Instruction

MI 020-532
December 2010

RTT30
I/A Series® Temperature Transmitter
With FOUNDATION Fieldbus Protocol

invensys
Foxboro®

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1. Introduction

General Description

The RTT30 Temperature Transmitter with FOUNDATION fieldbus communications protocol is a microprocessor-based, 2-wire temperature transmitter that receives input signals from thermocouples, RTDs, resistance (ohms), or millivolt sources. Remote communications are via a HART/FOUNDATION fieldbus Communicator or a PC-Based Configurator. It is available in an aluminum or stainless steel housing and can be mounted on a surface, to a DN 50 or 2-in pipe, or directly on a sensor.

Reference Documents

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

Table 1. Reference Documents

Document	Description
DP 020-530	Dimensional Print – RTT30 Temperature Transmitters
MI 014-900	Fieldbus Overview
MI 020-531	RTT30 Transmitter Safety Information

Transmitter Identification

See Figure 1 for a typical data plate. The data plate is externally mounted on the transmitter housing.

Figure 1. Typical Data Plate

Standard Specifications

Ambient Temperature Limits:

Without Integral Indicator: -40 and +85°C (-40 and +185°F)

With Integral Indicator: -40 and +70°C (-40 and +158°F)

NOTE

At temperatures < -20°C (-4°F), the display may react slowly. Readability of the display cannot be guaranteed at temperatures < -30°C (-22°F).

Supply Voltage Limits: 9 and 30 V dc

Vibration Limits: 30 m/s^2 (3 “g”) from 2 to 150 Hz

Span and Range Limits - RTD Input

RTD Designation and Description	Measurement Range Limits	Minimum Span
Cu10 alpha = 0.004274; To Edison Copper Winding No. 15	-100 and +260°C (-148 and +500°F)	10°C (18°F)
Cu50 alpha = 0.004278; To GOST	-200 and +200°C (-328 and +392°F)	10°C (18°F)
Cu100 alpha = 0.004278; To GOST	-200 and +200°C (-328 and +392°F)	10°C (18°F)

RTD Designation and Description	Measurement Range Limits	Minimum Span
Ni100 alpha = 0.006180; To DIN 43760	-60 and 250 °C (-76 and 482 °C)	10°C (18°F)
Ni120 alpha = 0.006720; To Edison Curve	-70 and +270°C (-94 and +518°F)	10°C (18°F)
Ni1000 alpha = 0.006180; To DIN 43760	-60 and +150°C (-76 and +302°F)	10°C (18°F)
Pt50 alpha = 0.003911; To GOST	-200 and +1100°C (-328 and +2012°F)	10°C (18°F)
Pt100 3-Wire, Factory Set-Up	0 and 100°C (32 and 212°F)	10°C (18°F)
Pt100 alpha = 0.003916; To JIS C1604-81	-200 and +649°C (-328 and +1200°F)	10°C (18°F)
Pt100 alpha = 0.003911; To GOST	-200 and +850°C (-328 and +1562°F)	10°C (18°F)
Pt100 alpha = 0.00385; To IEC 60751	-200 and +850°C (-328 and +1562°F)	10°C (18°F)
Pt100 Polynomial Ni		
Pt100 Polynomial Cu		
Pt500 alpha = 0.00385; To IEC 60751	-200 and +250°C (-328 and 482°F)	10°C (18°F)
Pt1000 alpha = 0.00385; To IEC 60751	-200 and +250°C (-328 and +482°F)	10°C (18°F)

Span and Range Limits - Thermocouple Input

Thermocouple Designation and Description	Measurement Range Limits	Minimum Span
Type B PtRh30-PtRh6; IEC 584-1	40 and 1820°C (104 and 3308°F)	500°C (900°F)
Type C W5Re-W26Re; ASTM E988	0 and 2315°C (32 and 4199°F)	500°C (900°F)
Type D W3Re-W25Re; ASTM E988	0 and 2315°C (32 and 4199°F)	500°C (900°F)
Type R PtRh13-Pt; IEC 584-1	-50 and +1768°C (-58 and +3214°F)	500°C (900°F)
Type S PtRh10-Pt; IEC 584-1	-50 and +1768°C (-58 and +3214°F)	500°C (900°F)
Type T Cu-CuNi; IEC 584-1	-270 and 400 °C (-454 and 752 °F)	50°C (90°F)

Thermocouple Designation and Description	Measurement Range Limits	Minimum Span
Type U Cu-CuNi; IEC 43710	-200 and +600°C (-328 and +1112°F)	50°C (90°F)
Type L Fe-CuNi; DIN 43710	-200 and +900°C (-328 and +1652°F)	50°C (90°F)
Type E NiCr-CuNi; IEC 584-1	-270 and +1000°C (-454 and +1832°F)	50°C (90°F)
Type J Fe-CuNi; IEC 584-1	-210 and +1200°C (-346 and +2192°F)	50°C (90°F)
Type K NiCr-Ni; IEC 584-1	-270°C and 1372 °C (-454 and 2501 °F)	50°C (90°F)
Type N NiCrSi-NiSi; IEC 584-1	-270 and +1300°C (-454 and 2372°F)	50°C (90°F)

Span and Range Limits - Voltage and Resistance Inputs

Input Source	Measurement Range Limits	Minimum Span
Voltage Transmitter	-20 and +100 mV	5 mV
Resistance Transmitter	10 and 400 Ω	10 Ω
Resistance Transmitter	10 and 2000 Ω	100 Ω

Housing Material:

Die-cast aluminum with a powder coating on a polyester base or 316L stainless steel

Housing Connections (2): 1/2 NPT or M20 as specified

Approximate Weight:

Aluminum Housing with Indicator: 1.4 kg (3.1 lb)

Stainless Steel Housing with Indicator: 4.2 kg (9.3 lb)

Dimensions: Refer to DP 020-530

Environmental Protection:

Dust tight and weatherproof per IEC IP67 and provides the environmental and corrosion resistant protection of NEMA 4X

Electromagnetic Compatibility (EMC)

The transmitter, when installed in accordance with this installation instruction, meets all relevant requirements listed in EN 61326 Series, and particular requirements listed in IEC 61000-4 Series and NAMUR NE 21.

- Electrostatic Discharge per IEC 61000-4-2: 6 kV Cont., 8 kV air.
- Radiated RF Immunity per IEC 61000-4-3:

  0.08 to 2.0 GHz; 10 V/m

0.08 to 2.0 GHz: 30 V/m

2.0 to 2.7 GHz: 1 V/m

- High Frequency Transient per IEC 61000-4-4: 2 kV
- Switching and Indirect Lightning Transient (Surge) per IEC 61000-4-5:

  1 kV asym. (0.5 kV sym.)
- Conducted RF Immunity per IEC 61000-4-6: 0.01 to 80 MHz; 10 V
- Interference Immunity requirements per NAMUR NE 21.

Measuring Category

Measuring Category II per IEC 61010-1. The measuring category is provided for measurements at circuits with a direct electrical connection to the low voltage supply.

Pollution Degree: 2 per IEC 61010-1.

Climate Class: Per IEC 60654-1, Class C.

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.

Table 2. Electrical Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Elec. Safety Design Code
None - Instrument in a nonhazardous area location.		A
FM intrinsically safe and nonincendive; Class I, Divisions 1 and 2, Groups A, B, C, and D.	Temperature Class T4; Ta = -40 to +85°C	C
FM explosionproof, nonincendive, and dust-ignitionproof; Class I, II, III, Divisions 1 and 2, Groups A to G.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	F
FM explosionproof, dust-ignitionproof, intrinsically safe, and nonincendive; Class I, II, III, Divisions 1 and 2, Groups A to G.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	J
CSA for use in Ordinary (General Purpose) locations.	– – –	O
CSA intrinsically safe and nonincendive; Class I, Divisions 1 and 2, Groups A, B, C, and D.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	D
CSA explosionproof, nonincendive, and dust-ignitionproof; Class I, II, III, Divisions 1 and 2, Groups A to G.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	G
CSA explosionproof, dust-ignitionproof, intrinsically safe, and nonincendive; Class I, II, III, Divisions 1 and 2, Groups A to G.	Temperature Class T4; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T6; Ta = -40 to +80°C	K
ATEX intrinsically safe; II 1 G, EEx ia IIC.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	B

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Elec. Safety Design Code
ATEX flameproof; II 2 G, EEx d IIC.	Temperature Class T4; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T6; Ta = -40 to +80°C	E
ATEX flameproof and intrinsically safe; EEx d and EEx ia.	See Codes B and E above	H
ATEX nonincendive; II 3 G, EEx nA nL IIC. See footnote (a).	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C[(a)]	L
ATEX II 1/2 D; IP66/67.	Maximum Surface Temperature = 110°C	N
ATEX II 1/2 GD and EEx ia IIC.	Temperature Class T6; Ta = -40 to +55°C Temperature Class T5; Ta = -40 to +70°C Temperature Class T4; Ta = -40 to +85°C	T

(a) With ATEX II 3 G, EEx nL IIC, T4 = -40 to + 70°C (not +85°C) when an LCD Indicator is used.

2. Installation

Mounting

The RTT30 Transmitter can be remotely mounted to a surface or a DN 50 or 2-inch pipe with an L-Shaped Bracket. It can also be mounted to a pipe with a U-Shaped Bracket. See Figure 2.

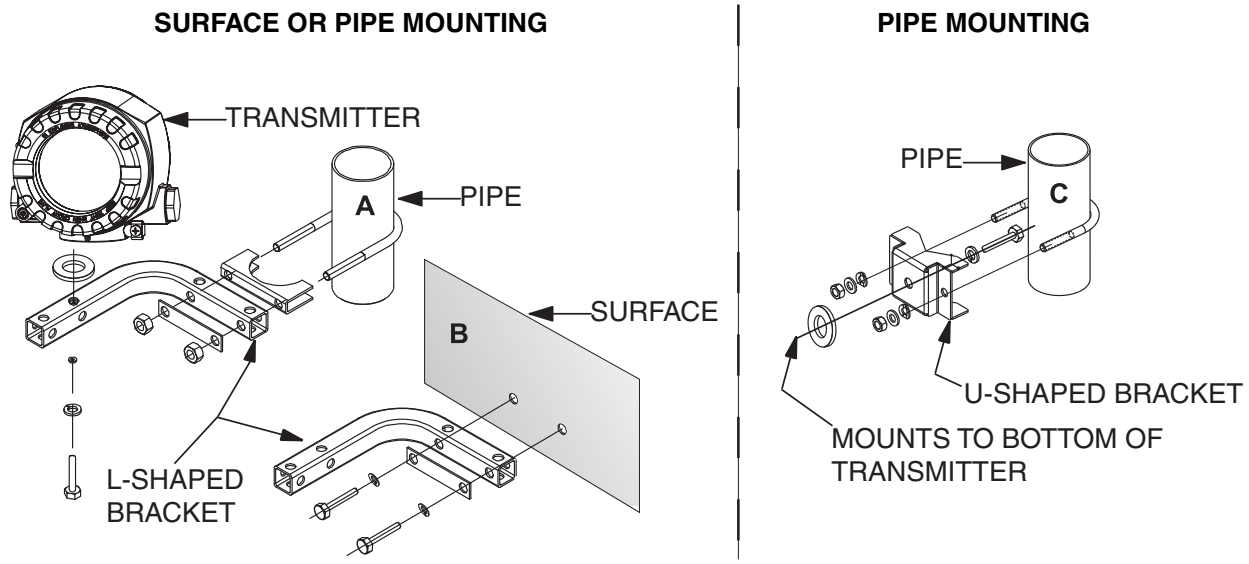

Figure 2. Mounting on a Surface or Pipe

Cover Lock

The covers for both the electronic and terminal compartments of the transmitter can be secured with cover locks. To lock a cover, unscrew the locking screw with an 1/8 inch hex wrench until you can swing the locking clamp into position against the cover. Then tighten the locking screw. To unlock a cover, reverse this procedure.

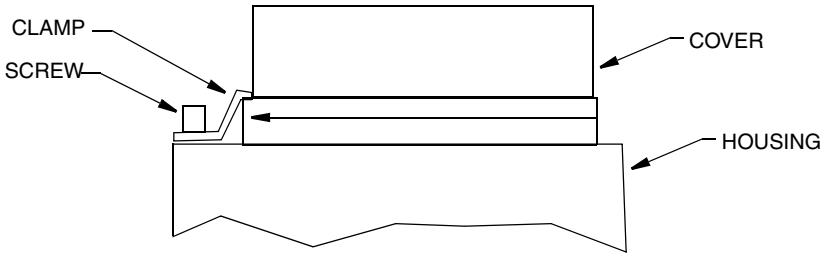

Figure 3. Cover Lock

Rotating the Display

The display can be rotated within the housing to any of four positions at 90° increments as follows:

1. Remove the cover clamp (if applicable).
2. Unscrew the cover to the electronics compartment (with its O-ring).
3. Remove the display (and its retainer) by pulling it straight up.
4. Rotate the display (and its retainer) in 90° increments as required and carefully place it back on the electronics module.

! CAUTION

Carefully line up the display with one of the arrows on the electronics module before gently pressing the display into place.

5. Replace the cover (with its O-ring) and clamp (if applicable).

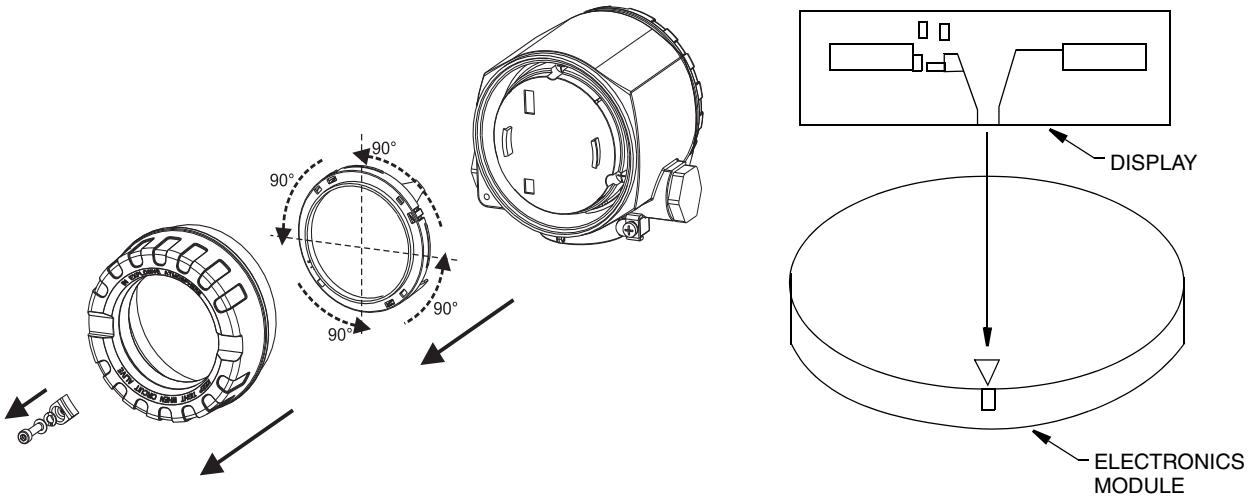

Figure 4. Rotating the Display

Setting the Transmitter DIP Switches

The DIP switches for write protection and simulation mode (for Analog Input) can be found in the electronics compartment. In order to set the switches, remove the electronics compartment cover. Remove the display (if present).

! CAUTION

Protect the terminals from electrostatic discharge. Failure to observe this may result in destruction of parts of the electronics.

The write protection switch is for transmitter security. Setting the write protection switch to the ON position prohibits users from modifying parameters. The current write protection status is displayed in the **WRITE_LOCK** parameter in the Resource Block.

NOTE

The simulation mode via its DIP switch has priority over the software setting.

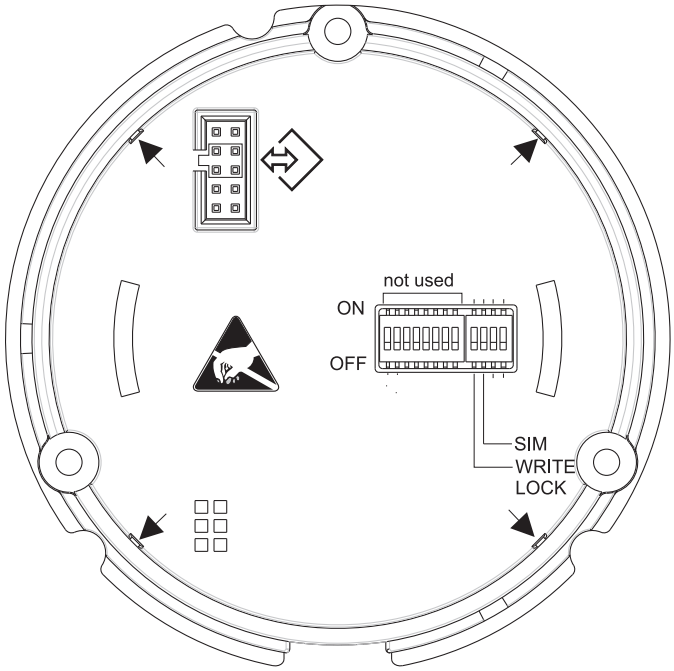

Figure 5. Write Protection and Simulation Mode DIP Switches

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

When installing electrical safety approved devices, please take special note of the following instructions and control drawings:

Foxboro drawing 10120RY: FM - Explosion proof and and Nonincendive
Foxboro drawing 10120RU: FM - Intrinsically Safe and Nonincendive
Foxboro drawing 10120RX: CSA - Explosion proof and and Nonincendive
Foxboro drawing 10120RZ: CSA - Intrinsically Safe and Nonincendive
Instruction MI 020-531: Safety Information for ATEX certified RTT30.

WARNING

On transmitters with Electrical Safety Code other than A: To maintain IEC IP67 and NEMA Type 4X protection, any unused conduit opening must be plugged with the metal plug provided. Use a suitable thread sealant on all conduit connections. In addition, the threaded housing covers must be installed. Hand tighten each cover as much as possible so that its O-ring is fully captured.

CAUTION

1. Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of parts of the electronics.
2. If the transmitter has not been grounded as a result of the housing being installed, Invensys recommends grounding it via one of the ground screws.
3. Protect the terminals from electrostatic discharge. Failure to observe this may result in destruction of parts of the electronics.

Accessing the Transmitter Field Terminals

For access to the field terminals, loosen the cover lock (if present) and remove the cover from the field terminals compartment as shown in Figure 6.

