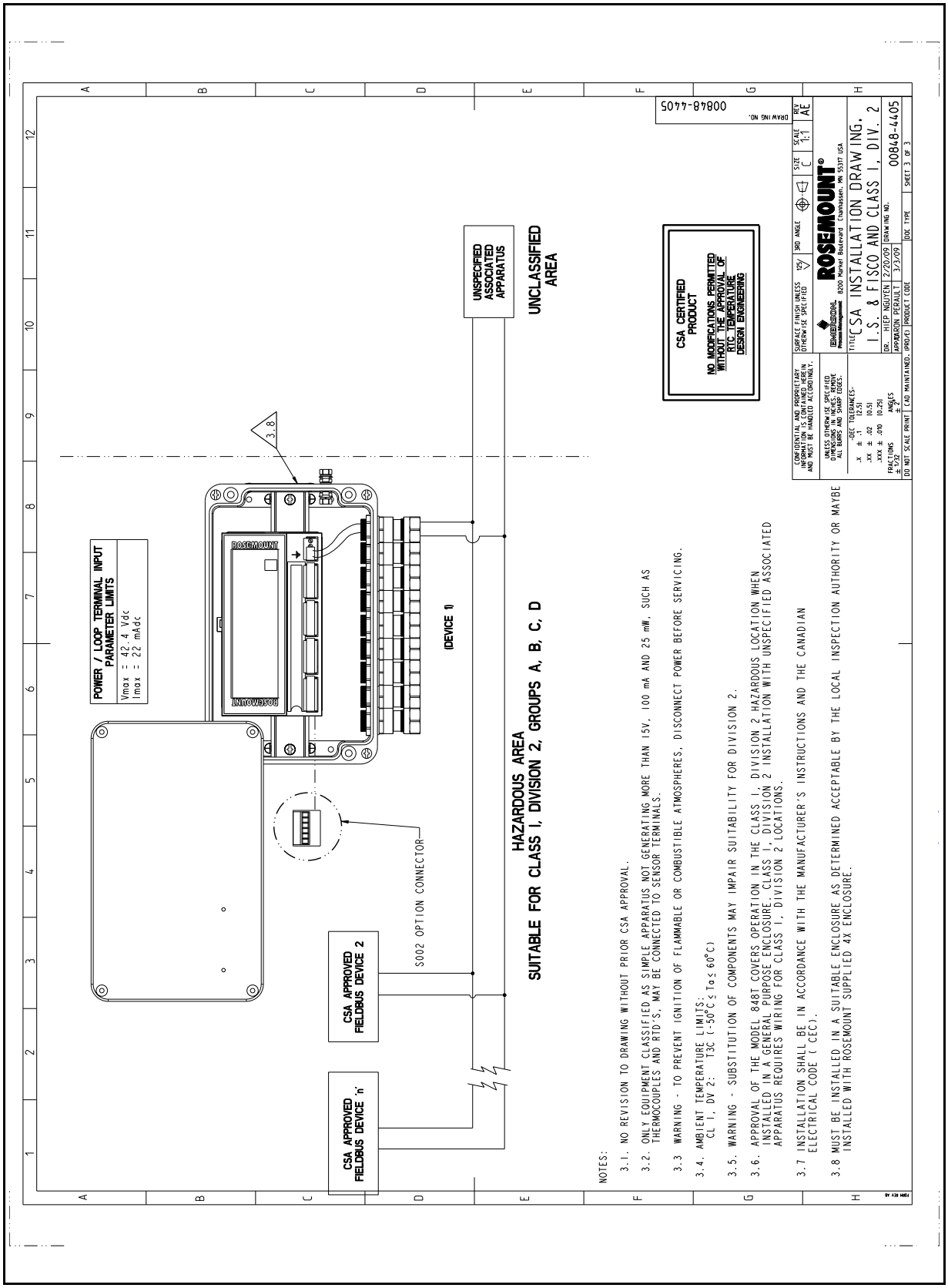
Figure B-2. CSA Intrinsic Safety/ FISCO



LIBERTY EXHIBIT 1031, Page 80
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274



LIBERTY EXHIBIT 1031, Page 81
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274



LIBERTY EXHIBIT 1031, Page 82
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Appendix C FOUNDATION™ fieldbus Technology

Overview . . . . . **page C-1**
Function Blocks . . . . . **page C-1**
Device Descriptions . . . . . **page C-3**
Block Operation . . . . . **page C-3**
Network Communication . . . . . **page C-4**

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 FOUNDATION 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.

