Instruction

MI 020-530
March 2010

RTT30
I/A Series® Temperature Transmitter
With HART® Protocol

invensys
Foxboro®

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1. Introduction

General Description

The RTT30 Temperature Transmitter with HART 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 Communicator or a PC-Based Configurator. It is available in an aluminum or stainless steel housing and can be monted 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 020-531	RTT30 Transmitter Safety Information
	HART Communicator Product Manual (supplied with the communicator)

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)

Supply Voltage Limits: 11 and 40 V dc

NOTE

For transmitters without an LCD indicator, the supply voltage can be reduced from 11 to 8 V dc with the use of a shorting bar.

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)
Ni100 alpha = 0.006180; To DIN 43760	-60 and +250°C (-76 and +482°F)	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 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)
Pt200 alpha = 0.00385; To IEC 60751	-200 and +850°C (-328 and +1562°F)	10°C (18°F)
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 T Cu-CuNi; IEC 584-1	-270 and +400°C (-454 and +752°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 N NiCrSi-NiSi; IEC 584-1	-270 and +1300°C (-454 and 2372°F)	50°C (90°F)
Type K NiCr-Ni; IEC 584-1	-270 and +1372°C (-454 and +2501°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 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 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 B (a)(b) PtRh30-PtRh6; IEC 584-1	0 and 1820°C (32 and 3308°F)	500°C (900°F)
Type C W5Re-W26Re; ASTM E988	0 and 2320°C (32 and 4208°F)	500°C (900°F)
Type D W3Re-W25Re; ASTM E988	0 and 2495°C (32 and 4523°F)	500°C (900°F)

Span and Range Limits - Voltage and Resistance Inputs

Input Source	Measurement Range Limits	Minimum Span
Voltage Transmitter	-10 and +100 mA	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:

Dustight 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.

Communication Rate: 1200 baud

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 Foxboro.

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

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Elec. Safety Design Code
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
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.

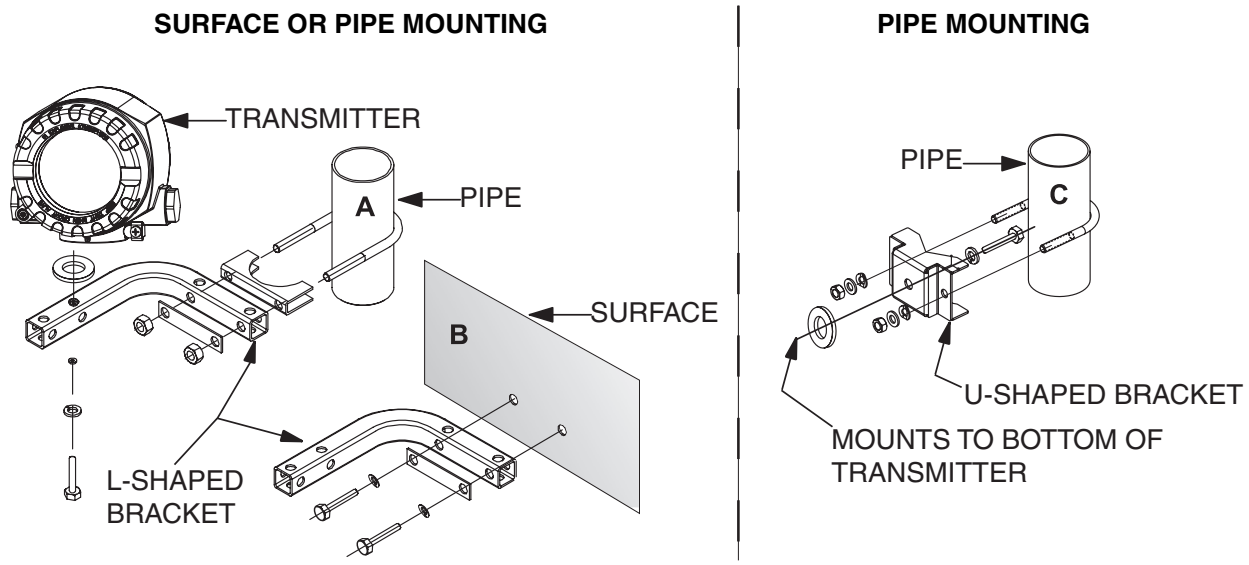

Figure 2. Mounting on a Surface or Pipe

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.

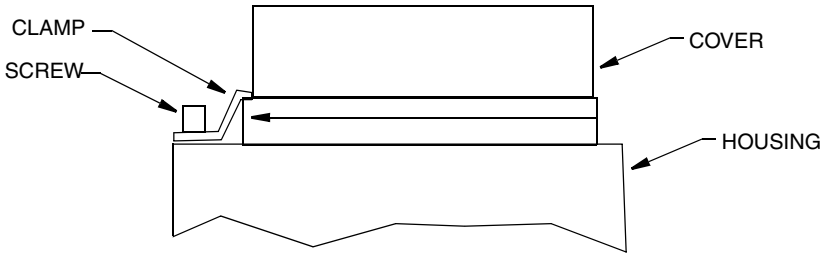

Figure 3. Cover Lock

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).

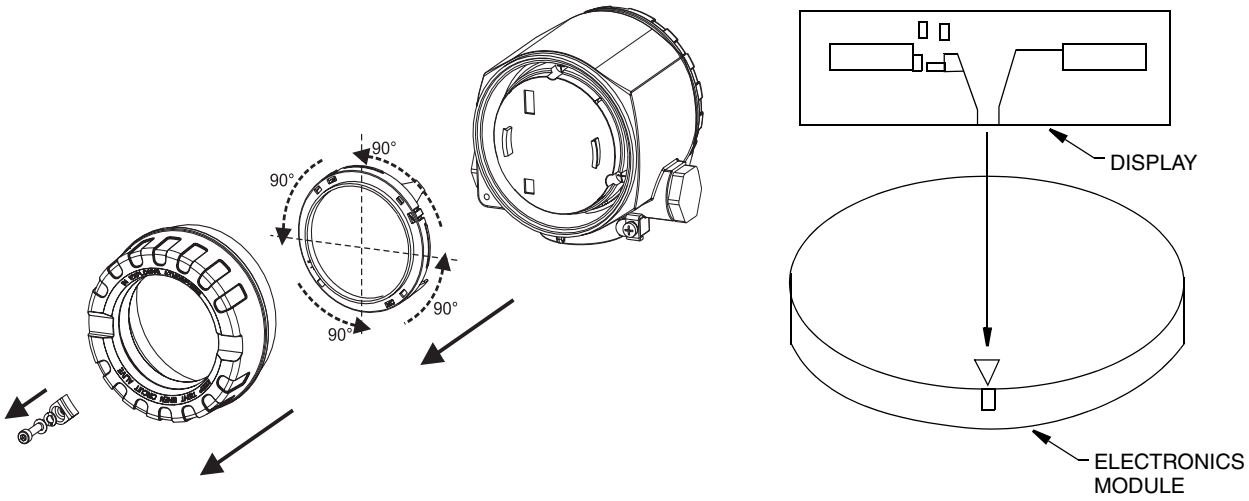

Figure 4. Rotating the Display

Setting the Transmitter Jumpers

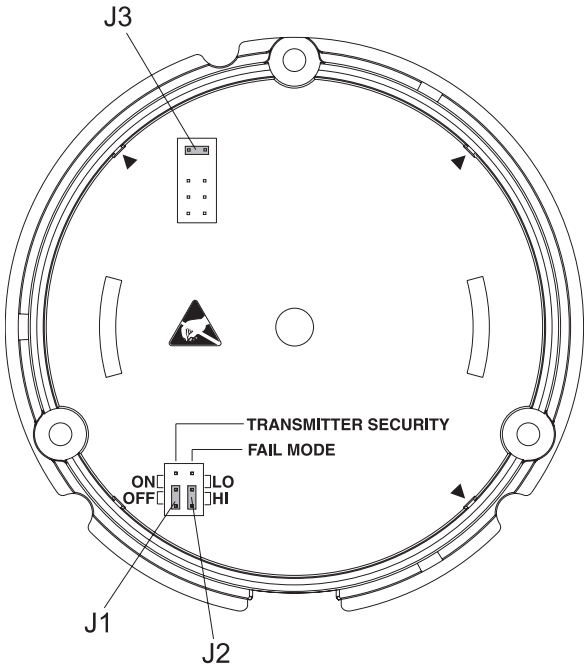

Figure 5. Security, Fail Mode, and Voltage Jumpers

CAUTION

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

Jumpers J1, J2 and J3 for the hardware setup can be found in the electronics compartment. In order to set the jumpers, remove the electronics compartment cover. Remove the display (if present).

Transmitter Security Jumper

Jumper J1 is for transmitter security. Setting the jumper to the ON position prohibits users from changing the transmitter configuration.

NOTE

This configuration lock has priority over the software setup.

Fault Conditioning Jumper

Jumper J2 drives the output to a fully upscale or downscale in the case of a microcontroller failure. The LO position drives the outpur to ≤3.6 mA. The HI position drives the output to ≥21.0 mA.

NOTE

Please check that the hardware and software failure mode conditioning correspond with each other.

Reduced Voltage Jumper

Jumper J3 is used to reduce the minimum operating voltage from 11 V to 8 V.

NOTE

Jumper J3 is only used for units without the local display.

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 10120RS: FM - Explosion proof and and Nonincendive
Foxboro drawing 10120RW: FM - Intrinsically Safe and Nonincendive
Foxboro drawing 10120RT: CSA - Explosion proof and and Nonincendive
Foxboro drawing 10120RV: 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, Foxboro 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.

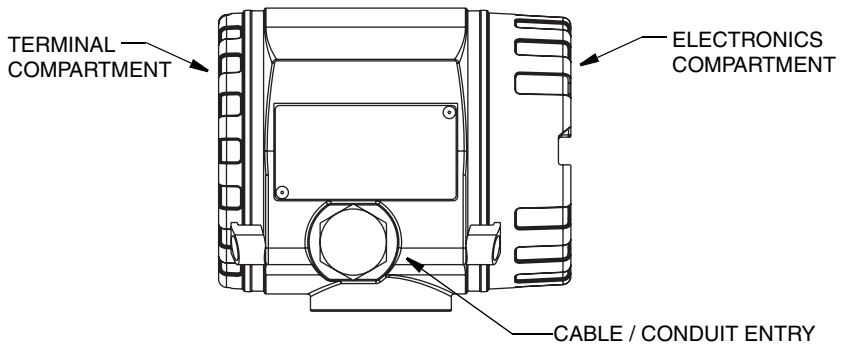

Figure 6. Accessing Field Terminals

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.