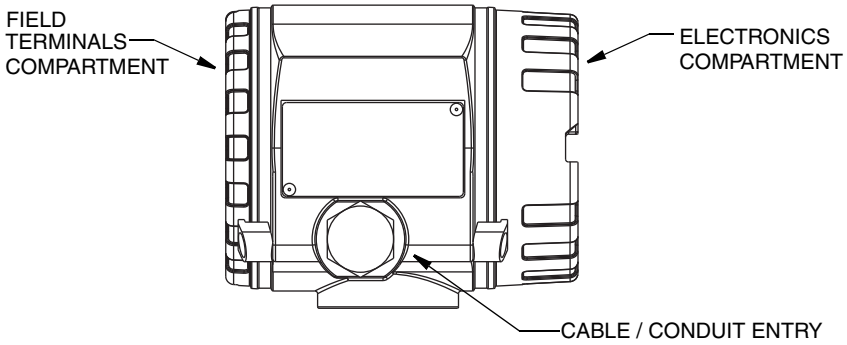

Figure 6. Accessing Field Terminals

Input Connections

There are six terminals on the basic module for input and output connections. Terminals + and - are for power input and measurement output. Terminals 1 through 4 are for Sensor 1 RTD, TC, ohm, or mV sensor inputs. Terminals 5 and 6 are for Sensor 2 inputs.

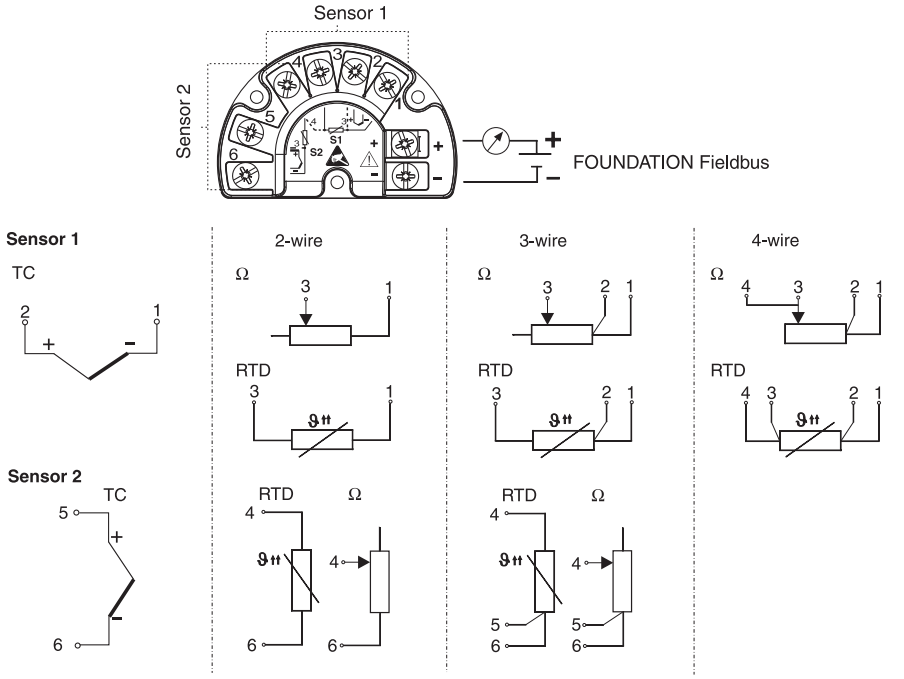

Figure 7. Input Connections

On two sensor inputs, the following connection combinations are possible:

Table 3. Two Sensor Allowable Combinations

	Sensor 1: RTD 2-wire	**Sensor 1: RTD 3-wire**	**Sensor 1: RTD 4-wire**	**Sensor 1: TC connection**
Sensor 2: RTD 2-wire	Yes	Yes	No	Yes
Sensor 2: RTD 3-wire	Yes	Yes	No	Yes
Sensor 2: RTD 4-wire	No	No	No	No
Sensor 2: TC connection	Yes	Yes	Yes	Yes

A special cable gland is required when connecting two sensors to the same port (not applicable for explosionproof transmitters).

CAUTION

When connecting two sensors, ensure that there is no galvanic connection between the sensors (for example, grounded duplex thermocouples). The resulting equalizing currents distort the measurements considerably. In this situation, the sensors have to be galvanically isolated from one another by connecting each sensor separately to a field transmitter. The device provides sufficient galvanic isolation (> 2 kV ac) between the input and output.

Wiring to an I/A Series System or other Host System

The RTT30-K Temperature Transmitters can be wired to a host System by connecting the output terminals to the FOUNDATION fieldbus as shown in Figure 8.

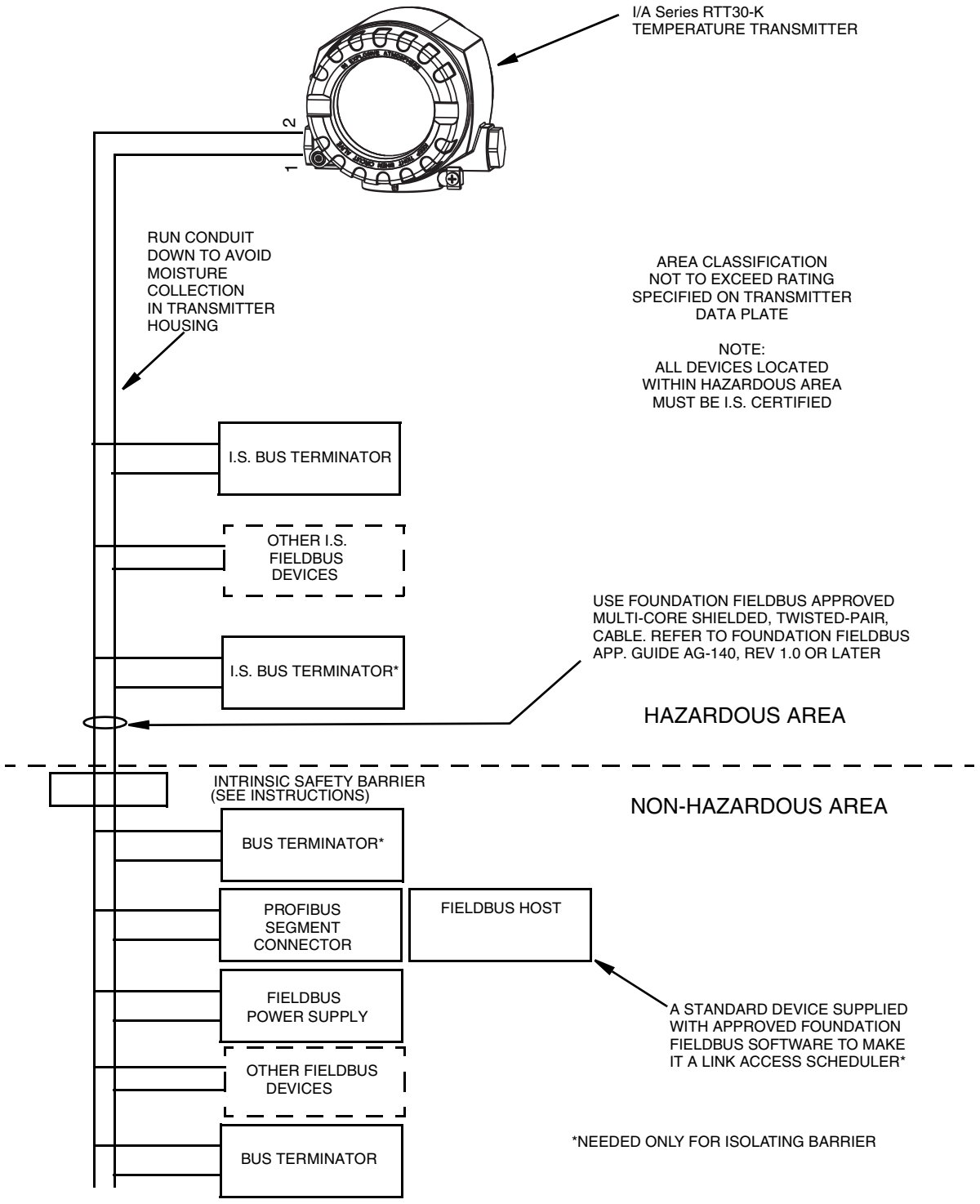

Figure 8. Connecting an RTT30-K to the FOUNDATION Fieldbus

Degree of Protection

The device conforms to the requirements to IEC IP67 and NEMA 4X ingress protection. In order to fulfil this degree of protection after installation or service, the following points must be taken into consideration:

- The housing seals must be clean and undamaged before they are replaced in the sealing rebate. If they are found to be too dry, they should be cleaned or replaced.
- All housing screws and covers must be tightened.
- The cables used for connection must be of the correct specified outside diameter (e.g. M20 x 1.5, cable diameter from 0.32 to 0.47 in; 8 to 12 mm).
- Tighten cable gland or NPT fitting.
- Loop the cable or conduit before placing into the entry so that any moisture that may form cannot enter the gland. Install the device so that the cable or conduit entries are not facing upwards.
- Entries not used are to plugged using the blanking plugs provided.
- The protective cable gland must not be removed from the NPT fitting.

Connection Check

After the electrical installation of the device, always perform the following final checks:

Device Condition and Specifications
Are the device or the cables damaged (visual check)?
Does the device to the measurement specifications, such as ambient temperature, measurement range, and so forth?
Electrical Connection
Does the supply voltage match the specifications on the nameplate? (9 to 32 V dc)
Do the cables used comply with the specifications?
Do the cables have adequate strain relief?
Are the power supply and fieldbus cables correctly connected?
Are all terminals firmly tightened?
Are all the cable glands installed, tightened and sealed? Cable run with "water trap"?

Are all the housing covers installed and tightened?
Electrical Connection of FOUNDATION Fieldbus
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?
Has each fieldbus segment been terminated at both ends with a bus terminator?
Has the max. length of the fieldbus cable been observed in accordance with the FOUNDATION Fieldbus specifications?
Has the max. length of the spurs been observed in accordance with the FOUNDATION Fieldbus specifications?
Is the fieldbus cable fully shielded and correctly grounded?

Installing the Fieldbus Software

Device Description (DD) files are used by a remote FOUNDATION fieldbus configurator (host) and can be found on the Invensys website.

FOUNDATION fieldbus device nomenclature and descriptor files are:

Manufacturer ID: 0x385884.

Device Type: 0xC034

Devise Descriptor Files:

xxyy.ffo or xxyy.ff5	Device Description binary file
xxyy.sym or xxyy.sy5	Device Description symbol file
xxyyzz.cff	Capability file

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

3. Operation

Display

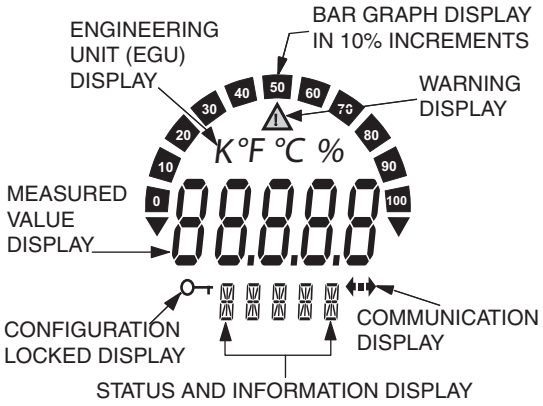

Figure 9. Display

Table 4. Indicator Display Elements

Display Elements	Description
Bar Graph Display	In 10% increments with overrange and underrange marks.
WARNING Display	This is displayed whenever an error or WARNING is given.
Engineering Unit Display (EGU): K, °F, °C, or %	Measured value displayed in selected Engineering Units.
Measured Value Display: 20.5 mm (0.81 in) Character Height.	Displays measured value. If a WARNING is present, the display alternates between measured value and WARNING Code. In the event of an error, the Error Code is displayed and alternating with "-----" instead of a measured value.
Status and Information Display	Indicates which value currently appears on the display. In the event of an error or warning, relevant error/warning information is displayed.
Communication Display	This communication icon appears and indicates that FOUNDATION fieldbus communication is active.
Configuration Locked Display	This cofiguration icon is displayed when the configuration is locked via a hardware jumper.

Switching on the Measuring Device

The measuring device performs a number of internal test functions after power-up. As this procedure progresses, the following sequence of messages appears on the local display:

StepDisplay

Step	Display
1	All segments on
2	All segments off
3	Display
4	Display: The current SW version appears on the display
5	Display: The current device revision appears on the display
6a	Display: The current measured value appears on the display. Bar graph displays the % value within the set bar graph range
6b	Display: The current status message appears on the display. Bar graph displays all segments *Note: If the switch-on procedure fails, the appropriate status message is displayed, depending on the cause.*

Normal measuring mode commences as soon as the switch-on procedure is completed. Various measured value and/or status variables appear on the display.

Initial Commissioning

The following description takes you step-by-step through commissioning the device and all the necessary configurations for a FOUNDATION Fieldbus commissioning:

1. Switch the device on.
2. Note the **DEVICE_ID** on the device nameplate.
3. Open the configuration program.
4. Load the device description files or the CFF file into the host system or the configuration program. Make sure you are using the right system files. The first time you establish a connection, the device reacts as follows:

   RTT30-Kxxxxxxxxxxx (tag name **PD-TAG**)

   385884C034-xxxxxxxxxxx (**DEVICE_ID**)

   Block structure:

Display Text (xxx... = serial number)	Base Index	Description
RS_xxxxxxxxxxx	400	Resource Block
TB_S1_xxxxxxxxxxx	500	Transducer Block Temperature Sensor 1
TB_S2_xxxxxxxxxxx	600	Transducer Block Temperature Sensor 2
TB_DISP_xxxxxxxxxxx	700	Transducer Block “Display”

Display Text (xxx... = serial number)	Base Index	Description
TB_ADVDIAG_xxxxxxxxxx	800	Transducer Block “Advanced Diagnostic”
AI_1_ xxxxxxxxxx	900	Analog Input Function Block 1
AI_2_ xxxxxxxxxx	1000	Analog Input Function Block 2
AI_3_ xxxxxxxxxx	1100	Analog Input Function Block 3
PID_ xxxxxxxxxx	1200	PID Function Block
ISEL_xxxxxxxxxx		

— NOTE

The device is delivered from the factory with the bus address **247** and is thus in the address range between 232 and 247 reserved for reserve devices. A lower bus address should be assigned to the device for commissioning.

5. Using the **DEVICE_ID** noted, identify the field device and assign the desired tag name (**PD_TAG**) to the fieldbus device in question.
   Factory setting: RTT30-Kxxxxxxxxxx (xxx... = serial number).

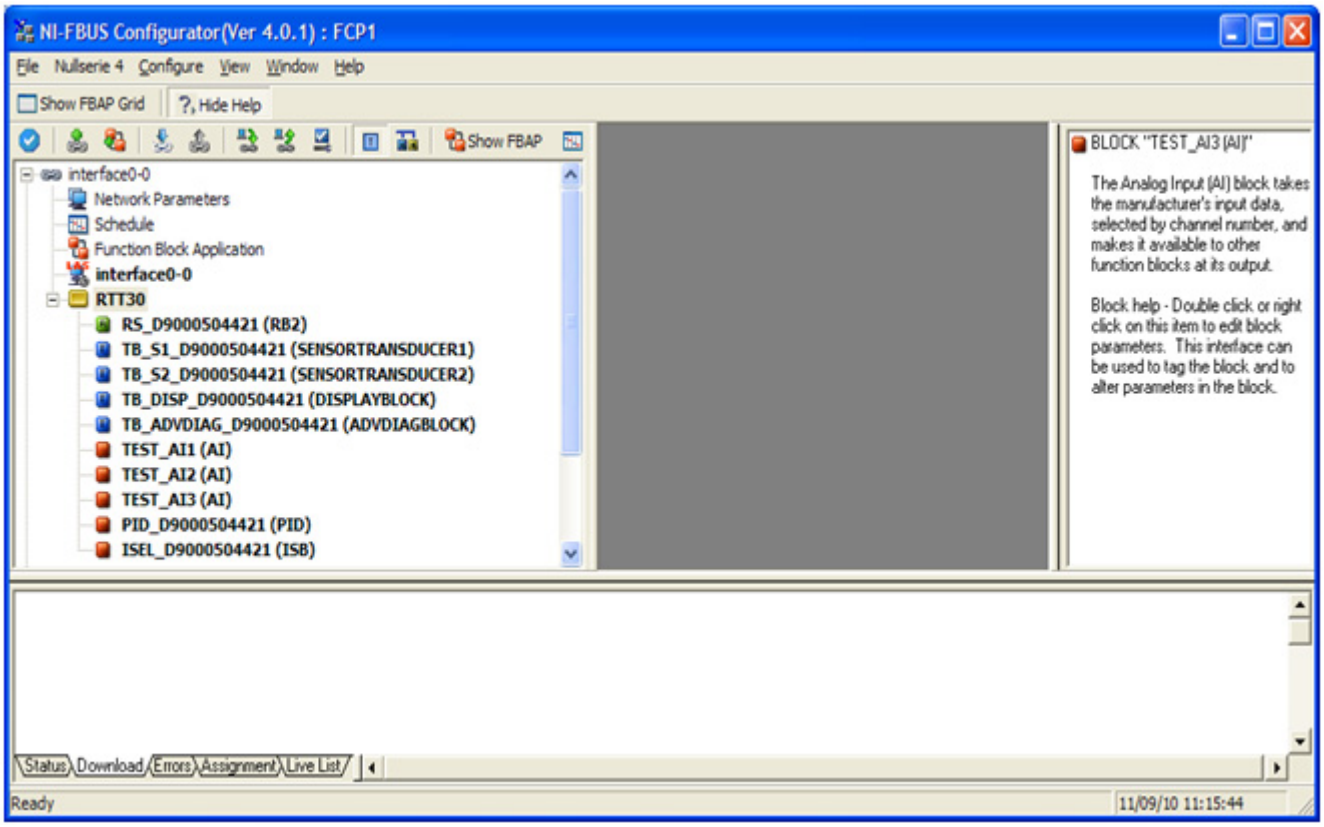

Figure 10. Screen Display After the Connection has Been Established

— NOTE

All parameters in all blocks contain help text that explains the function of that parameter.

Configuring the Resource Block (Base Index 400)

6. Open the Resource Block.
7. When the device is delivered, the hardware write protection is disabled so the write parameters can be accessed via the FF. Check the status via the **WRITE_LOCK** parameter:

   - Write protection enabled = **LOCKED**

   - Write protection disabled = **NOT LOCKED**

   Disable the write protection if necessary
8. Enter the desired name for the block (optional).
   Factory setting: **RS_ xxxxxxxxxxx** Set the operating mode in the **MODE_BLK** parameter group (**TARGET** parameter) to **AUTO**.

Configuring the Transducer Blocks

The individual Transducer Blocks comprise various parameter groups arranged by device-specific functions:

Temperature sensor 1	Transducer Block **TB_S1_xxxxxxxxxxx** (base index: 500)
Temperature sensor 2	Transducer Block **TB_S2_xxxxxxxxxxx** (base index: 600)
Local display functions	Transducer Block **TB_DISP_xxxxxxxxxxx** (base index: 700)
Advanced Diagnostics	Transducer Block **TB_ADVDIAG_xxxxxxxxxx** (base index: 800)

9. Enter the desired name for the block (optional). For factory settings, see the table above. Set the operating mode in the **MODE_BLK** parameter group (**TARGET** parameter) to **AUTO**.