FOUNDATION 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.

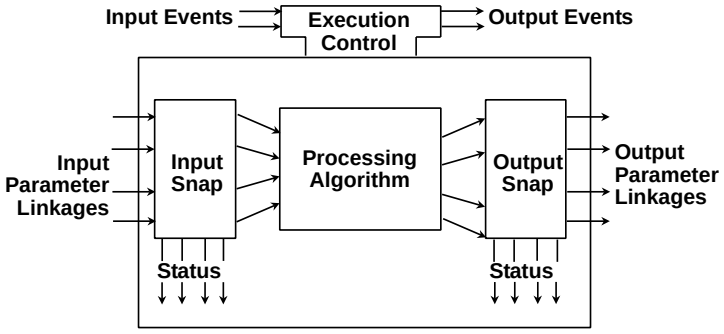
LIBERTY EXHIBIT 1031, Page 83
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 84
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

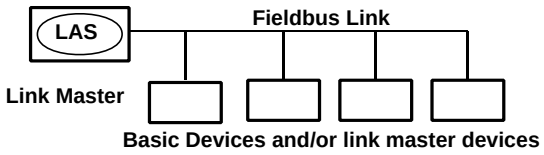
LIBERTY EXHIBIT 1031, Page 85
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 86
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

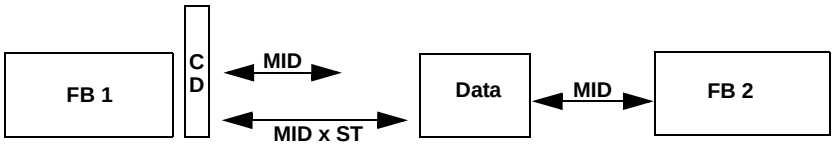
There may be many LM devices on a segment but only the LAS is actively controlling communication traffic. The remaining LM devices on the segment are in a stand-by state, ready to take over if the primary LAS fails. This is achieved by constantly monitoring the communication traffic on the bus and determining 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 FOUNDATION 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 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



LIBERTY EXHIBIT 1031, Page 87
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

FOUNDATION 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 FOUNDATION 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.

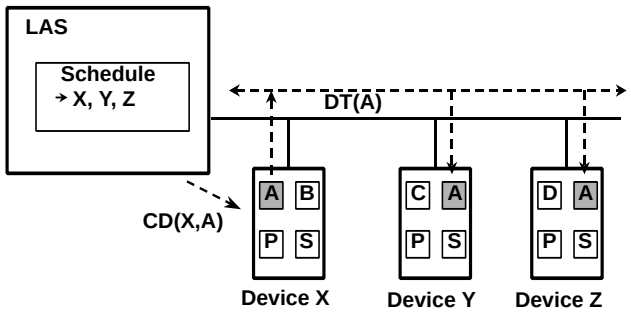
Client/Server

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.

LIBERTY EXHIBIT 1031, Page 88
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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



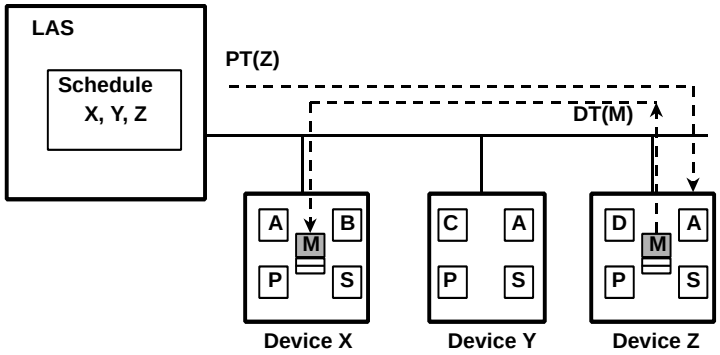
LAS = Link Active Scheduler
P = Publisher
S = Subscriber
CD = Compel Data
DT = Data Transfer Packet

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 FOUNDATION 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