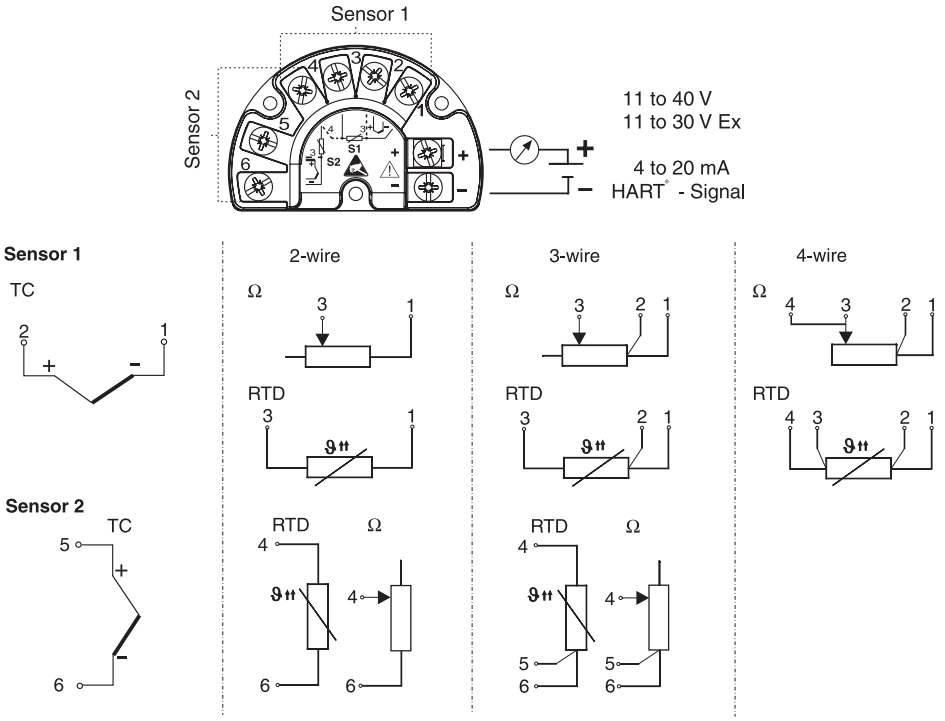

Figure 7. Input Connections

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.

Loop Wiring

When wiring the transmitter, the supply voltage and loop load must be within specified limits. The supply output load vs. voltage relationship is:

R_{MAX} = (V - 11) / 0.022 and is shown in Figure 8.

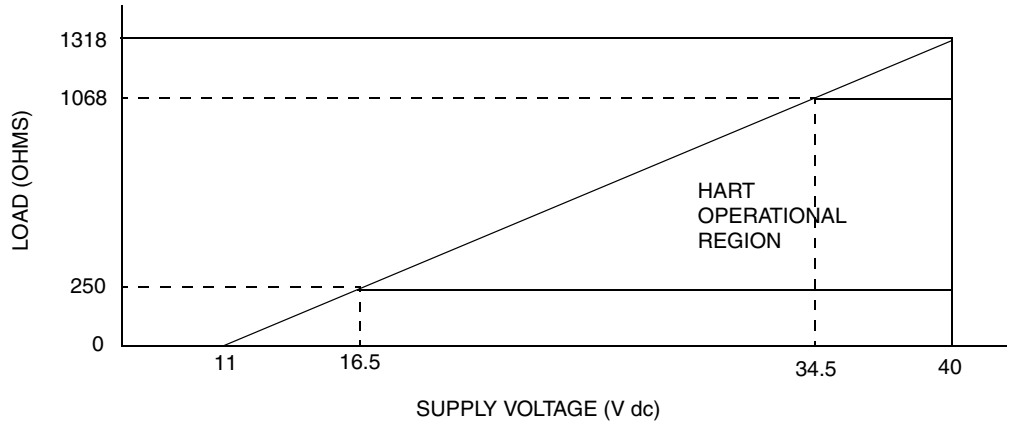

Figure 8. Supply Voltage and Loop Load

NOTE

If the HART communication resistance is not built into the power supply, a 250 Ω communication resistor must be fitted into the 2-wire supply lines. For connection hints, please take special notice of the documentation supplied by the HART Communication Foundation, specifically HCF LIT 20: "HART, a technical overview".

To wire one or more transmitters to a power supply, proceed with the following steps.

1. Remove the terminal compartment cover.
2. Open one or both of the transmitter conduit entries.
3. Feed the leads through the opening in the cable gland or through the conduit entry.
4. Connect the leads as shown in Figure 7. Ensure the terminal screws are tight.
5. Reseal the cable gland or conduit. Replace and tighten the terminal compartment cover.

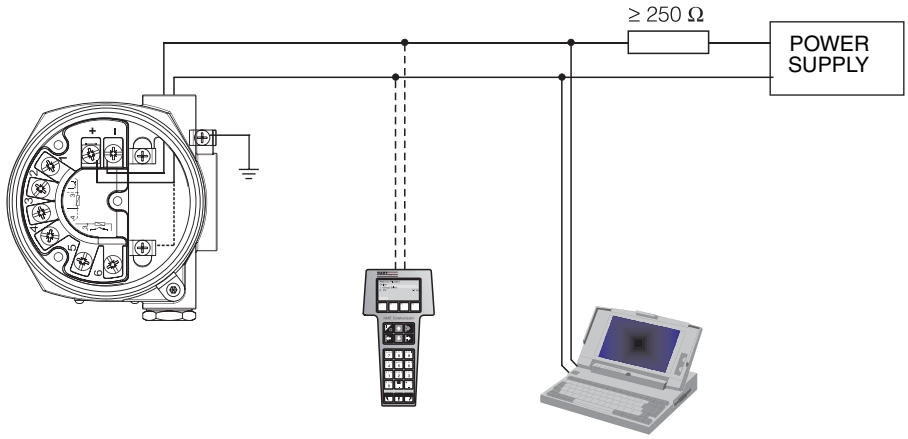

Figure 9. Loop Wiring

Shielding and Potential Equalization

If screened (shielded) cables are used then the shielding connected to the output (4 to 20 mA signal) must be at the same potential as the shielding at the sensor connection.

When operating in plants with high electromagnetic fields, it is recommended that all cables be shielded using a low ohm ground connection. Due to the possible danger of lightning strikes, shielding is also recommended for cables that are run outside buildings.

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:

- Are the device or the cables damaged (visual check)?
- Is the cable/conduit installation correctly separated, with no loops or crossovers?
- Are the cables load relieved?
- Have the cables been correctly connected? See Figure 7.
- Are all terminal screws tightened?
- Is the cable or conduit entry sealed?
- Is the housing cover screwed tight?

3. Operation

Display

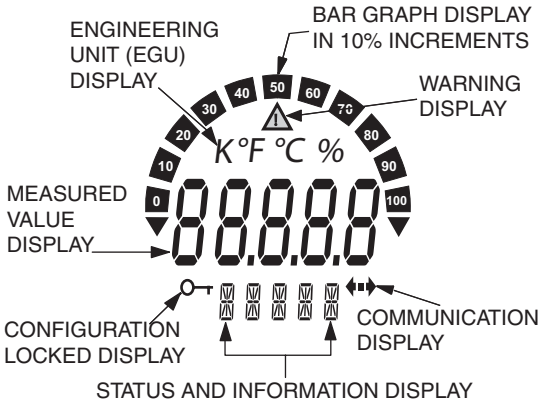

Figure 10. Display

Table 4. Indicator Display Elements

Display Elements	Description (a)
Bar Graph Display	In 10% increments with overrange and underrange marks. Display flashes when an error occurs.
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 rather than the 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 HART communication is active.
Configuration Locked Display	This communication icon is displayed when the configuration is locked via a hardware jumper.
(a) Refer to applicable Operation Manual for more specific details.	

Operation Using a HART Communicator

Online Menu

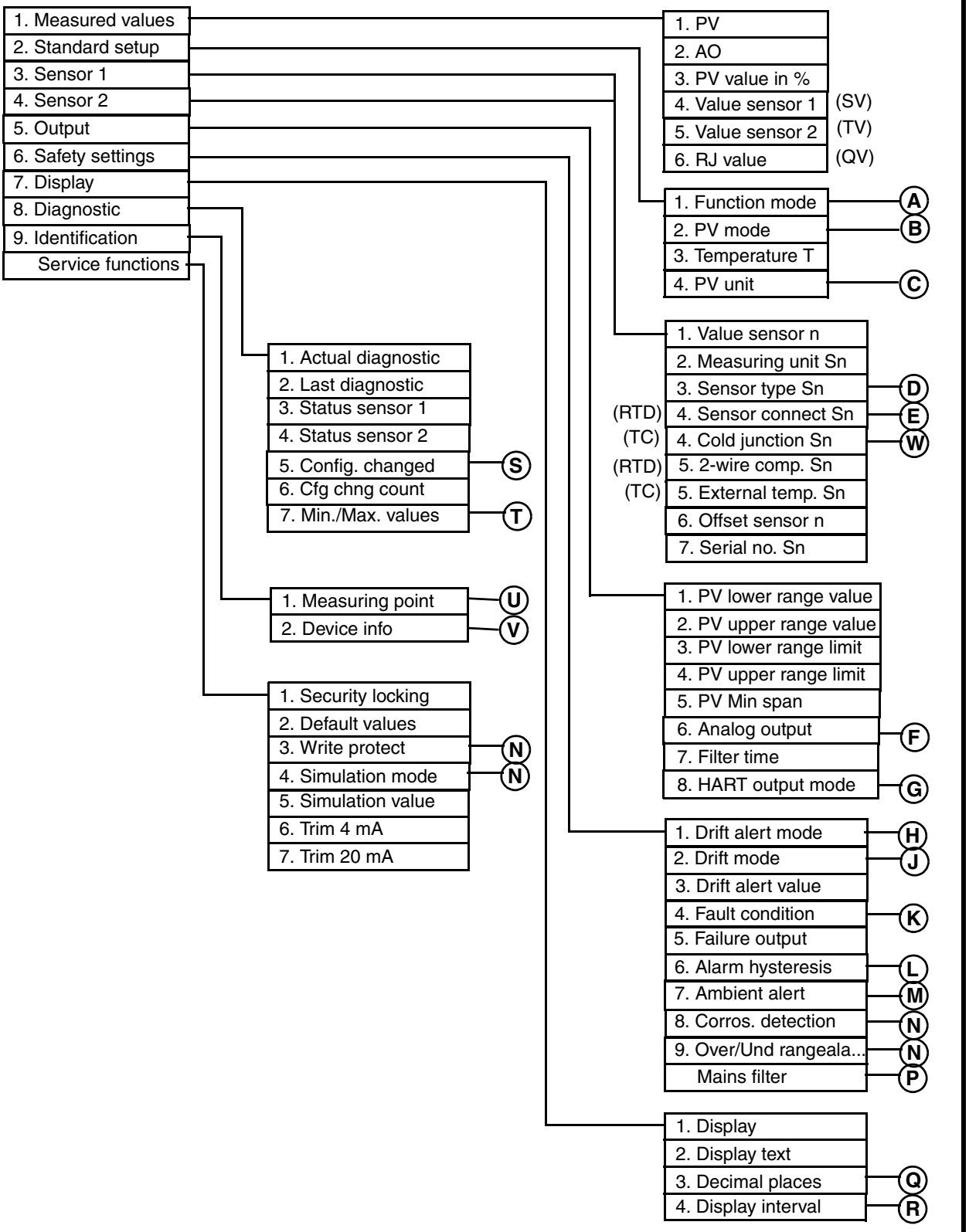

Figure 11. RTT30 Temperature Transmitter Online Menu Tree (1 of 2)

