MI 020-462
July 2007

I/A Series® Temperature Transmitters Model RTT15-F with FOUNDATION® Fieldbus Protocol Model RTT15-P with PROFIBUS® Protocol

Invensys®
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1. Introduction

General Description

The RTT15 Temperature Transmitter is a microprocessor-based temperature transmitter that receives input signals from thermocouples, RTDs, resistance (ohms), or millivolt sources. It is available as a basic module or in numerous housing configurations. It is available with FOUNDATION fieldbus, PROFIBUS, or HART® communications protocol. This instruction (MI 020-462) describes the transmitter with FOUNDATION fieldbus and PROFIBUS communication. For instructions on the HART version, see MI 020-463.

Reference Documents

For additional and related information, refer to the documents listed in Table 1.

Table 1. Reference Documents

Document	Description
DP 020-462	Dimensional Print – RTT15 Temperature Transmitters
PL 008-662	Parts List – RTT15 Temperature Transmitters
MI 014-900	Fieldbus Overview
MI 020-360	Wiring Guidelines for FOUNDATION Fieldbus Transmitters.
B0193RA	I/A Series System Measurement Integration
B0400FD	FOUNDATION Fieldbus H1 Communication Interface Modules (FBM 220/221)
B0400FE	PROFIBUS DP Communication Interface Module (FBM 223)

Transmitter Identification

See Figure 1 for typical agency and data labels. For transmitters enclosed in a housing, the agency label is located on the basic unit and both agency and data labels are externally mounted on the applicable transmitter housing.

— NOTE

Figure 1 shows typical data plates. For a recapitulation of the specific information that applies to each agency certification, see “Electrical Certification Rating” on page 5.

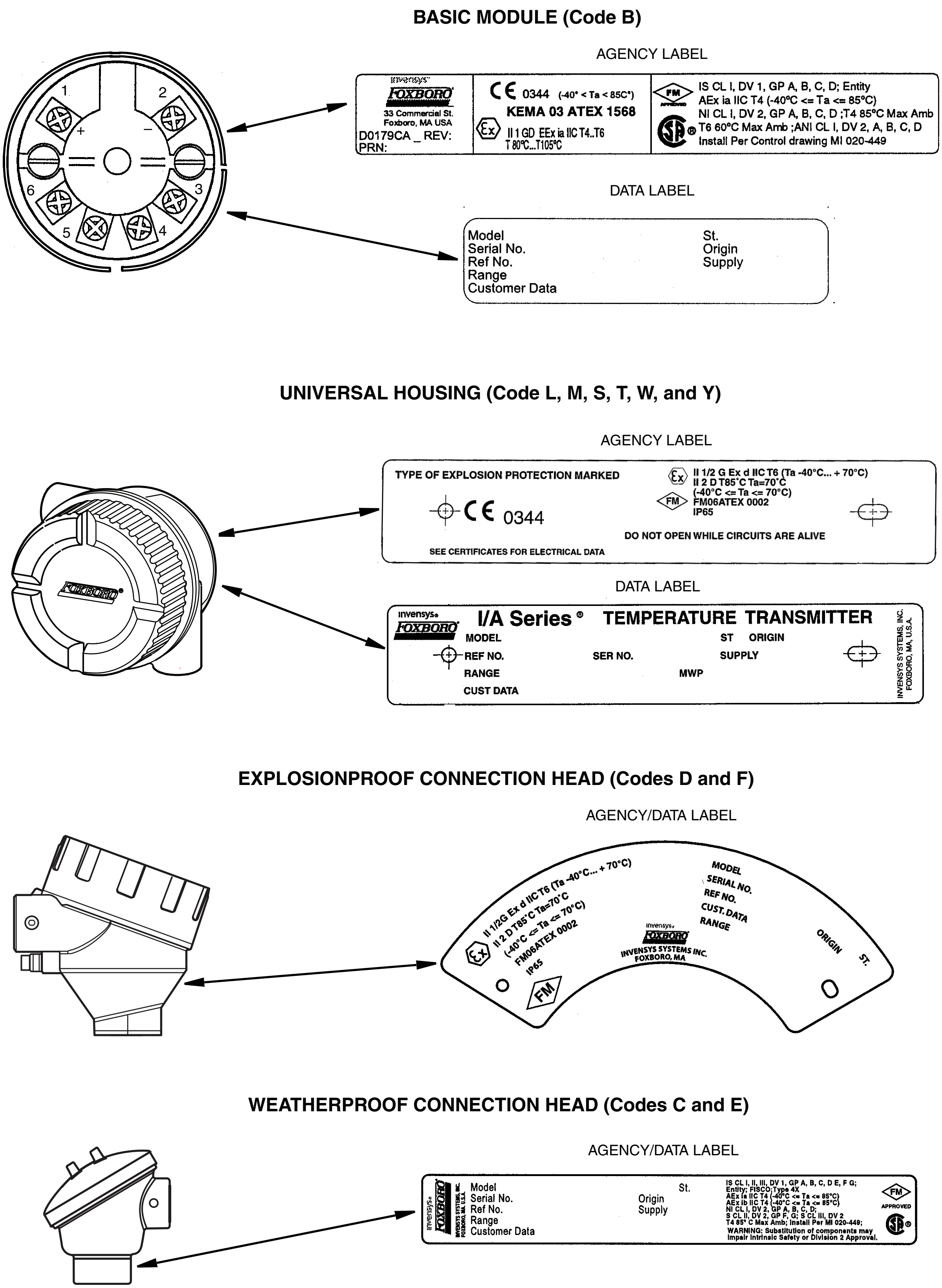

Figure 1. Typical Identification Labels

Standard Specifications

Ambient Temperature Limits: -40 and +85°C (-40 and +185°F)

Supply Voltage Limits: 9 and 30 V dc

— NOTE
For FISCO (Fieldbus Intrinsically Safe Concept) installations, the maximum voltage is 17.5 V dc.

Vibration Limits (for basic module): 40 m/s^2 (4 “g”) from 2 to 500 Hz

Range Limits - RTD Input

RTD Type	Range Limits	
	°C	°F
Platinum, 100 Ω	-200 and +850	-328 and +1562
Nickel, 100 Ω	-60 and +250	-76 and +482

Range Limits - T/C Input

TC Type	Range Limits °C	Range Limits °F
B	400 and 1820	752 and 3308
E	-100 and +1000	-148 and +1832
J	-100 and +1200	-148 and +2192
K	-180 and +1372	-292 and +2502
L	-200 and +900	-328 and +1652
N	-180 and +1300	-292 and +2372
R	-50 and +1760	-58 and +3200
S	-50 and +1760	-58 and +3200
T	-200 and +400	-328 and +752
U	-200 and +600	-328 and 1112
W3	0 and 2300	32 and 4172
W5	0 and 2300	32 and 4172

Range Limits - Millivolt Input: -800 and + 800 mV

Range Limits - Resistance (ohms) Input: 0 and 10 000 Ω

Housing Specifications

Housing Code	Material and Finish	IEC/NEMA Rating	Explosionproof and Flameproof	Mounting Configuration
B	Encapsulated plastic	IP68 (a)	NO	Basic Module (b) (c) DIN Form B Package
C	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral bare sensor
D	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral bare sensor
E	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral sensor and well
F	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral sensor and well
L	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing with integral sensor and well
M	Stainless steel	IP66 NEMA 4X	YES	Universal housing with integral sensor and well
S	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing for surface or pipe mounting (c)
T	Stainless steel	IP66 NEMA 4X	YES	Universal housing for surface or pipe mounting (c)
W	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing with integral bare sensor
Y	Stainless steel	IP66 NEMA 4X	YES	Universal housing with integral bare sensor

(a) IEC IP68 applies to the encapsulated electronics only, and not to the six protruding input/output terminals.

(b) The basic module is typically used for replacement and spares purposes; it can also be mounted to a DIN rail using a clip (Option -D1).

(c) Surface or pipe mounted using mounting set options -M1 or -M2.

Housing Connections (2): 1/2 NPT

> **— NOTE**
> Universal housings with optional PG 13.5 connections are available except in transmiters that are certified for explosionproof/flameproof installations.

Communication Rate: 31.25 kbits/s

Communication Distance: 1900 m (6235 ft) maximum. See MI 020-360 for wiring guidelines.

Electrical Certification Rating

The electrical certification is printed on the agency label which is located on the basic module and on the transmitter housing (if applicable). The Electrical Safety Design Code is also included as part of the model code on the data label which is located on the basic module or on the transmitter housing (if applicable). See Figure 1 for an example of typical agency and data labels. For a complete explanation of the model code, see PL 008-662.

Electrical Safety Specifications

> **— NOTE**
> These transmitters have been designed to meet the electrical safety description listed in Table 2. For detailed information or status of testing laboratory approvals/certifications, contact Invensys Foxboro.

Table 2. Electrical Safety Specifications

Agency Certification, Type of Protection, and Area Classification	Available with Housing Codes	Application Conditions	Electrical Safety Design Code
ATEX (KEMA) intrinsically safe, II 1 GD or II 2 (1) GD, EEx ia IIC or EEx ib [ia] IIC.	All	KEMA03ATEX1567 Temperature Class T4 to T6. Ta = -40 to + 85°C)	E
ATEX (FM) flameproof, II 1/2 G, Ex d, IIC.	F, L, M, S, T, Y	FM06ATEX0002 Temperature Class T6. Ta = -40 to +70°C. See Note (a).	
ATEX (FM) flameproof, II 2 G, Ex d, IIC.	D, W, Y	FM06ATEX0002 Temperature Class T6. Ta = -40 to +70°C.	D
ATEX (FM) flameproof, II 2 D.	D, F, L, M, S, T, W, Y	FM06ATEX0002 T85°C, Ta = 70°C max. ambient. See Note (a).	

Table 2. Electrical Safety Specifications (Continued)

Agency Certification, Type of Protection, and Area Classification	Available with Housing Codes	Application Conditions	Electrical Safety Design Code
CSA intrinsically safe for Class I, Division 1, Groups A, B, C, and D. Also, zone certified intrinsically safe Class I, Zone 0, Ex ia IIC.	B, C, E	Temperature Class T4 at 85°C maximum ambient Connect per MI 020-449.	C
CSA Class I, Division 2, Groups A, B, C, and D.		Temperature Class T4 at 85°C maximum ambient.	
CSA Intrinsically safe, Class I, Division 1, Groups A, B, C, and D; dustignition-proof; Class II, Division 1, Groups E, F, and G; Class III, Division 1. Also zone certified intrinsically safe Class I, Zone 0, Ex ia IIC and Class I, Zone 1, Ex ib IIC.	D, F, L, M, S, T, W, and Y	Temperature Class T4 at 85°C and T6 at 60°C maximum ambient Connect per MI 020-449.	C
CSA Class I, Division 2, Groups A, B, C, D, F, and G. Also zone certified for Class I, Zone 2, Ex nA II.		Temperature Class T4 at 85°C, T5 at 75°C, and T6 at 60°C maximum ambient.	
CSA Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class II, Division 1, Groups E, F, and G; and Class III, Division 1. Also, zone certified Class I, Zone 1, Ex d IIC.	D, F, L, M, S, T, W, and Y	Temperature Class T4 at 85°C, and T6 at 40°C maximum ambient. See Note (a).	

Table 2. Electrical Safety Specifications (Continued)

<table>
<tr><th>Agency Certification,
Type of Protection,
and Area Classification</th><th>Available with Housing Codes</th><th>Application Conditions</th><th>Electrical Safety Design Code</th></tr>
<tr><td>FM FISCO field device intrinsically safe for Class I, Division 1, Groups A, B, C, and D. Also zone certified intrinsically safe Class I, Zone 0, AEx ia IIC and Class 1, Zone 1, AEx ib IIC.</td><td rowspan="2">B, C,E</td><td rowspan="2">Temperature Class T4 at 85°C maximum ambient.
Connect per MI 020-449.</td><td rowspan="5">F</td></tr>
<tr><td>FM FNICO field device nonincendive for Class I, Division 2, Groups A, B, C, and D.</td></tr>
<tr><td>FM FISCO field device intrinsically safe for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G. Also zone certified intrinsically safe Class I, Zone 0, AEx ia IIC and Class 1, Zone 1, AEx ib IIC.</td><td rowspan="2">D, F, L, M, S, T, W, Y</td><td rowspan="2">Temperature Class T4 at 85°C maximum ambient.
Connect per MI 020-449.</td></tr>
<tr><td>FM FNICO field device nonincendive, Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; Class III, Division 2.</td></tr>
<tr><td>FM Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class I, Division 1, Groups E, F, and G; and Class III Division 1.[b]
Also, zone certified Class I, Zone 1, AEx d IIC.</td><td>D, F, L, M, S, T, W, and Y</td><td>Temperature Class T5 at 85°C and T6 at 70°C maximum ambient.

See Note (a).</td></tr>
<tr><td>IECEx flameproof, Ex d IIC</td><td>L, M, S, T, W, Y</td><td>IECEx FMG07.0001X
Temperature Class T6. Ta = 70°C</td><td>V</td></tr>
</table>

(a) Explosionproof/Flameproof certification not available for Housing Codes F, L or M if well is not supplied with transmitter (Code NA).

(b) Also includes Group A for Housing Codes D and F).

ATEX Warning

⚠ WARNING

Do not open while circuits are alive.

IECEx Warning

⚠ WARNING

Do not open when energized or when an explosive atmosphere may be present.

FM and CSA Warnings

⚠ WARNING
Substitution of components may impair intrinsic safety or Division 2 approvals.

For explosionproof certifications:

⚠ WARNING
Keep cover tight while circuits are alive unless area is known to be nonhazardous.

ATEX Compliance Documents

Directive 94/9/EC - Equipment or Protective Systems Intended for Use in Potentially Explosive Atmospheres.

Also, compliance with the essential health and safety requirements has been assured by compliance with the following documents as stated in the compliance certificate:

KEMA03ATEX1567

EN 50014: 1997; EN 50281-1-1:1998; EN 50284:1999; EN 50020: 2002

FM06ATEX0002

EN 60079-0:2004; EN 60079-1:2004; EN50281-1-1:1998 + A1:2002;
EN 60079-26: 2004; EN 60529:1991 + A1: 2000.

IECEx Compliance Documents

IEC 60079-0 (Fourth Edition):2004
IEC 60079-1 (Fifth Edition):2003

2. Installation

The following material provides information and procedures for installing the RTT15 Transmitter. For dimensional information, refer to DP 020-462.

— NOTE
Use a suitable thread sealant on all connections.

— ⚠ CAUTION
Bare sensor or thermowell mounting to the 316 ss housing should not be used in high vibration areas.

Mounting

The basic transmitter can be mounted on a DIN rail or to a flat surface. The transmitter in a field housing can be pipe mounted, surface mounted, mounted directly to a bare sensor, or thermowell mounted. See Figures 2 through 4. For extremely high process temperatures, a remote mounted sensor is recommended. Also, the mounting stability can influence how the sensor is attached to the transmitter. If the process vessel is highly insulated and the thermowell has considerable lagging, a remote mounted transmitter attached to a 50 mm (2 inch) pipe is recommended. When mounting the transmitter, take into account the necessary room to remove the cover.

Surface or Pipe Mount with Remote Sensor

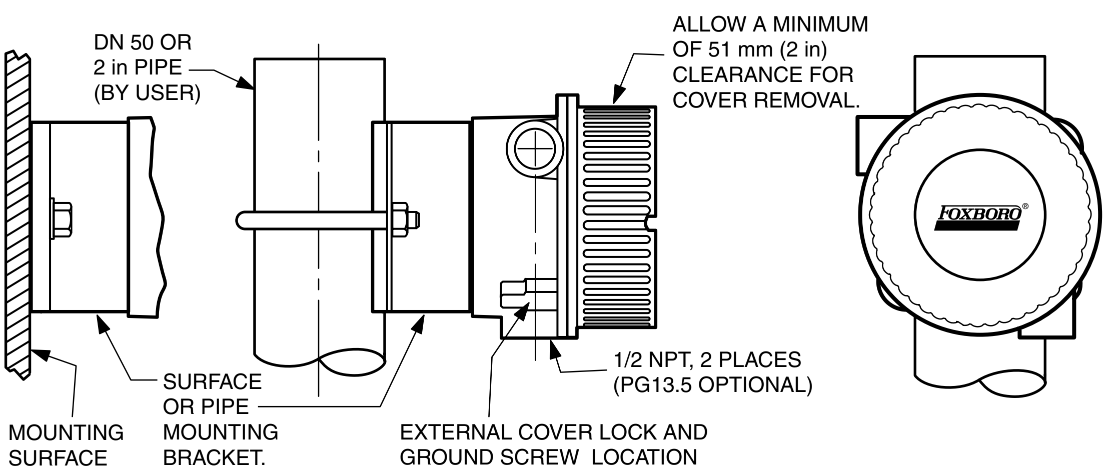

Figure 2. Surface or Pipe Mount with Remote Sensor (Housing Code S and T)

Basic Module Mount

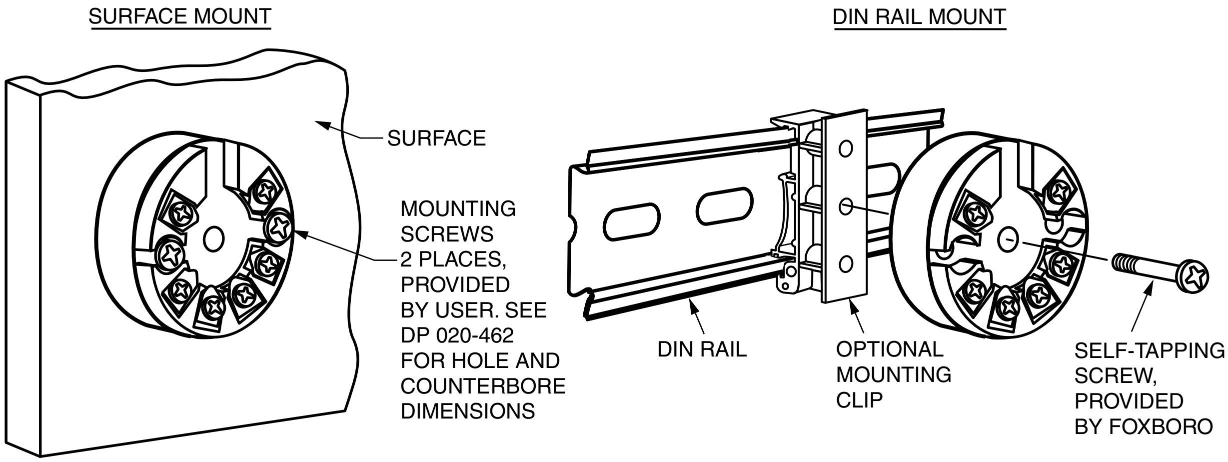

Figure 3. Basic Module Mount (Housing Code B)

Thermowell Mount

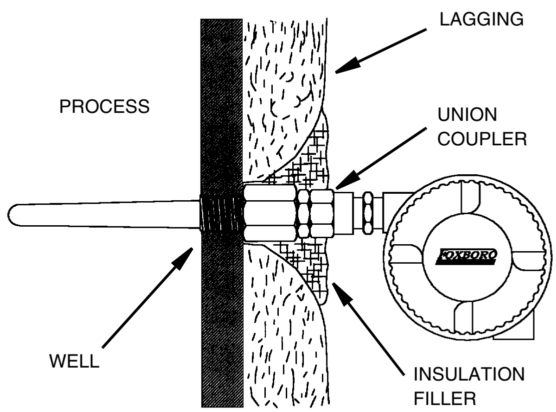

Figure 4. Thermowell Mount (Housing Codes E, F, L, and M)

Cover Locks

A cover lock is provided as standard with certain agency certifications and as part of the Custody Transfer Lock and Seal option. The type of lock varies with the housing used.

Universal Housing (Codes S, T, L, M, W, and Y)

To lock the cover on this housing, screw the cover onto the housing as far as possible, place the clamp as shown below and tighten the clamp screw. Insert the seal wire through the clamp and crimp the seal if applicable.