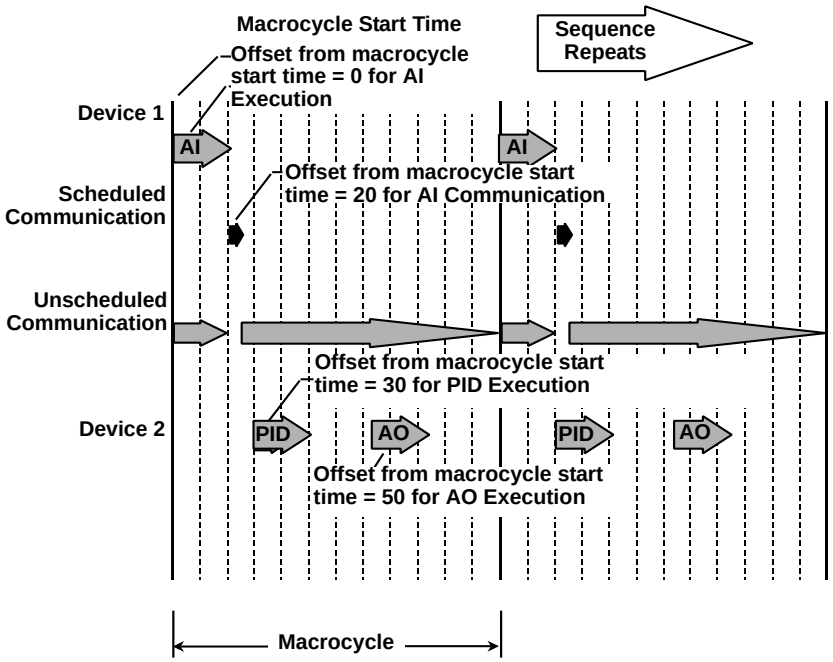
P = Publisher S = Subscriber PT = Pass Token M = Message

LIBERTY EXHIBIT 1031, Page 89
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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



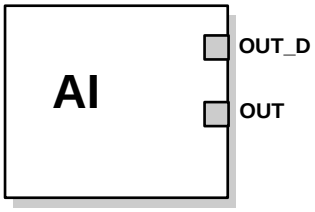
To support synchronization of schedules, periodically Link Scheduling (LS) time is distributed. The beginning of the macrocycle represents a common starting time for all Function Block schedules on a link and for the LAS link-wide schedule. This permits function block executions and their corresponding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

LIBERTY EXHIBIT 1031, Page 90
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Appendix D Function Blocks

Analog Input (AI) Function Block . . . . . page D-1
Multiple Analog Input (MAI) Function Block . . . . . page D-9
Input Selector Function Block . . . . . page D-15

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. The block execution time is 30 ms.

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.

LIBERTY EXHIBIT 1031, Page 91
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 92
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

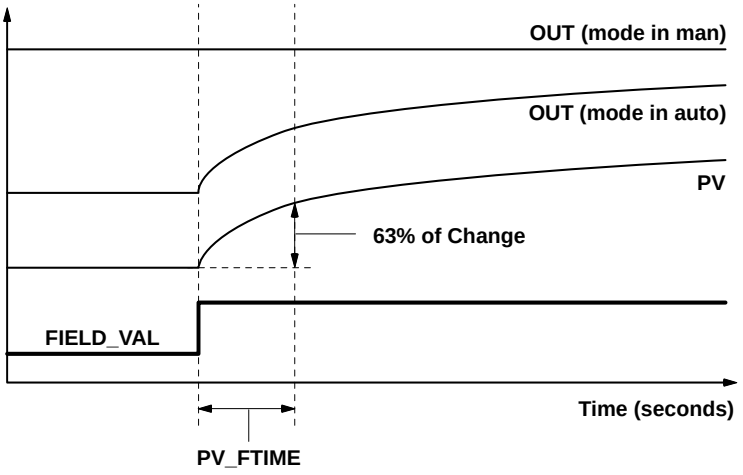
Simulation

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 FOUNDATION 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.