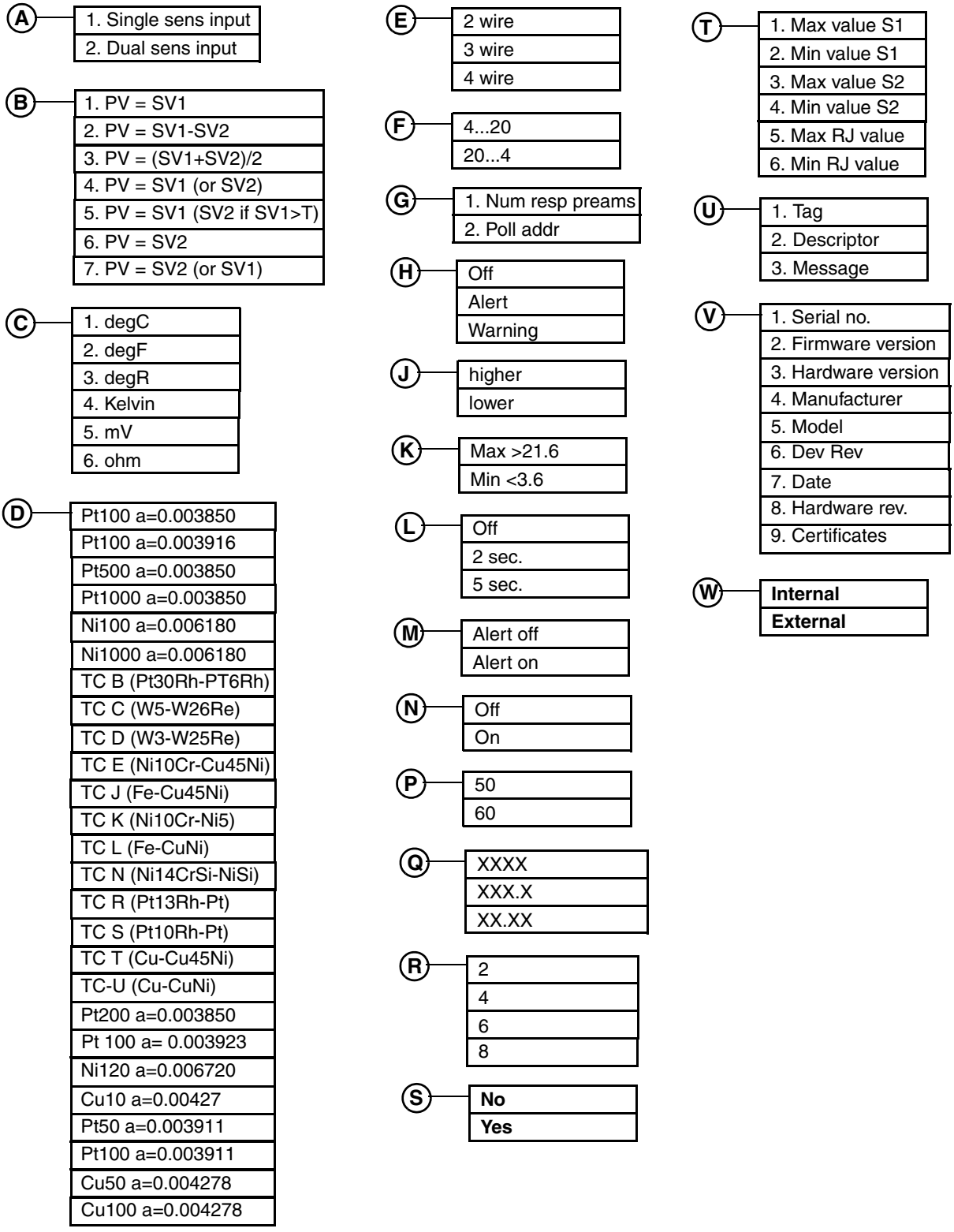

Figure 12. RTT30 Temperature Transmitter Online Menu Tree (2 of 2)

Explanation of Parameters

— NOTE

The fast-key path shown is based on a frequently used configuration. If certain parameters are configured off or infrequently used parameters configured on, the fast-key path may be different.

Table 5. Explanation of Parameters and Fast-Key Path

Parameter	Fast-Key Path	Explanation
2-wire comp. S1	3,5	Enter cable resistance compensation on a 2-wire RTD connection. *Note: Selection only present if a 2-wire was selected in Sensor connection S1.*
2-wire comp. S2	4,5	Enter cable resistance compensation on a 2-wire RTD connection. *Note: Selection only present if a 2-wire was selected in Sensor connection S2.*
Actual diagnostic	8,1	Shows the current diagnostic condition.
Alarm hysteresis	6,6	Select the time a transient alarm is to be suppressed as 0, 2, or 5 seconds. *Note: In the time entered, the last measured value before the alarm is entered. If an error is still present after this period, an alarm is signaled.*
Ambient alert	6,7	Activate (Alarm on) or deactivate (Alarm off) an alarm for exceeding ambient temperature limits. *Note: If this feature is deactivated, the unit does not alarm but still transmits a warning.*
Analog output	5,6	Select the analog output as 4 to 20 mA or 20 to 4 mA.
AO	1,2	Shows the analog output of the process variable in mA.
Certificates	9,2,9	Shows a list of the device approvals.
Cfg chng count	8,6	Shows the total number of changes made.
Cold junction S1	3,4	Select an internal (Pt100) or external comparison measuring point. *Note: Selection only present if a thermocouple was selected in Sensor type S1.*
Cold junction S2	4,4	Select an internal (Pt100) or external comparison measuring point. *Note: Selection only present if a thermocouple was selected in Sensor type S2.*
Config. changed	8,5	Select Yes or No.
Corres. detection	6,8	Select activation of corrosion detection feature (on, off). Off = Warning output just before the alarm setpoint. On = No warning but immediate alarm.
Date	9,2,7	Enter a date as desired.

Table 5. Explanation of Parameters and Fast-Key Path

Parameter	Fast-Key Path	Explanation
Decimal places	7,3	Select the number of decimal places after the decimal point (none, one, two).
Default values		Enter the code (162) to reset the configuration to factory default values.
degC	2,4,1	Sets the PV unit to degrees Celsius.
degF	2,4,2	Sets the PV unit to degrees Fahrenheit.
degR	2,4,3	Sets the PV unit to degrees Rankine.
Descriptor	9,1,2	Enter HART descriptor (16 characters maximum)
Device info	9,2	Path to accessing various identification data.
Dev rev	9,2,6	Shows the device revision level.
Diagnostic	8	Path to configuring Diagnostic parameters.
Display	7	Path to configuring Display parameters.
Display	7,1	Specify the items you want displayed. To do this, add the numbers given below for each item and enter the total in this parameter. Display PV 1 Display Sensor 1 value 2 Display Sensor 2 value 4 Display RJ value 8 Display analog output value 16 Display status 32 Display PV in % 64 Example: to display PV, Sensor 1, and AO values, enter 19 (1+2+16).
Display interval	7,4	Select the display interval in seconds (2, 4, 6, 8).
Display text	7,2	Enter user desired PV text (8 characters maximum).
Drift alert mode[(d)]	6,1	Select the action if the values of S1 and S1 differ from one another (off, warning, alarm). Warning: The Caution icon is displayed and a warning is transmitted via the HART protocol. Alarm: The Caution icon is displayed and the device switches to an error signal.
Drift alert value	6,3	Enter the limit value for the drift alert or warning.
Drift mode	6,2	Select higher or lower. Higher: Alarm/Warning occurs if absolute amount for difference between Sensor 1 - Sensor 2 overshoots the Drift alert value. Lower: Alarm/Warning occurs if absolute amount for difference between Sensor 1 - Sensor 2 undershoots the Drift alert value
Dual sensor input	2,1,2	Sets the Function mode to Dual sensor input.
External temp S1	3,5	Enter the external comparison temperature value. *Note: Selection only present if External was selected in Cold junction S1.*

Table 5. Explanation of Parameters and Fast-Key Path

Parameter	Fast-Key Path	Explanation
External temp S2	4,5	Enter the external comparison temperature value. *Note: Selection only present if External was selected in Cold junction S2.*
Failure output	6,5	Enter the mA value you want the output to go to in case of a failure. Must be within the limit of Fault condition.
Fault condition[e]	6,4	Select the output if a sensor rupture or short circuit occurs ($\geq$21.6 or $\leq$3.6).
Filter time	5,7	Enter the digital filter time constant from 0 to 60 seconds.
Firmware version	9,2,2	Shows the device firmware version.
Function mode	2,1	Select single sensor or dual sensor input. *Note: Selection is only present on two sensor input device.*
Hardware rev.	9,2,8	Shows the revision level of the device's electronic components.
Hardware version	9,2,3	Shows the device hardware version.
HART output mode	5,8	Path to enter the number of response preambles and poll address.
Identification	9	Path to configuring Identification parameters.
kelvin	2,4,4	Sets the PV unit to kelvin.
Last diagnostic	8,2	Shows the previous diagnostic condition.
Mains filter		Select the mains filter as 50 or 60 Hz.
Manufacturer	9,2,4	Shows the device manufacturer (Foxboro).
Max RJ value	8,7,5	Shows the maximum RJ value.
Max value S1	8,7,1	Enter the maximum value for Sensor 1.
Max value S2	8,7,3	Enter the maximum value for Sensor 2.
Measured values	1	Path to displaying values in normal operation.
Measuring point	9,1	Path to entering the Tag, HART Descriptor, and HART Message.
Measuring unit S1	3,2	Shows the measuring unit of Sensor 1.
Measuring unit S2	4,2	Shows the measuring unit of Sensor 2.
Message	9,1,3	Enter HART message (32 characters maximum)
Min RJ value	8,7,6	Shows the minimum RJ value.
Min value S1	8,7,2	Enter the minimum value for Sensor 1.
Min value S2	8,7,4	Enter the minimum value for Sensor 2.
Min./Max. values	8,7	Path to accessing the various minimum/maximum values.
Model	9,2,5	Shows the device model number (RTT30).
mV	2,4,5	Sets the PV unit to millivolts.
Num resp preams	5,8,1	Enter the number of response preambles from 0 to 15.
Offset sensor 1	3,6	Enter any zero point correction.
Offset sensor 2	4,6	Enter any zero point correction.
Ohm	2,4,6	Sets the PV unit to ohms.
Output	5	Path to configuring output parameters