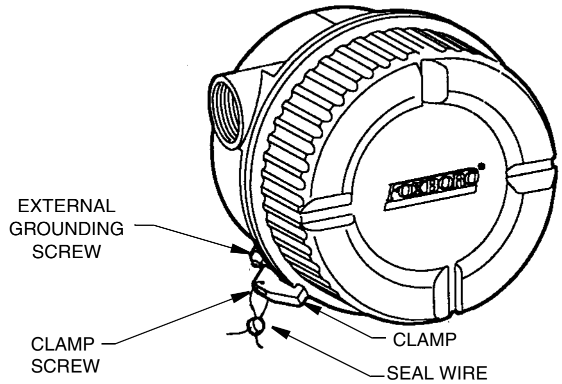

Figure 5. Universal Housing Cover Lock

Explosionproof Connection Head (Codes D and F)

To lock the cover on this housing, screw the cover onto the housing as far as possible and then screw the set screw into place. Make sure that the set screw is located between any two of the eight small tabs on the cover.

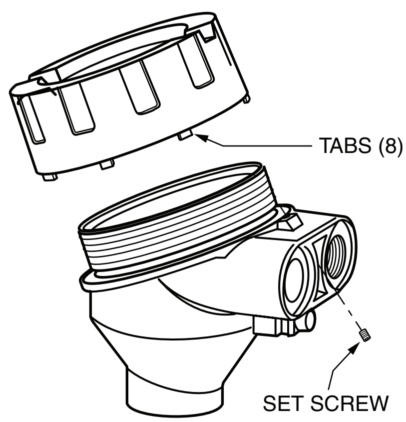

Figure 6. Explosionproof Connection Head Cover Lock

Wiring

Your transmitter must be installed to meet all local installation regulations, such as hazardous location requirements and electrical wiring codes. Persons involved in the installation must be trained in these code requirements. To maintain agency certification, your transmitter must also be installed in accordance with the agency requirements.

! WARNING

On transmitters with Housing Code L, M, S, T, W, and Y. to maintain IEC IP66 and NEMA Type 4X protection, any unused conduit opening must be plugged with a metal plug. In addition, the threaded housing cover must be installed. Hand tighten cover as much as possible so that the O-ring is fully captured.

NOTE

1. Review suggested wiring practices as described in MI 020-360 to ensure proper communications capability and operation.
2. Invensys Foxboro recommends the use of transient/surge protection in installations prone to high levels of electrical transients and surges.

The sensor circuit is not infallibly galvanically isolated from the fieldbus input circuit. However, the galvanic isolation between the circuits is capable of withstanding a test voltage of 500 V ac during 1 minute.

The transmitter must be mounted in an enclosure in order to provide a degree of ingress protection of at least IP 20. If the transmitter is installed in a potentially explosive atmosphere where equipment category 1 G is required and if the enclosure in which the transmitter is mounted is made of aluminum, then the requirements of EN 50284, clause 4.3.1 must be taken into account.

Input/Output Connections

There are six terminals on the basic module for input and output connections. Terminals 1 and 2 are for measurement output and terminals 3 through 6 are for RTD, TC, ohm, or mV sensor inputs. In addition, dual inputs for average, difference, and redundant measurement are available with housing codes B, S, or T. With dual inputs, the two sensors must be of the same linearization type except that a thermocouple can be used with an RTD. In this case the thermocouple must be Sensor 1, the RTD must be a 2- or 3-wire RTD, and the CJC cannot be measured externally.

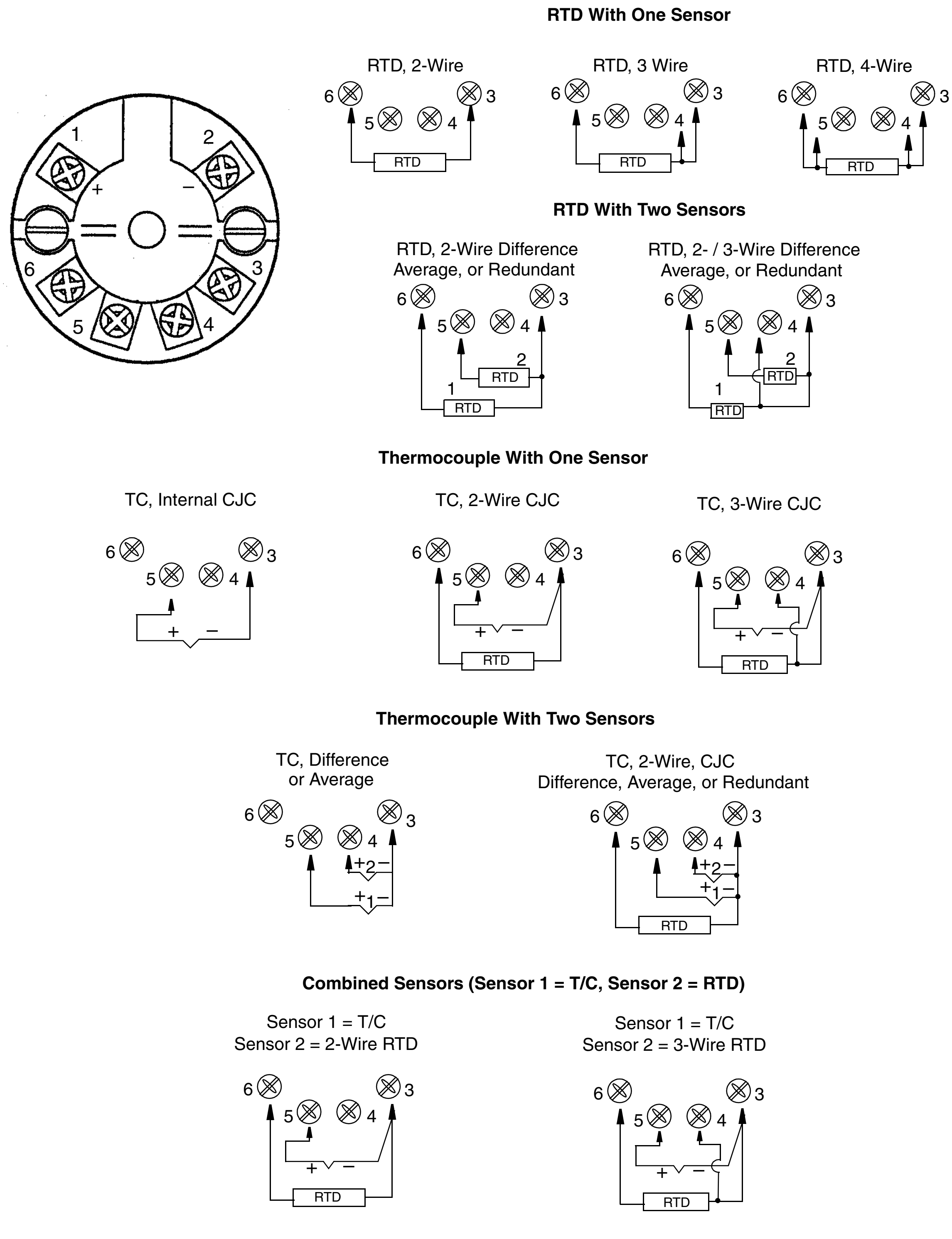

Figure 7. Input Connections (1 of 2)

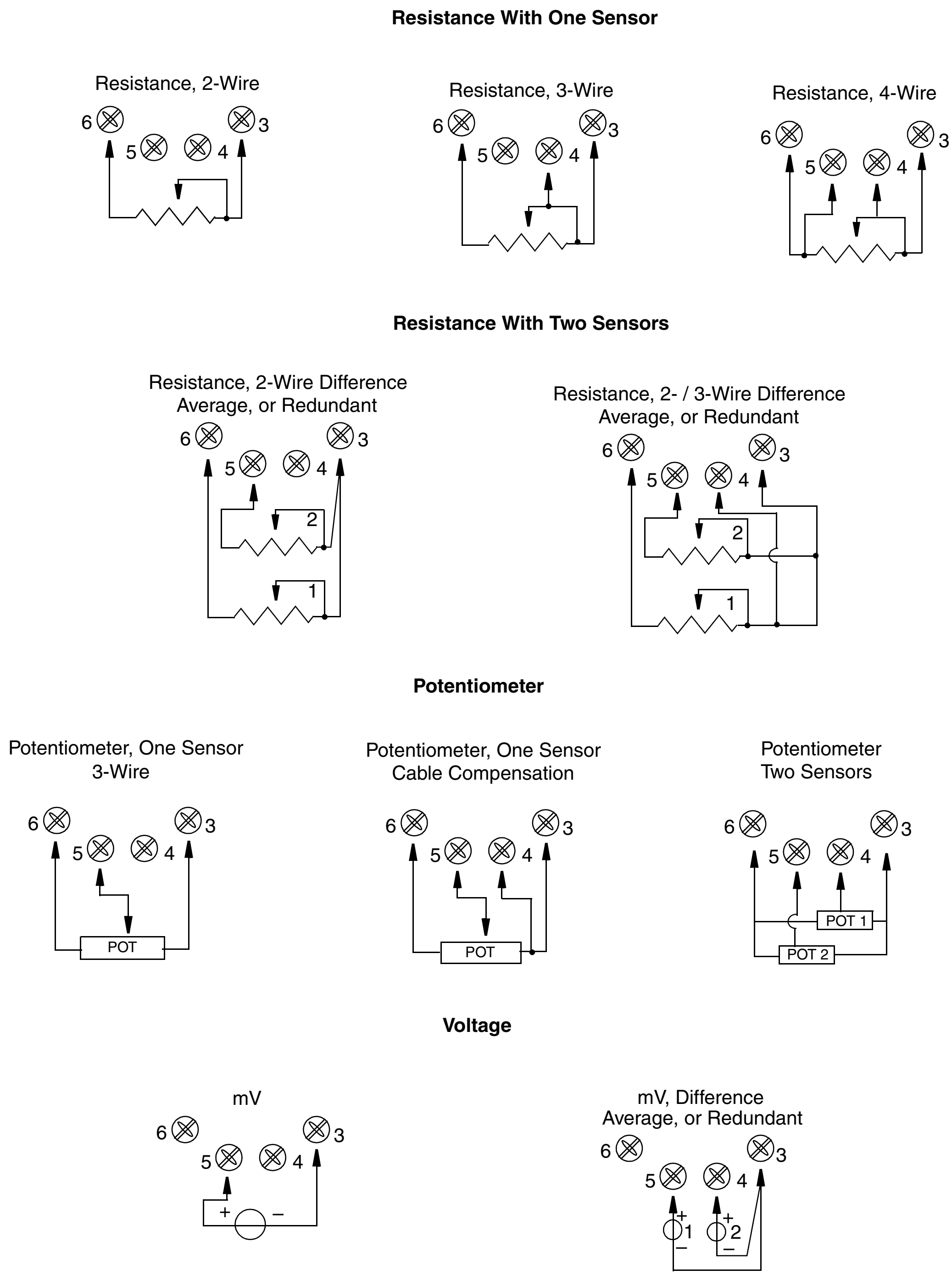

Figure 8. Input Connections (2 of 2)

Wiring to an I/A Series System

The RTT15-F and RTT15-P Temperature Transmitters can be wired to an I/A Series System by connecting the output terminals to the FOUNDATION fieldbus or PROFIBUS respectively as shown in Figure 9.

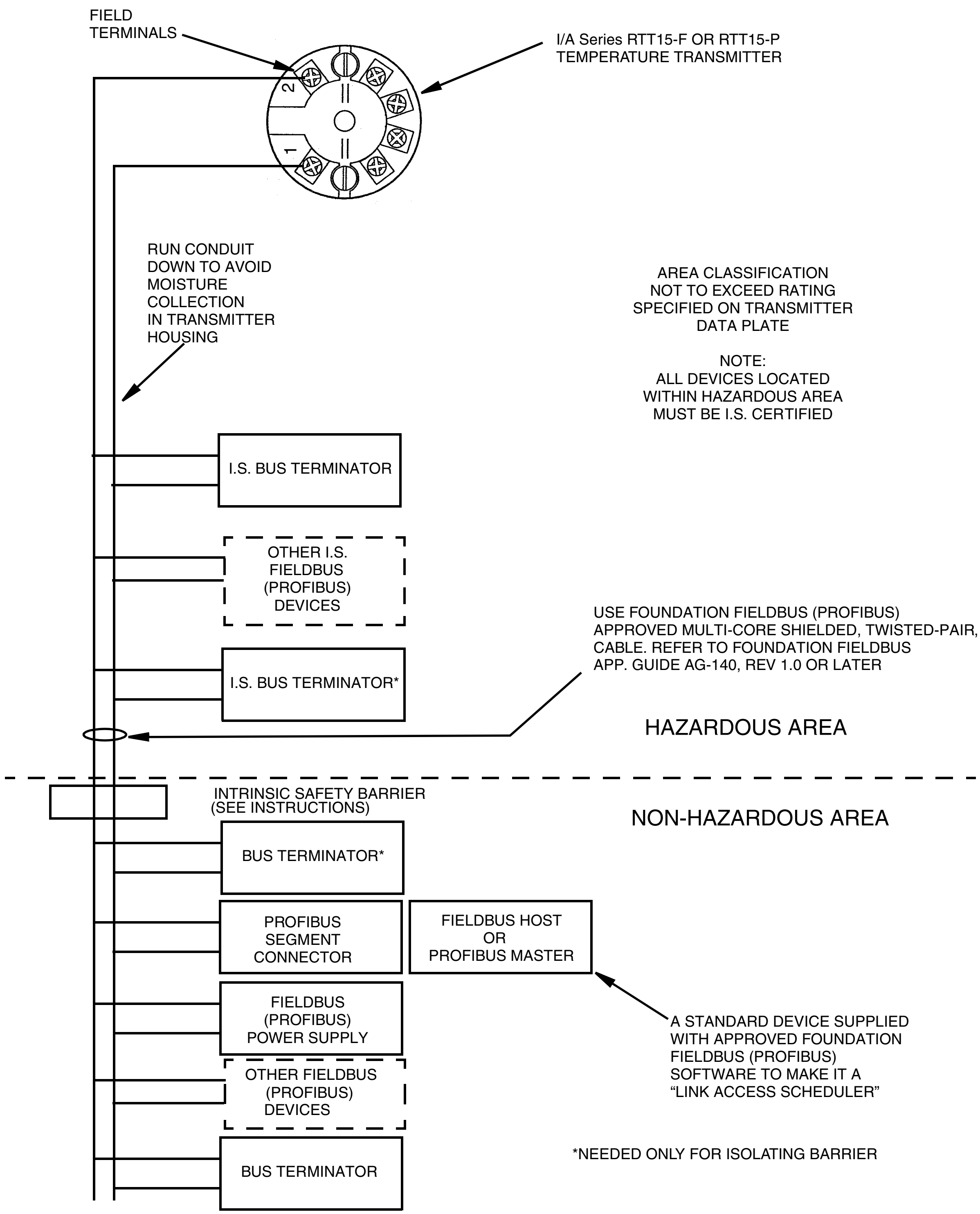

Figure 9. Connecting an RTT15-F or RTT15-P to the FOUNDATION Fieldbus or PROFIBUS

When you integrate a transmitter with an I/A Series system, refer to the following I/A Series document for setting up the control system:

B0193RA *Measurement Integration*

Grounding (Earthing)

The transmitter can operate with the output wiring floating or grounded. If the output wiring is grounded, the preferred method is to ground the lead close to the power supply. Never ground the loop at more than one point.

Since the transmitter is an isolated device, the sensor wiring can be grounded. If a grounded thermocouple is used, that will be the one ground point for the sensor wiring.

Shielded cable should be grounded at the power supply and floating (ungrounded) at the transmitter. Do **not** ground the shield to the transmitter.

Shielded cable around the sensor wiring should be grounded at the sensor, **not** at the transmitter.

The electronic module is not metallic and therefore does not need to be grounded. For certain electrical safety certifications, an external ground screw is provided.

Installing the Fieldbus or PROFIBUS Software

Your transmitter is shipped with a 3.5-inch diskette that contains the appropriate device descriptors for each device type. These descriptor files are used by a remote FOUNDATION fieldbus or PROFIBUS configurator (host).

FOUNDATION fieldbus device nomenclature and descriptor files are:

Manufacturer ID: 385884.

Device Type: 1036.

Devise Descriptor Files:

xxyy.ffo	Device Description binary file
xxyy.sym	Device Description symbol file
xxyyzz.cff	Capability file

where xx and yy refer to the device version number (for example 0101.ffo).

PROFIBUS device nomenclature and descriptor files are:

Manufacturer ID: Invensys Systems, Inc.

Device Identification: 1036.

Device Descriptor Files:

ISI_1036.gsd	Device Description data
ISI1036D.bmp	Icon for diagnostic mode
ISI1036N.bmp	Icon for normal mode
ISI1036S.bmp	Icon for special operation mode

3. Configuration (Fieldbus)

Quick Setup Guide

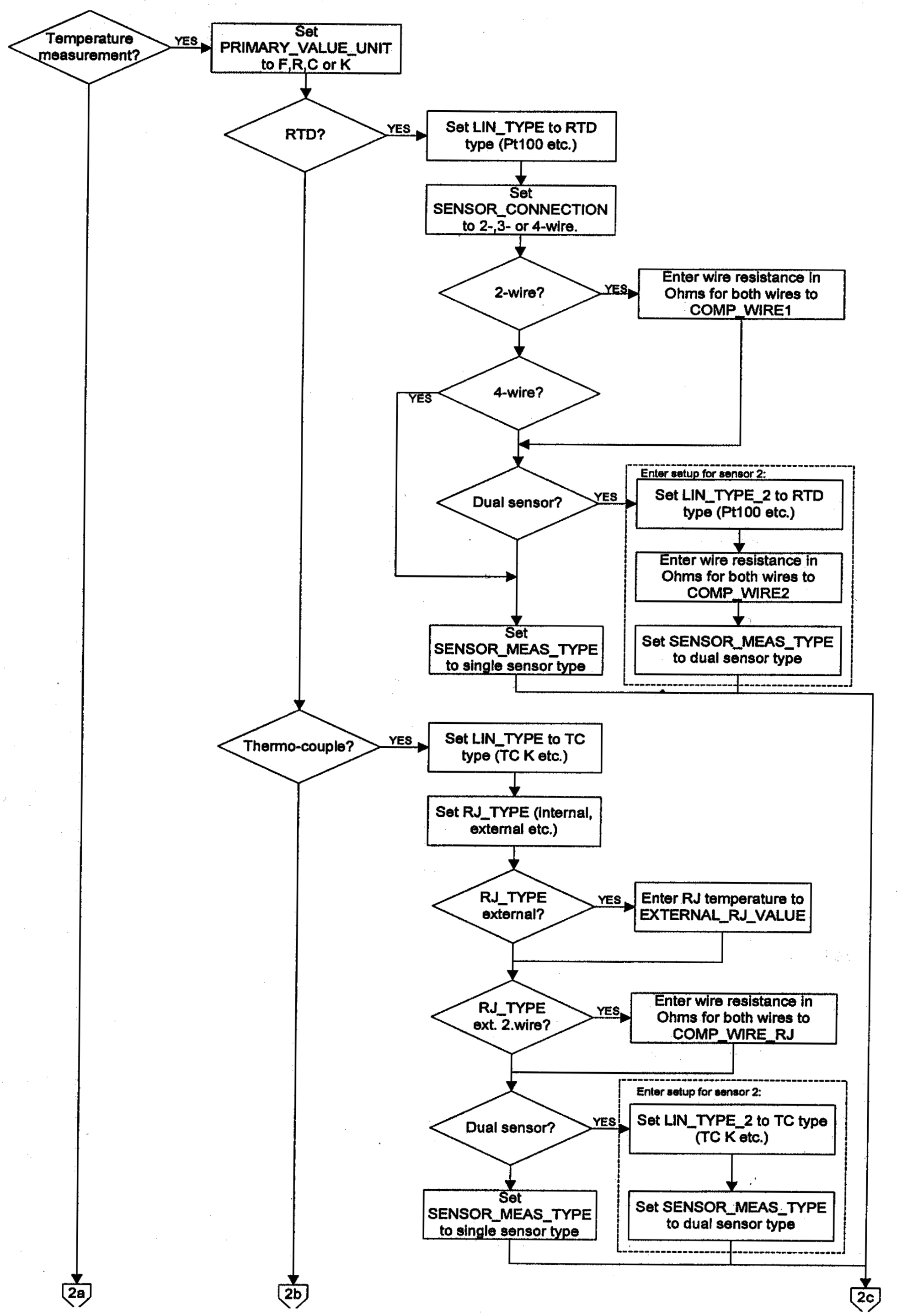

Figure 10. Quick Setup Flowchart (1 of 3)