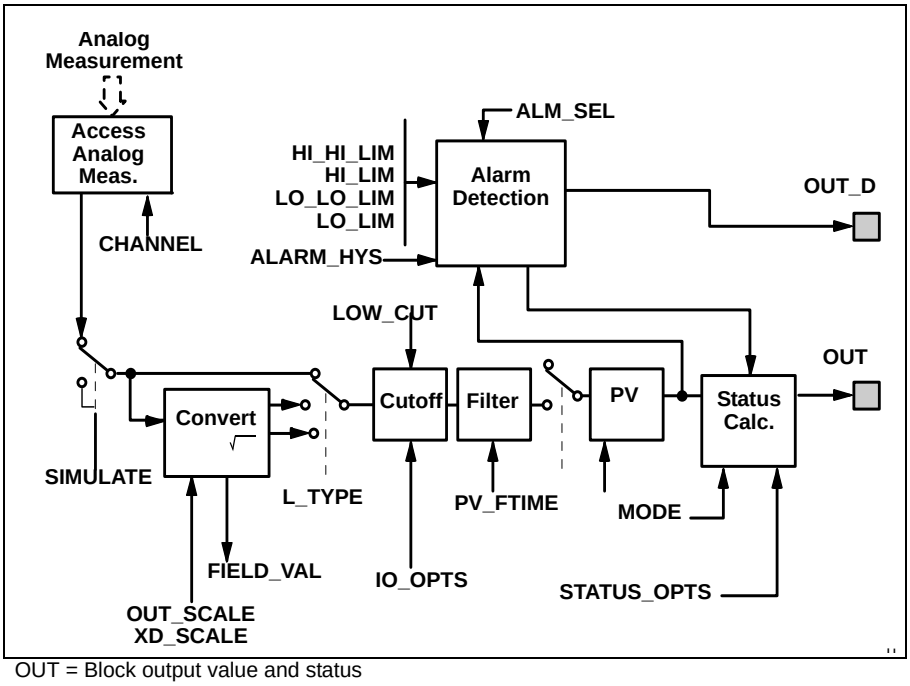
With simulation enabled, the actual measurement value has no impact on the OUT value or the status.

Figure D-1. Analog Input Function Block Timing Diagram



LIBERTY EXHIBIT 1031, Page 93
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

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

*** 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).

$$\text{PV} = \text{Channel Value}$$

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).

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

**** OUT_SCALE values**

LIBERTY EXHIBIT 1031, Page 94
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

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

**** OUT_SCALE values**

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.

LIBERTY EXHIBIT 1031, Page 95
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 96
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 97
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

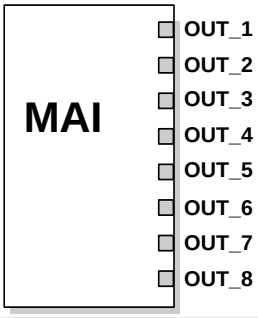
SCALING
XD_SCALE provides the range and units of the measurement and OUT_SCALE provides the range and engineering units of the output. OUT_SCALE is only used when in indirect or indirect square root.

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.

LIBERTY EXHIBIT 1031, Page 98
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 D-4 lists the MAI block parameters and their units of measure, descriptions, and index numbers. The block execution time is 30 ms.

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.

LIBERTY EXHIBIT 1031, Page 99
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 FOUNDATION 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.

LIBERTY EXHIBIT 1031, Page 100
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

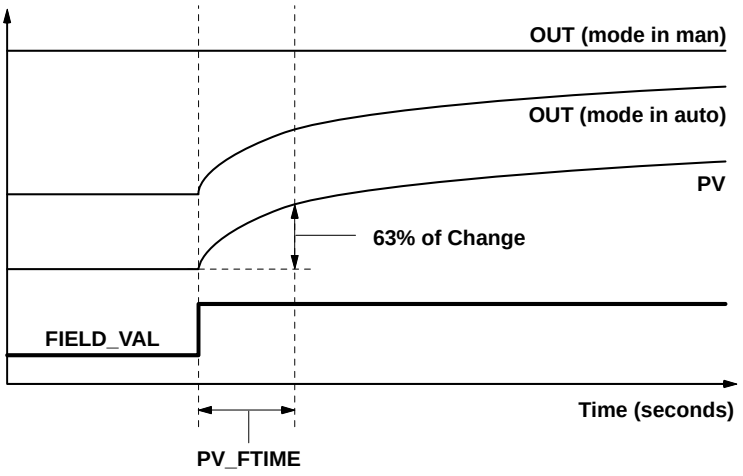
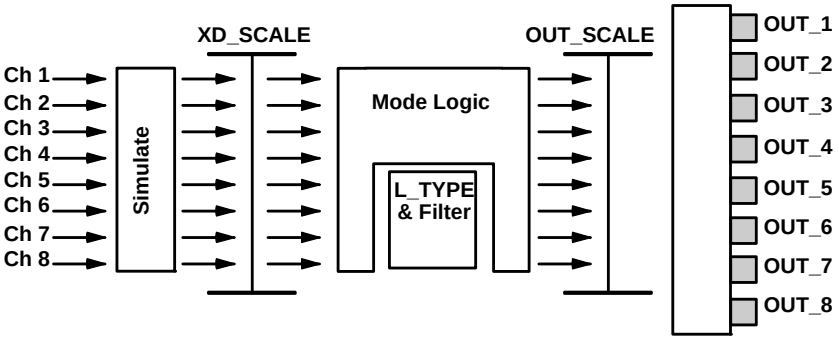