Table 5. Explanation of Parameters and Fast-Key Path

Parameter	Fast-Key Path	Explanation
Over/Und rangeala..	6,9	Activate (On) or deactivate (Off) the overrange/ underrange alarm. Off = Output signal linear to 3.8 mA or 20.5 mA and remains at these values. On = An error is signalled for an output of <3.8 mA or > 21.5 mA.
Poll addr	5,8,2	Enter the poll address from 0 to 15. A nonzero number applies to multidrop applications and the analog output is set to 4 mA. *Note: Device address is shown on the display in multidrop mode.*
PV	1,1	Shows the value of the process variable.
PV lower range limit	5,3	Shows the lower range limit.
PV lower range value	5,1	Enter the range value for 4 mA output.
PV min. span	5,5	Shows the minimum span.
PV mode[(a)]	2,2	Select the mode for the primary variable from the picklist provided.
PV- SV1 (or SV2)	2,2,4	Sets the primary variable to the value of Sensor 1 (Sensor 2 if Sensor 1 fails). An error signal is not displayed.
PV unit	2,4	Select the unit as degC, degF, DegR, kelvin, mV, or ohm.
PV upper range limit	5,4	Shows the upper range limit.
PV upper range value	5,2	Enter the range value for 20 mA output.
PV value in %	1,3	Shows the value of the process variable in percent.
PV=(SV1+SV2)/2	2,2,3	Sets the primary variable to the average of the values of Sensor 1 and Sensor 2.
PV=SV1	2,2,1	Sets the primary variable to the value of Sensor 1.
PV=SV1 (SV2 if SV1>T)	2,2,5	Sets the primary variable to the value of Sensor 1. If temperature T is exceeded at Sensor 1, the value of Sensor 2 becomes the PV. The PV switches back to S1 if the temperature at S1 is at least 3.6°F (2°C) below T. S1 or S2 appears on the display to indicate which sensor is currently active. *Note: Only available if the Function mode is set to Dual sensor input.*
PV=SV1-SV2	2,2,2	Sets the primary variable to the difference between the values of Sensor 1 and Sensor 2.
PV=SV2	2,2,6	Sets the primary variable to the value of Sensor 2.
PV=SV2 (or SV1)	2,2,7	Sets the primary variable to the value of Sensor 2 (Sensor 1 if Sensor 2 fails).
RJ value	1,6	Shows the value of the reference junction (internal temperature of the device).
Safety settings	6	Path to configuring safety settings.
Security locking		Enter the lock (0) or release (261) code.

Table 5. Explanation of Parameters and Fast-Key Path

Parameter	Fast-Key Path	Explanation
Sensor 1	3	Path to configuring Sensor 1 parameters.
Sensor 2	4	Path to configuring Sensor 2 parameters.
Sensor connect S1	3,4	Select the type of sensor connection (2-, 3-, or 4-wire). *Note: Selection only present if an RTD was selected in Sensor type S1.*
Sensor connect S2	4,4	Select the type of sensor connection (2-, 3-, or 4-wire). *Note: Selection only present if an RTD was selected in Sensor type S2.*
Sensor type S1(b)(c)	3,3	Select the type of sensor from the picklist provided.
Sensor type S2(c)	4,3	Select the type of sensor from the picklist provided.
Serial no.	9,2,1	Shows the device serial number.
Serial No. S1	3,7	Enter the serial number of Sensor 1.
Serial No. S2	4,7	Enter the serial number of Sensor 2.
Service functions		Path to configuring service functions
Simulation mode		Select activation (on) or deactivation (off) of simulation mode.
Simulation value		Input the simulation value (3.58 to 23 mA).
Single sensor input	2,1,1	Sets the Function mode to Single sensor input.
Standard setup	2	Path to configuring function mode, PV mode, and PV unit.
Status sensor 1	8,3	Shows the status of Sensor 1
Status sensor 1	8,4	Shows the status of Sensor 2
Tag	9,1,1	Enter measuring point tag (8 characters maximum)
Temperature T(f)	2,3	Enter temperature at which PV switches to backup sensor.
Trim 20 mA		Enter the amount of change (±0.150 mA)
Trim 4 mA		Enter the amount of change (±0.150 mA)
Value sensor 1	3,1	Shows the value of Sensor 1.
Value sensor 2	4,1	Shows the value of Sensor 2.
Value sensor n (1 or 2)	1,4 or 1,5	Shows the value of the applicable sensor.
Write protect		Shows whether write protection is on or off.

(a) If Function mode is **Dual sens input** and **PV mode** is **PV - SV1 (Sv2 if SV1 >T)**, then **Temperature T** appears in the menu for you to enter the temperature for the device to switch to Sensor 2.

(b) The picklist of the sensor type is displayed depending on the PV unit.

(c) Sensor 1 has priority. Sensor 2 is matched to the setup of Sensor 1.

Example: Sensor 1 is set up for a 4-wire connection, Sensor 2 is set up for a 3-wire connection; there is an automatic change of Sensor 2 to a Type K thermocouple.

(d) If **Draft alert mode** is **Warning** or **Alert**, then **if deviation is** appears in on the screen for you to select **higher** or **lower**. Then you are asked to enter the temperature value.

(e) If **Fault condition** is **max**, then **High alarm value** appears on the screen for you to enter a temperature value from 21.6 to 23 mA>

(f) Only active on two sensor inputs and if PV mode is PV=SV1 (SV2 if SV1>T)

Operation Using PC50 Intelligent Field Device Tool with Advanced DTM

Measured Values Screen

The Measured Values screen displays current values of PV, AO, PV in %, Sensor 1, and RJ.

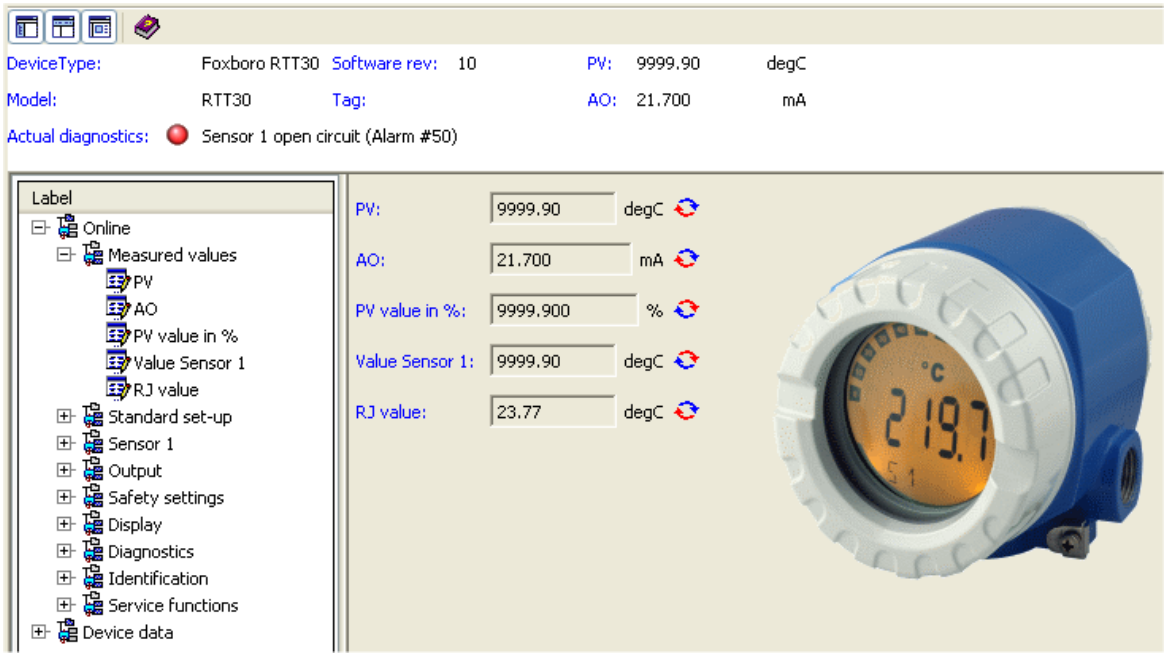

Figure 13. Sample RTT30 Temperature Transmitter Measured Values Screen

Standard Setup Screen

The Standard Setup screen enables you to select the function mode and PV unit.

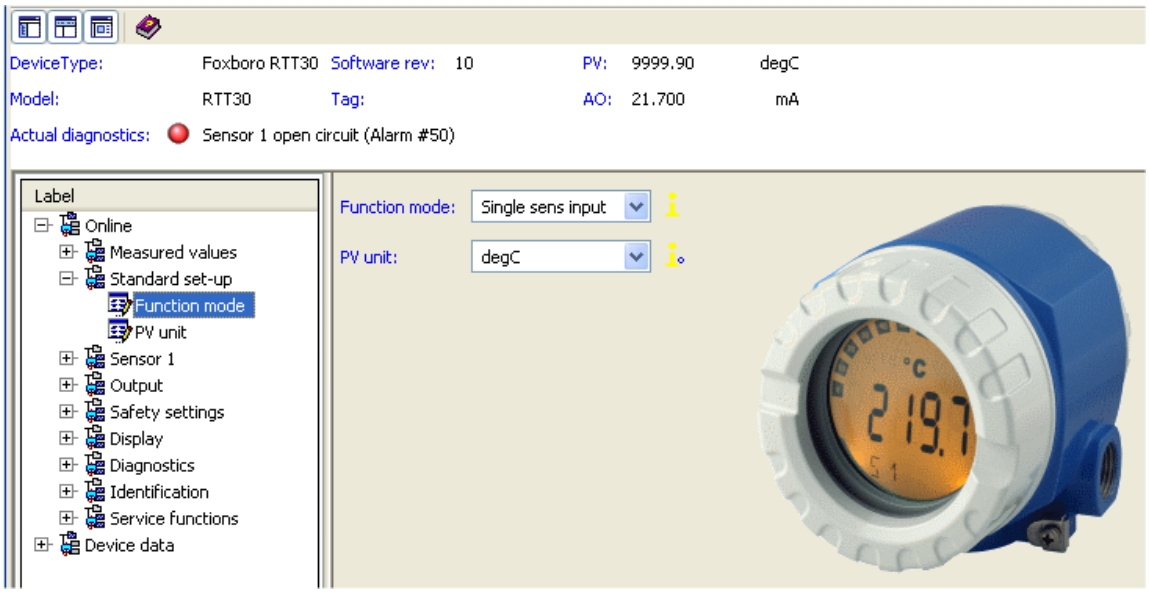

Figure 14. Sample RTT30 Temperature Transmitter Standard Setup Screen

Field	Entry
Function Mode	Select Single sens input or Dual sens input.
PV unit	Select degC, degF, degR, Kelvin, mV, ohm

Sensor 1 (or Sensor 2) Screen

The Sensor screen displays the value and measuring unit of the sensor. It also enables you to specify the sensor type, connection (if an RTD), any offset, and the sensor serial number.