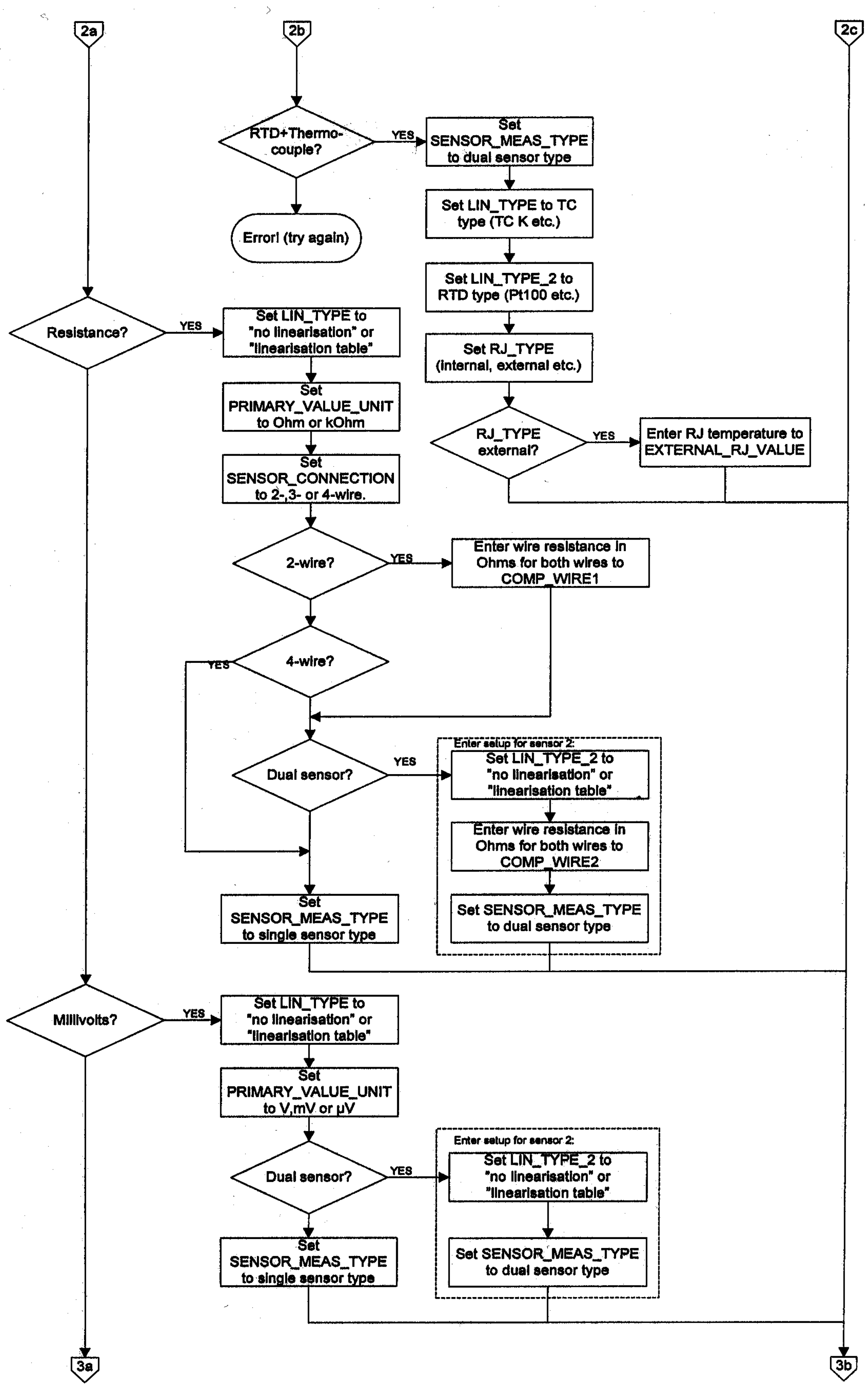

Figure 11. Quick Setup Flowchart (2 of 3)

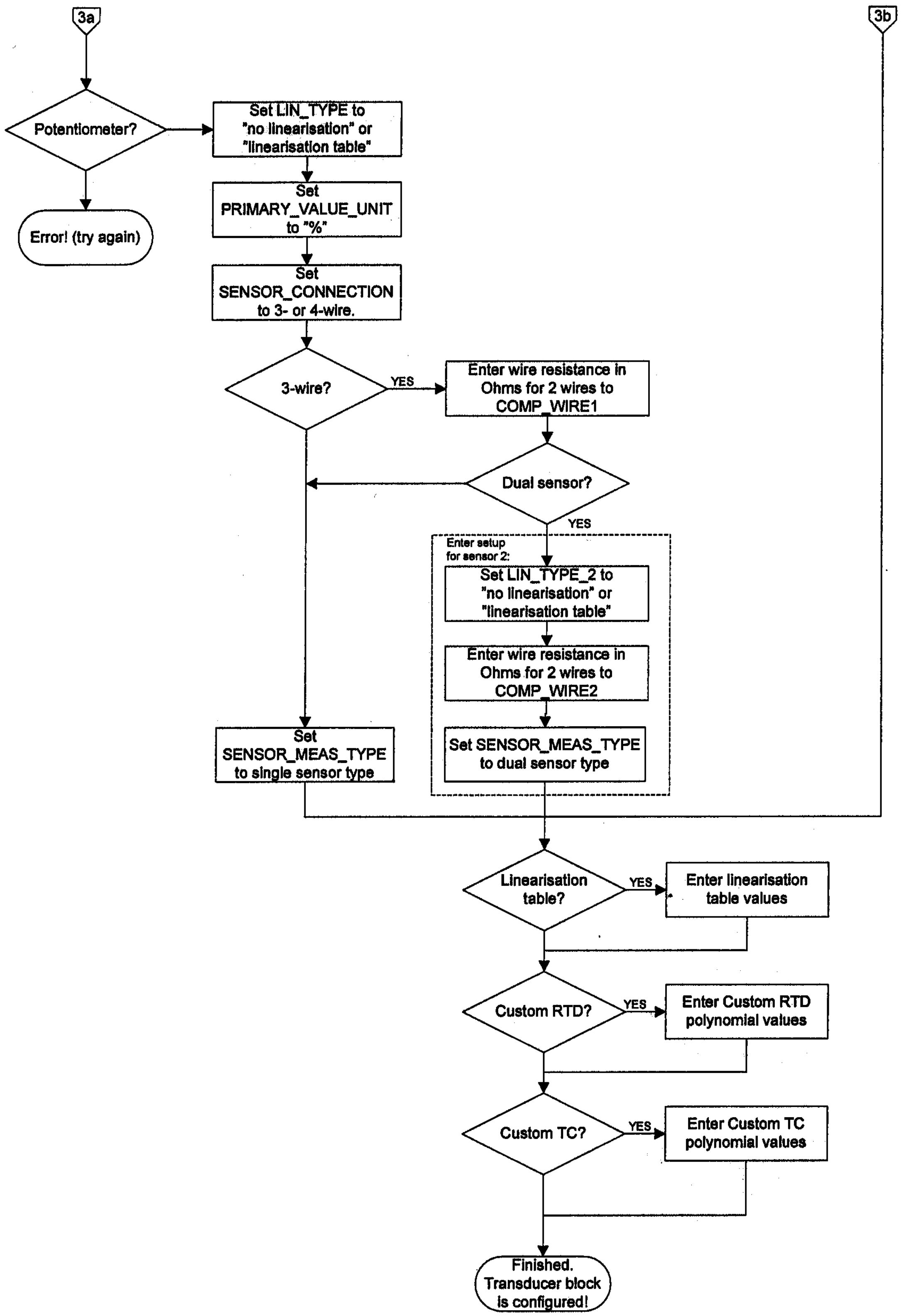

Figure 12. Quick Setup Flowchart (3 of 3)

Transducer Block Setup Examples

Measure Resistance (Linear) with One Sensor

PRIMARY_VALUE_UNIT	=	Ohm or kilohm
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	N/A
SENSOR_MEAS_TYPE	=	Sensor 1, Sensor 2 not available
SENSOR_CONNECTION	=	2-, 3-, or 4-wire
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	N/A

Measure Resistance (Linear) with Two Sensors

PRIMARY_VALUE_UNIT	=	Ohm or kilohm
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	No linearization
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	2- or 3-wire
SENSOR_CONNECTION_2	=	Default set to 2-wire
RJ_TYPE	=	N/A

Measure RTD with One Sensor

PRIMARY_VALUE_UNIT	=	K, °C, °F, or °R
LIN_TYPE_1	=	Any RTD
LIN_TYPE_2	=	N/A
SENSOR_MEAS_TYPE	=	Sensor 1, Sensor 2 not available
SENSOR_CONNECTION	=	2-, 3-, or 4-wire
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	N/A

Measure RTD with Two Sensors

PRIMARY_VALUE_UNIT	=	K, °C, °F, or °R
LIN_TYPE_1	=	Any RTD
LIN_TYPE_2	=	Any RTD
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	2- or 3-wire
SENSOR_CONNECTION_2	=	Default set to 2-wire
RJ_TYPE	=	N/A

Measure Potentiometer (Linear) with One Sensor

PRIMARY_VALUE_UNIT	=	%
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	N/A
SENSOR_MEAS_TYPE	=	Sensor 1, Sensor 2 not available
SENSOR_CONNECTION	=	3- or 4-wire
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	N/A

Measure Potentiometer (Linear) with Two Sensors

PRIMARY_VALUE_UNIT	=	%
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	No linearization
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	Default set to 3-wire
SENSOR_CONNECTION_2	=	Default set to 3-wire
RJ_TYPE	=	N/A

Measure Voltage (Linear) with One Sensor

PRIMARY_VALUE_UNIT	=	μV, mV, or V
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	No linearization
SENSOR_MEAS_TYPE	=	Sensor 1, Sensor 2 not available
SENSOR_CONNECTION	=	N/A
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	N/A

Measure Voltage (Linear) with Two Sensors

PRIMARY_VALUE_UNIT	=	μV, mV, or V
LIN_TYPE_1	=	No linearization
LIN_TYPE_2	=	No linearization
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	N/A
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	N/A

Measure Thermocouple with One Sensor

PRIMARY_VALUE_UNIT	=	K, °C, °F, or °R
LIN_TYPE_1	=	Any T/C
LIN_TYPE_2	=	N/A
SENSOR_MEAS_TYPE	=	Sensor 1, Sensor 2 not available
SENSOR_CONNECTION	=	N/A
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	No Reference Junction, Internal, External (constant value), Sensor 2-wire, or Sensor 3-wire

Measure Thermocouple with Two Sensors

PRIMARY_VALUE_UNIT	=	K, °C, °F, or °R
LIN_TYPE_1	=	Any T/C
LIN_TYPE_2	=	Any T/C
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	N/A
SENSOR_CONNECTION_2	=	N/A
RJ_TYPE	=	No Reference Junction, Internal, External (constant value), or Sensor 2-wire

Measure Combined Sensors (Sensor 1 - T/C, Sensor 2 = RTD)

PRIMARY_VALUE_UNIT	=	K, °C, °F, or °R
LIN_TYPE_1	=	Any T/C
LIN_TYPE_2	=	Any RTD
SENSOR_MEAS_TYPE	=	Anything but ‘Sensor 1, Sensor 2 not available’
SENSOR_CONNECTION	=	N/A
SENSOR_CONNECTION_2	=	2- or 3-wire
RJ_TYPE	=	No Reference Junction, Internal, External (constant value)

Resource Block

The Resource Block is used to define hardware specific characteristics of the Function Block Applications. It provides manufacturer name, device name, DD, block status, and hardware details. It also indicates how much resource (memory and CPU) is available and controls the overall device. All data is modeled within a controlled space so that no outside inputs into this block are required.

This parameter “set” is intended to be the minimum required for the function block application associated with the resource in which it resides. Some parameters that could be in the set, like calibration data and ambient temperature, are more part of their respective transducer blocks. The “mode” is used to control major states of the resource. OOS (out of service) mode stops all function block execution. The actual mode of the function blocks is changed to OOS but the target mode is not changed. Auto mode allows normal operation of the resource. **IMan** shows that the resource is initialized or receiving a software download. Parameters **MANUFAC_ID**, **DEV_TYPE**, **DEV_REV**, **DD_REV**, and **DD_RESOURCE** are required to identify and locate the DD so that Device Description Hosting Services can select the correct DD for use with the resource. The parameter **HARD_TYPES** is a read only bit string that indicates the types of hardware that are available to this resource. If an I/O block is configured that requires a type of hardware that is not available, the result is a block alarm for a configuration error. The **RS_STATE** parameter contains the operational state of the Function Block Application for the resource containing this resource block.

RESTART Parameter

The **RESTART** parameter allows degrees of initialization of the resource. They are:

- Run: Passive state of the parameter
- Restart resource: Intended to clear up problems (for example, the memory management resource)
- Restart with defaults: Intended to wipe configuration memory. It works like a factory initialization.
- Restart processor: Provides a way to hit the reset button on the processor associated with the resource. This parameter does not appear in a view because it returns to 1 shortly after being written.

Nonvolatile Parameters

All nonvolatile parameters are saved in EEPROM and therefore used if the device is restarted.

Timeout for Remote Cascade Modes

Parameters **SHED_RCAS** and **SHED_ROUT** set the time limit for loss of communication from a remote device. These constants are used by all function blocks that support a remote cascade mode. The effect of a timeout is described in Mode Calculation. Shedding from RCAS/ROUT does not happen when **SHED_RCAS** or **SHED_ROUT** is set to zero.

Alert Notification

The **MAX_NOTIFY** parameter value is the maximum number of alert reports that this resource can have sent without getting a confirmation, corresponding to the amount of buffer space available for alert messages. You can set the number lower than that, to control alert flooding, by adjusting the **LIM_NOTIFY** parameter value. If **LIM_NOTIFY** is set to zero, no alerts are reported. The **CONFIRM_TIME** parameter is the time for the resource to wait for confirmation of receipt of a report before trying again. If **CONFIRM_TIME** = 0, the device does not retry.

FEATURES and FEATURE_SEL Parameters

These parameters determine optional behavior of the resource. **FEATURES** defines the available features and is read only. **FEATURE_SEL** is used to turn on an available feature by configuration. If a bit is set in **FEATURE_SEL** that is not set in **FEATURES**, the result is a block alarm for a configuration error. The device supports the following features: Reports supported, Fault State supported, and Soft Write lock supported.

Fault State for Whole Resource

If you set the **SET_FSTATE** parameter, the **FAULT_STATE** parameter indicates **active** and causes all output function blocks in the resource to go immediately to the condition chosen by the fault state Type I/O option. It can be cleared by setting the **CLR_FSTATE** parameter. The set and clear parameters do not appear in a view because they are momentary.

Write Lock

The **WRITE_LOCK** parameter, if set, prevents any external change to the static or nonvolatile data base in the Function Block Application of the resource. Block connections and calculation results proceed normally, but the configuration is locked. It is set and cleared by writing to the **WRITE_LOCK** parameter. Clearing **WRITE_LOCK** generates the discrete alert **WRITE_ALM** at the **WRITE_PRI** priority. Setting **WRITE_LOCK** clears the alert, if it exists. Before setting the **WRITE_LOCK** parameter to **Locked**, it is necessary to select the soft **Write Lock supported** option in **FEATURE_SEL**.

Other Implemented Features

The **CYCLE_TYPE** parameter is a bit string that defines the types of cycles that this resource can do. **CYCLE_SEL** allows the configurator to choose one of them. If **CYCLE_SEL** contains more than one bit, or the bit is not set in **CYCLE_TYPE**, the result is a block alarm for a configuration error. **MIN_CYCLE_T** is the manufacturer specified minimum time to execute a cycle. It puts a lower limit on the scheduling of the resource.

The **MEMORY_SIZE** parameter declares the size of the resource for configuration of function blocks, in kilobytes. The **FREE_SPACE** parameter shows the percentage of configuration memory that is still available. **FREE_TIME** shows the approximate percentage of time that the resource has left for processing new function blocks, should they be configured.

Block Error

The **BLOCK_ERR** parameter reflects the following causes:

- Device Fault State Set - When **FAULT_STATE** is active
- Simulate Active - When the Simulate reed switch is activated
- Out of Service - When the block is in OOS mode.

Supported Modes

OOS, Man, and Auto

Transducer Block

The Transducer Block contains all of the manufacturer-specific parameters that define how the RTT15-F Transmitter functions. Selections, such as setting of input type, engineering units, defining the dual functionality when using the dual input, and so forth, are performed in this block. The Transducer Block allows you to select a large number of sophisticated functions. Therefore, the configuration of the transmitter must be carried out with greatest possible care.

Default Configuration

The transmitter is shipped with a default configuration that suits the user's requirements in many cases. The configuration task has thus been reduced considerably. The complete list of configurable default configurations are shown in "List of Configurable Parameters" on page 33 but briefly, it contains:

- **LIN_TYPE**: Pt100 Sensor
- **PRIMARY_VALUE_UNIT**: °C
- **SENSOR_CONNECTION**: 3-Wire
- **SENSOR_MEAS_TYPE**: One Sensor
- **SENSOR_WIRE_CHECK_1**: No Sensor Error Detection

Analog Input (AI) Block

The RTT15-F has two Analog Input (AI) Blocks that must be configured individually. The AI Block takes the manufacturer input data, selected by channel number, and makes it available to other function blocks at its output.

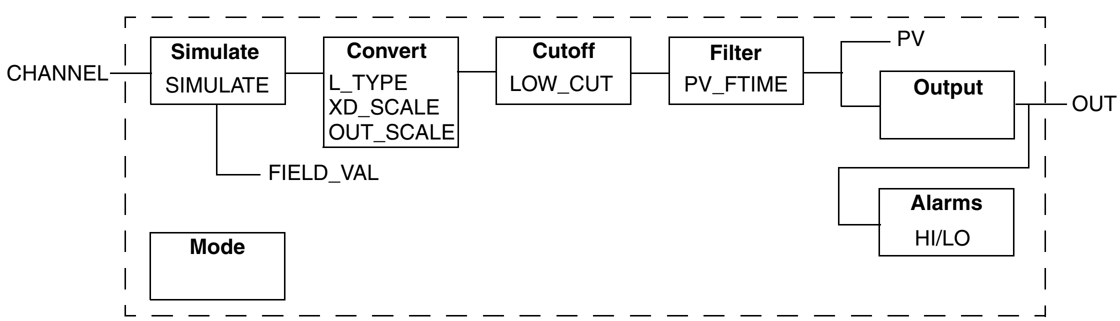

Figure 13. Analog Input Block Schematic

Transducer scaling (**XD_SCALE**) is applied to the value from the channel to produce the **FIELD_VAL** in percent. The **XD_SCALE** units code must match the channel units code or the an error message is generated. The **OUT_SCALE** is normally the same as the transducer, but if **L_TYPE** is set to **Indirect** or **Ind Sqr Root**, **OUT_SCALE** determines the conversion from **FIELD_VAL** to the output. **PV** and **OUT** always have identical scaling.

OUT_SCALE provides scaling for **PV**. The PV is always the value that the block places in **OUT** if the mode is **Auto**. If **Man** is allowed, you can write a value to the output. The status prevents any attempt at closed loop control using the **Man** value, by setting the Limit value to Constant.

The **LOW_CUT** parameter has a corresponding "Low cutoff" option in the **IO_OPTS** bit string. If the option is true, any calculated output below the low cutoff value is changed to zero. This is only useful for zero-based measurement devices, such as flow. The PV filter, whose time constant is **PV_FTIME**, is applied to the PV and not the **FIELD_VAL**.

Equations:

FIELD_VAL = 100*(channel value - EU@100%)/(EU@100% - EU@0%) [XD_SCALE]

Direct: PV = channel value

Indirect: PV = (FIELD_VAL/100)*(EU@100% - EU@0%) + EU@0% [OUT_SCALE]

Ind Sqr Root: PV = sqrt(FIELD_VAL/100)*(EU@100% - EU@0%) + EU@0% [OUT_SCALE]

Supported Modes

OOS, Man, and Auto

Simulation Mode

See “Simulation Mode” on page 49.

Alarm Types

Standard block alarms plus **HI_HI**, **HI**, **LO_LO**, and **LO** alarms applied to **OUT**.

Mode Handling

Standard transition in and out of OOS.