Figure D-4. Multiple Analog Input Function Block Schematic



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

LIBERTY EXHIBIT 1031, Page 101
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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).

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

**** 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.

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

**** OUT_SCALE values**

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
Low Cutoff 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.

LIBERTY EXHIBIT 1031, Page 102
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 103
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 **Direct** when the measurement is already 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. 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.

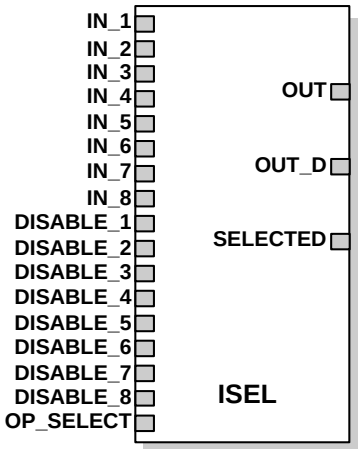
SCALING
XD_SCALE provides the range and units of the measurement and OUT_SCALE provides the range and engineering units of the output.

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

LIBERTY EXHIBIT 1031, Page 104
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

INPUT SELECTOR FUNCTION BLOCK



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

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. The block execution time is 30 ms.

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

LIBERTY EXHIBIT 1031, Page 105
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

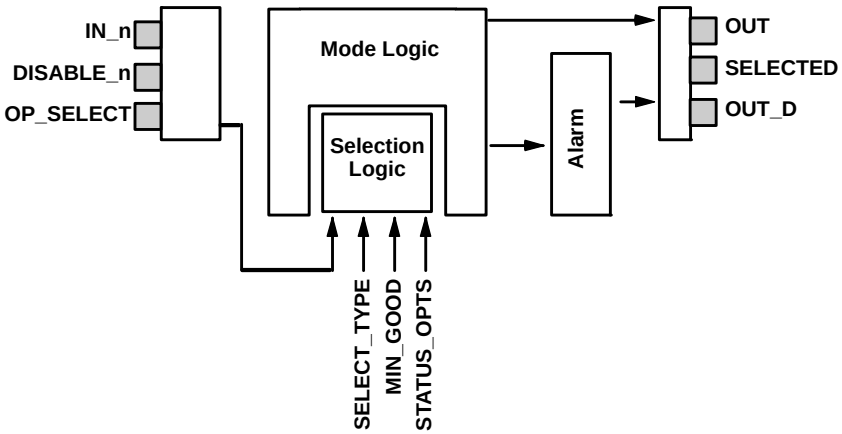
Table D-6. Input Selector Function Block Parameters

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.

LIBERTY EXHIBIT 1031, Page 106
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 107
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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.

LIBERTY EXHIBIT 1031, Page 108
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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 OP_SELECT.

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, OUT 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.