Configuring the Analog Input Function Blocks

The device has three Analog Input function blocks which can be assigned to the different process variables as desired. The following section describes an example for the Analog Input Function Block 1 (base index 900). All three Analog Input function blocks are the same.

10. Enter the required name for the Analog Input function block (optional).
    Factory setting: **AI1_ xxxxxxxxxx**
11. Open Analog Input function block 1.
12. Set the operating mode in the **MODE_BLK** parameter group (**TARGET** parameter) to **OOS**, i.e. the block is out of service.
13. Use the **CHANNEL** parameter to select the process variable which should be used as the input value for the function block algorithm (scaling and limit value monitoring functions).
    The following settings are possible:

CHANNEL	Uninitialized
	Primary Value 1

Primary Value 2

Sensor Value 1

Sensor Value 2

RJ Value 1

RJ Value 2

14. In the **XD_SCALE** parameter group, select the desired engineering unit which should be transmitted by means of the FOUNDATION fieldbus interface, as well as the block input range for the process variable in question.

! CAUTION

Make sure that the engineering unit selected suits the measured variable of the process variable chosen. Otherwise, the **BLOCK_ERROR** parameter displays the "Block Configuration Error" error message and the operating mode of the block cannot be set to **AUTO**.

15. In the **L_TYPE** parameter, select the type of linearization for the input variable (direct, indirect, indirect sq. root).

! CAUTION

Please note that if the "Direct" linearization type is selected, the settings in the **OUT_SCALE** parameter group are not taken into account. The engineering units selected in the **XD_SCALE** parameter group are communicated outside of the transducer block.

16. Use the following parameters to define the limit values for the alarm and warning messages:

HI_HI_LIM	Limit value for the upper alarm
HI_LIM	Limit value for the upper warning
LO_LIM	Limit value for the lower warning
LO_LO_LIM	Limit value for the lower alarm

The limit values entered must be within the value range specified in the **OUT_SCALE** parameter group.

17. In addition to the actual limit values, the behavior in the event of limit value overshoot must be specified by "alarm priorities" (**HI_HI_PRI**, **HI_PRI**, **LO_PRI**, **LO_LO_PRI** parameters). Reporting to the fieldbus host system only occurs if the alarm priority is greater than 2.

System Configuration / Connecting Function Blocks

18. A final "overall system configuration" is necessary so that the operating mode of the Analog Input function block can be set to **AUTO** and the field device is integrated in the system application.

For this purpose, configuration software, e.g. NI-FBUS Configurator from National Instruments maybe used to connect the function blocks to the desired control strategy (mostly using graphic display) and then the time for processing the individual process control functions is specified. Alternatively, most host systems support this capability.

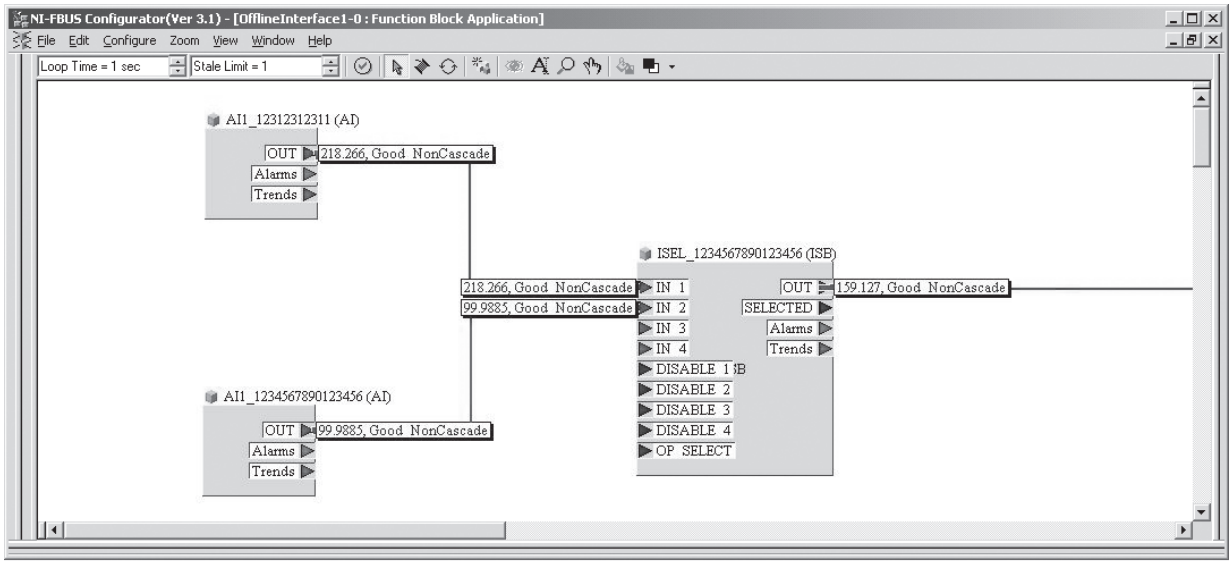

***Figure 11. Connecting Function Blocks** with the aid of the NI-FBUS Configurator*

Example: Averaging (output **OUT** in the Input Selector Block) of two temperature inputs (**OUT** in the Analog Input Blocks 1 and 2).

19. Once you have specified the active LAS, download all the data and parameters to the field device.
20. Set the operating mode in the **MODE_BLK** parameter group (**TARGET** parameter) to **AUTO**. This is only possible, however, under two conditions:

    - The function blocks are correctly connected to one another.

    - The Resource Block is in the **AUTO** operating mode.

Operation via FOUNDATION Fieldbus

Resource Block Parameters

The following table shows all the specified FOUNDATION fieldbus parameters of the Resource Block

Resource Block			
Parameter Index	**Parameter**	**Write Access With Operating**	**Description**
38	ACK_OPTION	AUTO - OOS	This parameter is used to specify whether a process alarm must be acknowledged at the time of alarm recognition by the fieldbus host system. If this option is enabled, the process alarm is acknowledged automatically. **Factory default: The option is not enabled for any alarm, the alarms must be acknowledged.**
37	ALARM_SUM	AUTO - OOS	Displays the current status of the process alarms in the Resource Block. *Note:* *In addition the process alarms can also be disabled in this parameter group.*
4	ALERT_KEY	AUTO - OOS	Use this function to enter the identification number of the plant unit. This information can be used by the fieldbus host system for sorting alarms and events. User input: 1 to 255 **Factory default: 0**
36	BLOCK_ALM	AUTO - OOS	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. The block alarm is triggered in the event of the following block errors: * SIMULATE ACTIVE * OUT OF SERVICE *Note:* *If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*
6	BLOCK_ERR	Read only	The active block errors appear on the display. Display: SIMULATE ACTIVE Simulation is possible in the Analog Input function block via the SIMULATE parameter (refer also to Hardware Write Protection Configuration on page 24. OUT OF SERVICE The block is in the "out of service" mode.
30	CLR_FSTATE	AUTO - OOS	This parameter can be used to manually disable the security behavior of the Analog Output and Discrete Output function blocks.
33	CONFIRM_ TIME	AUTO - OOS	Specifies the confirmation time for the event report. If the device does not receive confirmation within this time then the event report is sent to the fieldbus host system again. **Factory default: 640000 $^{1}/_{32}$ ms**
20	CYCLE_SEL	AUTO - OOS	Displays the block execution method used by the fieldbus host system. *Note:* *The block execution method is selected by the fieldbus host system.*
19	CYCLE_TYPE	Read only	Displays the block execution method supported by the device. Display: SCHEDULED timed block execution method BLOCK EXECUTION sequential block execution method MANUF SPECIFIC manufacturer specified
9	DD_RESOURCE	Read only	Displays the reference source for the device description in the device. Display: (NULL)

Resource Block			
Parameter Index	**Parameter**	**Write Access With Operating**	**Description**
13	DD_REV	Read only	Displays the revision number of the device description.
12	DEV_REV	Read only	Displays the revision number of the device
11	DEV_TYPE	Read only	Displays the device type in hexadecimal numeric format. Display: 0xC034 hex
28	FAULT_STATE	Read only	Current status display of the security behavior of the Analog Output and Discrete Output function blocks.
17	FEATURES	Read only	Displays the additional options supported by the device. Display: REPORTS FAULTSTATE SOFT W LOCK
19	FEATURES_SEL	AUTO - OOS	For selecting the additional functions supported by the device.
25	FREE_TIME	Read only	Displays the free system time (in percent) available for execution of further function blocks. *Note:* *Since the function blocks of the device are preconfigured, this parameter always displays the value 0.*
24	FREE_SPACE	Read only	Displays the free system memory (in percent) available for execution of further function blocks. *Note:* *Since the function blocks of the device are preconfigured, this parameter always displays the value 0.*
14	GRANT_DENY	AUTO - OOS	Enables or restricts the access authorization of a fieldbus host system to the field device.
15	HARD_TYPES	Read only	Displays the input signal type for the Analog Input function block.
32	LIM_NOTIFY	AUTO - OOS	This parameter is used to specify the number of event reports that can exist unconfirmed at the same time. Options: 0 to 3 **Factory default: 0**
10	MANUFAC_ID	Read only	Displays the manufacturer's ID number. Display: 0x385884 = Foxboro
31	MAX_NOTIFY	Read only	Displays the maximum number of event reports supported by the device that can exist unconfirmed at the same time. Display: 3
22	MEMORY_SIZE	Read only	Displays the available configuration memory in kilobytes. *Note:* *This parameter is not supported.*
21	MIN_CYCLE_T	Read only	Displays the minimum execution time

Resource Block			
Parameter Index	**Parameter**	**Write Access With Operating**	**Description**
5	MODE_BLK	AUTO - OOS	Displays the current (Actual) and desired (Target) operating mode of the Resource Block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO - OOS *Note:* *The Resource Block supports the following operating modes:* ** AUTO (automatic operation)* *In this mode the execution of the remaining blocks (ISEL, AI and PID function block) is permitted.* ** OOS (out of service):* *The block is in the "out of service" mode. In this mode execution of the remaining blocks (ISEL, AI and PID function block) is blocked. These blocks cannot be set to AUTO mode.* *Note:* *The current operating status of the Resource Block is also shown via the RS_STATE parameter.*
23	NV_CYCLE_T	Read only	Displays the time interval for which the dynamic device parameters are stored in the nonvolatile memory. The time interval displayed relates to storage of the following dynamic device parameters: OUT PV FIELD_VAL Factory default: 19.200.000 1/32 ms *Note:* The device saves dynamic NV parameters in non volatile memory every 10 minutes. Therefore the value of this parameter is 19.200.000 1/32 ms.
16	RESTART	AUTO - OOS	This parameter is used to reset the device in various ways. Options: Restart UNINITIALIZED RUN Restart RESOURCE Restart with DEFAULTS Restart PROCESSOR Restart PRODUCT DEFAULT Restart ORDER CONFIGURATION (all the parameters are reset to the factory setting)
7	RS_STATE	Read only	Displays the current operating status of the Resource Blocks. Display: STANDBY The Resource Block is in the OOS operating mode It is not possible to execute the remaining blocks. ONLINE LINKING The configured connections between the function blocks have not yet been made. ONLINE Normal operating status, the Resource Block is in the AUTO operating mode. The configured connections between the function blocks are established.
29	SET_FSTATE	AUTO - OOS	This parameter can be used to manually enable the security behavior of the device.

Resource Block			
Parameter Index	**Parameter**	**Write Access With Operating**	**Description**
26	SHED_RCAS	AUTO - OOS	Specifies the monitoring time for checking the connection between the fieldbus host system and a function block in the RCAS operating mode. When the monitoring time elapses, the function block changes from the RCAS operating mode to the operating mode selected in the SHED_OPT parameter. **Factory default: 640000 $^{1}/_{32}$ ms**
27	SHED_ROUT	AUTO - OOS	Specifies the monitoring time for checking the connection between the fieldbus host system and the PID function block in the ROUT operating mode. When the monitoring time elapses, the PID function block changes from the ROUT operating mode to the operating mode selected in the SHED_OPT parameter. **Factory default: 640000 $^{1}/_{32}$ ms**
3	STRATEGY	AUTO - OOS	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory default: 0** *Note:* *This data is neither checked nor processed by the Resource Block.*
1	ST_REV	Read only	The revision status of the static data appears on the display. *Note:* *The revision status is incremented on each modification of static data.*
2	TAG_DESC	AUTO - OOS	Entry of a user specific text for unique identification and assignment of the block.
8	TEST_RW	AUTO - OOS	*Note:* *This parameter is required only for interoperability tests and has no meaning in normal operation.*
35	UPDATE_EVT	Read only	Indicates whether static block data have been altered, including date and time.
40	WRITE_ALM	AUTO - OOS	Displays the status of the write protected alarm. *Note:* *The alarm is triggered if the write protection is disabled.*
34	WRITE_LOCK	Read only	Able and disable write protection Display: LOCKED Device data cannot be modified NOT LOCKED Device data can be modified UNINITIALIZED
39	WRITE_PRI	AUTO - OOS	Specifies the behavior of a write protected alarm ("WRITE_ALM" parameter). User input: 0 = The write protection alarm is not evaluated. 1 =No report to the fieldbus host system in the event of a write protection alarm. 2 = Reserved for block alarms. 3-7 = The write protection alarm is output with the appropriate priority (3 = low priority, 7 = high priority) to the fieldbus host system as a user notice. 8-15 = The write protection alarm is output with the appropriate priority (8 = low priority, 15 = high priority) to the fieldbus host system as a critical alarm. Factory default: 0

Transducer Block Parameters

The following table lists all the specified FOUNDATION Fieldbus parameters of the Transducer Blocks..

Transducer Block Parameters		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Static revision (STAT_REV)	Read only	The revision status of the static data appears on the display. *Note:* *The revision status parameter is incremented on each modification of static data. When a factory reset is done this parameter will be reset to 0 in all blocks.*
Tag description (TAG_DESC)	AUTO - OOS	Use this function to enter a user-specific text of max. 32 characters for unique identification and assignment of the block. **Factory setting: (_____) no text**
Strategy (STRATEGY)	AUTO - OOS	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory setting: 0** *Note:* *These data are neither checked nor processed by the Transducer Blocks.*
Alert key (ALERT_KEY)	AUTO - OOS	Use this function to enter the identification number of the plant unit. This information can be used by the fieldbus host system for sorting alarms and events. **User input: 1 to 255** **Factory setting: 0**
Block Mode (MODE_BLK)	AUTO - OOS	Displays the current (Actual) and desired (Target) operating mode of the corresponding Transducer Block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO OOS *Note:* *The Transducer Block supports the following operating modes:* ** AUTO (automatic mode):* *The block is executed.* ** OOS (out of service):* *The block is in the "out of service" mode. The process variable is updated, but the status of the process variable changes to BAD*

Transducer Block Parameters		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Block Error (BLOCK_ERR)	Read only	The active block errors appear on the display. **Display:** OUT OF SERVICE The block is in the "out of service" operating mode. The following block errors are only shown in the Sensor Transducer Blocks: INPUT FAILURE Failure at one or both sensor inputs MAINTENANCE NEEDED NOW The device must be checked since an active device error is pending. The detailed cause of the error can be called up in the "Advanced Diagnostic" Transducer Block by means of the * ACTUAL_STATUS_CATEGORY and * ACTUAL_STATUS_NUMBER parameters. LOST STATIC DATA The memory is inconsistent. Power-UP Status message during initialization. SIMULATE ACTIVE DIP switch for simulation is active. BLOCK CONFIGURATION ERROR Block has been configured wrong. An exact error description as well as information on rectifying faults can be found in section 5.
Update Event (UPDATE_EVT)	AUTO - OOS	Indicates whether static block data have been altered, including date and time.
Block Alarm (BLOCK_ALM)	AUTO - OOS	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. *Notes:* *In addition, the active block alarm can be acknowledged in this parameter group.* *The device does not use this parameter to display a process alarm since this is generated in the BLOCK_ALM parameter of the Analog Input function block.*
Transducer Type (TRANSDUCER_TYPE)	Read only	The Transducer Block type appears on the display. Display: * Sensor Transducer Blocks: Custom Sensor Transducer * Display Transducer Block: Custom Display Transducer * Advanced Diagnostic Block: Custom Adv. Diag. Transducer

Transducer Block Parameters		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Collection Directory (COLLECTION_ DIRECTORY)	Read only	A directory that specifies the number and starting indices of the collections in the transducer directory. In the RTT30, this is always set to 0.
Transducer Error (XD_ERROR)	Read only	The active device error appears on the display. **Possible display:** * No Error (normal status) * Electronics failure * Data Integrity Error * Mechanical failure * Configuration Error * Calibration error * General Error *Notes:* *Summarized device status/condition, more precise information on the pending error(s) is available by means of the manufacturer-specific error display. This can be read via the Transducer Block "Advanced Diagnostic" in the ACTUAL_STATUS_CATEGORY and ACTUAL_STATUS_NUMBER"parameters.* *An exact error description as well as information on rectifying errors can be found in section 4.*

Transducer Block "Sensor 1 and 2"

The "Sensor 1 and 2" Transducer Blocks analyze the signals of both sensors from a metrological perspective and display them as a physical variable (value and unit). Two physical measured values are available in every Sensor Transducer Block:

- The sensor value (SENSOR_VALUE) and its unit (SENSOR_RANGE → UNITS_INDEX)
- The value of the internal temperature measurement of the device (RJ_VALUE) and its unit (RJ_UNIT)
- The primary process value (PRIMARY_VALUE →VALUE)

The internal temperature measurement of the reference junction is analyzed in both Transducer Blocks but both values are identical. A third value in the Block, the PRIMARY_VALUE, is formed from the sensor values.

The rule for forming the PRIMARY_VALUE can be selected in the PRIMARY_VALUE_TYPE parameter. The sensor value can be mapped unchanged in PRIMARY_VALUE but there is also the option of forming the differential value or mean value for both sensor values. In addition, various backup functions are also available which allow redundant measurement if a sensor fails. These can help increase process safety, like the threshold function, backup function or sensor drift detection.

Threshold function

This function enables a measurement over a wide temperature range. Channel 1 can be connected with a sensor usable for the lower temperature range and channel 2 can be connected with a sensor usable for the higher temperature range. Set the temperature in the parameter THRESHOLD_VALUE in the transducer block for switching from channel 1 to channel 2 in the PRIMARY_VALUE. PRIMARY_VALUE_TYPE has to be set to "PV = SV_1 (OR SV_2 if SV_1 > T)".

Backup function

If a sensor fails, the system automatically switches to the remaining sensor and a warning message is sent to the distributed control system. The backup function ensures that the process is not interrupted by the failure of an individual sensor and that an extremely high degree of safety and availability is achieved.

Sensor drift detection

If 2 sensors are connected and the measured values differ by a specified value, a warning/alarm is sent to the distributed control system. The drift detection function can be used to verify the correctness of the measured values and for mutual monitoring of the connected sensors.

The electronics can be configured for various sensors and measured variables by means of the SENSOR_TYPE parameter.