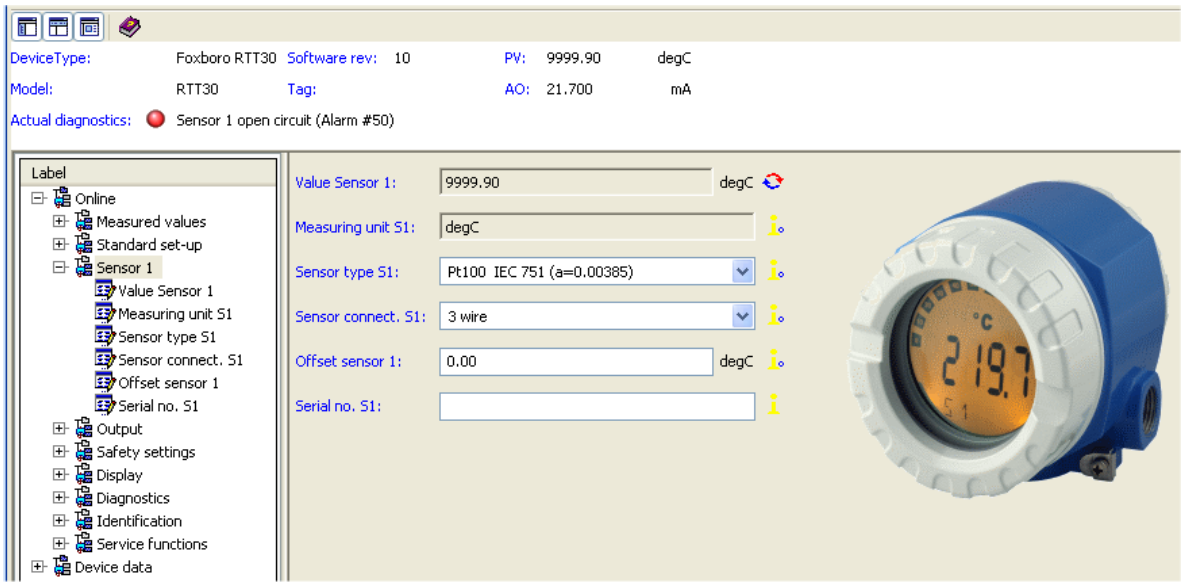

Figure 15. Sample RTT30 Temperature Transmitter Sensor 1 (or 2) Screen

Field	Entry
Value Sensor 1	Shows the current value of the sensor.
Measuring unit S1	Shows the measuring unit of the sensor.
Sensor type S1	Select the type of Sensor from the picklist provided.
Sensor connect S1	Select the sensor connection as 2-wire, 3-wire, or 4-wire. *Note: Only appears if an RTD was selected in Sensor type.*
Offset sensor 1	Enter any zero point correction.
Serial no. S1	Enter the serial number of the sensor.

Output Screen

The Output screen enables you to specify the range values, direction of the analog output, and the filter time.

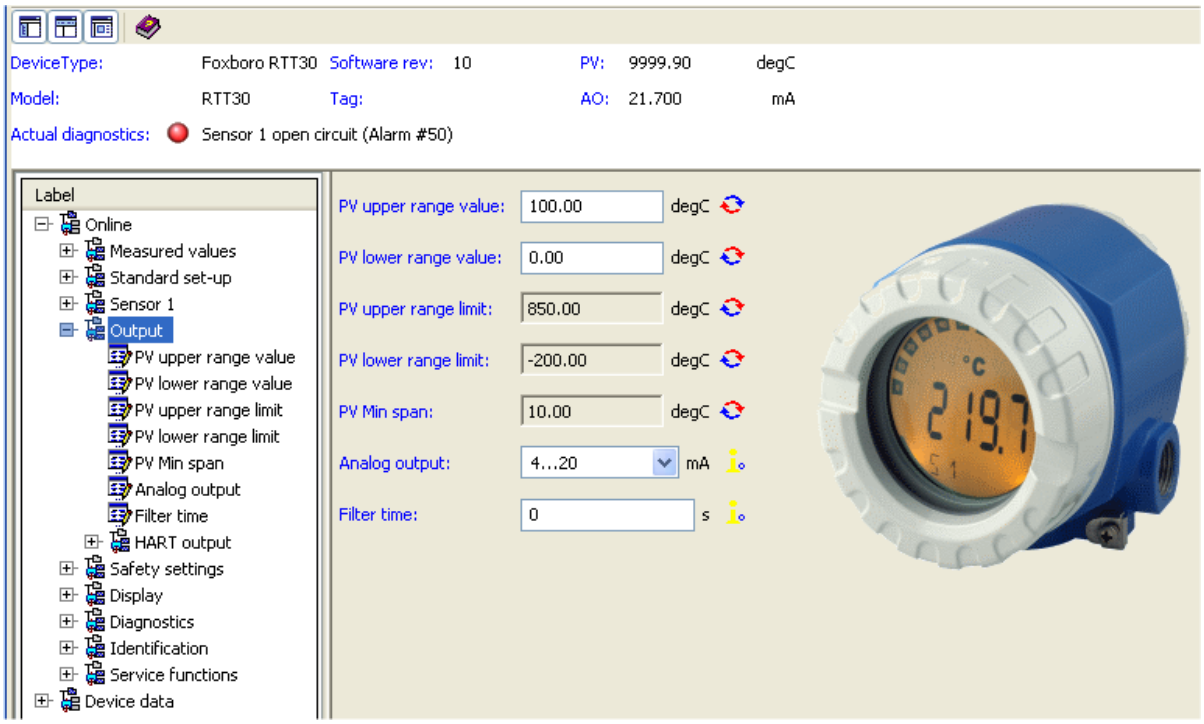

Figure 16. Sample RTT30 Temperature Transmitter Output Screen

Field	Entry
PV upper range value	Enter the PV upper range value.
PV lower range value	Enter the PV lower range value.
PV upper range limit	Shows the PV upper range limit.
PV lower range limit	Shows the PV lower range limit.
PV Min span	Shows the PV minimum span.
Analog output	Select the analog output as 4 to 20 mA or 20 to 4 mA.
Filter time	Enter the filter time in seconds.

HART Output Screen

The HART Output screen

Field	Entry
Transfer function	Shows the transfer function.
Num resp preams	Enter the number of response preambles from 0 to 15.
Poll Addr	Enter the poll address from 0 to 15. A nonzero number applies to multidrop applications and the analog output is set to 4 mA.

Safety Settings Screen

The Safety Settings screen enables you to configure various alarm parameters.

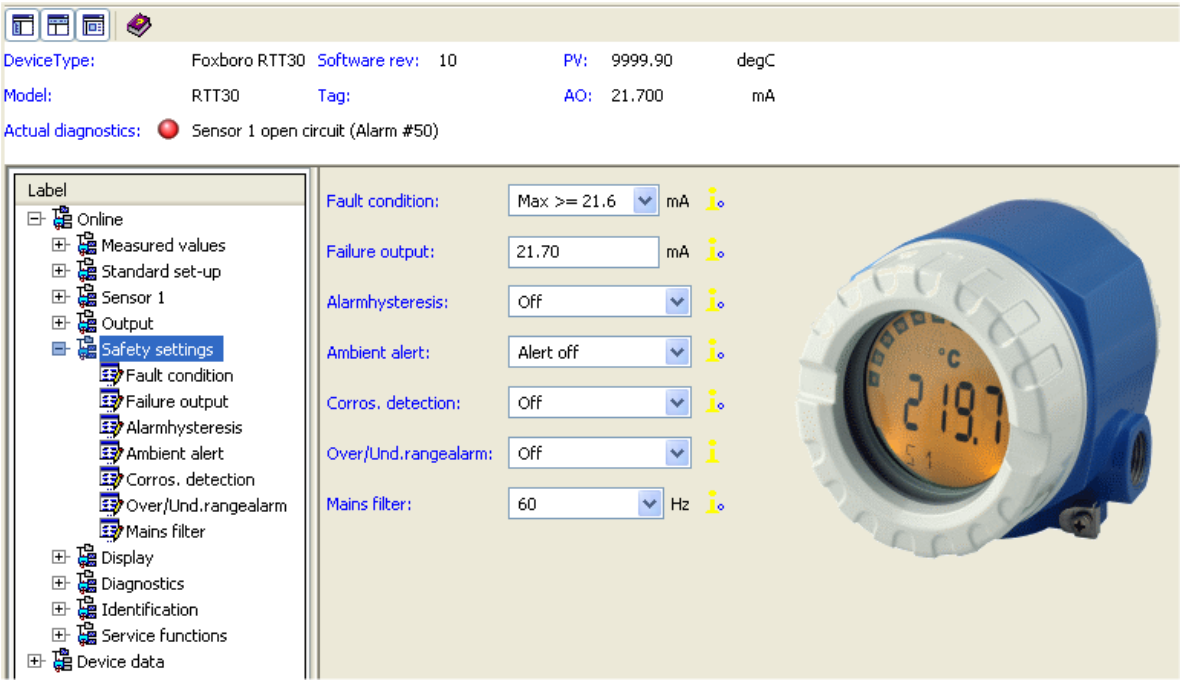

Figure 17. Sample I/A Series Pressure Transmitter Safety Settings Screen

Field	Entry
Fault condition	Select the output is a sensor rupture or short circuit occurs as max ≥ 21.6 or min ≤ 3.6.
Failure output	Enter the output you want the output to go to in case of a failure. Must be within the limit of Fault condition above.
Alarm hysteresis	Select the time a transient alarm is to be suppressed as off (0), 2, or 5 seconds.
Ambient alert	Select Alert on (activate) or Alert off (deactivate) an alarm for exceeding temperature limits. *Note: If this feature is deactivated, the device does not alarm but still transmits a warning.*
Corros. detection	Select corrosion detection as off or on. Off = Warning output just before the alarm setpoint. On = No warning but immediate alarm.
Over/Und. range alarm	Select Over/under range alarm as off or on. Off = Output signal linear to 3.8 mA or 20.5 mA and remains at these values. On = An error is signalled for an output of <3.8 mA or > 21.5 mA.
Mails filter	Select mains filter as 60 or 50 Hz.

Display Screen

The Display screen enables you to configure various display parameters.