LIBERTY EXHIBIT 1031, Page 109
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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

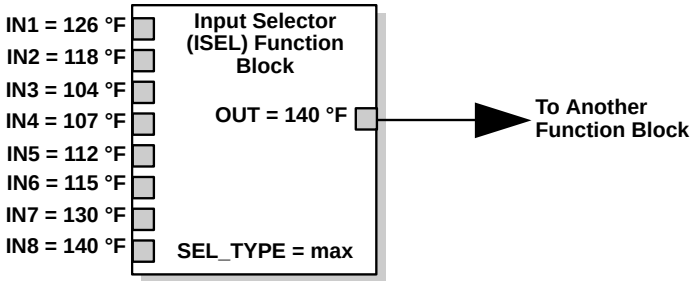
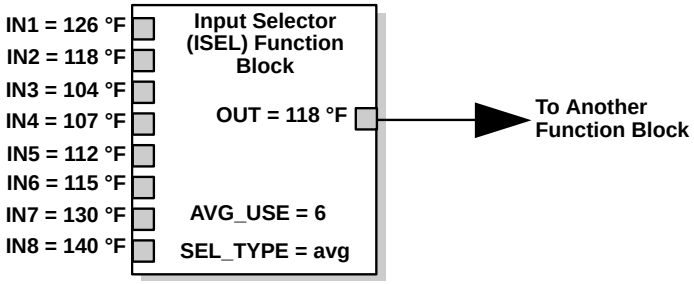


Figure D-7. Input Selector Function Block Application Example (SEL_TYPE = average) AVG_USE = 6



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.

$$\frac{107 + 112 + 115 + 118 + 126 + 130}{6} = 118°F$$

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.

LIBERTY EXHIBIT 1031, Page 110
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Index

Numerics
2-Inch Pipe Stand
Mounting 2-3

A
Alarms
Configuration 3-3
Analog Input
Configuration 3-6
Ground 2-9
Analog Input Function Block . . D-1
Advanced Features D-7
Alarm Detection D-6
Application Information . . D-8
Block Errors D-5
Configuration 3-6
Direct D-4
Filtering D-4
Functionality D-3
Indirect D-4
Indirect Square Root D-5
Modes D-6
Automatic D-6
Manual D-6
Out of Service D-6
Parameters D-1
Signal Conversion D-4
Simulation D-3
Status Handling D-7
Troubleshooting D-8
Wiring Diagram 2-6

B
Block Operation C-3
Alerts C-3
Instrument Specific Blocks C-3

C
Cable Glands
Installation 2-12
Commissioning 4-2
Tag 2-11
Conduit Entries 2-12
Configuration 3-2
Alarms 3-3
Analog Transmitters 3-6
Analog Input Block . . 3-6
Multiple Analog Input Block 3-6
Block 3-7
Custom 3-2
Damping 3-3
Differential Sensor Blocks . 3-3
Methods 3-2
Monitoring Applications
Single Selection 3-4
Typical 3-4
Reset 4-3
Restart Processor . . . 4-3
Restart with Defaults . 4-3
Resource Block 3-7
Standard 3-2
Transmitter 3-2
Connections 2-4
Analog Inputs 2-5
Millivolt Inputs 2-5
Ohm Inputs 2-5
Power Supply 2-7
RTD Inputs 2-5
Thermocouple Inputs 2-5

D
Damping
Configuration 3-3
Device Descriptions C-3
Differential Sensor Blocks
Configuration 3-3
Differential Transducer Block
Troubleshooting 4-4
DIN Rail
Mounting 2-2
Drawing
Switch Location 2-10
Drawings
848T Analog Connector . . 2-6
Analog Input Wiring 2-6
Block Diagram 4-2
Block Internal Structure . . C-2
Cable Gland Installation . 2-12
Commissioning Tag 2-11
Conduit Entries Installation 2-12
Installation B-10
Sensor Wiring 2-4
Transmitter Label 2-7
Transmitter Wiring 2-4

F
FOUNDATION Fieldbus 4-1
Addressing C-6
Block Operation C-3
Alerts C-3
Instrument- Specific Blocks C-3
Check 4-3
Device Descriptions C-3
Function Block Scheduling C-8
Function Blocks C-1
Link Active Scheduler . . . C-4
Network Communication . C-4
Overview C-1
Scheduled Transfers C-6
Troubleshooting 4-4
Unscheduled Transfers . . C-7
Function Blocks C-1
Analog Input D-1
Input Selector Function Block . D-15
Multiple Analog Input D-9
Scheduling C-8