If resistance thermometers or resistance transmitters are connected, the type of connection can be selected by means of the SENSOR_CONNECTION parameter. If the "two-wire" type of connection is used, the TWO_WIRE_COMPENSATION parameter is available. A resistance value is indicated here to compensate for the effect of the connecting cables on the sensor signal.

— NOTE

The Transducer Blocks for sensor 1 and 2 have a Wizard (configuration assistant) for calculating the resistance of sensor cables with different material properties, cross-sections and lengths.

When measuring temperature with thermocouples, the type of reference junction compensation is specified in the RJ_TYPE parameter. For the compensation, the internal terminal temperature measurement of the device (INTERNAL) can be used or a fixed value can be specified (EXTERNAL). This value has to be entered in the RJ_EXTERNAL_VALUE parameter.

The units displayed are selected with the PRIMARY_VALUE_UNIT and SENSOR_RANGE → UNITS_INDEX parameters. It must be ensured that the units selected physically suit the measured variables.

— NOTE

The Sensor 1 and 2 Transducer Blocks each make the "Quick Setup" Wizard available to configure the measuring settings quickly and safely.

The Sensor 1 and 2 Transducer Blocks also give users the option of linearizing any sensor type by entering polynomial coefficients. The design provides for three types:

Linear Scaling of Temperature-Linear Curve

With the aid of linear scaling (offset and slope), the complete measuring point (measuring device + sensor) can be adapted to the desired process. Users must run through the following procedure for this purpose:

1. Switch the setting for the SENSOR_CAL_METHOD parameter to "**user trim standard calibration**". Then apply the lowest process value to be expected (e.g. -10 °C) to the sensor of the device. This value is then entered in the CAL_POINT_LO parameter. Make sure that the status for SENSOR_VALUE is "Good".
2. Now expose the sensor to the highest process value to be expected (e.g. 120 °C), again ensure the status is "Good" and enter the value in the CAL_POINT_HI parameter. The device now precisely shows the specified process value at the two calibrated points. The curve follows a straight line between the points.
3. The SENSOR_CAL_LOC, SENSOR_CAL_DATE and SENSOR_CAL_WHO parameters are available to track sensor calibration. The place, date and time of calibration can be entered here as well as the name of the person responsible for the calibration.
4. To undo sensor input calibration, the SENSOR_CAL_METHOD parameter is set to "**factory trim standard calibration**".

— NOTE

Menu guidance via the "User Sensor Trim" Wizard is available for linear scaling. The "Factory Trim Settings" Wizard can be used to reset the scaling.

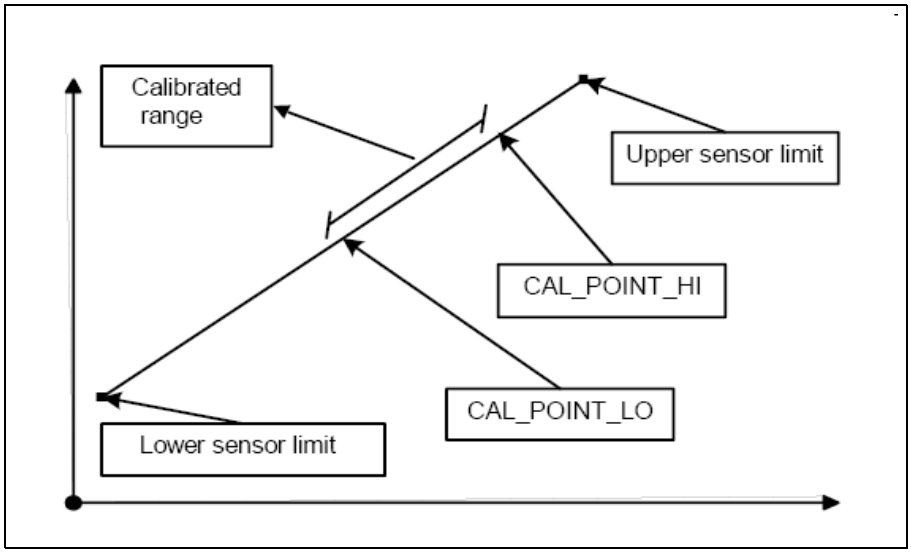

Figure 12. Linear Scaling of Temperature-Linear Curve.

Linearization of Platinum Resistance Thermometers With the Aid of Callendar Van Dusen Coefficients

The coefficients R0, A, B, C can be specified in the CALVANDUSEN_R0, CALVANDUSEN_A, CALVANDUSEN_B, CALVANDUSEN_C parameters. To activate this

linearization, select the "Callendar Van Dusen" setting in the SENSOR_TYPE parameter. In addition, the upper and lower calculation limits have to be entered in the SMC_MIN and SMC_MAX parameters.

— NOTE

The Callendar Van Dusen coefficients can also be configured by means of the Callendar Van Dusen" Wizard.

Linearization of Copper/Nickel Resistance Thermometers (RTD)

The coefficients R0, A, B, C can be specified in the POLY_COEFF_R0, POLY_COEFF_A, POLY_COEFF_B, POLY_COEFF_C parameters. To activate this linearization, select the "RTD Polynom Nickel" or "RTD Polynom Copper" setting in the SENSOR_TYPE parameter. In addition, the upper and lower calculation limits have to be entered in the POLY_COEFF_MIN and POLY_COEFF_MAX parameters.

— NOTE

The coefficients for nickel and copper polynoms can be entered with the aid of a wizard in the Transducer Blocks Sensor 1 and 2.

Each of the values can be passed onto an AI function block or shown on the display. The AI and the Display Block make further options available for displaying and scaling measured values.

The following table shows all the device specific parameters of the Sensor Transducer Blocks:

Transducer Block “Sensor 1 and 2”		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Primary value (PRIMARY_VALUE)	AUTO - OOS	Result of Link PRIMARY_VALUE_TYPE: * VALUE * STATUS *Note:* *The PRIMARY_VALUE can be made available to the AI Block for further processing. The assigned unit is the PRIMARY_VALUE_UNIT.*
Primary value unit (PRIMARY_VALUE_UNIT)	AUTO - OOS	Configuring the unit of the PRIMARY_VALUE *Note:* *The measurement range and engineering units are configured with an existing link in the relevant Analog Input function block using the XD_SCALE parameter group.*

Transducer Block "Sensor 1 and 2"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Primary value type (PRIMARY_VALUE_TYPE)	AUTO - OOS	The calculation process for the PRIMARY_VALUE appears on the display. **Display:** Sensor Transducer 1: * PV = SV_1: Secondary Value 1 * PV = SV_2: Secondary Value 2 * PV = SV_1-SV_2: Difference * PV = 0.5 x (SV_1+SV_2): Average * PV = 0.5 x (SV_1+SV_2) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. * PV = SV_1 (OR SV_2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. * PV = SV_1 (OR SV_2 if SV_1 > T): PV changes from SV_1 to SV_2 if SV_1 > value T (THRESHOLD_VALUE parameter) Sensor Transducer 2: * PV = SV_2: Secondary Value 2 * PV = SV_2-SV_1: Difference * PV = 0.5 x (SV_2+SV_1): Average * PV = 0.5 x (SV_2+SV_1) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. * PV = SV_2 (OR SV_1): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. * PV = SV_2 (OR SV_1 if SV_2 > T): PV changes from SV_2 to SV_1 if SV_2 > value T (THRESHOLD_VALUE parameter)
Threshold value (THRESHOLD_VALUE)	AUTO - OOS	Value for switching in the threshold PV mode. Entry in the range from -270°C to 2450°C (-454°F to 4442°F)
Primary value max. indicator (PV_MAX_INDICATOR)	AUTO - OOS	Max. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset by writing any value to this parameter.
Primary value min. indicator (PV_MIN_INDICATOR)	AUTO - OOS	Min. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset by writing any value to this parameter.
Sensor value (SENSOR_VALUE)	Dynamic / read only	Sensor Transducer 1: * VALUE = Value of the sensor connected to the S1 terminal group * STATUS = Status of this value Sensor Transducer 2: * VALUE = Value of the sensor connected to the S2 terminal group * STATUS = Status of this value

Transducer Block "Sensor 1 and 2"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Sensor type (SENSOR_TYPE)	AUTO - OOS	Configuration of the sensor type. Sensor Transducer 1: Terminals 1-4 Sensor Transducer 2: Terminals 4-6 *Note:* *Terminal 4 cannot be used simultaneously by both transducers (sensors). Example: In the event of a four-wire connection at terminal S1 (terminals 1-4), an RTD or Ohm-type sensor cannot be connected to terminal S2 as terminal 4 is already being used for terminal S1.*
Sensor connection (SENSOR_CONNECTION)	AUTO - OOS	Sensor connection mode: Sensor Transducer 1: * 2-wire * 3-wire * 4-wire Sensor Transducer 2: * 2-wire * 3-wire
Sensor range (SENSOR_RANGE)	Read only (EU_100, EU_0) AUTO - OOS (UNITS_INDEX, DECIMAL)	Physical measuring range of the sensor: EU_100 (upper sensor range limit) EU_0 (lower sensor range limit) UNITS_INDEX (unit of the SENSOR_VALUE) DECIMAL (places after the decimal point for the SENSOR_VALUE. This does not affect the measured value display.)
Sensor offset (SENSOR_OFFSET)	AUTO - OOS	Offset of the SENSOR_VALUE The following values are permitted: * -10 to +10 for Celsius, Kelvin, mV and Ohm * -18 to +18 for Fahrenheit, Rankine
2-wire compensation (TWO_WIRE_ COMPENSATION)	AUTO - OOS	Two-wire compensation The following values are permitted: 0 to 30 Ohm
Sensor serial number (SENSOR_SN)	AUTO - OOS	Serial number of the sensor
Sensor max. indicator (SENSOR_MAX_ INDICATOR)	AUTO - OOS	Maximum indicator of the SENSOR_VALUE Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
Sensor min. indicator SENSOR_MIN_ INDICATOR	AUTO - OOS	Minimum indicator of the SENSOR_VALUE Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
Mains filter (MAINS_FILTER)	AUTO - OOS	Mains filter for the A/D converter

Transducer Block "Sensor 1 and 2"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Calibration highest point (CAL_POINT_HI)	AUTO - OOS	Upper point for linear characteristic calibration (this affects offset and slope). *Note:* *To write to this parameter, SENSOR_CAL_METHOD must be set to "user trim standard calibration".*
Calibration lowest point (CAL_POINT_LO)	AUTO - OOS	Lower point for linear characteristic calibration (this affects offset and slope). *Note:* *To write to this parameter, SENSOR_CAL_METHOD must be set to "user trim standard calibration".*
Calibration minimum span (CAL_MIN_SPAN)	AUTO - OOS	Span of the measuring range, depending on the sensor type set
Calibration unit (CAL_UNIT)	Read only	Unit for sensor calibration.
Sensor calibration method (SENSOR_CAL_METHOD)	AUTO - OOS	Factory trim standard calibration: Sensor linearization with the factory calibration values User trim standard calibration: Sensor linearization with the values CAL_POINT_HI and CAL_POINT_LO *Note:* *The original linearization can be established by resetting this parameter to "factory trim standard calibration". For linear characteristic calibration, the Transducer Block makes a wizard available (User Sensor Trim).*
Sensor calibration location (SENSOR_CAL_LOC)	AUTO - OOS	Name of the location where the sensor calibration was carried out.
Sensor calibration date (SENSOR_CAL_DATE)	AUTO - OOS	Date and time of the calibration.
Sensor calibration who (SENSOR_CAL_WHO)	AUTO - OOS	Name of the person responsible for the calibration.
Callendar Van Dusen A (CALVANDUSEN_A)	AUTO - OOS	Sensor linearization based on the Callendar Van Dusen method. *Note:* *The CAL_VAN_DUSEN_XX parameters are used for calculating the response curve if "Callendar Van Dusen" is set in the SENSOR_TYPE parameter.* *Both Transducer Blocks make a wizard available for configuring the parameters based on the "Callendar Van Dusen method".*
Callendar Van Dusen B (CALVANDUSEN_B)	AUTO - OOS	
Callendar Van Dusen C (CALVANDUSEN_C)	AUTO - OOS	
Callendar Van Dusen R0 (CALVANDUSEN_R0)	AUTO - OOS	

Transducer Block "Sensor 1 and 2"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Reference junction (RJ_VALUE)	AUTO - OOS	Internal reference temperature measurement: * VALUE * STATUS
Reference junction type (RJ_TYPE)	AUTO - OOS	Configuration of reference junction measurement for temperature compensation: * NO_REFERENCE: No temperature compensation is used. * INTERNAL: Internal reference junction temperature is used for the temperature compensation. * EXTERNAL: RJ_EXTERNAL_VALUE is used for the temperature compensation.
Reference junction value unit (RJ_UNIT)	Read only	Unit of the internal reference temperature. This always corresponds to the unit set in SENSOR_RANGE: UNITS_INDEX.
Reference junction external value (RJ_EXTERNAL_VALUE)	AUTO - OOS	Value for temperature compensation (see RJ_TYPE parameter).
Reference junction maximum indicator (RJ_MAX_INDICATOR)	Read only	Max. indicator of the internal reference temperature is stored in the nonvolatile memory in intervals of 10 minutes.
Reference junction minimum indicator (RJ_MIN_INDICATOR)	Read only	Min. indicator of the internal reference temperature is stored in the nonvolatile memory in intervals of 10 minutes.

Transducer Block Advanced Diagnostic

Transducer Block "ADVANCED DIAGNOSTIC"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Corrosion detection (CORROSION_ DETECTION)	AUTO - OOS	* OFF: Corrosion detection off * ON: Corrosion detection on
Sensor drift monitoring (SENSOR_DRIFT_ MONITORING)	AUTO - OOS	Deviation betw. SV1 and SV2 as error (Failure) or as need for maintenance (Maintenance): * OFF: Sensor deviation monitoring off * FAILURE: (sensor deviation > SENSOR_DRIFT_ALERT_VALUE) => Failure * MAINTENANCE: (sensor deviation > SENSOR_DRIFT_ALERT_VALUE) => Maintenance

Transducer Block "ADVANCED DIAGNOSTIC"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Sensor drift mode (SENSOR_DRIFT_MODE)	AUTO - OOS	Select whether a status is generated if the value set in the SENSOR_DRIFT_ALERT_VALUE parameter is undershot or overshot.
Sensor drift alert value (SENSOR_DRIFT_ALERT_VALUE)	AUTO - OOS	Limit value of the permitted deviation from 1 to 999.99.
System alarm delay (SYSTEM_ALARM_DELAY)	AUTO - OOS	Time until a device status (failure or maintenance) and a measured value status (bad or uncertain) is transmitted. This parameter has no influence on the local display. Can be configured between 0 and 10 seconds. *Note:* *This setting does not affect the display.*
Ambient temp. alarm (AMBIENT_ALARM)	AUTO - OOS	Maintenance or Failure in the event of the operating temperature of the transmitter being undershot or overshot (< -40 °C (-40 °F) or > +80 °C (176 °F)): * Maintenance: Int. temperature overshoot/undershoot results in Maintenance. * Failure: Int. temperature overshoot/undershoot results in a Failure.
Actual status category / Previous status category (ACTUAL_STATUS_CATE GORY / PREVIOUS_STATUS_CATEGORY)	Read only / AUTO - OOS	Current/last status category * Good: No errors detected * F: Failure: Error detected * M: Maintenance equired: Maintenance necessary * C: Function Check: Device is in the service mode * S: Out of Spec.: Device is being operated outside the specifications

Transducer Block "ADVANCED DIAGNOSTIC"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Actual status/ previous status (ACTUAL_ STATUS_ NUMBER / PREVIOUS_ STATUS_ NUMBER)	Read only / AUTO - OOS	Current/past status number: 000 NO ERROR: No error is present 041 SENSOR BREAK: Sensor rupture 043 SENSOR SHORTCUT: Sensor short circuit 042 SENSOR CORROSION: Corrosion of connections or sensor cables 101 SENSOR UNDERUSAGE: Measured value of the sensor is below the linearization range 102 SENSOR OVERUSAGE: Measured value of the sensor is above the linearization range 104 BACKUP ACTIVATED: Backup function activated due to sensor failure 103 DEVIATION: Sensor drift detected 501 DEVICE PRESET: Reset routine in progress 411 UP-/DOWNLOAD: Uploading/downloading 482 SIMULATION: Device is in the simulation mode 402 STARTUP: Device is in the startup/initialization phase 502 LINEARIZATION: Linearization incorrectly selected or configured 901 AMBIENT TEMPERATURE LOW: Ambient temperature too low; RJ_Value < -40 °C (-40 °F) 902 AMBIENT TEMPERATURE HIGH: Ambient temperature too high; RJ_Value > 85 °C (185 °F) 261 ELECTRONICBOARD: Electronics module/hardware faulty 437 CONFIGURATION ERROR: A wrong configuration set in the device 431 NO CALIBRATION: Calibration values lost/modified 283 MEMORY ERROR: Contents of memory inconsistent 221 RJ ERROR: Error in reference junction measurement/internal temperature measurement
Actual status channel/previous status channel (ACTUAL/ PREVIOUS_ STATUS_ CHANNEL)	Read only / AUTO - OOS	Past/current channel for status message.
Actual status count (ACTUAL_ STATUS_ COUNT)	Read only / AUTO - OOS	The number of status messages currently pending in the device.
Primary value max. indicator PV1_MAX_ INDICATOR	AUTO - OOS	Maximum indicator for the maximum value to occur for PV1, can be reset by writing any value to this parameter.
Primary value min. indicator PV1_MIN_ INDICATOR	AUTO - OOS	Maximum indicator for the minimum value to occur for PV1, can be reset by writing any value to this parameter.
PV2 max. indicator PV2_MAX_ INDICATOR	AUTO - OOS	Maximum indicator for the maximum value to occur for PV2, can be reset by writing any value to this parameter.

Transducer Block "ADVANCED DIAGNOSTIC"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
PV2 min. indicator PV2_MIN_ INDICATOR	AUTO - OOS	Maximum indicator for the minimum value to occur for PV2, can be reset by writing any value to this parameter.
Sensor 1 max. indicator SV1_MAX_ INDICATOR	AUTO - OOS	Maximum indicator for the maximum value to occur at sensor 1, can be reset by writing any value to this parameter.
Sensor 1 min. indicator SV1_MIN_ INDICATOR	AUTO - OOS	Maximum indicator for the minimum value to occur at sensor 1, can be reset by writing any value to this parameter.
Sensor 2 max. indicator SV2_MAX_ INDICATOR	AUTO - OOS	Maximum indicator for the maximum value to occur at sensor 2, can be reset by writing any value to this parameter.
Sensor 2 min. indicator SV2_MIN_ INDICATOR	AUTO - OOS	Maximum indicator for the minimum value to occur at sensor 2, can be reset by writing any value to this parameter.
RJ max. indicator RJ_MAX_ INDICATOR	Read only	Maximum indicator for internal reference temperature
RJ min. indicator RJ_MIN_ INDICATOR	Read only	Minimum indicator for internal reference temperature

Transducer Block Display

The settings in the "Display" Transducer Block make it possible to display measured values from the two Transducer Blocks "Sensor 1 + 2" on the onsite display. Similarly, measured values from other FOUNDATION Fieldbus devices can also be displayed.
The selection is made by means of the DISPLAY_SOURCE_X[a] parameter. The number of decimal places displayed can be configured independently for every channel using the DISP_VALUE_X_FORMAT parameter. Symbols are available for the units °C, K, F and %. These units are displayed automatically when the measured value is selected. Other units can be entered as additional text and displayed.
This additional text is entered in the DISP_VALUE_X_TEXT parameter and has a maximum length of 16 characters. In addition, the display allows the user to display a scalable bar graph. The minimum and maximum values of the bar graph are specified by means of the DISP_VALUE_X_BGMIN and DISP_VALUE_X_BGMAX parameters. The "Display" Transducer Block can show up to 6 values alternately on the display, including the related text and bar graph. The system automatically switches between the values after a configurable time interval (between 4 and 20 seconds) which can be set in the ALTERNATING_TIME parameter.