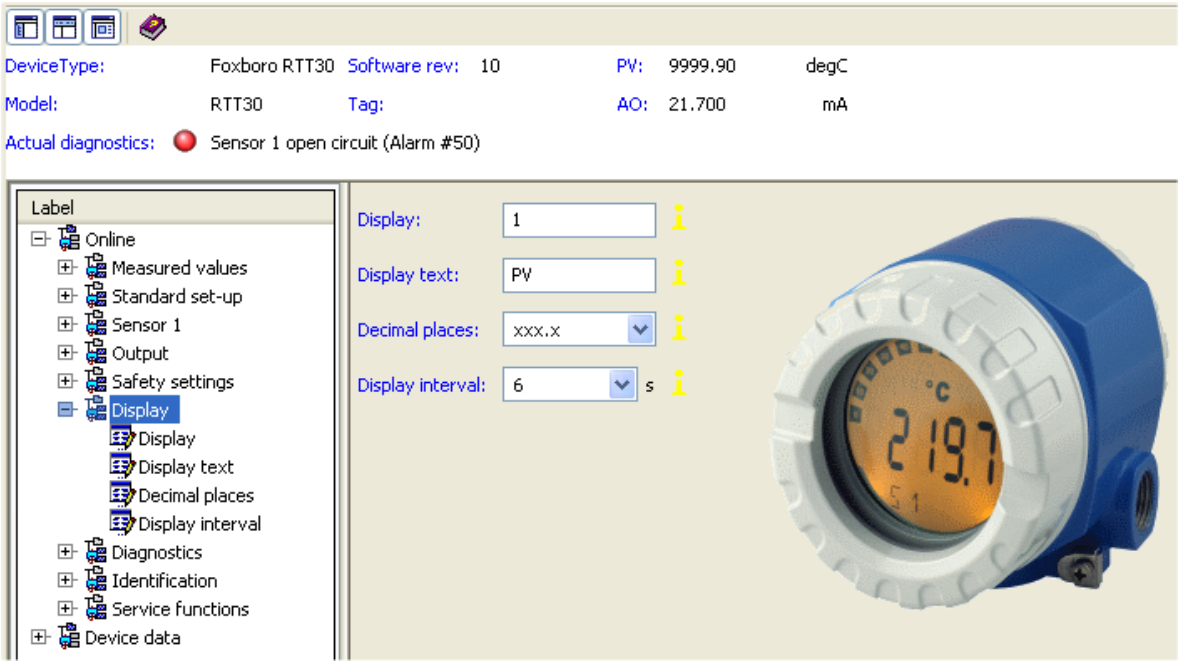

Figure 18. Sample RTT30 Temperature Transmitter Display Screen

Field	Entry
Display	Enter the items you want displayed. To do this, add the numbers given below for each item and enter the total in this parameter. Display PV 1 Display Sensor 1 value 2 Display Sensor 2 value 4 Display RJ value 8 Display analog output value 16 Display status 32 Display PV in % 64 Example: to display PV, Sensor 1, and AO values, enter 19 (1+2+16).
Display text	Enter user desired PV text (8 characters maximum).
Decimal places	Select decimal places as XXXX, XXX.X, or XX.XX.
Display interval	Select display interval as 2, 4, 6, or 8 seconds.

Diagnostics Screen

The Diagnostics screen shows the manufacturer device diagnostic information.

NOTE

HART device diagnostic information can be found in the Diagnostics screen shown in Figure 25.

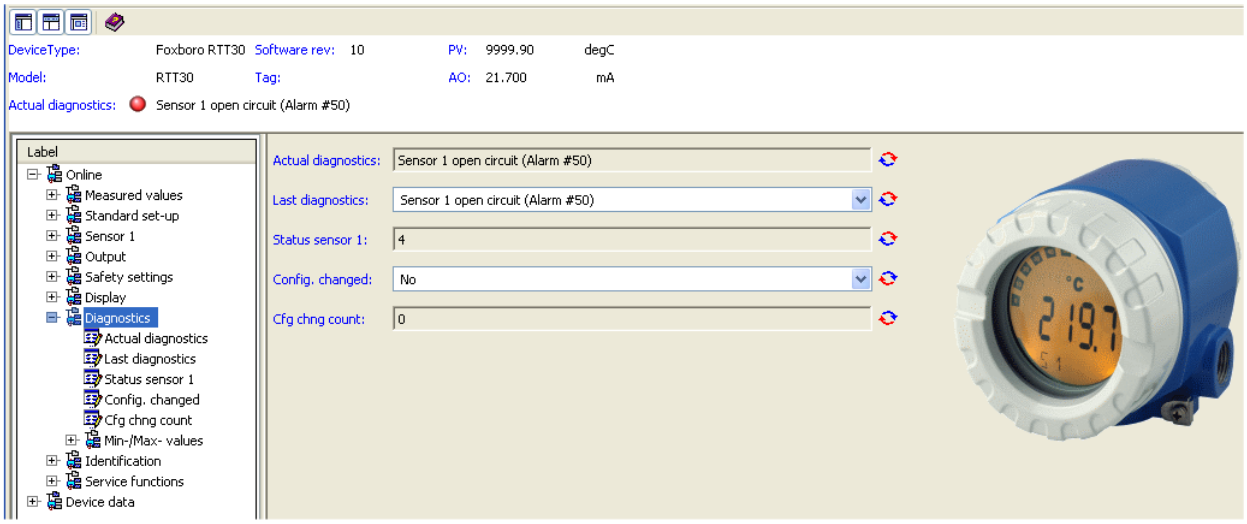

Figure 19. Sample RTT30 Temperature Transmitter Diagnostics Screen

Field	Entry
Actual diagnostics	Shows actual diagnostic condition.
Last diagnostics	Shows last diagnostic condition.
Status sensor 1 (or 2)	Shows the status of the sensor.
Config changed	Select yes or no
Cfg. chng count	Shows the total number of changes made.

Identification Screens

Measuring Point Screen

The Measuring Point screen enables you to enter tag, descriptor and message text.

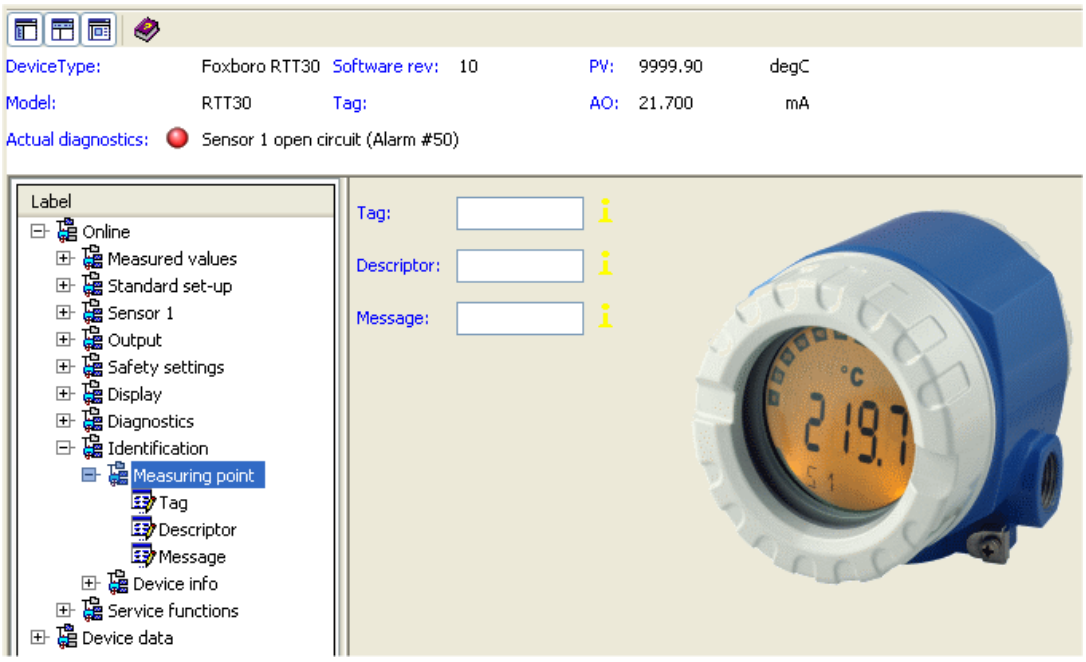

Figure 20. Sample RTT30 Temperature Transmitter Measuring Point Screen

Field	Entry
Tag	Enter the measuring point tag (8 characters maximum)
Descriptor	Enter the HART descriptor (16 characters maximum)
Message	Enter the HART message (32 characters maximum)

Device Info Screen

The Device Info screen displays various data about the device.

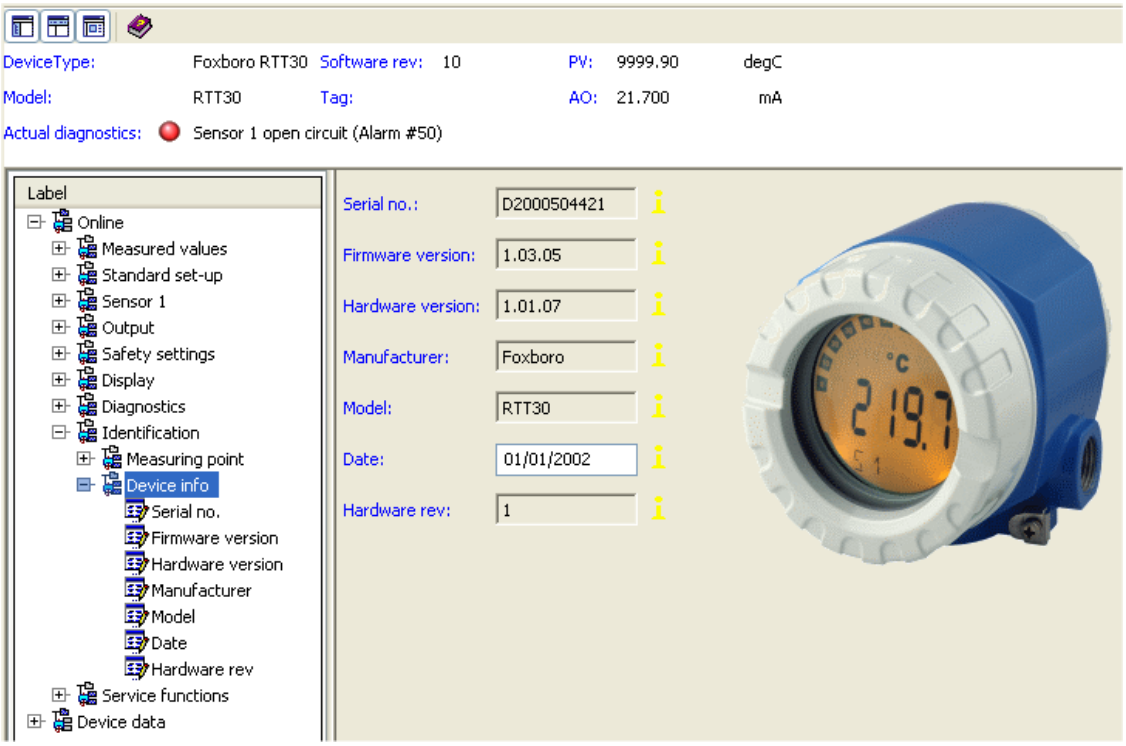

Figure 21. Sample RTT30 Temperature Transmitter Device Info Screen

Field	Entry
Serial no.	Shows the device serial number.
Firmware version	Shows the device firmware version.
Hardware version	Shows the device hardware version.
Manufacturer	Shows the device manufacturer (Foxboro).
Model	Shows the device model number (RTT30).
Date	Enter a date as desired.
Hardware rev.	Shows the revision level of the device's electronic components.