Standard transition from Man to Auto and back.

Status Handling

The status values described in Output parameter Formal Model of Part 1 apply with the exception of the control substatus values. The Uncertain - EU Range Violation status is always set if the **OUT** value exceeds the **OUT_SCALE** range and no worse condition exists. The following options from **STATUS_OPTS** apply, where Limited refers to the sensor limits:

Propagate Fault Forward
Uncertain if Limited
BAD if Limited
Uncertain if Man mode.

Initialization

The PV filter must be initialized. Other than that, no special initialization is required. This is a pure calculation algorithm.

PID Control Block

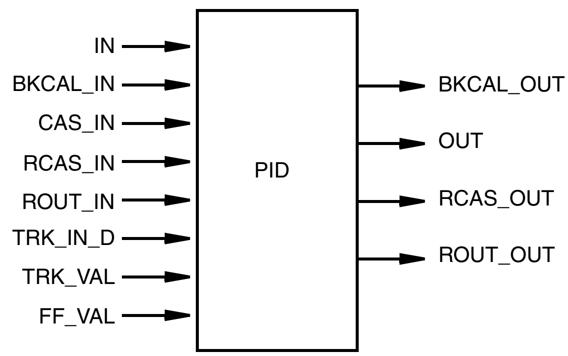

Figure 14. PID Block Parameter Summary

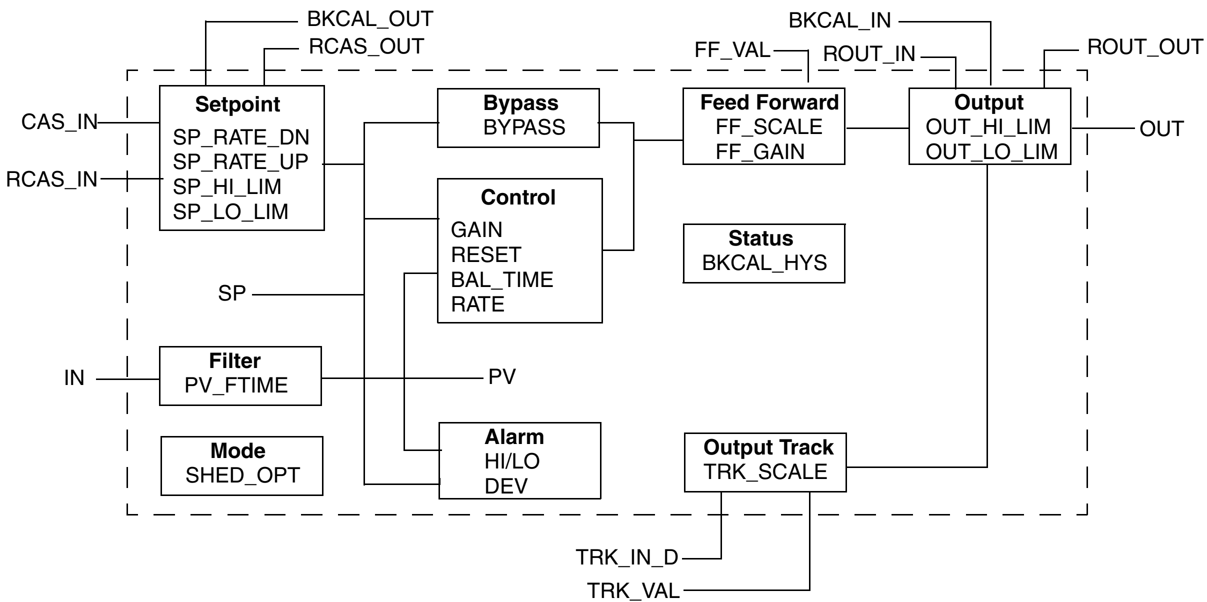

Figure 15. PID Block Schematic

The process value to be controlled is connected to the **IN** input. This value is passed through a filter whose time constant is **PV_FTIME**. The value is then shown as the **PV**, which is used in conjunction with the **SP** in the PID algorithm. A PID does not integrate if the limit status of **IN** is constant. A full PV and DV alarm subfunction is provided. The **PV** has a status, although it is a Contained parameter. This status is a copy of the IN status unless IN is good and there is a PV or block alarm.

The full cascade SP subfunction is used with rate and absolute limits. There are additional control options which cause the **SP** value to track the **PV** value when the block is in an actual mode of **IMan**, **LO**, **Man**, or **Rout**. Limits do not cause SP-PV tracking.

There is a switch for **BYPASS**, which is available to the operator if the Bypass Enable control option is true. **BYPASS** is used in secondary cascade controllers that have a bad PV. The Bypass

Enable option is necessary because not all cascade control schemes are stable if **BYPASS** is true. **BYPASS** can only be changed when the block mode is **Man** or **OOS**. While it is set, the value of **SP**, in percent of range, is passed directly to the target output, and the value of **OUT** is used for **BKCAL_OUT**. When the mode is changed to **Cas**, the upstream block is requested to initialize to the value of **OUT**. When a block is in Cas mode, then on the transition out of **BYPASS**, the upstream block is requested to initialize to the PV value, regardless of the "Use PV for **BKCAL_OUT**" option.

GAIN, **RESET**, and **RATE** are the tuning constants for the P, I, and D terms, respectively. **GAIN** is a dimensionless number. **RESET** and **RATE** are time constants expressed in seconds. There are existing controllers that are tuned by the inverse value of some or all of them, such as proportional band and repeats per minute. The human interface to these parameters should be able to display your preference. The Direct Analog control option, if true, causes the output to increase when the **PV** exceeds the **SP**. If false, the output decreases when the **PV** exceeds the **SP**. It makes the difference between positive and negative feedback, so it must be set properly and never changed while in automatic mode. The setting of the option must also be used in calculating the limit state for **BKCAL_OUT**.

The output supports the feed-forward algorithm. The **FF_VAL** input brings in an external value which is proportional to some disturbance in the current loop. The value is converted to percent of output span using the values of parameter **FF_SCALE**. This value is multiplied by the **FF_GAIN** and added to the target output of the PID algorithm. If the status of **FF_VAL** is **Bad**, the last usable value is used because this prevents bumping the output. When the status returns to **Good**, the block adjusts its integral term to maintain the previous output.

The output supports the track algorithm.

There is an option to use either the **SP** value after limiting or the **PV** value for the **BKCAL_OUT** value.

Supported Modes

OOS, IMan, LO, Man, Auto, Cas, RCas, and Rout

Alarm Types

Standard block alarm plus standard **HI_HI**, **HI**, **DV_HI**, **DV_LO**, **LO**, and **LO_LO** alarms applied to **PV**

Mode Handling

Standard transition in and out of OOS

Status Handling

Standard, plus the following things for the control selector. If **Not Selected** is received at **BKCAL_IN**, the PID algorithm should make necessary adjustments to prevent windup.

Initialization

Standard

Configuration Procedure

— **NOTE**

These instructions assume the following:

1. You are using the National Instruments Fieldbus Configurator Software (NI-FBUS).
2. You are familiar with the NI software.
3. The NI-FBUS software is running On-line and connected to a functional RTT15.
4. If you cannot find any parameter, do a right mouse click anywhere on the block window and select **Customize Parameters**. Check the box for the parameter you need. When you click again on the window, that parameter is added to that window. When you start to close out that window, you are prompted to save your customization. Click on **Yes**.
5. The following procedure covers 98% of all typical installations. For complex or advanced situations, you have to reconfigure other parameters for your application.
6. The FoxCAE Configurator in an I/A Series system is similar to the National Configurator software. If you are attaching the transmitter to an I/A Series system, please refer to B0400FD for specific details on parameter configuration limitations.

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1. Connect the sensor to terminals 3 through 6 per the wiring directions shown in Figure 7 and 8.
2. Connect the fieldbus wiring to terminals 1 and 2. The transmitter is polarity independent, so it cannot be wired backwards (no plus/minus labels).
3. The factory default for the **PD_TAG** parameter has been assigned a unique tag, such as "RTT15-F_030640020." You can change this tag, but it must be unique on the segment. Right click on the device and select **Set Tag**. Type in a new tag. Make sure the **Set to OOS** block is checked. Click on **Set**.
4. The factory default for the **NODE_ADDRESS** parameter has been factory defaulted to an address, such as "33(0x21)." You can modify this address, but it must be a unique value on the H1 wiring segment. Ensure that the address is within the valid address range of the host system. Right click on the device and select **Set Address**. Select a new Device Address from the drop down menu. Make sure the **Set to OOS** block is checked. Click on **Set**. Wait until the Set Address operation is complete before modifying different parameters.

— ⚠ **CAUTION**

Ensure that all devices on a wiring segment have a unique address within the range of the host system recommended addresses.

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5. If you do not see the Transducer Block on the NI-FBUS screen, click on the Show/Hide Transducers & Device ID's icon on the menu bar. The icon has a capital letter T with a red **X**. The factory default for the **BLOCK_TAG** parameter in the

Transducer Block has been assigned a unique device ID, such as “AI_TRANSDUCER RTT15_030640020”. You can reconfigure this tag, but it must be unique. Right click on the Transducer Block and select **Set Tag**. Type in a new tag. Make sure the **Set to OOS** block is checked. Click on **Set**.

6. The factory default for the **BLOCK_TAG** parameter in the Resource Block has been assigned a unique tag, such as “RESOURCE RTT15_030640020”. You can reconfigure this tag, but it must be unique. Right click on the Resource Block and select **Set Tag**. Type in a new tag. Make sure the **Set to OOS** block is checked. Click on **Set**.
7. The factory default for the **BLOCK_TAG** parameter in the Analog Input Blocks (AI#1 and AI#2) have been assigned a unique tag, such as “ANALOG_INPUT1 RTT15_030640020”. You can reconfigure this tag, but it must be a unique tag. Right click on the AI#1 block and select **Set Tag**. Type in a new tag. Make sure the **Set to OOS** block is checked. Click on **Set**. Repeat for AI#2.
8. The factory default for the **BLOCK_TAG** parameter in the PID Block has been assigned a unique tag, such as “PID RTT15_030640020”. You can reconfigure this tag, but it must be a unique tag. Right click on the PID block and select **Set Tag**. Type in a new tag. Make sure the **Set to OOS** block is checked. Click on **Set**.

TRANSDUCER BLOCK

9. Open the **Transducer** Block. Click on the **OOS** box to put the transmitter Out Of Service. Make sure that the **MODE_BLK•Actual** value reads **OOS**. Ignore this step if the **ACTUAL** mode reads **OOS**.

— **NOTE**

In the following text, the parameters shown first are those that are displayed on your computer screen. Those shown in parenthesis are the standardized fieldbus terms.

10. Configure **Characterization Type 1** (**LIN_TYPE**) to match the sensor that is wired to the sensor terminals. The factory default is for DIN Platinum RTD’s (**PT100a**) unless the transmitter was ordered configured for a different type of sensor. Set to **No linearization** for a resistance, voltage, or potentiometer sensor.
    If two sensors are used, configure **Characterization Type 2** (**LIN_TYPE_2**) to match the second sensor.
11. Configure **Prim Val Unit** (**PRIMARY_VALUE_UNIT**) to **K**, °**C**, °**F**, or °**R** if sensor is an RTD or thermocouple, **Ohm** or **kOhm** if sensor is resistance, **V**, **mV**, or µ**V** if sensor is voltage or % if sensor is a potentiometer.
12. If the sensor is an RTD or resistance, configure **Connection Type 1** (**SENSOR_CONNECTION**) to the correct number of sensor wires. If two sensors are used, set **Connection Type 2** (**SENSOR_CONNECTION_2**) to the correct number of sensor wires for the second sensor.
13. If Sensor 1 is a 2-wire RTD or resistance, enter a value in ohms in **Line Compensation 1** (**COMP_WIRE1**) to compensate for the line resistance. If Sensor 2 is a 2-wire RTD, enter a similar value in **Line Compensation 2** (**COMP_WIRE2**).

14. If the only sensor is a thermocouple, configure **Reference Junction** (**RJ_TYPE**) as:
    - **No Reference** if cold junction compensation (CJC) is not used
    - **Internal** if internal compensation is to be used
    - **External** if a fixed value is to be used for CJC. Also configure **Ext Reference Junction Temperature** (**EXTERNAL_RJ_VALUE**) with that value.
    - **Sensor, 2-wire** if reference junction temperature is measured by a 2-wire RTD. Also enter a value in ohms in **Reference Line Compensation** (**RJ_COMP_WIRE**) to compensate for the line resistance.
    - **Sensor, 3-wire** if reference junction temperature is measured by a 3-wire RTD
15. If an RTD is used with a thermocouple, **Reference Junction** (**RJ_TYPE**) can only be set to **No Reference**, **Internal**, or **External**.
16. If Sensor 1 is a potentiometer, configure **Connection Type 1** (**SENSOR_CONNECTION**) to the correct number of sensor wires (3- or 4-wire). Then enter the wire resistance for two wires (in ohms) in **Line Compensation 1** (**COMP_WIRE1**).
17. If two potentiometers are used, set **Connection Type 2** (**SENSOR_CONNECTION_2**) to **2-wire**. Then enter the wire resistance for two wires (in ohms) in **Line Compensation 2** (**COMP_WIRE2**).
18. Configure **Measure Type** (**SENSOR_MEAS_TYPE**) to one of the following:

    Sensor 1
    Sensor 2
    Sensor 1 - Sensor 2 (difference)
    Sensor 2 - Sensor 1 (difference)
    Average [(Sensor 1 + Sensor 2)/2]
    Average Sensor 1 or Sensor 2 [(Sens 1 + Sens 2)/2] but one sensor if other is bad
    Sensor 1, Sensor 2 not available
    Sensor 1, Sensor 2 if Sensor 1 is bad
    Sensor 2, Sensor 1 if Sensor 2 is bad

19. If you want to adjust the process value connected to a sensor, add the bias by entering it in **Bias of Channel 1** (**BIAS_1**) for sensor 1 and **Bias of Channel 2** (**BIAS_2**) for sensor 2. The resulting values are shown in **Process Temperature Channel 1** (**SECONDARY_VALUE_1**) for sensor 1 and **Process Temperature Channel 2** (**SECONDARY_VALUE_2**) for sensor 2.
20. Enter the maximum and minimum sensor values for the appropriate sensor in the following parameters:

    Sensor Value Max 1 (**MAX_SENSOR_VALUE_1**)
    Sensor Value Min 1 (**MIN_SENSOR_VALUE_1**)
    Sensor Value Max 2 (**MAX_SENSOR_VALUE_2**)
    Sensor Value Min 2 (**MIN_SENSOR_VALUE_2**)

21. Select the sensor error detection capability for each sensor as **Disabled** (not used), **Lead breakage detection**, **Short circuit detection**, or **Wire breakage and short circuit detection** in the following parameters:

For Sensor 1: **Sensor Wire Check 1** (**SENSOR_WIRE_CHECK_1**)
For Sensor 2: **Sensor Wire Check 2** (**SENSOR_WIRE_CHECK_2**)
For RJ Sensor: **RJ Sensor Wire Check** (**SENSOR_WIRE_CHECK_RJ**)

22. The factory default for the **MODE_BLK•Normal** parameter is **Auto**. If for some reason you want the transmitter to start in the Out Of Service mode, or other selection when power is first applied, set the parameter to the desired action.
23. Write your changes to the transmitter using the **Write Changes** button at the bottom of the display.
24. Set the **Target Mode** in the Transducer Block to **Auto** using the **Auto** button. **MODE_BLK•Actual** should change to **Auto**
25. Close the Transducer Block. In the dialog box, Click on **Yes**.

ANALOG INPUT BLOCKS

Now that the Transducer Block is configured, the Analog Input Blocks can be configured. There are two identical AI Blocks in the transmitter. The configurator procedure is identical for both AI Blocks.

26. Open Analog Input Block #1 and click on the **OOS** box to put the transmitter Out Of Service. Make sure that the **MODE_BLK•Actual** value reads **OOS**. Ignore this step if the **Actual** value reads **OOS**.
27. Set the **CHANNEL** parameter any of the following depending upon what measurement you want to use for this AI Block:
    - Primary Value
    - Sensor 1 Value
    - Sensor 2 Value
    - Internal Temperature (the cold junction measurement inside the transmitter)
28. The **L_TYPE** determines whether the selected value from the Transducer Block is passed directly through the AI Block, or if the value is rescaled based upon the 0% and 100% values entered in the **OUT_SCALE** parameter in the next step. Direct should be used in virtually all applications.
29. If the **L_TYPE** in step #28 was set for **Direct**, skip this step. If the **L_TYPE** was I**ndirect**, set the **OUT_SCALE** sub-parameters to the desired values for proper scaling. **Indirect Sq Root** should **never** be used for a temperature measurement.
30. Set the **XD_SCALE** sub-parameters to the measurement values of the channel parameter assigned to this AI Block in Step #27.
31. Set the **IO_OPTS** parameter to the desired options by adding check marks in the appropriate boxes.
32. Set the **STATUS_OPTS** parameter to the desired options by adding check marks in the appropriate boxes.
33. The factory default for the **MODE_BLK•Normal** parameter is **Auto**. If for some reason you want the transmitter to start in the Out Of Service mode, or other selection when power is first applied, set the parameter to the desired action.

34. Review the **ALARM_SUM•Disabled** parameter. There are a wide variety of selections in the drop down box, such as Disc Alm Disabled, HiHi Alm Disabled, and so forth. The factory default is that all alarms have a check mark which disables all of the "Fieldbus Alarms" in the transmitter.
35. Write your changes to the transmitter using the **Write Changes** button at the bottom of the display.
36. Set the **Target Mode** in the AI#1 Block to **Auto** using the **Auto** button. **MODE_BLK•Actual** should change to **Auto**
37. Close the AI#1 Block. In the dialog box, Click on **Yes**.
38. Repeat steps # 26 through 37 for Analog Input Block #2 if you are using that block.

List of Configurable Parameters

Parameters configurable from a Foundation fieldbus host are shown in Table 3. A full list of parameters is located in Appendix A. A glossary of parameter terms that are commonly configured by most users is given Appendix C.

Table 3. User Configurable Fieldbus Parameters

Parameter Name	Capability	Factory Default	Description & Comments
RESOURCE BLOCK			
TAG_DESC	32 characters, maximum	blank	User description of the block application
STRATEGY		0	Used to group a function block for ID purposes
ALERT KEY		0	ID number of plant unit
MODE_BLK	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used	Auto	Mode for operations. Block initiates in Auto mode.
TEST_RW		0	Read/Write test parameters - only used for conformance testing
GRANT_DENY	Program, Tune, Alarm, Local	0	Options for controlling access of host computers and local control panels to operating, tuning, and alarming
RESTART	Run, Restart Resource, Restart With Defaults, Restart Processor, Uninitialized	Run	Type of restart
FEATURE_SEL	Unicode, Reports, Faultstate, Soft W lock, Hard W lock, Out Readback, Direct write	0	Device features that are selected - No features are selected via factory default.
CYCLE_SEL	Scheduled, Block execution, Manuf specific	0xC000	Used to select cycle type
SHED_RCAS		640000	Timeout for write attempts to RCas locations
SHED_ROUT		640000	Timeout for write attempts to ROUT locations
SET_FSTATE	Uninitialized, Off, Set	Off	Allows faultstate conditions to be manually set
CLR_RSTATE	Uninitialized, Off, Clear	Off	Allows faultstate conditions to be cleared
LIM_NOTIFY		8	Max # of unconfirmed alert notify messages allowed

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
CONFIRM_TIME		640000	Minimum time between retries of alert reports
WRITE_LOCK	Uninitialized, Not Locked, Locked	Not Locked	If locked, no writes are allowed
ALARM_SUM•Disabled	Enable, Disable	All alarms disabled	Used to set the disabled state of each alarm
ACK_OPTION	Enable, Disable	All disabled	Used to select whether alarms associated with the block are automatically acknowledged
WRITE_PRI	0 - 15	0	Priority of alarm generated by clearing write lock
TRANSDUCER BLOCK			
TAG_DESC	32 characters, maximum	blank	User description of the block application
STRATEGY		0	To ID groups of blocks
ALERT_KEY		0	ID number of plant unit
MODE_BLK	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used	Auto	Mode for operations. Block initiates in Auto mode.
Sensor Characterizing Parameters			
PRIMARY_VALUE_UNIT	K, °C, °F, °R, V, mV, µV, Ohm, kOhm, or %	°C	Unit of primary value and other values.
LIN_TYPE	Type of RTD, Type of Thermocouple, Linear, or No Linearization	Pt100a	Type of Sensor 1.
LIN_TYPE_2	Type of RTD, Type of Thermocouple, or No Linearization	0	Type of Sensor 2.
RTD/Resistor Specific Parameters			
SENSOR_CONNECTION	2-wire, 3-wire, or 4-wire	3-wire	Sensor 1 connection.
COMP_WIRE1	Value in ohms	0	Line resistance compensation for Sensor 1 (2-wire sensor).
COMP_WIRE2	Value in ohms	0	Line resistance compensation for Sensor 2 (2-wire sensor).
SENSOR_CONNECTION_2	2-wire, 3-wire, or 4-wire	3-wire	Sensor 2 connection.
Thermocouple Specific Parameters			
RJ_TYPE	No reference, Internal, External, Sensor 2w, Sensor 3-w	0	Reference junction
EXTERNAL_RJ_VALUE	Value in PRIMARY_VALUE_UNIT (in °C for mV or ohm)	0	Fixed temperature value of an external reference junction.
RJ_COMP_WIRE	Value in ohms	0	Line resistance compensation when External RJ Sensor
Output Conditioning Parameters			
SENSOR_MEAS_TYPE	SV_1 SV_2 SV_1 - SV_2, (diff SV_2-SV_1, (diff) 1/2 (SC_1 + SV_2) (avg) 1/2 (SC_1 + SV_2) (avg but SV_1 or SV_2 if other is wrong SV_1, SV 2 not available SV_1 but SV2 if SV_1 is wrong SV_2 but SV1 if SV_2 is wrong	SV_1, SV 2 not avail	Math function to calculate PRIMARY_VALUE
BIAS_1		0	Bias added to SV1.
BIAS_2		0	Bias added to SV2.