The measured values of external devices are read into the device with the "Input Selector (ISEL)" or "PID" function block provided these values are available on the bus. Four values are available in the display from the Input Selector Block (ISEL) and one from the PID. The unit of the measured value is not displayed automatically for values from the Input Selector (ISEL) and PID Blocks. It is recommended to enter the unit as additional text here (DISP_VALUE_X_TEXT). The value displayed and its status are shown in the "DISPLAY_VALUE_X" parameter for every channel of the display.

Transducer Block "DISPLAY"		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Altenating time ALTERNATING_TIME	AUTO - OOS	Entry (in s) as to how long a value should be shown on the display. Setting from 4 to 60 s.
Display value x DISP_VALUE_X	Read only	Selected measured value: * Status * Value
Display source x DISP_SOURCE_X[a]	AUTO - OOS	For selecting the value to be displayed. Possible settings: * Off * Primary Value 1 * Sensor Value 1 * RJ Value 1 * Primary Value 2 * Sensor Value 2 * RJ Value 2 * ISEL In 1 * ISEL In 2 * ISEL In 3 * ISEL In 4 * PID In 1 *Note:* *If all six display channels are switched off (selection 'Off'), the value of the primary value 1 (PV1) is displayed. Primary value 2 (PV2) will be displayed if the value of the PV1 is not available (e. g. selection 'no sensor' at sensor Transducer block 1 parameter 'SENSOR_TYPE').*
Display text x DISP_VALUE_X_TEXT	AUTO - OOS	Text to be displayed on the selected value. *Note:* *Maximum 16 letters. Certain lower-case letters or special characters can be displayed on the 14-segment-display.*
Decimal places x DISP_VALUE_X_FORMAT	AUTO - OOS	For selecting the number of places displayed after the decimal point. Configuration option 0-3.
Bargraph max. x DISP_VALUE_X_BGMAX	AUTO - OOS	Scaling for the bar graph display. Specify the maximum value (100%) here.

Transducer Block “DISPLAY”		
Parameter	**Write Access With Operating Mode (MODE_BLK)**	**Description**
Bargraph min. x DISP_VALUE_X_BGMIN	AUTO - OOS	Scaling for the bar graph display. Specify the minimum value (0%) here.

a. X = Number of the display channel in question (1 to 6)

Configuration example:

The following measured values should be shown on the display:

- Value 1:

  Measured value to be displayed: Primary Value of sensor transducer 1
  Text to be displayed: TEMP PIPE 11
  Decimal places: 2
  Maximum temperature: 250 °C
  Minimum temperature: 50 °C

- Value 2:

  Measured value to be displayed: RJ Value of sensor transducer 2
  Text to be displayed: INTERN TEMP
  Decimal places: 1
  Maximum temperature: 0 °C
  Minimum temperature: 40 °C

- Value 3:

  Measured value to be displayed: Measured value of an external device read in by the bus with Input Selector (ISEL) Channel 2
  Text to be displayed: VALVE 3 POS
  Decimal places: 3
  Maximum temperature: 0
  Minimum temperature: 100

Every measured value should be visible on the display for 12 seconds.

For this purpose, the following settings should be made in the "Display" Transducer Block:

Parameter	Value
DISP_SOURCE_1	’Primary Value 1’
DISP_VALUE_1_TEXT	TEMP PIPE 11

Parameter	Value
DISPLAY_VALUE_1_FORMAT	'xxx.xx'
DISP_VALUE_1_BGMAX	250
DISP_VALUE_1_BGMIN	50
DISP_SOURCE_2	'RJ Value 2'
DISP_VALUE_2_TEXT	INTERN TEMP
DISPLAY_VALUE_2_DECIMAL_PLACES	'xxxx.x'
DISP_VALUE_2_BGMAX	40
DISP_VALUE_2_BGMIN	0
DISP_SOURCE_3	'ISEL IN 2'
DISP_VALUE_3_TEXT	VALVE 3 POS
DISPLAY_VALUE_3_DECIMAL_PLACES	'xx.xxx'
DISP_VALUE_3_BGMAX	100
DISP_VALUE_3_BGMIN	0
ALTERNATING_TIME	12

Description of the Function Block Parameters

The Function Block column indicates what function blocks the parameter appears in.

Analog Input = AI

In the Analog Input (AI) function block, the process variables of the Transducer Blocks are prepared for subsequent automation functions (e.g. linearization, scaling and limit value processing). The automation function is defined by connecting up the outputs.

PID controller = PID

A PID function block contains the input channel processing, the proportional integral-differential control (PID) and the analog output channel processing. The configuration of the PID function block depends on the automation task. The following can be realized: Basic controls, feedforward control, cascade control, cascade control with limiting.

Input Selector = ISEL

The signal selector block (Input Selector block = ISEL) provides selection of up to four inputs and generates an output based on the configured action.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
ACK_OPTION	AI PID	ROUT - RCAS - CAS - AUTO MAN - OOS	This parameter is used to specify whether a process alarm must be acknowledged at the time of alarm recognition by the fieldbus host system. If this option is enabled, the process alarm is acknowledged automatically. Options: 1 HI_HI_ALM Upper limit value alarm 2 HI_ALM Upper limit value/warning 3 LO_LO_ALM Lower limit value alarm 4 LO_ALM Lower limit value/warning 5 DV_HI_ALM Limit alarm for upper differential control (SP-PV) 6 DV_LO_ALM Limit alarm for lower differential control (SP-PV) DISC ALM Write protection no longer exists, thus data access 7 BLOCK ALM Block alarm Factory setting: The option is not enabled for any alarm, the alarms must be acknowledged
ALARM_HYS	AI PID	AUTO - MAN - OOS	For entry of the hysteresis value for the upper and lower warning or alarm limit values. The alarm conditions remain active as long as the measured value is within the hysteresis. The hysteresis value affects the following warning and alarm limit values of the PID function block: HI_HI_ALM Upper limit value alarm HI_ALM Upper limit value warning LO_LO_ALM Lower limit value alarm LO_ALM Lower limit value warning DV_HI_ALM Limit value for upper control deviation DV_LO_ALM Limit value for lower control deviation
ALARM_SUM	AI PID	AUTO - MAN - OOS	The current status of the process alarms appears on the display (0 = OK/inactive; 1 = error/active) Display: HI_HI_ALM Violation of the upper limit value alarm HI_ALM Violation of the upper limit value warning LO_LO_ALM Violation of the lower limit value alarm LO_ALM Violation of the lower limit value warning DV_HI_ALM Violation of the limit value alarm for the upper control deviation DV_LO_ALM Violation of the limit value alarm for the lower control deviation DISC_ALM Write protection BLOCK ALM Block alarm
ALERT_KEY	AI PID ISEL	MAN - OOS	The identification number of the plant unit. Thios information may be used in the host for sorting alarms, and so forth.
BAL_TIME	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	This parameter is used to enter the time for which the weighting factor counteracts the integral term of the saturation (calculated actuating variable > OUT_HI_LIM).

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
BKCAL_HYS	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	For entering the hysteresis value for the upper and lower actuating variable range limit value OUT_HI_LIM and OUT_LO_LIM. The hysteresis value is a percentage of the value in the OUT_SCALE parameter group. If the calculated actuating variable is outside the range defined by the range limit values then this range violation is shown in the LIMITS monitoring parameter in the OUT parameter group and communicated to the subsequent blocks. The range violation remains active whilst the value of the calculated actuating variable is outside the hysteresis value.
BKCAL_IN	PID	Read only	Displays the analogue input value and status copied in the case of cascade control from the output BKCAL_OUT of the subsequent function block. The cascade control is initialized with this value to provide smooth transfer.
BKCAL_OUT	PID	Read only	Displays the analogue output value and output status transferred in the case of cascade control to the input BKCAL_IN of the preceding function block. The cascade control is initialized with this value to provide smooth transfer.
BLOCK_ALM	AI PID ISEL	AUTO - MAN - OOS	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. The block alarm is triggered in the event of the following block errors: * SIMULATE ACTIVE * INPUT FAILURE * OUT OF SERVICE * OUTPUT FAILURE * READBACK FAILURE * BLOCK CONFIG ERROR *Note:* *If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*
BLOCK_ERR	AI PID ISEL	Read only	This paramter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors can be shown.
BYPASS	PID	MAN - OOS	This parameter can be used to activate and deactivate calculation of the actuating variable by the PID control algorithm. Options: Uninitialized OFF Bypass deactivated: The actuating variable determined by the PID control algorithm is output via the OUT parameter. ON BYPASS activated: The value of the setpoint value SP is output directly via the OUT parameter. ***Caution*** *The BYPASS parameter is enabled in the controller options (CONTROL_OPTS parameter). This must be set before commissioning.*
CAS_IN	PID	Read only	Displays the remote setpoint value and status copied from an external function block in the CAS operating mode. This value is shown in the unit of the PV_SCALE parameter group. *Note:* *The remote setpoint value read in via the CAS_IN parameter is only used if the PID function block is in the CAS operating mode. In the AUTO operating mode the value of SP parameter is used as a setpoint value.*
CHANNEL	AI	OOS	Assignment between the logical hardware channels of the Transducer Block and the input of the relevant Analog Input function block. The device has got six possible channels.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
CONTROL_ OPTS	PID	OOS	For selecting the available controller options for specifying the automation strategy. Options: Bypass Enable Activates the BYPASS parameter Direct Acting Direct effect Track Enable Activates tracking Track in Manual MAN operating mode with active tracking PV for BKCAL_OUT Use value and status of the PV parameter for the BKCAL_OUT parameter No OUT Limits in Manual No output restriction in the MAN operating mode. If the range limit values OUT_HI_LIM or OUT_LO_LIM are exceeded or undershot, this has no effect on the OUT parameter.
DISABLE_n	ISEL	Read only	Parameter that switches off the corresponding input (1 to 4). If this parameter has the status "Disable", the corresponding input should not be used in determining the output.
DV_HI_ALM	PID	Read only	Status display of the alarm for the upper control deviation, including details of the time of the alarm (date, time) and the value that triggered the alarm. The controlled variable exceeds the setpoint value by more than the value specified in the DV_HI_LIM parameter. *Note:* *In addition the active block alarm can be acknowledged in this parameter group.*
DV_HI_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the limit value for the upper control deviation. If the controlled variable exceeds the setpoint value by this value, then the warning DV_HI_ALM is output. User input: Range and unit of PV_SCALE *Note:* *If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly.*
DV_HI_PRI	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Specifies the action taken when the upper control deviation (DV_HI_LIM) is exceeded. User input: 0 = Violation of the limit value for the upper control deviation is not evaluated. 1 = No notification if the limit value for the upper control deviation is infringed. 2 = Reserved for block alarms. 3-7 = Violation of the limit value for the upper control deviation is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = Violation of the limit value for the upper control deviation is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
DV_LO_ALM	PID	Read only	Alarm status display for the lower control deviation, including details of the time of the alarm (date, time) and the value that triggered the alarm. The controlled variable is below the setpoint value by more than the value specified in the DV_LO_LIM parameter. *Note:* *In addition the active alarm can be acknowledged in this parameter group.*
DV_LO_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the limit value for the lower control deviation. If the controlled variable is below the setpoint value by this value then the warning DV_LO_ALM is output. User input: Range and unit of PV_SCALE
DV_LO_PRI	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Specifies the action taken if the lower control deviation (DV_LO_LIM) is not reached. User input: 0 = Violation of the limit value for the lower control deviation is not evaluated. 1 = No notification if the limit value for the lower control deviation is infringed. 2 = Reserved for block alarms. 3-7 = Violation of the limit value for the lower control deviation is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = Violation of the limit value for the lower control deviation is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
FF_GAIN	PID	MAN - OOS	Entry of the disturbance gain for the feedforward control. The disturbance gain is multiplied by the disturbance variable (FF_VAL), the result is added to the calculated actuating variable.
FF_SCALE	PID	MAN - OOS	Definition of the measurement range (lower and upper limit), the physical unit and the number of decimal places for the disturbance variable (FF_VAL).
FF_VAL	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Display and entry of the value and status of the disturbance variable. User input:Range and unit of FF_SCALE
FSAFE_TYPE	AI	MAN - OOS	Enables you top switch between Fail Safe Value, Last Good Value, and Wrong Value.
FSAFE_VALUE	AI	MAN - OOS	Enables you to enter a Fail Safe Value.
FIELD_VAL	AI	Dynamic / read only	Displays the process variable with the associated status from the Transducer Block. The value relates to a percentage of the input range XD_SCALE and when simulation is active is replaced by the simulation value. FIELD_VAL = 100 x (process variable - XD_SCALE_0%) (XD_SCALE_100% - XD_SCALE_0%)
GAIN	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of proportional gain factor K_P (Factor). If the value 0 is specified for this parameter then the status of the OUT parameter changes to BAD.
GRANT_DENY	AI PID ISEL	AUTO - OOS	Enables or restricts the access authorization of a fieldbus host system to the field device.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
HI_ALM	AI PID	Read only	Alarm status display for the upper warning limit value (HI_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. *Note:* *In addition the active alarm can be acknowledged in this parameter group. If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*
HI_HI_ALM	AI PID	Read only	Alarm status display for the upper alarm limit value (HI_HI_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. *Note:* *In addition the active alarm can be acknowledged in this parameter group. If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*
HI_HI_LIM	AI PID	AUTO - MAN - OOS	Entry of the alarm limit value for the upper alarm (HI_HI_ALM). If the output value OUT exceeds this limit value then the HI_HI_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
HI_HI_PRI	AI PID	AUTO - MAN - OOS	Specifies the action taken when the upper alarm limit value (HI_HI_LIM) is exceeded. User input: 0 = The violation of the upper alarm limit is not evaluated. 1 = No notification if the upper alarm limit is infringed. 2 =Reserved for block alarms. 3-7 = The violation of the upper alarm limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the upper alarm limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
HI_LIM	AI PID	AUTO - MAN - OOS	Entry of the alarm limit value for the upper warning (HI_ALM). If the output value OUT exceeds this limit value, then the HI_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
HI_PRI	AI PID	AUTO - MAN - OOS	Specifies the action taken when the upper early warning alarm limit value (HI_LIM) is exceeded. User input: 0 = The violation of the upper early warning limit is not evaluated. 1 = No notification if the upper warning limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the upper warning limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the upper warning limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
IN	PID	Read only	Displays the controlled variable with information on the status and value. Scaling of the input range and selection of the unit of the controlled variable are carried out via the PV_SCALE parameter group.
IN_n	ISEL	MAN	Auxiliary input value n of the block. Normally read only unless simulation in MAN is possible, see respective block description.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
IO_OPTS	AI	OOS	Activates the options for processing the input and output values of the function block (I/O options). The following options when the appropriate bit is set to true. 0: Invert 1: SP-PV Track in Man 2: Reserved 3: SP-PV Track in LO 4: SP Track retained target 5: Increase or close 6: Fault State to value 7: Use Fault State value on restart 8: Target to Man if Fault State activated 9: Use PV for BKCAL_OUT 10: Low cutoff
L_TYPE	AI	MAN	For selecting the type of linearization for the input value. Options: Uninitialized Direct: With this setting the measured value from the Transducer Block (input value) avoids the linearization function and is looped unchanged with the same unit by the Analog Input function block. This setting must be selected when the input value already has got the designated phyical units. **PV = input value** Indirect (linear conversion): With this setting the measured value from the Transducer Block (input value) is rescaled linearly via the input scaling XD_SCALE to the desired output range OUT_SCALE. **PV = (FIELD_VAL / 100) x (OUT_SCALE 100% - OUT_SCALE 0%) - OUT_SCALE 0%** Indirect Square Root: With this setting the measured value from the Transducer Block (input value) is rescaled via the XD_SCALE parameter group and recalculated using a square root function. Further rescaling follows to the desired output range via the OUT_SCALE parameter group. **PV = (÷(FIELD_VAL / 100)) x (OUT_SCALE 100% - OUT_SCALE 0%) - OUT_SCALE 0%**
LO_ALM	AI PID	Read only	Alarm status display for the lower warning limit value (LO_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. *Note:* *In addition the active alarm can be acknowledged in this parameter group. If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*
LO_LIM	AI PID	AUTO - MAN - OOS	Entry of the alarm limit value for the lower warning (LO_ALM). If the output value OUT is below this limit value then the LO_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
LO_LO_ALM	AI PID	Read only	Alarm status display for the lower alarm limit value (LO_LO_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. *Note:* *In addition the active alarm can be acknowledged in this parameter group. If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.*