Service Screen

The Service screen enables you to configure security (write protection), simulation, and trim functions. it also allows you to reset the configuration to factory default values.

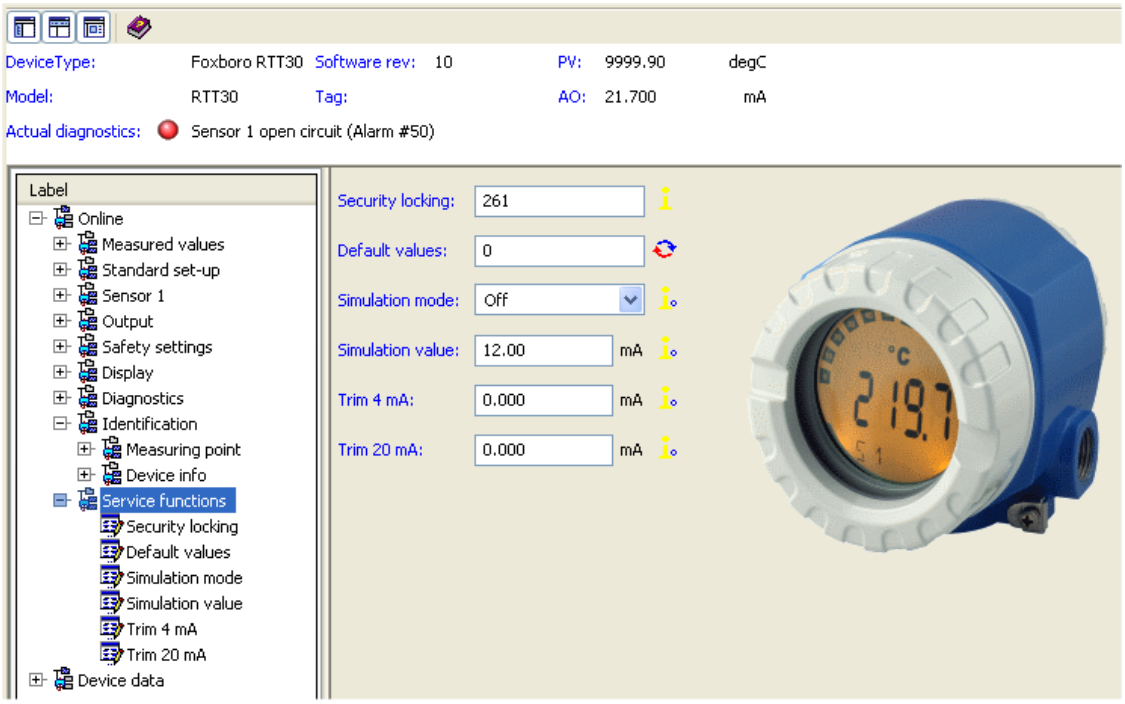

Figure 22. Sample RTT30 Temperature Transmitter Service Screen

Field	Entry
Security locking	Enter the lock (0) or the release (261) code.
Default values	Enter the code 162 to reset the configuration to factory default values.
Simulation mode	Select activate (on) or deactivate (off).
Simulation value	Enter the simulation value (3.58 to 23 mA).
Trim 4 mA	Enter the amount of change (±0.150 mA).
Trim 20 mA	Enter the amount of change (±0.150 mA).

Device Data Screen

The Device Data screen displays tag, descriptor, and message information,

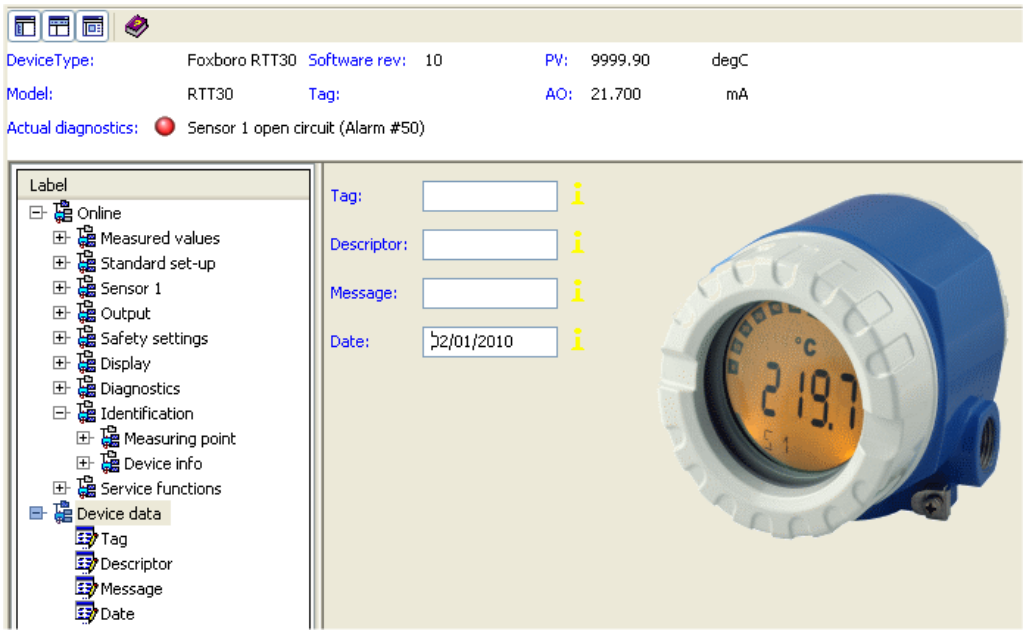

Figure 23. Sample RTT30 Temperature Transmitter Device Data Screen

Field	Entry
Tag	Enter the measuring point tag (8 characters maximum)
Descriptor	Enter the HART descriptor (16 characters maximum)
Message	Enter the HART message (32 characters maximum)
Date	Enter a date as desired.

Other Screens

The following screens are accessed via the PC50 Device menu.

Simulation Screen

The Simulation screen enables you to turn the simulation mode on or off and to set the simulation value.

NOTE

This can also be done via the Service screen.

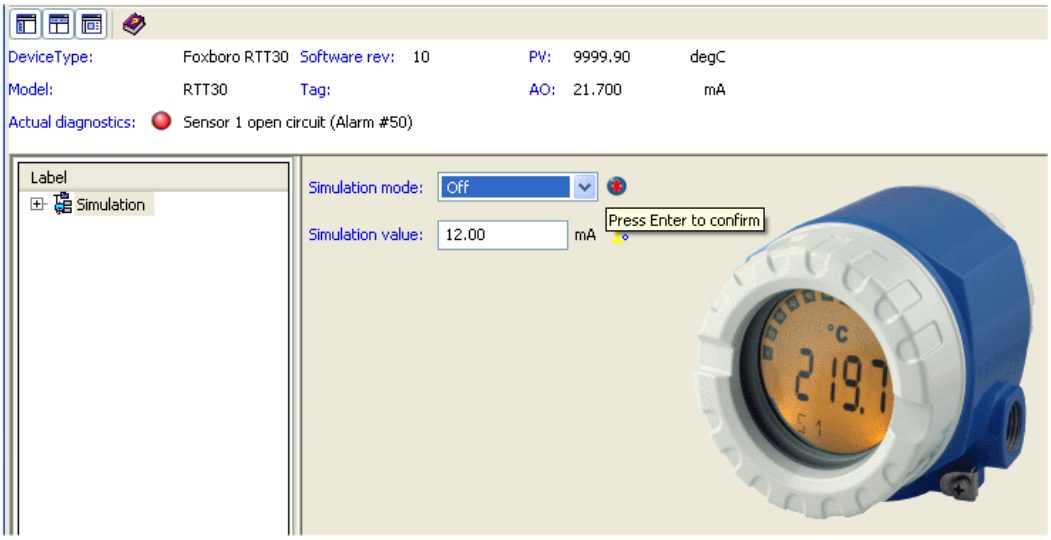

Figure 24. Sample RTT30 Temperature Transmitter Simulation Screen

Field	Entry
Simulation mode	Select activate (on) or deactivate (off).
Simulation value	Enter the simulation value (3.58 to 23 mA).

Diagnostics

The Diagnostics screen shows the HART device diagnostic condition.

NOTE

Figure 25 shows only part of the display. It is necessary to scroll down to see the latter status groups.