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
MAX_SENSOR_VALUE_1		0	Holds the maximum SECONDARY_VALUE_1
MIN_SENSOR_VALUE_1		0	Holds the minimum SECONDARY_VALUE_1.
MAX_SENSOR_VALUE_2		0	Holds the maximum SECONDARY_VALUE_2.
MIN_SENSOR_VALUE_2		0	Holds the minimum SECONDARY_VALUE_2.
Sensor Error Detection Parameters			
SENSOR_WIRE_CHECK_1	Lead break and short enable, Lead break enable, short disable, Lead break disable, short enable Lead break and short disable.	Lead break and short disable.	Enables lead breakage and short detection for Sensor 1.
SENSOR_WIRE_CHECK_2	Same as SENSOR_WIRE_CHECK_1	Lead break and short disable.	Enables lead breakage and short detection for Sensor 2.
SENSOR_WIRE_CHECK_RJ	Same as SENSOR_WIRE_CHECK_1	Lead break and short disable.	Enables lead breakage and short detection for RJ sensor.
Sensor Calibration Parameters			
CAL_POINT_LO_1		-10^{38}	Low calibration value applied to Sensor 1
CAL_ACTUAL_LO_1		-10^{38}	Enter any value to force device to measure and store the actual low point value.
CAL_POINT_HI_1		10^{38}	High calibration value applied to Sensor 1
CAL_ACTUAL_HI_1		10^{38}	Enter any value to force device to measure and store the actual high point value.
SENSOR_CAL_METHOD_1	Factory trim standard User trim standard	Factory trim standard	Last method used to calibrate device.
SENSOR_CAL_LOC_1			Last location of calibrated sensor.
SENSOR_CAL_DATE_1			Last date calibration performed.
SENSOR_CAL_WHO_1			Person performing last calibration.
CAL_POINT_LO_2		-10^{38}	Low calibration value applied to Sensor 2
CAL_ACTUAL_LO_2		-10^{38}	Enter any value to force device to measure and store the actual low point value.
CAL_POINT_HI_2		10^{38}	High calibration value applied to Sensor 2
CAL_ACTUAL_HI_2		10^{38}	Enter any value to force device to measure and store the actual high point value.
SENSOR_CAL_METHOD_2	103=Factory trim standard 104=User trim standard	Factory trim standard	Last method used to calibrate device.
SENSOR_CAL_LOC_2			Last location of calibrated sensor.
SENSOR_CAL_DATE_2			Last date calibration performed.
SENSOR_CAL_WHO_2			Person performing last calibration.
ANALOG INPUT BLOCK			
TAG_DESC	32 characters, maximum	blank	User description of the block application
STRATEGY	0 to 65,535	0	Used to identify groupings of blocks
ALERT_KEY	0 to 255	0	ID number of plant unit used in the host for sorting alarms, and so forth.
MODE_BLK	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used	Auto	Mode requested by the operator
OUT • Value			Primary analog value calculated as a result of executing this function

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
SIMULATE			Simulates the transducer analog input or output to the block
Simulate Value		0	Used for the transducer value when simulate is enabled
Simulate En/Disabled		Disabled	Enable/disable simulation
XD_SCALE			Scale of the value obtained from the transducer
EU_at_100%		Per Sales Order(1)	Engineering units value at 100% of range
EU_at_0%		Per Sales Order(1)	Engineering units value at 0% of range
Units_Index	K, °C, °F, °R, V, mV, µV, Ohm, kOhm, or %	Per Sales Order(1)	Engineering units
Decimal		1	# of digits to the right of the decimal point
OUT_SCALE			
EU_100		Per Sales Order(1)	Value in engineering units for range at 100%
EU_0		Per Sales Order(1)	Value in engineering units for range at 0%
Units_Index	K, °C, °F, °R, V, mV, µV, Ohm, kOhm, or %	Per Sales Order(1)	Engineering units
Decimal	0 to 4	1	The number of digits displayed to the right of the decimal point
GRANT/DENY	Program, Time, Alarm, Local		Options for controlling access of host computer to operating, tuning, and alarm parameters
IO_OPTS	Invert, SP tracks PV if Man, SP tracks PV if Lo, SP tracks RCas or Cas if Lo or Man, Inverse to close, Faultstate Type, Faultstate restart, Target to Man, PV for BKCal_Out, Low Cutoff	0	Options to alter input and output block processing
STATUS_OPTS	IFS if Bad IN, IFS if Bad CAS_IN, Uncertain as Good, Propagate Fail Fwd, Propagate Fail Bkwd, Target to Man if Bad IN, Uncertain if limited, Bad if Limited, Uncertain if Man, No select if not Auto, No select if not Cas	0	Options for block processing of status
CHANNEL	Primary Value, Sensor 1 Value, Sensor 2 Value, Internal Temperature	Sensor 1 Value	Logical channel connected to this block
L_TYPE	Uninitialized, Direct, Indirect, Indirect Sq Root	Direct	Determines if value is to be used directly or converted
LOW_CUT		2	Limit used in square root processing
PV_TIME	0 - 100	0	Filter time constant (s)
ALARM_SUM • Disabled	Enable, Disable	All alarms disabled	The disabled state of each alarm
ACK_OPTION	Unack alarm 1 - 16	0	Selection of which alarms will be automatically acknowledged
ALARM_HYS	0 - 50	0.5	% by which the PV must return within alarm limits (%)
HI_HI_PRI	0 - 15	0	Priority of the High-High alarm
HI_HI_LIM		+INF	Setting for High-High alarm in engineering units
HI_PRI	0 - 15	0	Priority of the High alarm
HI_LIM		+INF	Setting for High alarm in engineering units

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
LO_PRI	0 - 15	0	Priority of the Low alarm
LO_LIM		-INF	Setting for Low alarm in engineering units
LO_LO_PRI	0 - 15	0	Priority of the Low-Low alarm
LO_L0_LIM		-INF	Setting for Low-Low alarm in engineering units
PID CONTROL BLOCK			
TAG_DESC	32 characters, maximum	blank	User description of the block application
STRATEGY	0 to 65,535	0	Used to identify groupings of blocks
ALERT_KEY	0 to 255	0	ID number of plant unit used in the host for sorting alarms, and so forth.
MODE_BLK	Auto, Man, OOS, Rout, Rcas, Cas, LO, IMan	OOS	Mode requested by the operator
SP • Value			Analog setpoint of this block
OUT • Value			Primary analog value calculated as a result of executing this function
PV_SCALE			Scale of the PV parameter
EU_100		Per Sales Order(1)	Engineering units value at 100% of range
EU_0		Per Sales Order(1)	Engineering units value at 0% of range
Units_Index	K, °C, °F, °R, V, mV, µV, Ohm, kOhm, or %	Per Sales Order(1)	Engineering units
Decimal	0 to 4	1	No. of digits to the right of the decimal point
OUT_SCALE			Scale of the output of this block
EU_100		Per Sales Order(1)	Engineering units value at 100% of range
EU_0		Per Sales Order(1)	Engineering units value at 0% of range
Units_Index	K, °C, °F, °R, V, mV, µV, Ohm, kOhm, or %	Per Sales Order(1)	Engineering units
Decimal	0 to 4	1	No. of digits to the right of the decimal point
GRANT/DENY	Program, Time, Alarm, Local		Options for controlling access of host computer to operating, tuning, and alarm parameters
CONTROL_OPTS	Bypass Enable, SP-PV Track Man, SP-PV Track ROut, SP-PV Track LO-IMan, SP Track retain, Direct acting, Balance Ramp, Track enable, Track in manual, PV for BK_Cal_Out, Bias may be adjusted, Current IN_1 to OUT_SCALE, Retract SP to limits in Cas and RCas, No output limits in Man	0	Options to alter calculations in a control block
STATUS_OPTS	IFS if Bad IN, IFS if Bad CAS_IN, Uncertain as Good, Propagate Fail Fwd, Propagate Fail Bkwd, Target to Man if Bad IN, Uncertain if limited, Bad if Limited, Uncertain if Man, No select if not Auto, No select if not Cas	0	Options for block processing of status
IN • Value			Primary input value of the block
PV_FTIME		0	Time constant of a single exponential filter for the PV in seconds
BYPASS	Uninitialized, On, Off	0	See Glossary

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
CAS_IN • Value			Remote setpoint value
SP_RATE_DN		+INF	Ramp rate at which downward setpoint changes are acted upon in Auto mode
SP_RATE_UP		+INF	Ramp rate at which upward setpoint changes are acted upon in Auto mode
SP_LO_LIM		0	Setpoint low limit
SP_HI_LIM		100	Setpoint high limit
GAIN		0	Used by the block algorithm in calculating the block output
RESET		+INF	Integral time constant in seconds per repeat
BAL_TIME		0	See Glossary
RATE		0	Derivative time constant in seconds
BKCAL_IN • Value			Value and status from a lower block's BKCAL_OUT
OUT_HI_LIM		100	Limits the maximum output value
OUT_LO_LIM		0	Limits the minimum output value
BKCAL_HYS		0.5	Amount the output must be away from its output limit before the limit status is turned off (in % of span of the output
RCAS_IN • Value			Target setpoint and status provided by a supervisory host to an analog control or output block
ROUT_IN			Target setpoint and status provided by a host to the control block for use as the output
SHED_OPT	Uninitialized, NormalShed_NormalReturn, NormalShed_NoReturn, ShedToAuto_NormalReturn, ShedToAuto_NoReturn, ShedToManual_NormalReturn, ShedToManual_NoReturn, ShedToRetainedTarget_ NormalReturn, ShedToRetainedTarget_NoReturn	0	Action to be taken on remote control device timeout
TRK_SCALE			Scale data associated with TRK_VAL
EU_at_100%		100	Engineering units value at 100% of scale
EU_at_0%		0	Engineering units value at 0% of scale
Units_Index		ºC	Engineering units
Decimal		1	No. of digits to the right of the decimal point
TRK_IN_D	Discrete state 0 - 16		Used to initiate external tracking of the block output to the value specified in TRK_VAL
TRK_VAL			Input used as the track value when external tracking is enabled by TRK_IN_D
FF_VAL			The feedforward value
FF_SCALE			Feedforward input
EU_at_100%			Engineering units value at 100% of scale
EU_at_0%			Engineering units value at 0% of scale
Units_Index			Engineering units
Decimal			No. of digits to the right of the decimal point

Table 3. User Configurable Fieldbus Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
FF_GAIN		0	Gain that the feedforward input is multiplied by before it is added to the calculated control output
ALARM_SUM • Disabled	Enable, Disable	All alarms disabled	The disabled state of each alarm
ACK_OPTION	Unack Alarm 1 - 16	0	Selection of which alarms will be automatically acknowledged
ALARM_HYS	0 - 50	0.5	% by which the PV must return within alarm limits (%)
HI_HI_PRI	0 - 15	0	Priority of the High-High alarm
HI_HI_LIM		+INF	Setting of High-High alarm in engineering units
HI_PRI	0 - 15	0	Priority of the High alarm
HI_LIM		+INF	Setting of High alarm in engineering units
LO_PRI	0 - 15	0	Priority of the Low alarm
LO_LIM		-INF	Setting for Low alarm in engineering units
LO_LO_PRI	0 - 15	0	Priority of the Low-Low alarm
LO_L0_LIM		-INF	Setting of Low-Low alarm in engineering units
DV_HI_PRI		0	Priority for the high deviation alarm
DV_HI_LIM		+INF	Setting of high deviation alarm in engineering units
DV_LO_PRI		0	Priority for the low deviation alarm
DV_LO_LIM		-INF	Setting of low deviation alarm in engineering units

(1)Transmitter parameters are configured for 0 to 100 °C if calibrated range is not provided with the order.

Calibration

The Sensor Calibration parameters in the Transducer Block can be used if the transmitter output needs to be adjusted to the sensor signal (for example, when the temperature sensor does not correspond to the ideal values for a selected temperature range). The results depend on the accuracy of the calibrator or reference equipment. In the calibration procedure, you apply two “known good” signals to the transmitter and write the “should have been” parameters. The sensor calibration changes the slope of the linearization curve so that the curve is adjusted to the connected sensor.

SENSOR_CAL_METHOD_# defines the use of either **Factory trim standard** (the factory defined values calculated according to the valid norms) or **User trim standard** (the sensor calibrated values) in the transmitter for the sensor. During sensor calibration, **SENSOR_CAL_METHOD_#** must be set to **Factory trim standard**.

In the following example, a temperature calibration for Sensor 1 is described. However, the principle can be used for any input type or combination of input types since the calibration can be done for each of the sensor inputs.

Example:

To obtain an accurate temperature measurement in the range 0 - 100°C, apply an accurate temperature source at the low end of the range (for example 5°C) as the low calibration point and one at the high end of the range (for example 95°C) as the high calibration point.

1. Set **SENSOR_CAL_METHOD_1** to **Factory trim standard**
2. Apply 5°C to the sensor and set **CAL_POINT_LO_1** to 5.00
3. Set **CAL_ACTUAL_LO_1** to 1 (a random value)
4. Apply 95°C to the sensor and set **CAL_POINT_HI_1** to 95.00
5. Set **CAL_ACTUAL_HI_1** to 1 (a random value)
6. Calibration is complete.

To use this new user calibration, set **SENSOR_CAL_METHOD_1** to **User trim standard** or to use the factory calibration, set **SENSOR_CAL_METHOD_1** to **Factory trim standard**.

4. Configuration (PROFIBUS)

Quick Setup Guide

See “Quick Setup Guide” on page 17.

Transducer Block Setup Examples

See “Transducer Block Setup Examples” on page 20.

Physical Block

The Physical Block is used to define hardware specific characteristics of the Function Block Applications. It provides manufacturer name, device name, block status, and hardware details. All data is modelled within a controlled space so that no outside inputs into this block are required.

This parameter “set” is intended to be the minimum required for the function block application associated with the resource in which it resides. Some parameters that could be in the set, like calibration data and ambient temperature, are more part of their respective transducer blocks. The “mode” is used to control major states of the block. O/S (out of service) mode stops all function block execution. The actual mode of the function blocks is changed to O/S but the target mode is not changed. Auto mode allows normal operation of the resource.

Diagnosis

In order to provide some information about the device to the control application and the human interface, there are diagnosis parameters in the device. These parameters have a bit string data type.

Diagnosis of Device Characteristics

In the Physical Block, the **DIAGNOSIS** parameter has the information about the alerts into the device (for example, device not initialized, power up, factory initialization, hardware failure, and so forth).

Transducer Block

The Transducer Block contains all of the manufacturer-specific parameters that define how the RTT15-P Transmitter functions. Selections, such as setting of input type, engineering units, defining the dual functionality when using the dual input, and so forth, are performed in this block. The Transducer Block allows you to select a large number of sophisticated functions. Therefore, the configuration of the transmitter must be carried out with greatest possible care.

Default Configuration

The transmitter is shipped with a default configuration that suits the user’s requirements in many cases. The configuration task has thus been reduced considerably. The complete list of configurable default configurations are shown in “List of Configurable Parameters” on page 43 but briefly, it contains:

- **LIN_TYPE**: Pt100 Sensor
- **PRIMARY_VALUE_UNIT**: °C
- **SENSOR_CONNECTION**: 3-Wire
- **SENSOR_MEAS_TYPE**: One Sensor
- **SENSOR_WIRE_CHECK_1**: No Sensor Error Detection

Analog Input (AI) Block

The RTT15-P has two Analog Input (AI) Blocks that must be configured individually. The AI Block takes the manufacturer input data, selected by channel number, and makes it available to other function blocks at its output.

Parameter Summary

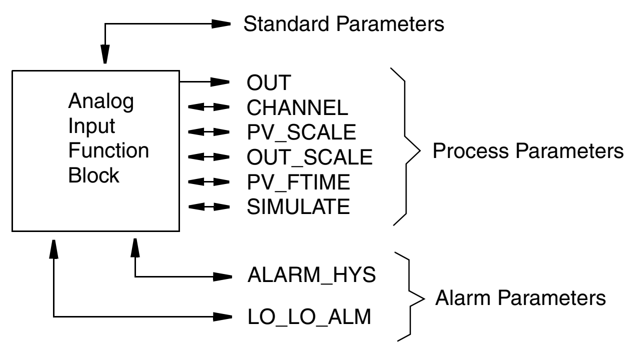

Figure 16. Analog Input Block Parameter Summary

Simulation, Mode, and Status Diagram

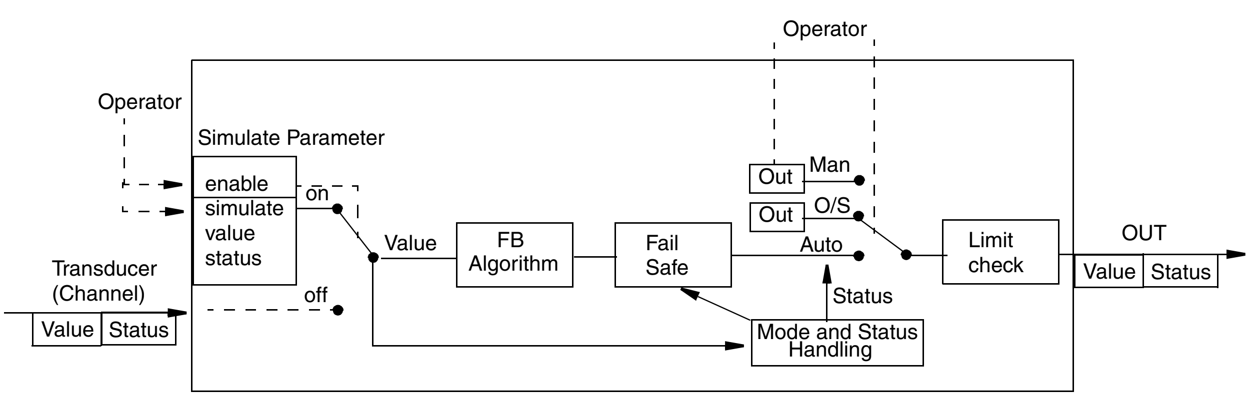

Figure 17. Analog Input Block Simulation, Mode, and Status Diagram

List of Configurable Parameters

Parameters configurable from a PROFIBUS host are shown in Table 4. A full list of parameters is located in Appendix B. A glossary of parameter terms that are commonly configured by most users is given Appendix C.