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
LO_LO_LIM	AI PID	AUTO - MAN - OOS	Entry of the alarm limit value for the lower alarm (LO_LO_ALM). If the output value OUT is below this limit value then the LO_LO_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
LO_LO_PRI	AI PID	AUTO - MAN - OOS	Specifies the action taken when the lower alarm limit value (LO_LO_LIM) is not reached. User input: 0 = The violation of the lower alarm limit is not evaluated. 1 = No notification to master if the lower alarm limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the lower alarm limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the lower alarm limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
LO_PRI	AI PID	AUTO - MAN - OOS	Specifies the action taken when the lower pre alarm limit value (LO_LIM) is exceeded. User input: 0 = the violation of the lower warning limit is not evaluated. 1 = no notification to master if the lower warning limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the lower warning limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the lower warning limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority.
LOW_CUT	AI	AUTO - MAN - OOS	This parameter is used in flow measurement for example. For entry of a limit value for the Low Flow Cut Off. If the converted measured value is below this limit value then PV is shown as zero. User input: Range and unit of OUT_SCALE
MIN_GOOD	ISEL	MAN - OOS	If the number of inputs which are good is less than the value of MIN_GOOD the OUT status is set to bad.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
MODE_BLK	AI PID ISEL	AUTO - MAN - OOS	Displays the current (Actual) and desired (Target) operating mode of the Analog Input function block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO - MAN - OOS - CAS - RCAS - ROUT *Note:* *The Analog Input function block supports the following operating modes:* AUTO (automatic mode): The block is executed. MAN (manual intervention by the operator): The output value OUT can be specified. OOS (out of service): The block is in the “out of service” mode. With the output value OUT the last valid value is output. The status of the output value OUT switches to BAD. CAS (Cascade Mode) Via the input or CAS_IN parameter, the PID function block receives the setpoint value for internal calculation of the actuating variable directly from another function block. The internal PID algorithm is executed. RCAS (External Cascade) Via the RCAS_IN parameter, the PID function block receives the setpoint value for internal calculation of the actuating variable directly from the fieldbus host system. The internal PID algorithm is executed. ROUT (External Output) Via the ROUT_IN parameter, the PID function block receives the actuating value directly from the fieldbus host system. The actuating variable is output again via the OUT parameter without the internal PID algorithm being executed.
OP_SELECT	ISEL	AUTO - MAN - OOS	An operator settable parameter to force a given input to be used.
OUT	AI PID ISEL	MAN - OOS	Displays the output value with alarm evaluation and the status of the Analog Input function block. User input: Range and unit of OUT_SCALE In the PID Block, the output value OUT is a function of the range limit values OUT_HI_LIM and OUT_LO_LIM.
OUT_HI_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the maximum permissible analogue actuating variable that can be output from the PID function block. User input: Range and unit of OUT_SCALE ±10
OUT_LO_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the minimum permissible analogue actuating variable that can be output from the PID function block. User input: Range and unit of OUT_SCALE ±10
OUT_RANGE	ISEL	OOS	The display scaling for the output. It has no effect on the block.
OUT_SCALE	AI PID	MAN - OOS	Definition of the output range (lower and upper limit), the physical unit and the number of decimal places for the output value (OUT). Defining the measurement range in this parameter group does not restrict the output value OUT. If the output value OUT is outside the measurement range, this value is transferred.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
PV	AI PID	Read only	Displays the process variable used for the block execution, including the status of the process variable. *Note:* *The unit used is copied from the OUT_SCALE parameter group.*
PV_FTIME	AI PID	AUTO - MAN - OOS	Entry of the filter time constant (in seconds) of the digital filter of the 1st order. This time is required in order for 63% of a change in the FIELD_VAL parameter to have an effect on the value of PV.
PV_SCALE	AI PID	OOS	Definition of the measurement range (lower and upper limit), the physical unit and the number of decimal places for the process variable (PV). *Note:* *If this parameter group is modified then the following parameters should be checked and modified if necessary:* - DV_HI_LIM- DV_LO_LIM - HI_LIM- HI_HI_LIM - LO_LIM- LO_LO_LIM - RCAS_IN- RCAS_OUT - SP_LO_LIM- SP_HI_LIM - SP
RATE	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the time constant for the derivative action T_d (D-term).
RCAS_IN	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	In this parameter the analogue actuating variable provided by the fieldbus host system (value and status) is read in for internal calculation of the actuating variable and displayed. * Value statement and unit of PV_SCALE * If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly. * This parameter is only active in the RCAS operating mode.
RCAS_OUT	PID	Read only	Displays the analogue output value and output status of the specified setpoint value transferred to the fieldbus host system in the course of cascade control. The cascade control is initialized with this value to provide smooth transfer. * Value statement and unit of PV_SCALE * If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly. * This parameter is only active in the RCAS operating mode.
RESET	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the time constant for the integral action T_r (I-term). The integral function is disabled by entering 0 seconds.
ROUT_IN	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	In this parameter the actuating variable provided by the fieldbus host system (value and status) is read in and displayed. * Value statement and unit of OUT_SCALE * This parameter is only active in the ROUT operating mode. * The PID algorithm is no longer executed.
ROUT_OUT	PID	Read only	Displays the analogue output value and output status of the actuating variable transferred to the fieldbus host system in the course of cascade control. The cascade control is initialized with this value to provide smooth transfer. * Value statement and unit of OUT_SCALE * This parameter is only active in the ROUT operating mode.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
SELECT_TYPE	ISEL	AUT - OOS	Determines the selector action. * First Good: First usable input value * Minimum: Minimum usable value * Maximum: Maximum usable value * Middle: Middle value or average, depending upon number of usable inputs * Average: Average of all usable inputs
SELECTED	ISEL	AUTO - MAN	An integer indicating which input of the block has been selected by the SELECT_TYPE algorithm. Can be overwritten when OP_SELECT is greater than 0.
SHED_OPT	PID	ROUT - RCAS - AUTO - MAN - OOS	For selecting the action taken if the monitoring time is exceeded (see SHED_RCAS, SHED_ROUT parameters) in the RCAS or ROUT operating mode. During the monitoring time parameter updating between the fieldbus host system and the PID function block is checked. If the parameters are not being updated, the PID function block switches from the RCAS or ROUT operating mode to the mode selected here when the monitoring time elapses. Options: 0: Uninitialized 1: NormalShed_NormalReturn 2: NormalShed_NoReturn 3: ShedToAuto_NormalReturn 4: ShedToAuto_NoReturn 5: ShedToManual_NormalReturn 6: ShedToManual_NoReturn 7: ShedToRetainedTarget_NormalReturn 8: ShedToRetainedTarget_NoReturn
SIMULATE	AI	AUTO - MAN - OOS	Simulation of the input value and input status. Since this value runs through the entire algorithm, the behavior of the Analog Input function block can be checked. The BLOCK_ERROR parameter of the Resource Block shows whether simulation is possible
SP	PID	AUTO - MAN - OOS	Entry of the analogue setpoint value. User input: Range and unit of PV_SCALE ±10% If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly.
SP_HI_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the upper limit of the setpoint value. User input: Range and unit of PV_SCALE ±10 If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly.
SP_LO_LIM	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the lower limit of the setpoint value. User input: Value and range of PV_SCALE ±10 If the setting for the end of the scale is changed in the PV_SCALE parameter this value should be modified accordingly.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
SP_RATE_DN	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the ramping rate of a diminishing setpoint value in the AUTO operating mode. * If the value "0" is entered then this parameter is deactivated and the setpoint value is used directly. * In control blocks, the speed restriction is only active in the AUTO operating mode. In output blocks, the restriction is active in AUTO, CAS and RCAS.
SP_RATE_UP	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of the ramping rate of an increasing setpoint value in the AUTO operating mode. * If the value "0" is entered then this parameter is deactivated and the setpoint value is used directly. * In control blocks, the speed restriction is only active in the AUTO operating mode. In output blocks, the restriction is active in AUTO, CAS and RCAS.
STATUS_OPTS	AI PID ISEL	OOS	For selecting the available status options for specifying the status processing and processing of the OUT output parameter. Options: IFS if Bad IN Trigger disturbance status of subsequent Analog Output function block if the controlled variable (IN) changes the status to BAD. IFS if Bad CAS_IN Trigger disturbance status of downstream Analog Output function block if the external setpoint value (CAS_IN) changes the status to BAD. Use Uncertain as Good The status UNCERTAIN is used as GOOD. Target In Manual if Bad IN Switch to the MAN operating mode if the controlled variable switches the status to BAD. etc.
STRATEGY	AI PID ISEL	ROUT - RCAS - CAS - AUTO - MAN - OOS	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. *Note:* *This data is neither checked nor processed by the Analog Input function block.*
ST_REV	AI PID ISEL	Read only	The revision level of the static dataassociated with the function block. To support tracking changes in static parameter attributes, the associated block's static revision parameter is incremented each time a static parameter attribute value wa changed. Also the associated block's static revision parameter can be incremented if a static parameter attribute is written but the value is not changed.
TAG_DESC	AI PID ISEL	ROUT - RCAS - CAS - AUTO - MAN - OOS	Entry of a user-specific text of max. 32 characters for unique identification and assignment of the block.
TRK_IN_D	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Displays the discrete input (value and status) that initiate the external tracking function. On activation of tracking the operating mode switches to LO (Local Compulsory Tracking). In so doing the actuating variable at the output OUT adopts the value specified at input TRK_VAL.
TRK_SCALE	PID	MAN - OOS	Definition of the measurement range (lower and upper limit), the physical unit and the number of decimal places for the external tracking variable (TRK_VAL). This normally matches the OUT_SCALE parameter.

Parameter	Function Block	Write Access With Operating Mode (Mode_blk)	Description
TRK_VAL	PID	ROUT - RCAS - CAS - AUTO - MAN - OOS	Displays the analogue input value and input status read in from another function block for the external tracking function in the unit of the TRK_SCALE parameter group.
UPDATE_EVT	AI PID ISEL	Read only	Indicates whether static block data have been altered, including date and time.
XD_SCALE	AI	MAN - OOS	In this parameter group the measurement range of the sensor is scaled and the unit of the process variable is determined. User input: Measurement range of the sensor * Defining the measurement range in this parameter group does not represent a restriction. If the value is outside the measurement range, it is transferred nonetheless. * The unit selected in this parameter group is also valid for the Transducer Block. If the unit is changed in XD_SCALE parameter, this unit will also be adapted automatically in the connected unit at the Transducer function block. An exception is the connection with the internal temperature, whose unit won't be adapted automatically at the Transducer function block. * Entry of the measurement range via the XD_SCALE parameter does not restrict the output.

4. RTT30 DTM

This chapter provides information that is exclusive to using the RTT30 Temperature Transmitter with Foundation fieldbus communications protocol.

Display/Operation screen

The Display/Operation screen allows you to configure what the display will show. White fields are writeable while grayed fields are not, as shown in Figure 13.

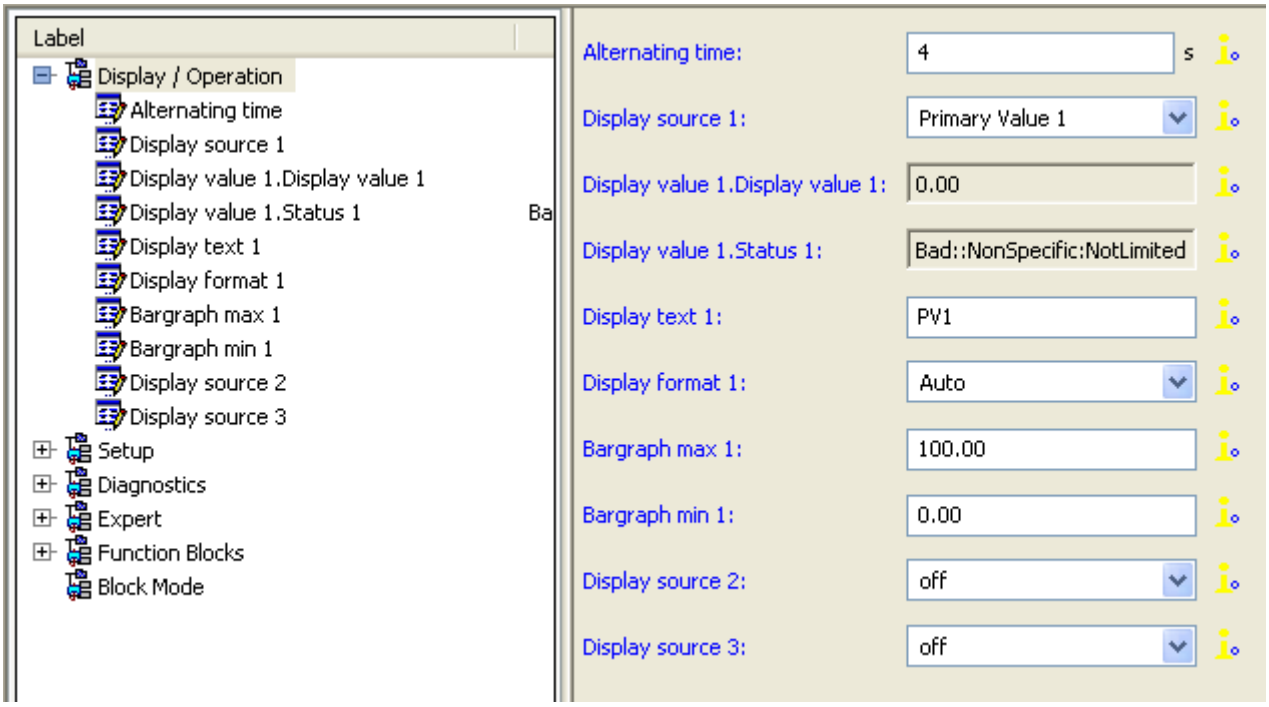

Figure 13. Display/Operation Screen

Table 5. Display/Operation Fields and Functionalities

Field	Entry
Alternating Time	Enables you to specify, in seconds, how long each value will be displayed, before toggling, when more than one is displayed. Up to 3 variables can be mapped to the display. These include inputs of the Input Selector function block, which enables mapping of outputs from other devices on the bus segment to this display
Display Source 1	Enables you to specify the source for the 1st display measurement. This can be Sensor Value 1, Sensor Value 2, Primary Value 1, Primary Value 2, Reference Junction Temperature, Input Selector inputs 1 through 4, or PID Input 1

Table 5. Display/Operation Fields and Functionalities

Field	Entry
Display Text 1	Enables you to define the text that displayed in the 14-segment area
Display Format 1	Enables you to specify where the decimal will be placed
Bargraph Max 1	Value that represents the bargraph at 100%
Bargraph Min 1	Value that represents the bargraph at 0%
Display Source 2	Has the same selections as those in Display Source1
Display Source 3	Has the same selections as those in Display Source1

Setup screen

The Setup screen allows you to configure what sensor connections are to be defined for the transmitter. White fields are writeable while grayed fields are not, as shown in Figure 14.

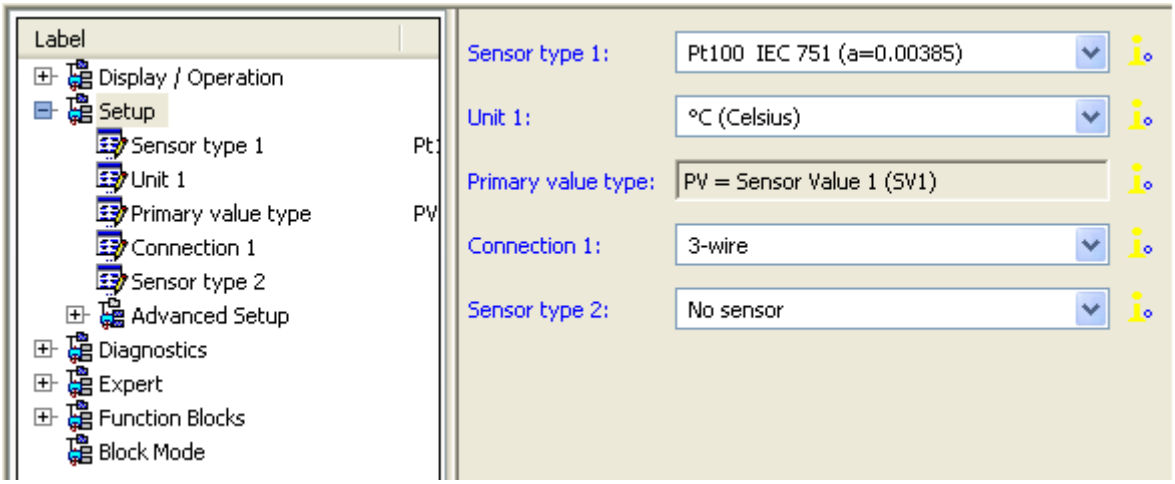

Figure 14. Setup Screen

Table 6. Setup Fields and Functionalities

Field	Description
Sensor Type 1 or Sensor Type 2	Enables you to define what type of sensor is connected to the respective input terminals
Unit 1 or Unit 2	Enables you to define the engineering unit that is to be associated with the respective measurement
Primary value type	Enables you to defines whether a direct measurement, differential measurement, average measurement, or redundant measurement is to be configured for Sensor 1 and Sensor 2
Connection 1 or Connection 2	Enables you to define the number of wires to be associated with the respective sensor *Note* *Thermocouple is a 2-wire only input*

Diagnostics Screen

The Diagnostics screen enables you to read the current and historical diagnostic information stored in the transmitter.

— NOTE

The diagnostic information can also be accessed via the Expert screen.

The information displayed in the diagnostics screen, includes:

- Actual diagnostic category
- Actual diagnostics code
- Actual diagnostics
- Actual diagnostics channels
- Actual diagnostic count
- Last diagnostic category
- Last diagnostics code
- Last diagnostics description
- Last diagnostics channel
- Static Revision

Expert Screen

The Expert screen allows you to navigate to 5 additional screens, System, Sensor, Diagnostics, Measured values, and Min-/max- values.

System Screen

The System screen allows you to set mains filter, system alarms, and the manifestation of ambient temperature alarms. An example of the System screen is shown in Figure 15.

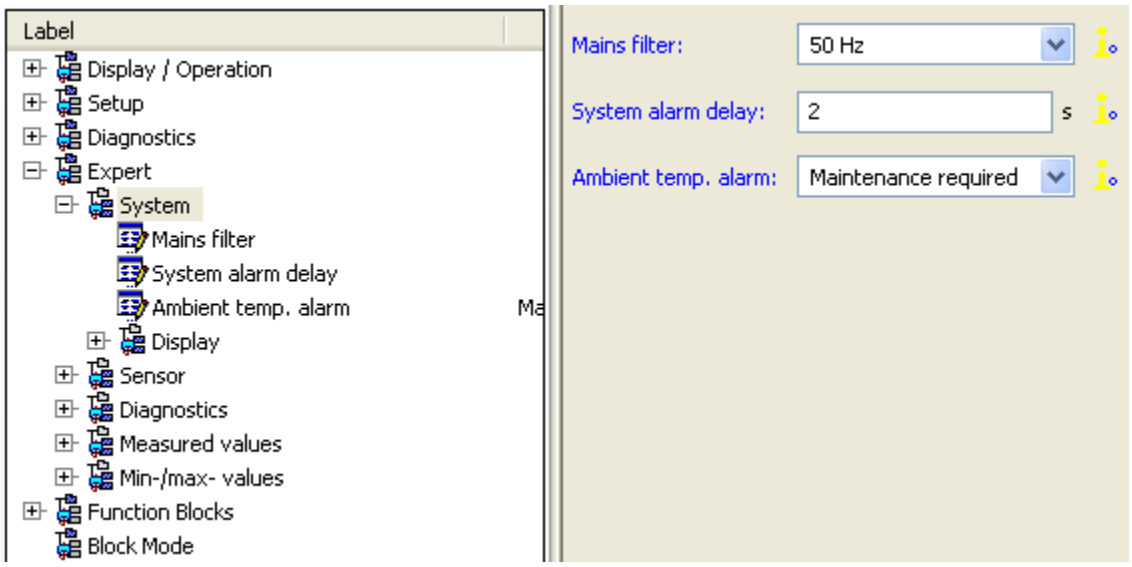

Figure 15. Example of a System Screen

Table 7. System Screen Fields and Functionalities

Field	Description
Mains filter	Enables you to set the mains filter to 50 or 60 Hz
System alarms delay	Enables you specify the delay time for a system alarm
Ambient temp. alarms	Enables you to specify how an ambient temperature alarm can be manifested. Use the drop-down menu to choose between Maintenance Required or Failure.