G
Grounding 2-8
Analog Device 2-9
Grounded Thermocouple . 2-9
Shielded Wire 2-8
Transmitter Enclosure . . . 2-9
Ungrounded mV 2-8
Ungrounded RTD/Ohm . . 2-8
Ungrounded Thermocouple 2-8

H
Hardware
Maintenance 4-3
Communication Check 4-3
Power Check 4-3
Reset Configuration . 4-3
Sensor Check 4-3

I
Input Selector Function Block D-15
Alarm Detection D-18
Application Information . D-19
Block Execution D-19
Errors D-17
Functionality D-17

LIBERTY EXHIBIT 1031, Page 111
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Modes D-18
Automatic D-18
Manual D-18
Out of Service D-18
Parameters D-15
Status Handling D-19
Troubleshooting D-20
Installation 2-12
Intrinsically Safe B-9
Non-Incendive B-9
Using Cable Glands 2-12
Using Conduit Entries . . 2-12

J
Junction Box
Mounting 2-2

L
Link Active Scheduler C-4
Backup LAS C-6
LAS Parameters C-5

M
Maintenance
Hardware 4-3
Communication Check 4-3
Power Check 4-3
Reset Configuration . 4-3
Sensor Check 4-3
Measurement Transducer Block
Parameters 3-17
Monitoring Applications
Common Configurations
Single Selection 3-4
Typical 3-4
Mounting 2-1
2-Inch Pipe Stand 2-3
DIN Rail Without an Enclosure 2-2
Panel with a Junction Box 2-2
Multiple Analog Input
Configuration 3-6
Multiple Analog Input Block
Troubleshooting D-14
Multiple Analog Input Function Block D-9
Application Information . . D-14
Configuration 3-6
Errors D-12
Filtering D-11
Functionality D-10
Modes D-13
Automatic D-13
Manual D-13
Out of Service D-13
Parameters D-9
Signal Conversion D-11
Direct D-11
Indirect D-12
Indirect Square Root D-12
Modes D-13
Simulation D-10
Status Handling D-13

N
Network Communication C-4
Addressing C-6
Function Block Scheduling C-8
Link Active Scheduler . . . C-4
Scheduled Transfer C-6
Unscheduled Transfer . . . C-7

O
Overview 1-2
FOUNDATION Fieldbus . . . C-1
Manual 1-2
Transmitter 1-2

P
Performance specifications . . . A-4
Power Supply 2-7
Connections 2-7

R
Resource Block
Alarm Detection 3-11
Configuration 3-7
Errors 3-10
Modes 3-10
Automatic 3-11
Out of Service (OOS) 3-11
Parameters 3-7
PlantWeb Alerts
Recommended Actions 3-14
PlantWeb™ Alerts 3-11
advisory alarms . . . 3-13
failed_alarms 3-11
maint_alarms 3-12
Troubleshooting 4-4

S
Scheduled Transfers C-6
Client C-6
Publisher C-6
Report Distribution C-6
Server C-6
Subscriber C-6
Security Switch 2-10
Senor
Connection Check 4-3
Sensor
Tag 2-11
Sensor Transducer Block
Change Sensor Configuration 3-21
Sensor Calibration 3-21
Troubleshooting 4-4
Sensor Wiring Diagram 2-4
Shield Wire
Ground 2-8
Simulate Enable Switch 2-10
Specifications
performance A-4
Surges 2-7
Switches 2-10
Security 2-10
Simulate Enable 2-10

T
Tagging 2-11
Commissioning 2-11
Sensor 2-11
Transmitter 2-11
Transducer Block
Alarm Detection 3-17
Channel Definitions 3-15
Errors 3-16
Modes 3-16
Automatic 3-17
Out of Service 3-17
Status Handling 3-17
Transients 2-7
Transmitter
Configuration 3-2
Tag 2-11
Transmitter Wiring Diagram . . . 2-4
Troubleshooting 4-4
Analog Input Function Block D-8
Differential Transducer Block 4-4
FOUNDATION Fieldbus 4-4
Input Selector Function Block D-20
Multiple Analog Input Block D-14
Resource Block 4-4
Sensor Transducer Block . 4-4

U
Unscheduled Transfers C-7

W
Wiring 2-4
Communication Check . . . 4-3
Power Check 4-3

LIBERTY EXHIBIT 1031, Page 112
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

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