Table 4. User Configurable PROFIBUS Parameters

Parameter Name	Capability	Factory Default	Description & Comments
PHYSICAL BLOCK			
TAG_DESC	32 characters, maximum	blank	Tag name of block. Must be unique in the configuration
STRATEGY		0	Used to group a function block for ID purposes
ALERT KEY		0	ID number of plant unit
TARGET_MODE	AUTO, MAN, or O/S		Target mode for operations. Block initiates in AUTO mode.
WRITE_LOCKING	Uninitialized, Locked, Not Locked		If locked, no writes are allowed
FACTORY_RESET	Restart with default Restart processor Recover default address to the device		
DESCRIPTOR	32 characters, maximum		User supplied descriptor of the block
DEVICE_MESSAGE	32 characters, maximum		User supplied message of the block
DEVICE_INSTAL_DATE			Date of the device installation
LOCAL_OP_ENA			Not used
IDENT_NUMBER_SELECT	0: Profile specific Ident_Num 1: Manufacturer specific Ident_Number 2: Manufacturer specific Ident_Number of V2.0 3: Ident number of multi-variable device		
TRANSDUCER BLOCK			
TAG_DESC	32 characters, maximum	blank	User description of the block application
STRATEGY		0	To ID groups of blocks
ALERT_KEY		0	ID number of plant unit
MODE_BLK	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used	Auto	Mode for operations. Block initiates in Auto mode.
Sensor Characterizing Parameters			
PRIMARY_VALUE_UNIT	K, °C, °F, °R, mV, ohm	(°C)	Unit of primary value and other values.
LIN_TYPE	Type of RTD, Type of Thermocouple, or No Linearization.	Pt100	Type of Sensor 1.
LIN_TYPE_2	Type of RTD, Type of Thermocouple, or No Linearization.	0	Type of Sensor 2.
RTD/Resistor Specific Parameters			
SENSOR_CONNECTION	2-wire, 3-wire, or 4-wire	4-wire	Sensor 1 connection.
COMP_WIRE1	Value in ohms	0	Line resistance compensation for Sensor 1 (2-wire sensor).

Table 4. User Configurable PROFIBUS Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
COMP_WIRE2	Value in ohms	0	Line resistance compensation for Sensor 2 (2-wire sensor).
SENSOR_CONNECTION_2	2-wire, 3-wire, or 4-wire	3-wire	Sensor 2 connection.
RTDX_FACTOR_1			X-factor for custom PtX or NiX for LIN_TYPE.
RTDX_FACTOR_2			X-factor for custom PtX or NiX for LIN_TYPE_2.
Thermocouple Specific Parameters			
RJ_TYPE	No reference, Internal, External, Sensor 2w, Sensor 3-w	0	Reference junction
EXTERNAL_RJ_VALUE	Value in PRIMARY_VALUE_UNIT (in °C for mV or ohm)	0	Fixed temperature value of an external reference junction.
RJ_COMP_WIRE	Value in ohms	0	Line resistance compensation when External RJ Sensor
Output Conditioning Parameters			
SENSOR_MEAS_TYPE	SV_1 SV_2 SV_1 - SV_2, (diff SV_2-SV_1, (diff) 1/2 (SC_1 + SV_2) (avg) 1/2 (SC_1 + SV_2) (avg but SV_1 or SV_2 if other is wrong SV_1, SV 2 not available SV_1 but SV2 if SV_1 is wrong SV_2 but SV1 if SV_2 is wrong	SV_1, SV 2 not avail	Math function to calculate PRIMARY_VALUE
BIAS_1		0	Bias added to SV1.
BIAS_2		0	Bias added to SV2.
MAX_SENSOR_VALUE_1		0	Holds the maximum SECONDARY_VALUE_1
MIN_SENSOR_VALUE_1		0	Holds the minimum SECONDARY_VALUE_1.
MAX_SENSOR_VALUE_2		0	Holds the maximum SECONDARY_VALUE_2.
MIN_SENSOR_VALUE_2		0	Holds the minimum SECONDARY_VALUE_2.
Output Parameter			
PRIMARY_VALUE • Value		0	Process value. Function determined by SENSOR_MEAS_TYPE of SECONDARY_VALUE_n.
Sensor Error Detection Parameters			
SENSOR_WIRE_CHECK_1	Lead break and short enable, Lead break enable, short disable, Lead break disable, short enable Lead break and short disable.	Lead break and short disable.	Enables lead breakage and short detection for Sensor 1.
SENSOR_WIRE_CHECK_2	Same as SENSOR_WIRE_CHECK_1	Lead break and short disable.	Enables lead breakage and short detection for Sensor 2.
SENSOR_WIRE_CHECK_RJ	Same as SENSOR_WIRE_CHECK_1	Lead break and short disable.	Enables lead breakage and short detection for RJ sensor.
Table Linearization Parameters - Not used at this time			
Polynomial Linearization Parameters - Not used at this time			
Sensor Calibration Parameters			
CAL_POINT_LO_1		0	Low calibration value applied to Sensor 1

Table 4. User Configurable PROFIBUS Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
CAL_ACTUAL_LO_1			Enter any value to force device to measure and store the actual low point value.
CAL_POINT_HI_1		0	High calibration value applied to Sensor 1
CAL_ACTUAL_HI_1			Enter any value to force device to measure and store the actual high point value.
SENSOR_CAL_METHOD_1	Factory trim standard or User trim standard	0	Last method used to calibrate device.
SENSOR_CAL_LOC_1		0	Last location of calibrated sensor.
SENSOR_CAL_DATE_1			Last date calibration performed.
SENSOR_CAL_WHO_1			Person performing last calibration.
CAL_POINT_LO_2		0	Low calibration value applied to Sensor 2
CAL_ACTUAL_LO_2			Enter any value to force device to measure and store the actual low point value.
CAL_POINT_HI_2		0	High calibration value applied to Sensor 2
CAL_ACTUAL_HI_2			Enter any value to force device to measure and store the actual high point value.
SENSOR_CAL_METHOD_2	Factory trim standard or User trim standard	0	Last method used to calibrate device.
SENSOR_CAL_LOC_2		0	Last location of calibrated sensor.
SENSOR_CAL_DATE_2			Last date calibration performed.
SENSOR_CAL_WHO_2			Person performing last calibration.
ANALOG INPUT BLOCK			
TAG_DESC	32 characters, maximum	blank	Used to described the intended application of the block
STRATEGY	0 to 65,535	0	Used to identify groupings of blocks. This is a way to label blocks with a commonality, such as boiler temperature
ALERT_KEY	0 to 255	0	Used by the host for sorting alarms, and so forth.
TARGET_MODE	AUTO, MAN, or O/S		Target mode for operations and Block initiates in AUTO mode
BATCH			Identification of a certain batch
PV_SCALE			
EU_100		See Note 1	Value in engineering units for range at 100%
EU_0		See Note 1	Value in engineering units for range at 0%
Units_index	K, °C, °F, °R, mA, mV or Ohm	See Note 1	
Decimal	0 to 4	1	The number of digits displayed to the right of the decimal point
OUT_SCALE			
EU_100		See Note 1	Value in engineering units for range at 100%
EU_0		See Note 1	Value in engineering units for range at 0%
Units_index	K, °C, °F, °R, mA, mV or Ohm	See Note 1	Engineering units

Table 4. User Configurable PROFIBUS Parameters (Continued)

Parameter Name	Capability	Factory Default	Description & Comments
Decimal	0 to 4	1	The number of digits displayed to the right of the decimal point
CHANNEL			The logical channel connected to this block
LIN_TYPE		0	Type of linearization
PV_FTIME	0 to 100 seconds	0	Process Variable filter time. Time constant of a single exponential filter for the measurement, in seconds.
PV_FTIME			Filter time constant
FSAFE_TYPE			Defines the action of the device if a fault is detected
FSAFE_VALUE			Default value for the OUT parameter if a fault is detected
ALARM_HYS		0.5	% by which the PV must return within alarm limits (0-50%)
HI_HI_LIM		+INF	Value for the upper limit of alarms
HI_LIM		+INF	Value for the upper limit of warnings
LO_LIM		-INF	Value for the lower limit of warnings
LO_L0_LIM		-INF	Value for the lower limit of alarms
SIMULATE VALUE		0	Used for the transducer value when simulated is enabled
SIMULATE ENABLED		0	Enable/disable simulation
OUT_UNIT_TEXT			See Glossary

1) Transmitter parameters are configured for 0 to 100 ºC if calibrated range is not provided with the order.

Calibration

See “Calibration” on page 39.

5. Maintenance

The RTT15-F and RTT15-P Transmitter basic unit has no moving parts and is a completely sealed unit. If there is a problem, refer to the following troubleshooting section for possible corrective actions.

CAUTION

The transmitter is completely sealed unit and cannot be repaired. Any attempt to open the basic transmitter voids the warranty.

DANGER

For nonintrinsically safe installations, to prevent a potential explosion in a Division 1 hazardous area, de-energize the transmitter before you remove the threaded housing cover. Failure to comply with this warning could result in an explosion resulting in severe injury or death.

Troubleshooting Guidelines

Guidelines on what to do if a FOUNDATION fieldbus/PROFIBUS network is not working are described in this section.

In the context of this document, this means that the network is either dead (no apparent communication) or slow (too many communication retries). Also, one or more devices on an otherwise working network may appear dead or slow. These conditions may be caused by incorrect installation, incorrect setup (incorrect commissioning), or malfunctioning devices. Other problems, such as a device transmitting bad data (with correct FOUNDATION fieldbus/ PROFIBUS protocol), are not physical layer problems and are therefore outside the scope of this document.

Reduction to Known Working State

Although the technique may be obvious, a powerful troubleshooting approach is to reduce the size of the network until you reduce it to something that works. At the junction box, for example, you can disconnect major sections of the network. When satisfied that the remainder works, add the sections back one at a time until you can identify the offending section. Then begin picking the offending section apart just as you did the whole network.

Remember that connecting and disconnecting things from the live network may cause momentary communication problems. Do not confuse these with the network problem you're trying to find.

Addressing

Incorrect addressing makes a device appear dead. Make sure you have ruled this out before you begin looking for installation problems.

Works on Bench But Not in Network

If a field device works on the test bench but not in the network, this can be caused by incorrect addressing. If this device has the same address as another device already on the network, it will appear to work when removed from the network and fail when reconnected.

Another possibility is that the device has malfunctioned and is causing heavy loading of the network. Other devices may or may not communicate with this device connected. The loading is not apparent when the device is operating by itself, but when the device is added to an already loaded network, it causes excessive loading. This can be examined by using an oscilloscope. The scope must be a differential type (or battery operated) and must be set to ac coupling to view the wave packets (one packet = one message) traveling on the network. If the packets become greatly attenuated when the offending device is connected, then it is likely that the device has failed.

Open Trunk

If the trunk has become open at some point, either through accident or careless maintenance, the network may appear to work some of the time and not at other times, depending on whether devices try to communicate across the break. Master software will probably be capable of quickly providing a list of devices that are “present” versus those that have disappeared. This narrows down the location of the break.

Other evidence of a break can be gathered with an oscilloscope. (The scope must be of a type and must be set up as described earlier.) A break means that only one terminator will be present, which will usually cause almost double the normal signal level. This situation exists at both sides of the break.

Hand-held Master Works at One End of Trunk But Not Other End

Suppose that a master connected at end A of the trunk talks to devices also connected at end A, but the same master connected at end B of the trunk cannot talk to devices connected at end B. This may indicate that the network is shorted or shorted to ground or too heavily loaded at the non-working end (end B). It may also mean that one of the trunk conductors is continuous throughout the trunk, but that the other is broken with one side of the break open and the other side of the break shorted to the other trunk conductor.

Working Network Suddenly Stops

Assume that no communication occurs on a network that was previously OK. This could mean that a device has malfunctioned and is short-circuiting the network. It could also mean that a device has malfunctioned and is jabbering (transmitting continuously and not allowing any other communication). Both of these conditions may be observable with an oscilloscope. (The scope must be of a type and must be set up as described earlier.) A short circuit will often not be a perfect short, so that highly attenuated packets may still be seen. Jabbering will appear to be one long packet with no observed breaks.

If a device has short-circuited or is causing excessive loading to the extent that it prevents or slows all network traffic, it may not be easy to find. If it is network powered, it may present a short circuit at communication frequencies but not at dc. It may be necessary for you to remove devices one by one to find the offender.

Test Equipment

A network analyzer may be useful. It performs somewhat the same functions as a master, but may have more diagnostic capability. For example, it should be able to tell you quickly if devices have been addressed, but do not answer. The analyzer is itself a FOUNDATION fieldbus/PROFIBUS device and must be specifically designed for bus used.

An oscilloscope is useful for observing the quality of the signal packets. Various specific uses of the oscilloscope were given earlier. The scope should be differential or should be battery operated to avoid grounding one side of the network through a scope probe. Use probes that have at least 1 Megohm input resistance and less than 1000 pf input capacitance.

A DVM is useful for checking connections. The ohmmeter function can tell you whether the network has been shorted or whether one side is shorted to ground. Before making such measurements, however, you may have to disconnect the power supply in a network powered bus. Shutting off the power is not enough. The reason is that the power supply may contain dc paths that, although ineffective at communication frequencies, have all three conductors (the two network lines and ground) connected. There may be devices other than the power supply that also create this deceptive situation. Consult the manufacturer's specifications or temporarily disconnect a suspect device before using the ohmmeter. The DVM is also useful in checking supply voltage in powered networks. The DVM input capacitance should be less than 1000 pf.

Switch Mode Check List

1. Verify that the block is scheduled. (Note that Resource Block and Transducer Block are always scheduled.)
2. Verify that Resource/Physical Block is in Auto Mode.
3. Verify that requested mode is permitted.

Schedule Download Check List

1. Verify that all blocks in the network have different tags.
2. Verify that no two blocks from the same devices are scheduled to be executed at the same time.
3. Verify that there is enough time for block execution.

Simulation Mode

The transmitter has a Simulation mode that can be used for debugging/troubleshooting the system when the process is not running. The hardware for the simulation mode is a reed switch mounted in the transmitter. The reed switch is activated with a special magnet (Part Number D0179EE) that mounts on transmitter terminals 1 and 2. In Simulation mode, you can select any value as the input to the AI block for testing or debugging purposes.

The following procedure is that used with the RTT15-F (fieldbus) transmitter. The procedure for the RTT15-P (PROFIBUS) transmitter is similar.

1. Place the appropriate AI block in Out of Service (OOS) mode using the configurator software. Make sure the **MODE_BLK•Actual** reads **OOS**.
2. Remove the housing cover and custody transfer lock, if any.
3. Mount the special magnet on transmitter terminals 1 and 2.
4. Set the **SIMULATE•Simulate_Enabled** parameter to **Enabled**.
5. Type in the value you want as the output from the transducer block in the **SIMULATE•Simulate_Value** parameter. Please note that the value typed in is the output from the Transducer Block. Therefore, if you have any scaling using the **L_TYPE** parameter, the value on the integral transmitter display will not agree with the value typed in the **Simulate_Value** parameter. The display will reflect the "typed in" value only if the **L_TYPE** is set for **Direct**.
6. Click on the **Write Changes** button. If you try to send a simulated output without mounting the special magnet (step #3), the software will not change anything except to show an Error Code.
7. Set the AI block to Auto mode
8. Proceed with troubleshooting remembering that the output of the AI block has been set by the value typed in step #5
9. Set the **SIMULATE•SImulate_Enabled** to **Disabled**
10. Click on the **Write Changes** button
11. Place the AI block in Auto mode using the configurator software. Make sure the **MODE_BLK•Actual** reads **Auto**.
12. Remove the special magnet installed in Step 3.
13. Reassemble any housing cover and reapply any custody transfer lock that was removed in Step 2.

Restart (Fieldbus) or Factory Reset (PROFIBUS)

The **RESTART** (Fieldbus) or **FACTORY_RESET** (PROFIBUS) parameter in the Resource (Fieldbus) or Physical (PROFIBUS) Block should only be used when the configuration in the transmitter has been incorrect and the user cannot fix the problem by using the troubleshooting information provided. In all cases, try cycling the power to the transmitter first. Then go back to the block with the problem and try to write the changes to the transmitter. If that does not clear the problem, proceed with the **RESTART** (Fieldbus) or **FACTORY_RESET** (PROFIBUS) procedure.

Restart Procedure (Fieldbus)

⚠ CAUTION

When you do a "Defaults" **RESTART** command in the Resource Block, the configured parameters will automatically default to the values predetermined by the Foundation, which are **not** the same as the factory defaults.

1. Open the Transducer Block and put it in the **OOS** mode.
2. In the Resource Block, select one of the following in the **RESTART** parameter:
   - **Run** – this is the default setting, the nominal state when not restarting
   - **Resource** – do not use
   - **Defaults** – Sets the parameters to the Foundation defaults
   - **Processor** – does a warm restart of the CPU.
3. Click on the **Write Changes** button. Wait until the **RESTART** parameter value goes back to **Run**.
4. Put the Transducer Block back into Auto mode (the **RESTART** selection will automatically default to the Run position).
5. Reconfigure the appropriate function blocks.

Factory Reset Procedure (PROFIBUS)

The **FACTORY_RESET** parameter in the Physical Block should only be used when the configuration in the transmitter has been incorrect and the user cannot fix the problem by using the troubleshooting information provided. In all cases, try cycling the power to the transmitter first. Then go back to the block with the problem and try to write the changes to the transmitter. If that does not clear the problem, proceed with the **FACTORY_RESET** procedure.

1. Open the Transducer Block and put it in the **O/S** mode.
2. In the Resource Block, select one of the following in the **FACTORY_RESET** parameter:
   - **Restart with default** – Sets the parameters to factory defaults
   - **Restart processor** – does a warm restart of the CPU.
   - **Recover default address** – Recovers the default address to the device
3. Click on the **Write Changes** button.
4. Put the Transducer Block back into Auto mode.
5. Reconfigure the appropriate function blocks.

Block Errors (Fieldbus)

The following table lists all of the possible error codes in the various function blocks. Not all error codes are possible in all of the blocks.

Condition Number	Name and Description
0	No error.
1	Block Configuration Error: (See Note 1)
2	Link Configuration Error: A link used in one of the function blocks is improperly configured.
3	Simulate Active: The Simulation jumper is enabled. This is not an indication that the I/O blocks are using simulated data.
4	Local Override:
5	Device Fault State Set:
6	Device Needs Maintenance Soon:
7	Input Failure/Process Variable Has Bad Status: The hardware is bad, an input is not connected, or a status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	Memory Failure: A memory failure has occurred in Flash, RAM or EEPROM memory.
10	Lost Static Data: Static data stored in non-volatile memory has been lost.
11	Lost NV Data: Non-volatile data stored in non-volatile memory has been lost.
12	Readback Check Failed:
13	Device Needs Maintenance Now:
14	Power Up: The Device was just powered - wait
15	Out Of Service: The actual mode is OSS, change to AUTO
16	Unspecified Error – An Unidentified Error occurred
17	General Error – cannot be specified per #18 to #25
18	Calibration Error: An error occurred during calibration of the device or a calibration error was detected during normal operation.
19	Configuration Error: An error occurred during configuration of the device or a configuration error was detected during normal operation.
20	Electronics Failure: An electronic component failed.
21	Mechanical Failure: A mechanical component failed.
22	I/O Failure: An I/O failure occurred.
23	Data Integrity Error: Data stored in the device is no longer valid due to a non-volatile memory checksum failure, a data verify after write failure, etc.
24	Software Error: The software has detected an error due to an improper interrupt service routine, an arithmetic overflow, a watchdog time-out, etc.
25	Algorithm Error: The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.

(1)If the error is in the Transducer block, a feature in FEATURES_SEL is set that is not supported by FEATURES or an execution cycle in CYCLE_SEL is set that is not supported by CYCLE_TYPE
If the error is in the Analog Input Block, the selected channel carries a measurement that is incompatible with the EGU's selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.

Replacement of Transmitter

1. Turn off the transmitter power source.
2. Remove the housing cover (if applicable).
3. Disconnect all wires from transmitter terminals.
4. Remove the sensor.
5. Install the new sensor by reversing Steps 1-4 above.

⚠ CAUTION

When replacing a housing cover, hand tighten it as much as possible so that O-ring is fully captured.

Appendix A. Fieldbus Parameters

Parameters that can be viewed or configured from the fieldbus host are listed in Table 5. A glossary of parameter terms is incluced in MI 014-900, Fieldbus Overview.