Sensor Screen

The Sensor screens replicates the configurable options in the Setup screen, as shown in Figure 16 and Figure 17.

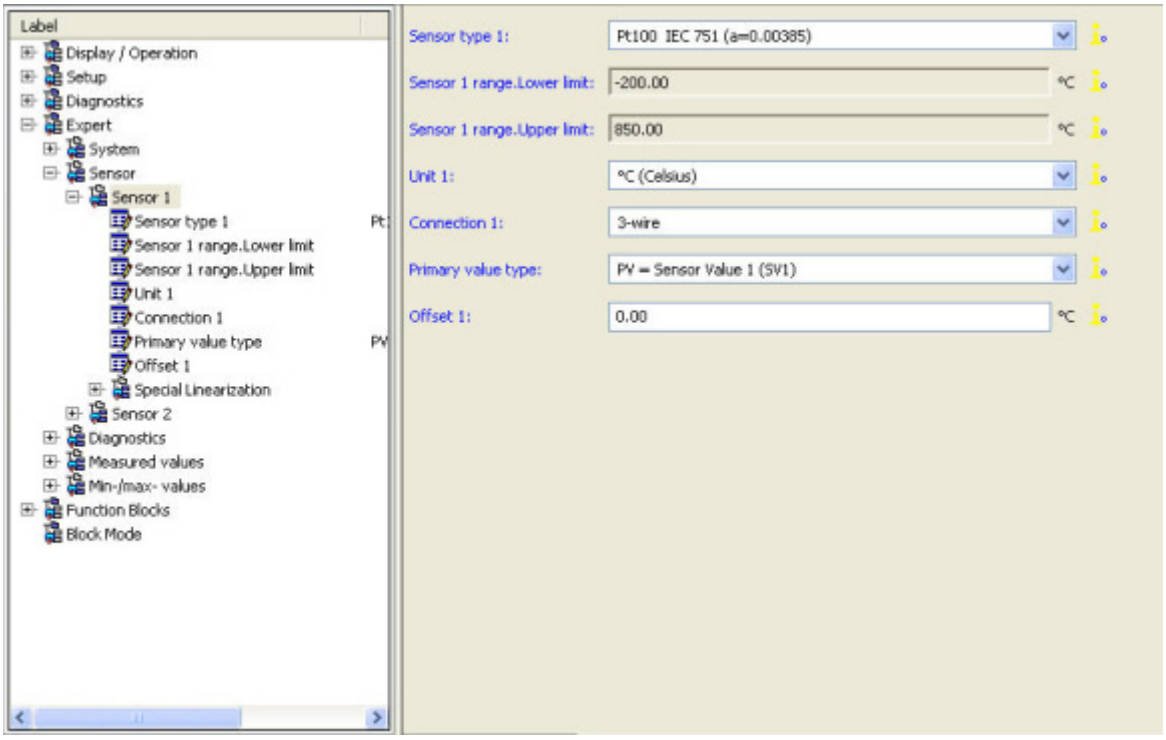

Figure 16. Example of a Sensor Screen 1

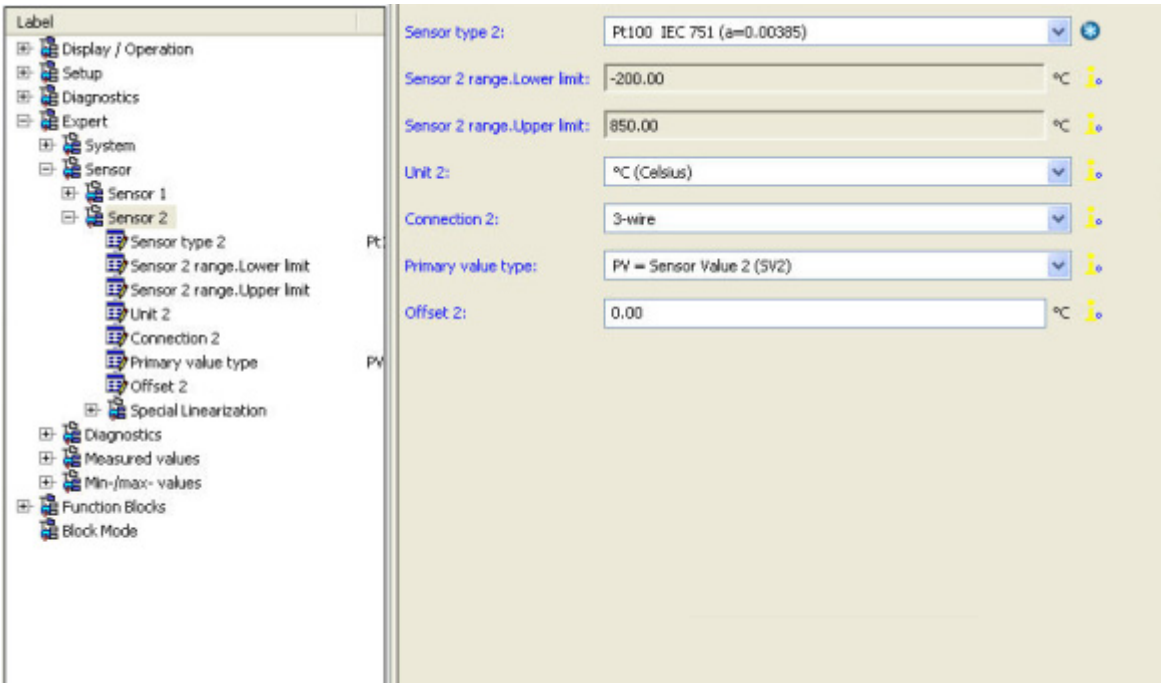

Figure 17. Example of a Sensor Screen 2

Diagnostics Screen

The Diagnostics subscreen replicates the information in the Diagnostics screen except that you can navigate to a System Information screen from within this screen, as shown in Figure 18.

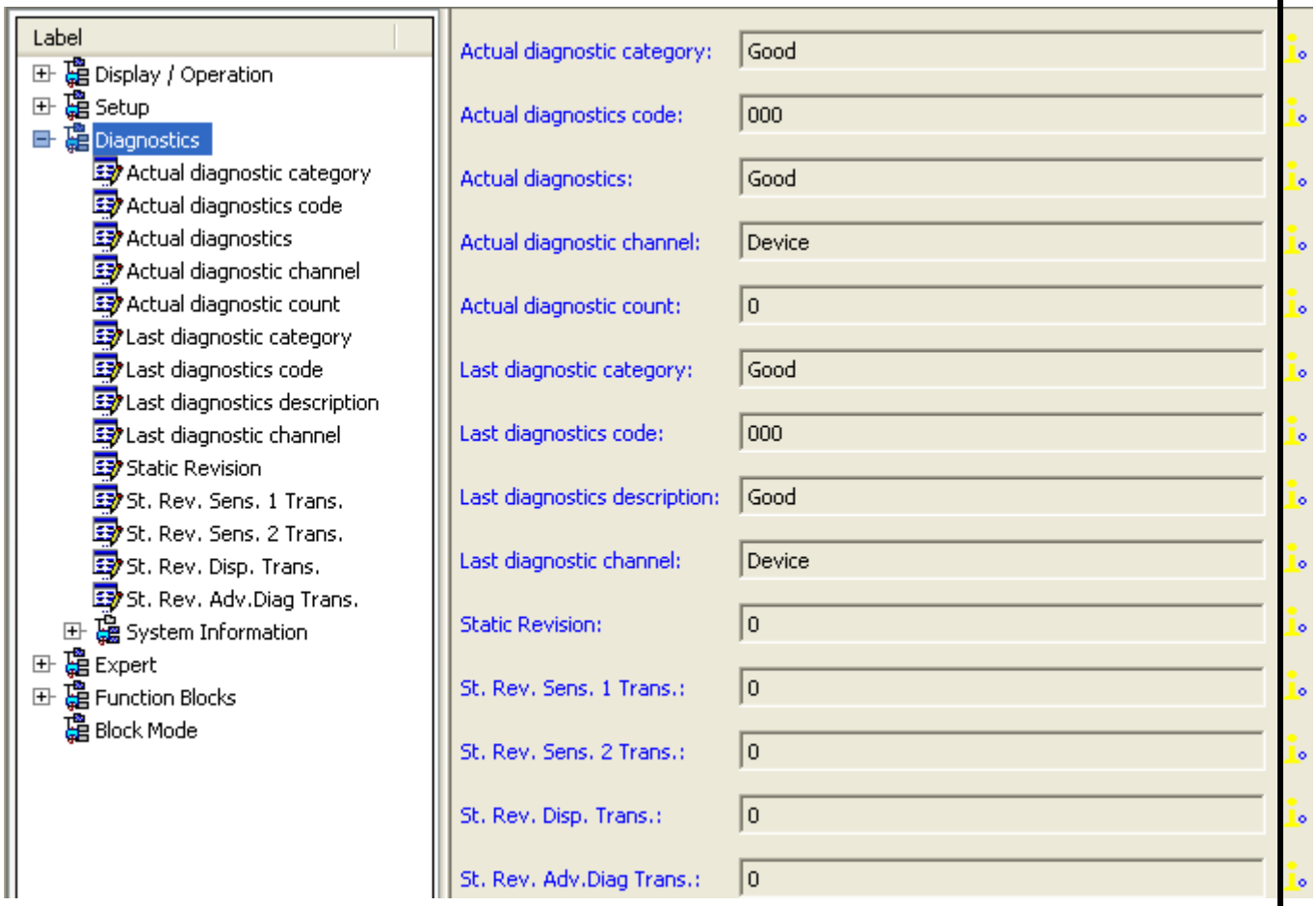

Figure 18. Example of a Diagnostics Subscreen

System Information Screen

The System Information screen gives you specific information about the transmitter to which a DTM is connected.

Measured Values Screen

The Measured Value screen depicts read-only information related to the measurement and the quality of measurement of each input, including sensor value and primary value, as shown in Figure 19.

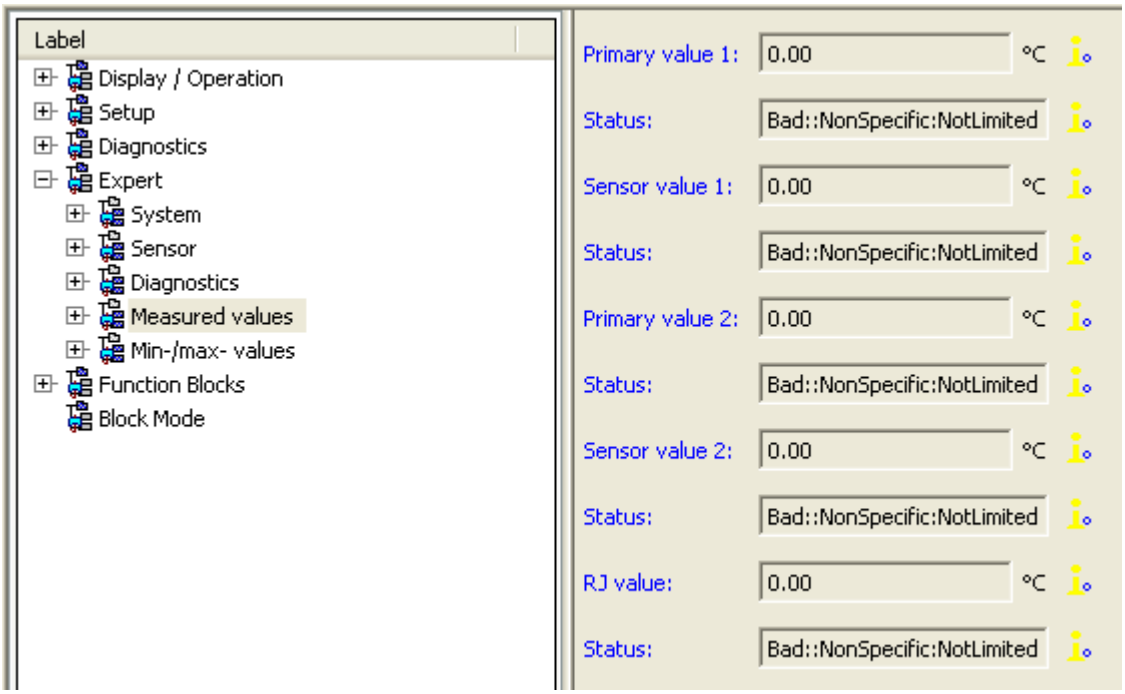

Figure 19. Example of a Measured Values Screen

NOTE

The primary value could be the same as the sensor value or it could be a calculated result of the 2 sensor measurements.

Min-/max - Values Screen

The Min-/max- values screen is a read-only screen showing the minimum and maximum values read by each measurement type, as shown Figure 20.

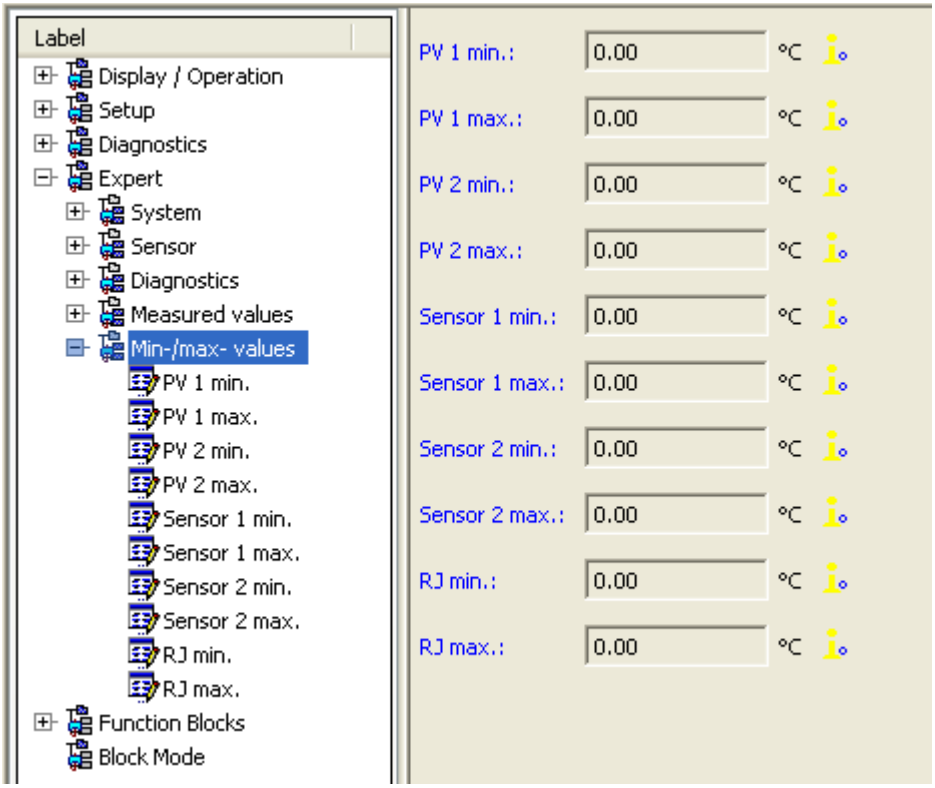

Figure 20. Example of a Min-/max- Values Screen

It displays information about the following:

- Process variables minimum
- Process variables maximum
- Sensor minimum
- Sensor maximum
- RJ minimum
- RJ maximum

Function Block Screen

The Function Blocks screen navigates to 3 subscreens related to each Analog Input block. Each subscreen allows for complete configuration of the respective Analog Input function block, as shown Figure 21.

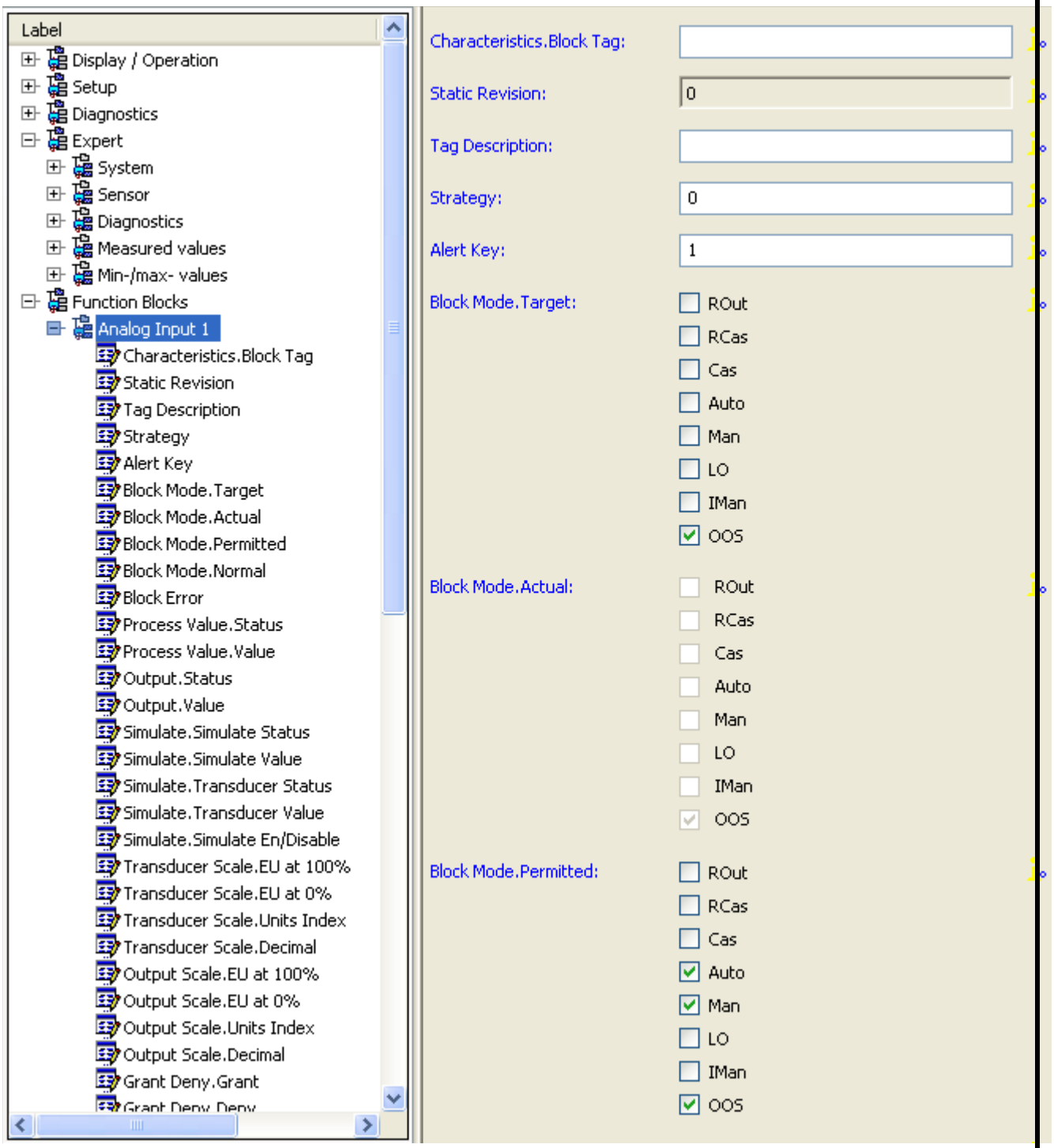

Figure 21. Example of an Analog Input Screen

Block Mode Screen

The Block Mode screen allows you to set the target modes for the Resource, Transducer, and Analog Input blocks, as shown in Figure 22.