Table 5. Fieldbus Parameters

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
RESOURCE BLOCK				
1	ST_REV	RO	0	Static Data revision level
2	TAG_DESC	R/W	blank	Tag name of block. Must be unique in the configuration.
3	STRATEGY	R/W	0	To ID groups of blocks (0, 1-65,535)
4	ALERT_KEY	R/W	0	ID number of plant unit (0, 1-255)
5	MODE_BLK			
	Target	R/W	Auto	Mode requested by operator
	Actual	RO	Actual Mode	Current mode of the block
	Permitted	R/W	Auto, Man, OOS	Modes allowed for this block
	Normal	R/W	Auto	Mode of block during normal operations
6	BLOCK_ERR	RO	0	Error status of the hardware or software
7	RS_STATE	RO	0	State of the function block application
8	TEST_RW	R/W	0	Test parameter used only for conformance testing
9	DD_RESOURCE	RO		Tag of the resource identifying the DD
10	MANUFAC_ID	RO	385884 (Invensys Foxboro)	Manufacturer ID number
11	DEV_TYPE	RO	1036	Manufacturer Model number
12	DEV_REV	RO	Current Device Rev	Device revision number
13	DD_REV	RO	Current DD Rev	DD Revision
14	GRANT_DENY	R/W	0	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
15	HARD_TYPES	RO	0	Type of hardware available as channel numbers
16	RESTART	R/W	Run	Defines the type of restart to be initiated
17	FEATURES	RO	0	Shows supported Resource Block options
18	FEATURE_SEL	R/W	0	Used to select Resource Block options
19	CYCLE_TYPE	RO	0	Block execution methods available for this resource
20	CYCLE_SEL	R/W	0	Used to select Cycle Type
21	MIN_CYCLE_T	RO	0	Duration of the shortest cycle interval
22	MEMORY_SIZE	RO	0	Available configurable memory in the empty resource (kBytes)
23	NV_CYCLE_T	RO	0	Interval between writes to NV memory (ms)
24	FREE_SPACE	RO	0.0	% of memory available for further config (0-100%
25	FREE_TIME	RO	0.0	% of block processing time avail (0-100%)
26	SHED_RCAS	R/W	640000	Timeout for write attempts to RCAS locations in ms
27	SHED_ROUT	R/W	640000	Timeout for write attempts to ROUT locations in ms
28	FAULT_STATE	RO		Condition set by loss of communication to an output block, failure promoted to an output block, or a physical contact.
29	SET_FSTATE	R/W	Off	Allows faultstate conditions to be manually set

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
30	CLR_RSTATE	R/W	Off	Allows faultstate conditions to be cleared
31	MAX_NOTIFY	RO	8	Max # of unconfirmed notify messages possible
32	LIM_NOTIFY	R/W	8	Max # of unconfirmed alert notify messages allowed
33	CONFIRM_TIME	R/W	640000	Minimum time between retries of alert reports in ms
34	WRITE_LOCK	R/W	Not Locked	If locked, no writes are allowed
35	UPDATE_EVT	RO		Alert generated by any change in the static data of the block
36	BLOCK_ALM	RO		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 sets 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			
	Current	RO	0	The active state of each alarm
	Unacknowledged	RO	0	The unacknowledged state of each alarm
	Unreported	RO	0	The unreported state of each alarm
	Disabled	R/W	All alarms disabled	The disabled state of each alarm
38	ACK_OPTION	R/W	0	Used to select whether alarms associated with the block are automatically acknowledged
39	WRITE_PRI	R/W	0	Priority of alarm generated by clearing the write lock
40	WRITE_ALM	RO		Alert generated if the write lock parameter is cleared
41	ITK_VER	RO	0	Major revision number of interoperability test used to register the device
TRANSDUCER BLOCK				
	ST_REV	RO	0	Static data revision
	TAG_DESC	R/W	blank	User description of the block application
	STRATEGY	R/W	0	To ID groups of blocks
	ALERT_KEY	R/W	0	ID number of plant unit
	MODE_BLK			
	Target	R/W	Auto	Mode requested by operator
	Actual	RO	Actual Mode	The current mode of the block
	Permitted	R/W		Modes allowed for this block
	Normal	R/W	Auto	Mode of block during normal operations
	BLOCK_ERR	RO	0	Error status of the hardware or software
	UPDATE_EVT	RO		Generated by any change to static data
	BLOCK_ALM	RO		For all config, H/W, connection failures
	TRANSDUCER_ DIRECTORY	RO	0	Directory that specifies the number & start of data collection
	TRANSDUCER_TYPE	RO		Identifies the transducer
	TRANSDUCER_ERROR	RO	0	Transducer block alarm subcode
	COLLECTION_ DIRECTORY	RO	0	Directory that specifies the number & start of each transducer
Sensor Characterizing Parameters				
14	PRIMARY_VALUE_UNIT	R/W	°C	Unit of primary value and other values.
18	LIN_TYPE	R/W	Pt100	Type of Sensor 1.
21	UPPER_SENSOR_LIMIT	RO	850	Upper limit of Sensor 1.
22	LOWER_SENSOR_LIMIT	RO	-200	Lower limit of Sensor 1.
39	LOWER_SENSOR_LIMIT_2	RO	0	Lower limit of Sensor 2.

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
40	UPPER_SENSOR_LIMIT_2	RO	0	Upper limit of Sensor 2.
41	LIN_TYPE_2	R/W	0	Type of Sensor 2.
RTD/Resistor Specific Parameters				
35	SENSOR_CONNECTION	R/W	3-wire	Sensor 1 connection (2-, 3-, or 4-wire)
36	COMP_WIRE1	R/W	0	Line resistance compensation for Sensor 1 (2-wire sensor).
37	COMP_WIRE2	R/W	0	Line resistance compensation for Sensor 2 (2-wire sensor).
38	SENSOR_CONNECTION_2	R/W	3-wire	Sensor 2 connection (2- or 3-wire)
63	CABLE_RES1	RO		On 3- and 4-wire measurements, indicates cable resistance in the wire connected to Terminal 3. For 3-wire measurements it is multiplied by 2.
64	CABLE_RES2	RO		On 4-wire measurements, indicates cable resistance in the wire connected to Terminal 6.
Thermocouple Specific Parameters				
32	RJ_TEMP	RO	0	Reference junction temperature.
33	RJ_TYPE	R/W	0	Reference junction type (Internal, External, Sensor (2-w), or Sensor (3-w)
34	EXTERNAL_RJ_VALUE	R/W	0	Fixed temperature value of an external reference junction.
42	RJ_COMP_WIRE	R/W	0	Line resistance compensation (in ohms) when External RJ Sensor
Output Conditioning Parameters				
17	SENSOR_MEAS_TYPE	R/W	SV_1, SV_2 not available	Math function to calculate PRIMARY_VALUE
19	BIAS_1	R/W	0	Bias added to SV1.
20	BIAS_2	R/W	0	Bias added to SV2.
28	MAX_SENSOR_VALUE_1	R/W	0	Holds the maximum SECONDARY_VALUE_1
29	MIN_SENSOR_VALUE_1	R/W	0	Holds the minimum SECONDARY_VALUE_1.
30	MAX_SENSOR_VALUE_2	R/W	0	Holds the maximum SECONDARY_VALUE_2.
31	MIN_SENSOR_VALUE_2	R/W	0	Holds the minimum SECONDARY_VALUE_2.
Output Parameters				
13	PRIMARY_VALUE	RO	0	Process value. Function determined by SENSOR_ MEAS_TYPE of SECONDARY_VALUE_1/2
15	SECONDARY_VALUE_1	RO	0	Process value connected to Sensor 1 corrected by BIAS_1.
16	SECONDARY_VALUE_2	RO	0	Process value connected to Sensor 2 corrected by BIAS_2.
Diagnostic Parameters				
23	INPUT_FAULT_GEN	RO	0	Diagnosis object for errors that concern all functions
24	INPUT_FAULT_1	RO	0	Diagnosis object for errors that concern SV_1
25	INPUT_FAULT_2	RO	0	Diagnosis object for errors that concern SV_2
43	RJ_FAULT	RO	0	Diagnosis object for errors that concern RJ sensor
62	HW_ERROR	RO	???	Diagnostic bit value indicating hardware status
Sensor Error Detection Parameters				
26	SENSOR_WIRE_CHECK_1	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for Sensor 1.
27	SENSOR_WIRE_CHECK_2	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for Sensor 2.
44	SENSOR_WIRE_CHECK_RJ	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for RJ sensor.

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
Internal Temperature				
45	INTERN_TEMP	RO	0	Internal electronics temperature.
Sensor Calibration Parameters				
46	CAL_POINT_LO_1	R/W	-10^{38}	Low calibration value applied to Sensor 1
47	CAL_ACTUAL_LO_1	R/W	-10^{38}	Any value entered forces the device to measure and store the actual low point value.
48	CAL_POINT_HI_1	R/W	10^{38}	High calibration value applied to Sensor 1
49	CAL_ACTUAL_HI_1	R/W	10^{38}	Any value entered forces the device to measure and store the actual high point value.
50	SENSOR_CAL_METHOD_1	R/W	Factory trim standard	Last method used to calibrate device.
51	SENSOR_CAL_LOC_1	R/W		Last location of calibrated sensor.
52	SENSOR_CAL_DATE_1	R/W		Last date calibration performed.
53	SENSOR_CAL_WHO_1	R/W		Person performing last calibration.
54	CAL_POINT_LO_2	R/W	-10^{38}	Low calibration value applied to Sensor 2
55	CAL_ACTUAL_LO_2	R/W	-10^{38}	Any value entered forces the device to measure and store the actual low point value.
56	CAL_POINT_HI_2	R/W	$10^{38}0$	High calibration value applied to Sensor 2
57	CAL_ACTUAL_HI_2	R/W	10^{38}	Any value entered forces the device to measure and store the actual high point value.
58	SENSOR_CAL_METHOD_2	R/W	Factory trim standard	Last method used to calibrate device.
59	SENSOR_CAL_LOC_2	R/W		Last location of calibrated sensor.
60	SENSOR_CAL_DATE_2	R/W		Last date calibration performed.
61	SENSOR_CAL_WHO_2	R/W		Person performing last calibration.
ANALOG INPUT BLOCK				
1	ST_REV	RO	0	Static data revision level
2	TAG_DESC	R/W	blank	User description of the block application
3	STRATEGY	R/W	0	Used to identify groupings of blocks
4	ALERT_KEY	R/W	0	ID number of plant unit used in the host for sorting alarms, and so forth
5	MODE_BLK			
	Target	R/W	Auto	Mode requested by operator
	Actual	RO	Actual Mode	Current mode of the block
	Permitted	R/W	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used.	Modes allowed for this block
	Normal	R/W	Auto	Mode of block during normal operations
6	BLOCK_ERR	RO	0	Error status of the hardware or software
7	PV	RO		Process value and status for this block
8	OUT	R/W		Primary analog value calculated as result of executing the function
9	SIMULATE			Simulates the transducer analog input or output to the block
	Simulate Status	RO	Disable	Status of enable/disable simulation
	Simulate Value	R/W	0	Used for the transducer value when simulate is enabled
	Simulate Enabled	R/W	Disable	Enable/disable simulation

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
10	XD_SCALE	R/W		Scale of the value obtained from the transducer
	EU_at_100%	R/W	Per Sales Order	Engineering units value at 100% of range
	EU_at_0%	R/W	Per Sales Order	Engineering units value at 0% of range
	Units_Index	R/W	Per Sales Order	Engineering units
	Decimal	R/W	1	# of digits to the right of the decimal point
11	OUT_SCALE	R/W		Scale of the output of this block
	EU_at_100%	R/W	100	Engineering units value at 100% of range
	EU_at_0%	R/W	0	Engineering units value at 0% of range
	Units_Index	R/W	ºC	Engineering units for the Dual value
	Decimal	R/W	1	# of digits to the right of the decimal point
12	GRANT_DENY	R/W	0	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
13	IO_OPTS	R/W	0	Options to alter input and output block processing
14	STATUS_OPTS	R/W	0	Options for block processing of status
15	CHANNEL	R/W	0	Logical channel connected to this block
16	L_TYPE	R/W	Direct	Determines if value is to be used directly or converted
17	LOW_CUT	R/W	0	Limit used in square root processing
18	PV_TIME	R/W	0	Filter time constant (0-100 s)
19	FIELD_VAL	RO		Raw value of the field device in % of PV range
20	UPDATE_EVT	RO		Generated by any change to static data
21	BLOCK_ALM	RO		For all config, hardware, connection failures, or system problems in this block
22	ALARM_SUM			
	Current	RO	0	The active state of each alarm
	Unacknowledged	RO	0	The unacknowledged state of each alarm
	Unreported	RO	0	The unreported state of each alarm
	Disabled	R/W	All alarms disabled	The disabled state of each alarm
23	ACK_OPTION	R/W	0	Selection of which alarms will be automatically acknowledged
24	ALARM_HYS	R/W	0.5	% by which the PV must return within alarm limits (0-50%)
25	HI_HI_PRI	R/W	0	Priority of the High-High alarm (0-15)
26	HI_HI_LIM	R/W	+INF	Setting for High-High alarm in engineering units
27	HI_PRI	R/W	0	Priority of the High alarm (0-15)
28	HI_LIM	R/W	+INF	Setting for High alarm in engineering units
29	LO_PRI	R/W	0	Priority of the Low alarm (0-15)
30	LO_LIM	R/W	-INF	Setting for Low alarm in engineering units
31	LO_LO_PRI	R/W	0	Priority of the Low-Low alarm (0-15)
32	LO_L0_LIM	R/W	-INF	Setting for Low-Low alarm in engineering units
33	HI_HI_ALM	RO		Status of the High-High alarm
34	HI_ALM	RO		Status of the High alarm
35	LO_ALM	RO		Status of the Low alarm
36	LO_LO_ALM	RO		Status of the Low-Low alarm
PID CONTROL BLOCK				
0	BLOCK_OBJECT	RO		Contains the characteristics of the block
1	ST_REV	RO	0	Static Data revision level
2	TAG_DESC	R/W	blank	User description of the block application
3	STRATEGY	R/W	0	Used to ID groups of blocks (0, 1-65,535)

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
4	ALERT_KEY	R/W	0	ID number of plant unit (0, 1-255)
5	MODE_BLK			
	Target	R/W	OOS	Mode requested by operator
	Actual	RO	Actual mode	Current mode of the block
	Permitted	R/W	Auto, Man, OOS Also Rout, RCas, Cas, LO, and IMan if PID control is used.	Modes allowed for this block
	Normal	R/W	OOS	Mode of block during normal operations
6	BLOCK_ERR	RO		Error status of the hardware or software
7	PV	RO		Process value and status for this block
8	SP	R/W		Analog setpoint of this block
9	OUT	R/W		Primary analog value calculated by this function block
10	PV_SCALE	R/W		Scale of the PV parameter
	EU_at_100%	R/W	Per Sales Order	Engineering units value at 100% of range
	EU_at_0%	R/W	Per Sales Order	Engineering units value at 0% of range
	Units_Index	R/W	Per Sales Order	Engineering units
	Decimal	R/W	1	# of digits to the right of the decimal point
11	OUT_SCALE	R/W		Scale of the output of this block
	EU_at_100%	R/W	100	Engineering units value at 100% of range
	EU_at_0%	R/W	0	Engineering units value at 0% of range
	Units_Index	R/W	ºC	Engineering units
	Decimal	R/W	1	# of digits to the right of the decimal point
12	GRANT_DENY	R/W		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
13	CONTROL_OPTS	R/W	0	Options to alter calculations in a control block
14	STATUS_OPTS	R/W	0	Options for block processing of status
15	IN	R/W		Primary input value of the block
16	PV_FTIME	R/W	0	Time constant of a single exponential filter for the pV in seconds
17	BYPASS	R/W	0	See Glossary
18	CAS_IN	R/W		Remote setpoint value
19	SP_RATE_DN	R/W	+INF	Ramp rate at which downward setpoint changes are acted upon in Auto mode
20	SP_RATE_UP	R/W	+INF	Ramp rate at which upward setpoint changes are acted upon in Auto mode
21	SP_LO_LIM	R/W	0	Setpoint low limit
22	SP_HI_LIM	R/W	100	Setpoint high limit
23	GAIN	R/W	0	Used by the block algorithm in calculating the block output
24	RESET	R/W	+INF	Integral time constant in seconds per repeat
25	BAL_TIME	R/W	0	See Glossary
26	RATE	R/W	0	Derivative time constant in seconds
27	BKCAL_IN	R/W		Value and status from a lower block's BKCAL_OUT
28	OUT_HI_LIM	R/W	100	Limits the maximum output value
29	OUT_LO_LIM	R/W	0	Limits the minimum output value
30	BKCAL_HYS	R/W	0.5	Amount the output must change away from its output limit before the limit status is turned off (in % of span of the output)

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
31	BKCAL_OUT	RO		Value and status required by an upper block's BKCAL_IN
32	RCAS_IN	R/W		Target setpoint and status provided by a supervisory host to an analog control or output block
33	ROUT_IN	R/W		Target setpoint and status provided by a host to the control block for use as the output
34	SHED_OPT	R/W	0	Action to be taken on remote control device timeout
35	RCAS_OUT	RO		Block setpoint and status after ramping
36	ROUT_OUT	RO		Block output and status provided to a host
37	TRK_SCALE			Scale of the TRK_VAL parameter
	EU_at_100%	R/W	100	Engineering units value at 100% of scale
	EU_at_0%	R/W	0	Engineering units value at 0% of scale
	Units_Index	R/W	ºC	Engineering units
	Decimal	R/W	1	No. of digits to the right of the decimal point
38	TRK_IN_D	R/W		Used to initiate external tracking of the block output to the value specified in TRK_VAL
39	TRK_VAL	R/W		Input used as the track value when external tracking is enabled by TRK_IN_D
40	FF_VAL			
	Value	R/W		Feedforward value
	Status	RO		Feedforward status
41	FF_SCALE			Feedforward input
	EU_at_100%	R/W	100	Engineering units value at 100% of scale
	EU_at_0%	R/W	0	Engineering units value at 0% of scale
	Units_Index	R/W	ºC	Engineering units
	Decimal	R/W	1	# of digits to the right of the decimal point
42	FF_GAIN	R/W	0	Gain that the feedforward input is multiplied by before it is added to the calculated control output
43	UPDATE_EVT	RO		Generated by any change to static data
44	BLOCK_ALM	RO		For all config, hardware, connection failures, and system problems
45	ALARM_SUM			
	Current	RO	0	The active state of each alarm
	Unacknowledged	RO	0	The unacknowledged state of each alarm
	Unreported	RO	0	The unreported state of each alarm
	Disabled	R/W	All alarms disabled	The disabled state of each alarm
46	ACK_OPTION	R/W	0	Selection of which alarms will be automatically acknowledged
47	ALARM_HYS	R/W	0.5	% by which the PV must return within alarm limits (0-50%)
48	HI_HI_PRI	R/W	0	Priority of the High-High alarm (0-15)
49	HI_HI_LIM	R/W	+INF	Setting of High-High alarm in engineering units
50	HI_PRI	R/W	0	Priority of the High alarm (0-15)
51	HI_LIM	R/W	+INF	Setting of High alarm in engineering units
52	LO_PRI	R/W	0	Priority of the Low alarm (0-15)
53	LO_LIM	R/W	-INF	Setting for Low alarm in engineering units
54	LO_LO_PRI	R/W	0	Priority of the Low-Low alarm (0-15)
55	LO_L0_LIM	R/W	-INF	Setting of Low-Low alarm in engineering units
56	DV_HI_PRI	R/W	0	Priority for the high deviation alarm
57	DV_HI_LIM	R/W	+INF	Setting of high deviation alarm in engineering units

Table 5. Fieldbus Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
58	DV_LO_PRI	R/W	0	Priority for the low deviation alarm
59	DV_LO_LIM	R/W	-INF	Setting of low deviation alarm in engineering units
60	HI_HI_ALM	RO		Status of the High-High alarm
61	HI_ALM	RO		Status of the High alarm
62	LO_ALM	RO		Status of the Low alarm
63	LO_LO_ALM	RO		Status of the Low-Low alarm
64	DV_HI_ALM			
	Status	RO		Status of high deviation alarm
	Time stamp	RO		Time stamp of high deviation alarm
65	DV_LO_ALM			
	Status	RO		Status of low deviation alarm
	Time stamp	RO		Time stamp of low deviation alarm

Appendix B. PROFIBUS Parameters

Parameters that can be viewed or configured from the PROFIBUS host are listed in Table 6. A glossary of parameter terms is included in a “Glossary” on page 67.

Table 6. PROFIBUS Parameters

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
PHYSICAL BLOCK				
1	ST_REV	RO	0	Static Data revision
2	TAG_DESC	R/W	blank	User description of the block application
3	STRATEGY	R/W	0	To ID groups of blocks (0, 1-65,535)
4	ALERT_KEY	R/W	0	ID number of plant unit (0, 1-255)
5	TARGET_MODE	R/W		Current desired mode of the block
6	MODE_BLK			
	Actual	RO	Actual Mode	Current mode of the block
	Permitted	R/W		Modes allowed for this block
	Normal	R/W	Auto	Mode of block during normal operations
7	ALARM_SUM	RO		Current state of the blocks alarms
8	SOFTWARE_REVISION	RO		Software revision level of the device
9	HARDWARE_REVISION	RO		Hardware revision level of the device
10	DEVICE_MAN_ID	RO		Manufacturer identification number
11	DEVICE_ID	RO		Manufacturer device number
12	DEVICE_SER_NUM	RO		Device serial number
13	DIAGNOSIS	RO		Bit string indicating the diagnosis of the device
14	DIAGNOSIS_EXT	RO		Not used
15	DIAGNOSIS_MASK	RO		Not used
16	DIAGNOSIS_MASK_EXT	RO		Not used
17	DEVICE_CERTIFICATION	RO		PA device certification
18	WRITE_LOCKING	R/W		If locked, no writes are allowed except to clear WRITE_LOCK.
19	FACTORY_RESET	R/W		Restart with default Restart processor Recover default address to the device
20	DESCRIPTOR	R/W		User supplied descriptor of the block
21	DEVICE_MESSAGE	R/W		User supplied message of the block
22	DEVICE_INSTAL_DATE	R/W		Date of the device installation
23	LOCAL_OP_ENA	R/W		Not used
25	IDENT_NUMBER_SELECT	R/W		Profile specific Ident_Number Manufacturer specific Ident_Number Manufacturer specific Ident_Number of V2.0 Ident number of multi-variable device
26	HW_WRITE_PROTECTION	RO		Nor used
26-32	RESERVED			Reserved
TRANSDUCER BLOCK				
Sensor Characterizing Parameters				
25	PRIMARY_VALUE_UNIT	R/W	°C	Unit of primary value and other values.
30	LIN_TYPE	R/W	Pt100	Type of Sensor 1.
37	UPPER_SENSOR_LIMIT	RO	850	Upper limit of Sensor 1.

Table 6. PROFIBUS Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
38	LOWER_SENSOR_LIMIT	RO	-200	Lower limit of Sensor 1.
79	LOWER_SENSOR_LIMIT_2	RO	0	Lower limit of Sensor 2.
80	UPPER_SENSOR_LIMIT_2	RO	0	Upper limit of Sensor 2.
81	LIN_TYPE_2	R/W	0	Type of Sensor 2.
RTD/Resistor Specific Parameters				
52	SENSOR_CONNECTION	R/W	4-wire	Sensor 1 connection.
53	COMP_WIRE1	R/W	0	Line resistance compensation for Sensor 1 (2-wire sensor).
54	COMP_WIRE2	R/W	0	Line resistance compensation for Sensor 2 (2-wire sensor).
78	SENSOR_CONNECTION_2	R/W	3-wire	Sensor 2 connection.
103	CABLE_RES1	RO		Used for 3- and 4-wire measurements. Indicates cable resistance in wire connected to Terminal 3. Double for 3-wire measurements.
104	CABLE_RES2	RO		On 4-wire measurements, cable resistance in wire connected to Terminal 6.
105	RTDX_FACTOR_1	R/W		X-factor for custom PtX or NiX for LIN_TYPE.
106	RTDX_FACTOR_2	R/W		X-factor for custom PtX or NiX for LIN_TYPE_2.
Thermocouple Specific Parameters				
49	RJ_TEMP	RO	0	Reference junction temperature.
50	RJ_TYPE	R/W	0	Reference junction
51	EXTERNAL_RJ_VALUE	R/W	0	Fixed temperature value of an external reference junction.
82	RJ_COMP_WIRE	R/W	0	Line resistance compensation when External RJ Sensor
Output Conditioning Parameters				
28	SENSOR_MEAS_TYPE	R/W	SV_1, SV_2 not available	Math function to calculate PRIMARY_VALUE
35	BIAS_1	R/W	0	Bias added to SV1.
36	BIAS_2	R/W	0	Bias added to SV2.
45	MAX_SENSOR_VALUE_1	R/W	0	Holds the maximum SECONDARY_VALUE_1
46	MIN_SENSOR_VALUE_1	R/W	0	Holds the minimum SECONDARY_VALUE_1.
47	MAX_SENSOR_VALUE_2	R/W	0	Holds the maximum SECONDARY_VALUE_2.
48	MIN_SENSOR_VALUE_2	R/W	0	Holds the minimum SECONDARY_VALUE_2.
Output Parameters				
24	PRIMARY_VALUE	RO	0	Process value. Function determined by SENSOR_ MEAS_TYPE of SECONDARY_VALUE_1/2
26	SECONDARY_VALUE_1	RO	0	Process value connected to Sensor 1 corrected by BIAS_1.
27	SECONDARY_VALUE_2	RO	0	Process value connected to Sensor 2 corrected by BIAS_2.
85	INTERN_TEMP	RO	0	Internal electronics temperature.
Diagnostic Parameters				
40	INPUT_FAULT_GEN	RO	0	Input malfunction (0=RJ error, 1=hardware error, 2-4=reserved, 5-7=manufacturer specific).
41	INPUT_FAULT_1	RO	0	
42	INPUT_FAULT_2	RO	0	
83	RJ_FAULT	RO	0	
102	HW_ERROR	RO		
Sensor Error Detection Parameters				
43	SENSOR_WIRE_CHECK_1	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for Sensor 1.

Table 6. PROFIBUS Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
44	SENSOR_WIRE_CHECK_2	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for Sensor 2.
84	SENSOR_WIRE_CHECK_RJ	R/W	Lead break and short detection disabled	Enables lead breakage and short detection for RJ sensor.
Internal Temperature				
85	INTERN_TEMP	RO	0	Internal electronics temperature.
Sensor Calibration Parameters				
86	CAL_POINT_LO_1	R/W	0	Low calibration value applied to Sensor 1
87	CAL_ACTUAL_LO_1	R/W		Enter any value to force device to measure and store the actual low point value.
88	CAL_POINT_HI_1	R/W	0	High calibration value applied to Sensor 1
89	CAL_ACTUAL_HI_1	R/W		Enter any value to force device to measure and store the actual high point value.
90	SENSOR_CAL_METHOD_1	R/W	0	Last method used to calibrate device.
91	SENSOR_CAL_LOC_1	R/W	0	Last location of calibrated sensor.
92	SENSOR_CAL_DATE_1	R/W		Last date calibration performed.
93	SENSOR_CAL_WHO_1	R/W		Person performing last calibration.
94	CAL_POINT_LO_2	R/W	0	Low calibration value applied to Sensor 2
95	CAL_ACTUAL_LO_2	R/W		Enter any value to force device to measure and store the actual low point value.
96	CAL_POINT_HI_2	R/W	0	High calibration value applied to Sensor 2
97	CAL_ACTUAL_HI_2	R/W		Enter any value to force device to measure and store the actual high point value.
98	SENSOR_CAL_METHOD_2	R/W	0	Last method used to calibrate device.
99	SENSOR_CAL_LOC_2	R/W	0	Last location of calibrated sensor.
100	SENSOR_CAL_DATE_2	R/W		Last date calibration performed.
101	SENSOR_CAL_WHO_2	R/W		Person performing last calibration.
ANALOG INPUT BLOCK				
0	BLOCK_OBJECT	RO		Contains the characteristics of the block
1	ST_REV	RO	0	Static Data revision
2	TAG_DESC	R/W	blank	User description of the block application
3	STRATEGY	R/W	0	To ID groups of blocks (0, 1-65,535)
4	ALERT_KEY	R/W	0	ID number of plant unit (0, 1-255)
5	TARGET_MODE	R/W		Contains the desired mode normally set by a control application or an operator
6	MODE_BLK			
	Actual	RO	Actual Mode	The current mode of the block
	Permitted	R/W	Auto, Man, OOS	Modes allowed for this block
	Normal	R/W	Auto	Mode of block during normal operations
7	ALARM_SUM	RO		Contains the current states of the block alarms
8	BATCH	R/W		identification of a certain batch
10	OUT			
	Value	RO	Actual Value	Numerical quantity calculated by the transmitter
	Status	RO	Actual Status	Set by transmitter - status of measurement value
11	PV_SCALE	R/W		Scale of the output of this block
12	OUT_SCALE			
	EU_at_100%	R/W	100	The engineering units value at 100% of range
	EU_at_0%	R/W	0	The engineering units value at 0% of range
	Units_Index	R/W	ºC	Engineering units for the Dual value
	Decimal	R/W	1	# of digits to the right of the decimal point

Table 6. PROFIBUS Parameters (Continued)

Rel Index	Parameter Name	RO or R/W	Default Value	Comments
13	LIN_TYPE	R/W		Linear or square root
14	CHANNEL	R/W		The logical channel connected to this block
16	PV_FTIME	R/W		Filter time constant
17	FSAFE_TYPE	R/W		Defines the action of the device if a fault is detected
18	FSAFE_VALUE	R/W		Default value for the OUT parameter if a fault is detected
19	ALARM_HYS	R/W		% by which the PV must return within alarm limits (0-50%)
21	HI_HI_LIM	R/W		Value for the upper limit of alarms
23	HI_LIM	R/W	1.#INF	Value for the upper limit of warnings
25	LO_LIM	R/W	1.#INF	Value for the lower limit of warnings
27	LO_L0_LIM	R/W	1.#INF	Value for the lower limit of alarms
30	HI_HI_ALM	RO		The status of the High-High alarm
31	HI_ALM	RO		The status of the High alarm
32	LO_ALM	RO		The status of the Low alarm
33	LO_LO_ALM	RO		The status of the Low-Low alarm
34	SIMULATE			
	Simulate Status	RO		Status of enable/disable simulation
	Simulate Value	R/W	0	Used for the transducer value when simulated is enabled
	Simulate enabled	R/W	0	Enable/disable simulation
35	OUT_UNIT_TEXT	R/W		See Glossary

Appendix C. Glossary

This glossary defines PROFIBUS parameter terms that are listed in “PROFIBUS Parameters” on page 63.

Parameter Name	Description
ALERT_KEY	**Alert Key.** Identification number of the plant unit used in sorting alarms or events generated by the block.
ALARM_HYS	**Alarm Hysteresis.** Amount the PV must return within the alarm limits before the alarm condition clears. This parameter is expressed as a percent of the PV span.
ALARM_SUM	**Alarm Summary.** Current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with this function block.
BATCH	**Batch.** Used to identify a certain batch in case of alerts.
BIAS_1	**Bias 1.** Bias added to SV1.
BIAS_2	**Bias 2.** Bias added to SV2.
BLOCK_OBJECT	**Block Object.** Contains the characteristics of the block.
CABLE_RES_1	**Cable Resistance 1.** Used for 3- and 4-wire measurements. Indicates the measured cable resistance in the wire connected to Terminal 3. Double for 3-wire measurements.
CABLE_RES_2	**Cable Resistance 2.** Used for 4-wire measurements. Indicates the measured cable resistance in the wire connected to Terminal 6.
CAL_ACTUAL_HI_1	**Calibration Actual High 1.** Any value entered forces the device to measure and store the actual high point value. Must be entered with the applied CAL_POINT_HI_1 value.
CAL_ACTUAL_HI_2	**Calibration Actual High 2.** Any value entered forces the device to measure and store the actual high point value. Must be entered with the applied CAL_POINT_HI_2 value.
CAL_ACTUAL_LO_1	**Calibration Actual Low 1.** Any value entered forces the device to measure and store the actual low point value. Must be entered with the applied CAL_POINT_LO_1 value.
CAL_ACTUAL_LO_2	**Calibration Actual Low 2.** Any value entered forces the device to measure and store the actual low point value. Must be entered with the applied CAL_POINT_LO_2 value.
CAL_POINT_HI_1	**Calibration Point High 1.** The high calibration value applied to Sensor 1.

CAL_POINT_HI_2	**Calibration Point High 1.** The high calibration value applied to Sensor 2.
CAL_POINT_LO_1	**Calibration Point Low 1.** The low calibration value applied to Sensor 1.
CAL_POINT_LO_2	**Calibration Point Low 1.** The low calibration value applied to Sensor 2.
CHANNEL	**Channel Variable*.*** The number of the logical hardware channel that is connected to the AI function block. This information defines the transducer to be used going from the physical world***.***
COMP_WIRE1	**Compensation Wire 1**. Line resistance compensation (in ohms) for Sensor 1 (2-wire sensor).
COMP_WIRE2	**Compensation Wire 2**. Line resistance compensation (in ohms) for Sensor 2 (2-wire sensor).
DESCRIPTOR	**Descriptor**. User supplied description of the block in the application.
DEVICE_CERTIFICATION	**Device Certification.** Certification of the device.
DEVICE_ID	**Device Identification**. Manufacturer device number.
DEVICE_INSTAL_DATE	**Device Installation date.** Date of the device installation.
DEVICE_MAN_ID	**Device Manufacturer Identification**. Manufacturer identification number.
DEVICE_MESSAGE	**Device Message.** User supplied message of the block in the application.
DEVICE_SER_NUM	**Device Serial Number.** Serial number of the device.
DIAGNOSIS	**Diagnosis**. Bit string indicating the diagnosis of the device.
EXTERNAL_RJ_VALUE	**External Reference Junction Value.** Fixed temperature value of an external reference junction.
FACTORY_RESET	**Factory Reset**. Allows manual restart to be initiated.
FSAFE_TYPE	**Failsafe Type.** Defines the reaction of the device if a fault is detected. The calculated actual mode remains Auto.
FSAFE_VALUE	**Failsafe Value.** Default value for the OUT parameter if a sensor or sensor electronic fault is detected. The unit of this parameter is the same as the OUT unit.
HARDWARE_REVISION	**Hardware Revision.** Physical revision level of the device.
HI_ALM	**High Alarm.** Status of the High alarm and its associated time stamp.
HI_HI_ALM	**High-High Alarm.** Status of the High-High alarm and its associated time stamp.

HI_HI_LIM	**High-High Limit.** Setting of the High-High alarm limit in engineering units.
HI_LIM	**High Limit.** Setting of the High alarm limit in engineering units.
HW_ERROR	**Hardware Error**. Diagnostic bit value indicating hardware status.
IDENT_NUMBER_SELECT	**Identification Number Selection.** Used to specify the type of identification number.
INPUT_FAULT_1	**Input Fault 1**. Diagnosis object for errors that concern SV_1.
INPUT_FAULT_2	**Input Fault 2**. Diagnosis object for errors that concern SV_2.
INPUT_FAULT_GEN	**Input Fault Generation.** Diagnosis object for errors that concern all values.
INTERN_TEMP	**Internal Temperature**. Internal electronics temperature.
LIN_TYPE	**Linearization Type**. The type of Sensor 1.
LIN_TYPE_2	**Linearization Type 2**. The type of Sensor 2.
LO_ALM	**Low Alarm.** Status of the low alarm and its associated time stamp.
LO_LIM	**Low Limit.** Setting of the Low alarm limit in engineering units.
LO_LO_ALM	**Low-Low Alarm.** Status of the Low-Low alarm and its associated time stamp.
LO_LO_LIM	**Low-Low Limit.** Setting of the Low-Low alarm limit in engineering units.
LOWER_SENSOR_LIMIT	**Lower Sensor Limit.** Physical lower limit function of Sensor 1.
LOWER_SENSOR_LIMIT_2	**Lower Sensor Limit 2.** Physical lower limit function of Sensor 2.
MAX_SENSOR_VALUE_1	**Maximum Sensor Value 2.** Holds the maximum SECONDARY_VALUE_2.
MAX_SENSOR_VALUE_2	**Maximum Sensor Value 1.** Holds the maximum SECONDARY_VALUE_1.
MIN_SENSOR_VALUE_1	**Minimum Sensor Value 1.** Holds the minimum SECONDARY_VALUE_1.
MIN_SENSOR_VALUE_2	**Minimum Sensor Value 2.** Holds the minimum SECONDARY_VALUE_2.
MODE_BLOCK	**Mode Block.** The actual, target, permitted, and normal modes for the block.
OUT	**Primary Output.** The primary analog value calculated as a result of executing the function.

OUT_SCALE **Output Scale.** The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.

OUT_UNIT_TEXT **OUT Unit Text.** If a specific unit of the OUT parameter is not in the code list, you have the possibility of writing the specific text in this parameter. The unit code is then equal to "textual unit definition."

PRIMARY_VALUE **Primary Value**. Process value. Function determined by SENSOR_MEAS_TYPE of SECONDARY_VALUE_n.

PRIMARY_VALUE_UNIT

Primary Value Unit. The unit of the primary value and other values.

PV_FTIME **Process Variable Filter Time.** Time constant of a single exponential filter for the PV, in seconds.

PV_SCALE **Process Variable Scale.** The high and low scale values, engineering units code and number of digits to the right of the decimal point to be used in displaying the PV parameter and parameters which have the same scaling as the PV.

RJ_COMP_WIRE **Reference Junction Compensation Wire**. Line resistance compensation (in ohms) when an external RJ sensor is used.

RJ_FAULT **Reference Junction Fault**. Diagnosis object for errors that concern the RJ sensor.

RJ_TEMP **Reference Junction Temperature**. Temperature at the reference junction.

RJ_TYPE **Reference Junction Type**. Internal, External, Sensor (2-w), or Sensor (3w).

SECONDARY_VALUE_1

Secondary Value 1. Process value connected to Sensor 1 corrected by BIAS_1.

SECONDARY_VALUE_2

Secondary Value 2. Process value connected to Sensor 2 corrected by BIAS_2.

SENSOR_CAL_DATE_n

Sensor Calibration Date 1.The date of last sensor calibration. Month/Day/Year /Hours/Minutes/Seconds.

SENSOR_CAL_LOC_n

Sensor Calibration Location. The last physical location at which the sensor was calibrated.

SENSOR_CAL_METHOD_n

Sensor Calibration Method. The last method used to calibrate the device.

SENSOR_CAL_WHO_n

Sensor Calibration Who. The name of the person responsible for the last sensor calibration.

SENSOR_CONNECTION
Sensor Connection. Sensor 1 Connection (2-, 3-, or 4-wire RTD).

SENSOR_CONNECTION_2
Sensor Connection 2. Sensor 1 Connection (2- or 3-wire RTD).

SENSOR_MEAS_TYPE
Sensor Measurement Type. Math function to calculate PRIMARY_VALUE.

SENSOR_WIRE_CHECK_1
Sensor Wire Check 1. Enables lead breakage and short detection for Sensor 1.

SENSOR_WIRE_CHECK_2
Sensor Wire Check 2. Enables lead breakage and short detection for Sensor 2.

SENSOR_WIRE_CHECK_RJ
Sensor Wire Check Reference Junction. Enables lead breakage and short detection for the RJ sensor.

SIMULATE **Simulate Variable.** Allows the transducer analog input or output to the block to be manually supplied when **simulate** is enabled. When **simulate** is disabled, the simulate value and status track the actual value and status.

SOFTWARE_REVISION
Software Revision. Software revision level of the device.

ST_REV **Static Revision.** The revision level of the static data associated with the function block. The revision value is incremented each time a static parameter value in the block is changed.

STRATEGY **Strategy.** Used to identify grouping of blocks. This data is not checked or processed by the block.

TAG_DESC **Tag Description.** In the Resource Block - the tag name of the block. This parameter must be unique in the configuration. In the AI Block - the user description of the intended application of the block.

TARGET_MODE **Target Mode.** Current desired mode of the block.

UPPER_SENSOR_LIMIT
Upper Sensor Limit. Physical upper limit function of Sensor 1.

UPPER_SENSOR_LIMIT_2
Upper Sensor Limit 2. Physical upper limit function of Sensor 2.

WRITE_LOCKING **Write Locking**. If set, no writes from anywhere are allowed, except to clear WRITE_LOCK.

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Vertical lines to the right of text or illustrations indicate areas changed at the last issue date.

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MB 100 Printed in U.S.A. 0707