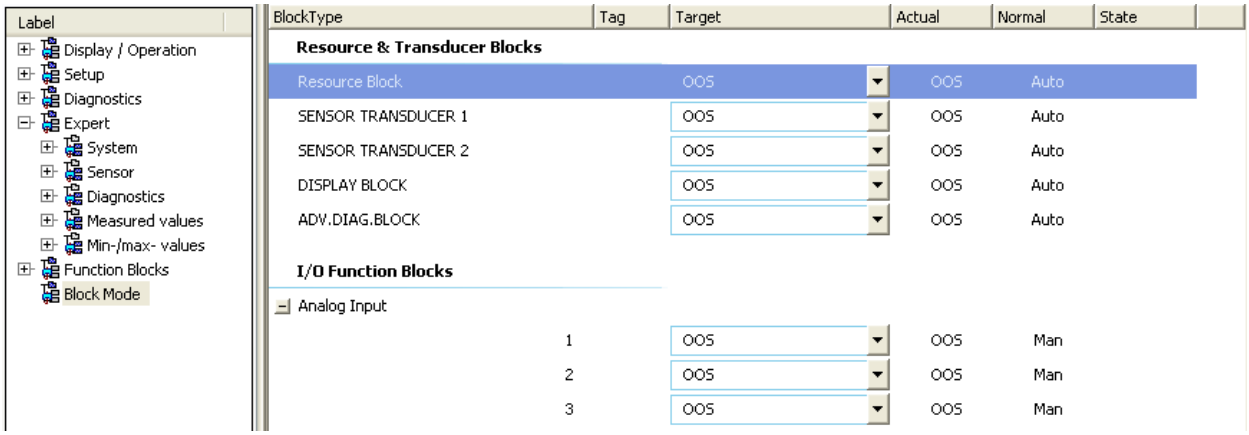

Figure 22. Example of a Block Mode Screen

NOTE

When performing online configuration, the respective block must be put out of service (OOS) via the Block Mode screen before parameter values can be written to the block.

5. Troubleshooting

Troubleshooting Instructions

The Warning icon and error code appear in the display on warnings and errors. During a failure a measured value can no longer be displayed, therefore the value is shown as "-----" alternating with the error code.

Always start troubleshooting with the checklists below if faults occur after start up or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

In the event of a serious fault, a measuring device might have to be returned to the manufacturer for repair.

Check Display (local display)	
No display visible - No connection to the FF host system.	1. Check the supply voltage →Terminals + and - 2. Electronics defective –Replace device
No display visible - However, connection has been established to the FF host system.	1. Check whether the retainers of the display module are correctly seated on the electronics module 2. Display module defective –Replace device 3. Electronics defective –Replace device

Local Error Messages on the Display
See “Status Messages” on page 67.

Faulty Connection to the Fieldbus Host System	
No connection can be made between the fieldbus host system and the device. Check the following points:	
Fieldbus connection	Check data lines
Fieldbus connector (optional)	Check pin assignment / wiring
Fieldbus voltage	Check that a minimum bus voltage of 9 V dc is present at the +/- terminals. Permissible range: 9 to 32 V dc

Network structure	Check permissible fieldbus length and number of spurs
Basic current	Is there a basic current of min. 11 mA
Terminating resistors	Has the FOUNDATION Fieldbus network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in communication.
Current consumption Permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply unit.

Error Messages in the FF Configuration Program
See "Status Messages" on page 67.

Problems When Configuring Function Blocks	
Transducer Blocks: The operating mode cannot be set to **AUTO**.	Check whether the operating mode of the Resource Block is set to **AUTO** ***Caution**: Make sure that the unit selected suits the process variable chosen in the **SENSOR_TYPE** parameter. Otherwise the **BLOCK_ERROR** parameter displays the "Block Configuration Error" error message. In this state, the operating mode cannot be set to **AUTO**.*

Analog Input function block: The operating mode cannot be set to **AUTO**.	There can be several reasons for this. Check the following points one after another: Check whether the operating mode of the Analog Input function block is set to **AUTO**. If not and the mode cannot be changed to **AUTO**, first check the following points. Make sure that the **CHANNEL** parameter (select process variable) has already been configured in the Analog Input function block. The option **CHANNEL = 0** (uninitialized) is not valid. Make sure that the **XD_SCALE** parameter group (input range, unit) has already been configured in the Analog Input function block. Make sure that the **L_TYPE** parameter (linearization type) has already been configured in the Analog Input function block. Check whether the operating mode of the Resource Block is set to **AUTO. MODE_BLK** parameter group / **TARGET** parameter Make sure that the function blocks are correctly connected together and that this system configuration has been sent to the fieldbus users.
Analog Input function block: Although the operating mode is set to **AUTO**, the status of the AI output value **OUT** is “BAD” or “UNCERTAIN”.	Check whether an error is pending in the Transducer Block “Advanced Diagnostic”→“Actual Status Category” and “Actual Status Number” parameters. See “Status Messages” on page 67.

Parameters cannot be changed or No write access to parameters	Parameters that only show values or settings cannot be changed (so-called Read-only-parameter)! The hardware write protection is enabled. Disable the write protection. You can check whether the hardware write protection is enabled or disabled via the **WRITE_LOCK** parameter in the Resource Block: **LOCKED** = write protection enabled **UNLOCKED** = write protection disabled The block operating mode is set to the wrong mode. Certain parameters can only be changed in the **OOS** (out of service) mode or the **MAN** (manual) mode. Set the operating mode of the block to the desired mode **MODE_BLK** parameter group. The value entered is outside the specified input range for the parameter in question: -Enter a suitable value -Increase input range if necessary
Transducer Blocks: The manufacturer-specific parameters are not visible.	The device description file (Device Description, DD) has not yet been loaded to the host system or the configuration program? Download the file to the configuration system. Make sure you are using the correct system files for integrating field devices into the host system. Relevant version information can be queried with RTT30 by means of the following functions/parameters: FOUNDATION Fieldbus interface: Resource Block - **DD_REV** parameter Example: Display in **DEV_REV** parameter – 02 Display in the **DD_REV** parameter - 02 Device description file (DD) required – 0202.sym/0202.ffo
Analog Input function block: The output value **OUT** is not updated despite a valid "GOOD" status.	Simulation is active –Deactivate simulation by means of the **SIMULATE** parameter group.

Status Messages

The device displays warnings or alarms as status messages. If errors occur during commissioning or measuring operation, these errors are displayed immediately. This takes place on the local display by means of the error message saved in the device and in the configuration program by means of the parameter in the Adv. Diagnostic Block. A distinction is made here between the following four status categories:

Status Category	Description	Error Category
F	Fault detected ('Failure')	ALARM
M	Maintenance necessary	WARNING
C	Device is in the service mode (check)	
S	Specifications not observed ('Out of specification')	

WARNING Error Category

With "M", "C" and "S" status messages, the device tries to continue measuring (uncertain measurement!). Alternating with the main measured value, the status is displayed onsite in the form of the letter in question plus the defined error number (7-segment display). The '#' symbol is also displayed.

ALARM Error Category

The device does not continue measuring when the status message is "F". No measured value is displayed on the device! Via the fieldbus the last measured value with the measured value status ’BAD’ will be transmitted. The fault condition is indicated on the display in the form of the letter "F" plus a defined number.

NOTE

In both instances, the 14-segment display outputs the sensor that generates the status, e.g. 'SENS1', 'SENS2'. If nothing is displayed on the 14-segment display, the status message does not refer to a sensor but refers to the device itself.

Category	No.	Status Messages ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block Local display	Error Messages in the Sensor Transducer Block in Question	Sensor Transducer Block Measured Value Status	Cause of Error / Remedy	Output Variables Affected
F-	041	Device status message (FF): Sensor break F-041 Local display: Δ F-041 SENS1 or SENS2	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: 1) Electr. interruption of sensor or sensor wiring 2) Incorrect setting for type of connection in the SENSOR_ CONNECTION parameter Remedy: 1) Reestablish electr. connection or replace sensor. 2) Configure correct type of connection.	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_error = Mechanical failure	SUBSTATUS = Sensor failure		
F-	042	Device status message (FF): Sensor corrosion F-042 Local display: Δ F-042 SENS1 or SENS2	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: Corrosion detected on the sensor terminals Remedy: Check wiring and replace if necessary	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = Mechanical failure	SUBSTATUS = Sensor failure		
M-	042	Device status message (FF): Sensor corrosion M-042 Local display: Δ M-042 ´ Measured value SENS1 or SENS2	BLOCK_ERR = Device needs maintenance now	QUALITY = UNCERTAIN	Cause of error: Corrosion detected on the sensor terminals Remedy: Check wiring and replace if necessary	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		
F-	043	Device status message (FF): Sensor shortcut F-043 Local display: Δ F-043 SENS1 or SENS2	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: Short circuit detected at the sensor terminals Remedy: Check sensor and sensor wiring	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = Mechanical failure	SUBSTATUS = Sensor failure		
F-	101	Device status message (FF): Under-usage of sensor range F-101 Local display: Δ F-101 SENS1 or SENS2	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: Physical measuring range undershot Remedy: Select suitable sensor type	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = General error	SUBSTATUS = Sensor failure		
M-	101	Device status message (FF): Under-usage of sensor range M-101 Local display: Δ M-101 ´ Measured value SENS1 or SENS2	BLOCK_ERR = Device needs maintenance now	QUALITY = UNCERTAIN	Cause of error: Physical measuring range undershot Remedy: Select suitable sensor type	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		
F-	102	Device status message (FF): Exceeded sensor range F-102 Local display: Δ F-102 SENS1 or SENS2	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: Physical measuring range overshot Remedy: Select suitable sensor type	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = General error	SUBSTATUS = Sensor failure		

Category	No.	Status Messages ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block Local display	Error Messages in the Sensor Transducer Block in Question	Sensor Transducer Block Measured Value Status	Cause of Error / Remedy	Output Variables Affected
M-	102	Device status message (FF): Exceedence of sensor range M-102 Local display: Δ M-102 ´ Measured value SENS1 or SENS2	BLOCK_ERR = Device needs maintenance now	QUALITY = UNCERTAIN	Cause of error: Physical measuring range overshot Remedy: Select suitable sensor type	SV1, SV2 Also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		
F-	103	Device status message (FF): Sensor drift detected F-103 Local display: Δ F-103	BLOCK_ERR = Other Input failure Device needs maintenance now	QUALITY = BAD	Cause of error: Sensor drift has been detected (in accordance with the settings in the Advanced Diagnostic Block) Remedy: Check the sensors depending on the application	PV1, PV2 SV1, SV2
			Transducer_Error = General error	SUBSTATUS = Sensor failure		
M-	103	Device status message (FF): Sensor drift detected M-103 Local display: Δ M-103 ´ Measured value	BLOCK_ERR = Device needs maintenance now	QUALITY = UNCERTAIN	Cause of error: Sensor drift has been detected (in accordance with the settings in the Advanced Diagnostic Block) Remedy: Check the sensors depending on the application	PV1, PV2 SV1, SV2
			Transducer_Error = No error	SUBSTATUS = Non-specific		
M-	104	Device status message (FF): Backup active M-104 Local display: Δ M-104 ´ Measured value	BLOCK_ERR = Device needs maintenance now	QUALITY = GOOD / BAD	Cause of error: Backup function activated and an error was detected at one sensor Remedy: Rectify sensor error	SV1, SV2 PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Ok / sensor failure		
F-	221	Device status message (FF): RJ Error F-221 Local display: Δ F-221	BLOCK_ERR = Device needs maintenance now	QUALITY = BAD	Cause of error: Internal reference junction defective Remedy: Device defective. Send to manufacturer for repair	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = General error	SUBSTATUS = Device failure		
F-	261	Device status message (FF): Electronics board defective F-261 Local display: Δ F-261	BLOCK_ERR = Other¾	QUALITY = BAD	Cause of error: Error in the electronics Remedy: Replace electronics module,	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = Electronic failure	SUBSTATUS = Device failure		
F-	283	Device status message (FF): Memory error F-283 Local display: Δ F-283	BLOCK_ERR = Other Lost static data	QUALITY = BAD	Cause of error: Error in memory Remedy: Replace electronics module,	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = Data integrity error	SUBSTATUS = Device failure		

Category	No.	Status Messages ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block Local display	Error Messages in the Sensor Transducer Block in Question	Sensor Transducer Block Measured Value Status	Cause of Error / Remedy	Output Variables Affected
C-	402	Device status message (FF): Startup of device C-402 Local display: Δ C-402 ´ Measured value	BLOCK_ERR = Power up	QUALITY = UNCERTAIN	Cause of error: Device starting/initializing Remedy: Message is only displayed during power-up	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = No error	SUBSTATUS = Non-specific		
F-	431	Device status message (FF): No calibration F-431 Local display: Δ F-431	BLOCK_ERR = Other	QUALITY = BAD	Cause of error: Error in calibration parameters Remedy: Replace electronics module,	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = Calibration error	SUBSTATUS = Device failure		
F-	437	Device status message (FF): Configuration Error F-437 Local display: Δ F-437	BLOCK_ERR = Other ¾ Block Configuration Error	QUALITY = BAD	Cause of error: Wrong configuration within sensor transducer block "Sensor 1 and 2" Remedy: Check configuration of used units, settings of PV1 and/or PV2 and used sensor types.	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = Calibration error	SUBSTATUS = Device failure		
C-	482	Device status message (FF): Simulation Mode Active C-482 Local display: Δ C-482 ´ Measured value	BLOCK_ERR = Simulate active	QUALITY = UNCERTAIN	Cause of error: Simulation is active Remedy: -	
			Transducer_Error = No error	SUBSTATUS = Substitute		
C-	501	Device status message (FF): Device preset C-501 Local display: Δ C-501 ´ Measured value	BLOCK_ERR =	QUALITY = UNCERTAIN/GOOD	Cause of error: Device reset is performed Remedy: Message is only displayed during reset	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = No error	SUBSTATUS = Non-specific/update event		
S-	502	Device status message (FF): Linearization S-502 Local display: Δ C-502 ´ Measured value	BLOCK_ERR = Other ¾ Block configuration error	QUALITY = BAD	Cause of error: Error in linearization Remedy: Select valid type of linearization (sensor type)	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = Configuration error	SUBSTATUS = Configuration error		
S-	901	Device status message (FF): Ambient temperature too low S-901 Local display: Δ S-901 ´ Measured value	BLOCK_ERR =	QUALITY = UNCERTAIN	Cause of error: Reference junction temperature < -40 °C (-40 °F); parameter Alarm_Ambient_ Temp = OFF Remedy: Observe ambient temperature as per specification	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = No error	SUBSTATUS = Non-specific		

Category	No.	Status Messages ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block Local display	Error Messages in the Sensor Transducer Block in Question	Sensor Transducer Block Measured Value Status	Cause of Error / Remedy	Output Variables Affected
F-	901	Device status message (FF): Ambient temperature too low F-901 Local display: Δ F-901	BLOCK_ERR = Device needs maintenance now	QUALITY = BAD	Cause of error: Reference junction temperature < -40 °C (-40 °F); parameter Alarm_Ambient_ Temp = ON Remedy: Observe ambient temperature as per specification	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = General error	SUBSTATUS = Device failure		
S-	902	Device status message (FF): Ambient temperature too high S-902 Local display: Δ S-901 ´ Measured value	BLOCK_ERR =	QUALITY = UNCERTAIN	Cause of error: Reference junction temperature > +85 °C (+185 °F); parameter Alarm_Ambient_ Temp = OFF Remedy: Observe ambient temperature as per specification	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = No error	SUBSTATUS = Non-specific		
F-	902	Device status message (FF): Ambient temperature too high F-902 Local display: Δ F-902	BLOCK_ERR = Device needs maintenance now	QUALITY = BAD	Cause of error: Reference junction temperature > +85 °C (+185 °F); parameter Alarm_Ambient_ Temp = ON Remedy: Observe ambient temperature as per specification	SV1, SV2, PV1, PV2, RJ1, RJ2
			Transducer_Error = General error	SUBSTATUS = Device failure		

Corrosion Detection

Sensor connection cable corrosion can lead to false measured value readings. Therefore the transmitter offers the possibility to recognize any corrosion before the measured values are affected.

There are two different steps selectable in the **CORROSION_DETECTION** parameter depending on the application requirements:

- Off (no corrosion detection)
- On (warning output just before reaching the alarm set point. This allows for preventative maintenance/troubleshooting to be done.) An alarm message is output as of the alarm set point).

The following table shows the reaction of the device on sensor cable connection resistance change. These also indicate the reaction dependent on the parameter selection on/off.

— NOTE

Corrosion detection only applicable to RTD 4-wire connection

The sensor resistance can influence the resistance shown in the tables. On simultaneous increase of all sensor connection cable resistances the values indicated in the tables can be divided by two. In corrosion detection it has been assumed that this is a slow process with a continuous increase in resistance.

Application Errors Without Messages

Application Errors for RTD Connection

— NOTE

These apply to Pt100/Pt500/Pt1000/Ni100 RTDs.

Error	Cause	Action/Remedy
Measured value incorrect/inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Observe the face-to-face length of the sensor.
	Transmitter setup faulty (number of wires)	Change the **SENSOR_CONNECTION** device function
	Transmitter setup incorrect (scaling)	Change scale
	Incorrect RTD set up	Change **SENSOR_TYPE** device function
	Sensor connection (2-wire)	Check sensor connection
	Sensor cable resistance (2-wire) not compensated	Compensate cable resistance
	Offset incorrectly set	Check offset
	Sensor defective	Check sensor
	RTD connection incorrect	Connect the connecting cables correctly
	Programming	Incorrect sensor type set in the **SENSOR_TYPE** device function; change to the correct sensor type
	Device defective	Replace device

Application Errors for TC Connection

Error	Cause	Action/Remedy
Measured value incorrect/inaccurate	Incorrect sensor installation	Install the sensor correctly
	Heat conducted by sensor	Observe the face-to-face length of the sensor
	Device programming is incorrect (scaling)	Change scaling
	Incorrect thermocouple type (TC) configured	Change **SENSOR_TYPE** device function
	Incorrect comparison measurement point set	See 'Description of Device Functions' chapter
	Offset incorrectly set	Check offset
	Interference via the thermocouple wire welded in the thermowell (interference voltage coupling)	Use a sensor where the thermocouple wire is not welded
	Sensor incorrectly connected	Connect the sensor as per the terminal diagram (polarity)
	Sensor defective	Check sensor
	Programming	Incorrect sensor type set in the **SENSOR_TYPE** device function; set the correct thermocouple
	Device defective	Replace device

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