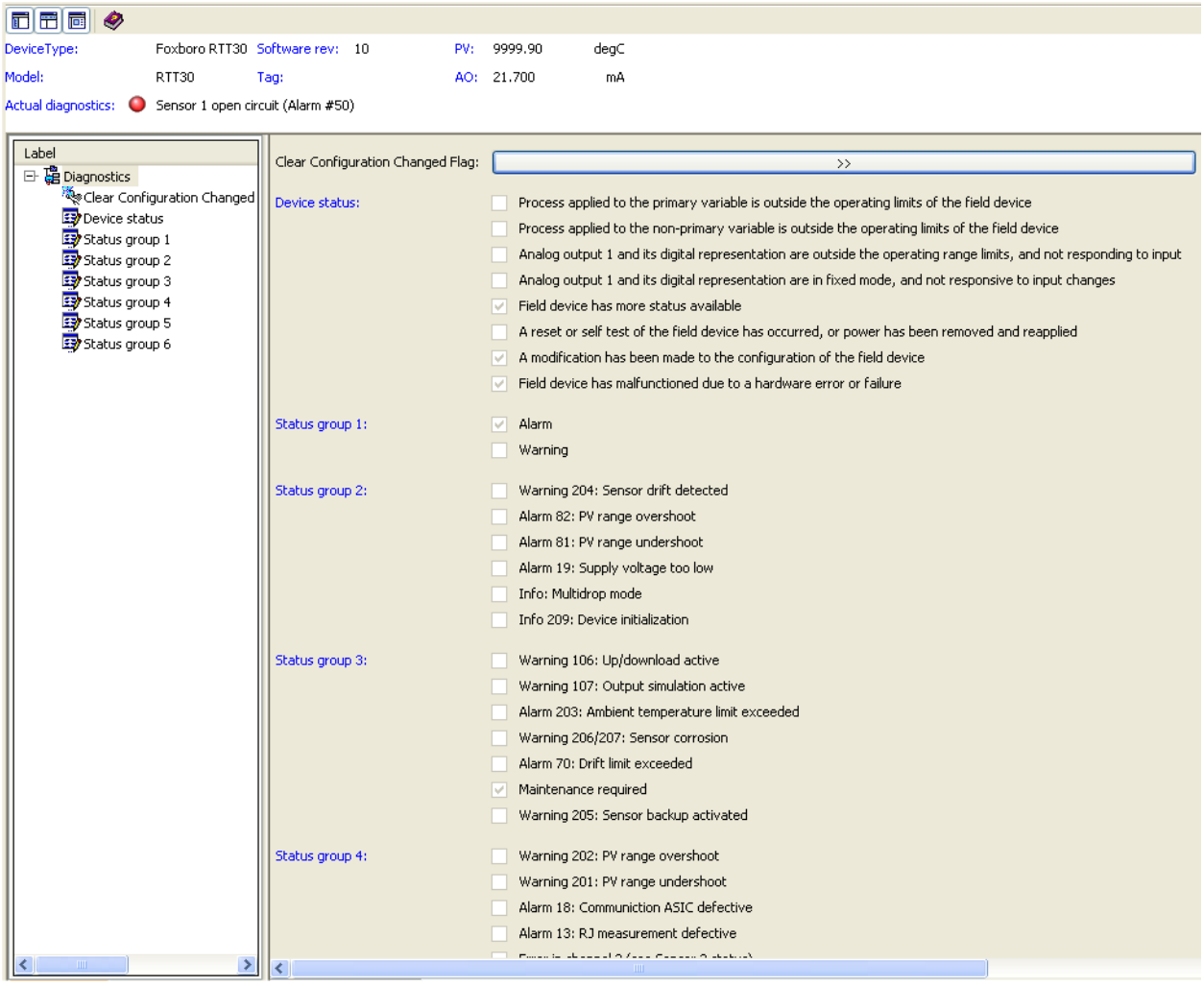

Figure 25. Sample RTT30 Temperature Transmitter Diagnostics Screen

Lock/Unlock Screen

The Lock/Unlock screen enables you to activate or deactivate write protection and to enter the write protection code.

NOTE

1. The hardware security jumper has priority over this software selection.
2. This can also be done under **Security locking** on the Service screen.

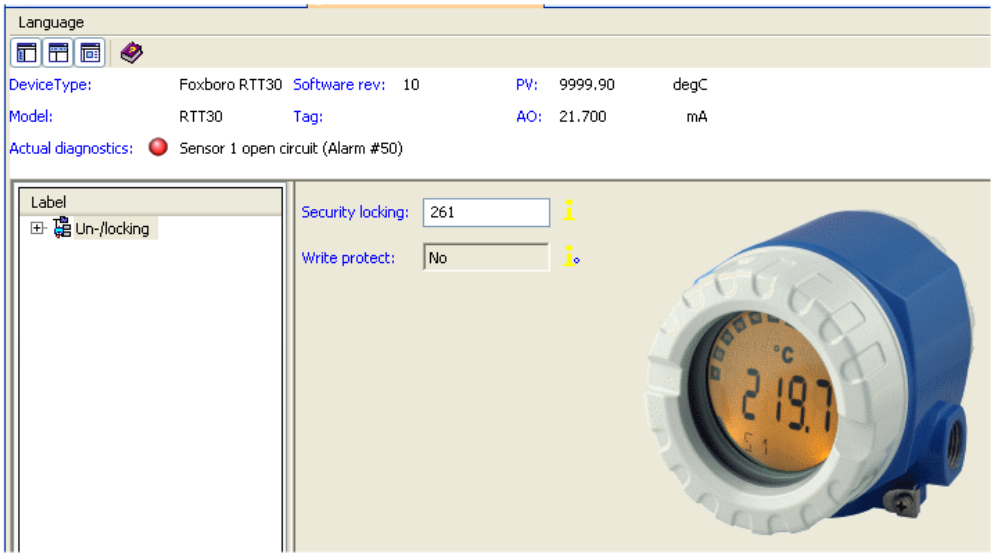

Figure 26. Sample RTT30 Temperature Transmitter Lock/Unlock Screen

Field	Entry
Security locking	Enter the lock (0) or the release (261) code.
Write protect	Shows whether the device is write protected or not.

Reset Screen

Enter the code 162 to reset the configuration to factory default values.

NOTE

This can also be done under **Default values** on the Service screen.

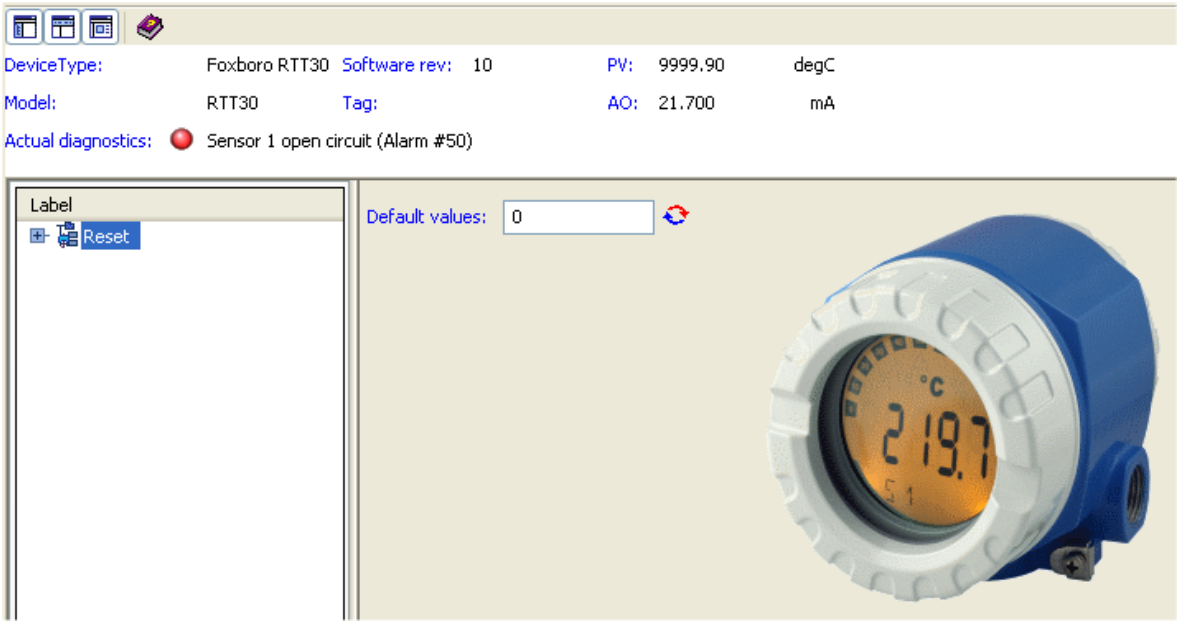

Figure 27. Sample RTT30 Temperature Transmitter Reset Screen

Process Trend Screen

The Process Trend screen enables you to analyze trends in your process measurements.

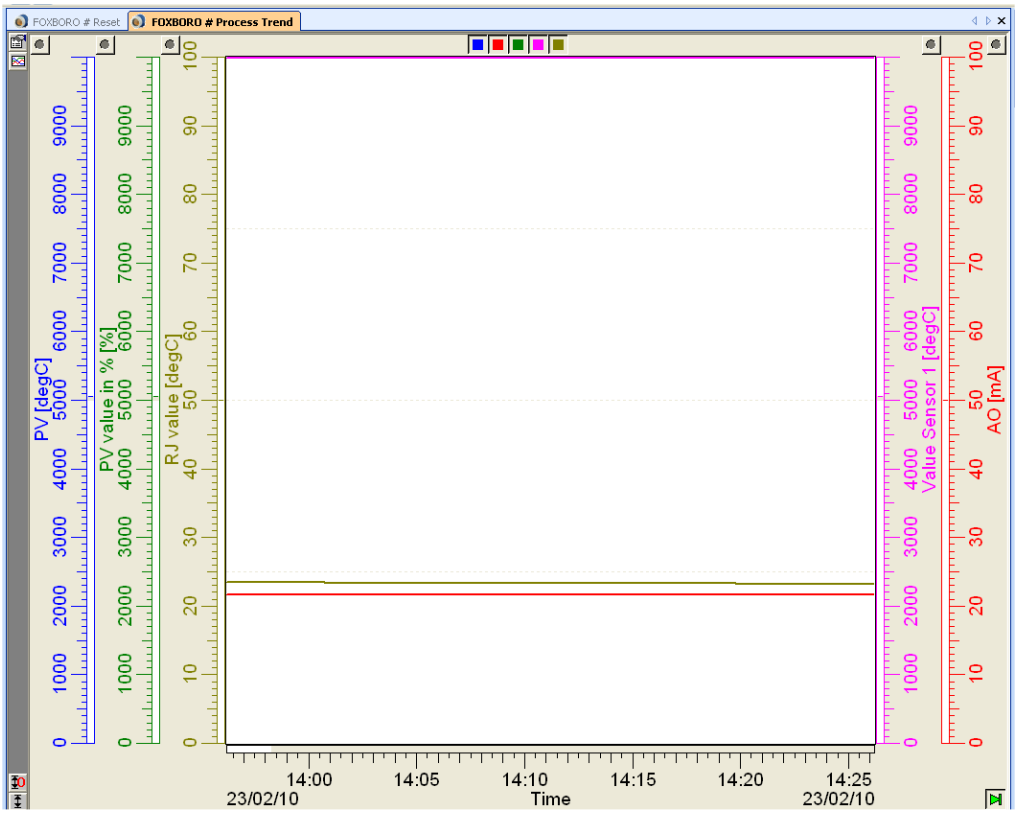

Figure 28. Sample RTT30 Temperature Transmitter Process Trend Screen

4. Troubleshooting

Troubleshooting Instructions

If faults occur after commissioning or during measurement always start any fault-finding sequence using the following checklists.

Error Messages

Fault Code	Cause	Action/Remedy	Mode (a)
0	No fault, warning	-	-
10	Hardware fault (device defective)	Replace device	F
13	Reference measurement point defective	Replace device	F
15	EEprom defective	Replace device	F
16	A/D convertor defective	Replace device	F
17	Ambient temperature limit exceeded	Electronics possibly damaged due to exceeding the ambient temperature range, return electronics to manufacturer for check	0, F
19	Supply voltage too low	Check supply voltage; check connection wires for corrosion	F
50	Sensor 1 open circuit	Monitor sensor 1	*
51	Sensor 1 short circuit	Monitor sensor 1	*
52	Sensor 1 corrosion	Monitor sensor 1	*
53	Outside sensor range	Incorrect sensor type 1 for application	*
60	Sensor 2 open circuit	Monitor sensor 2	*
61	Sensor 2 short circuit	Monitor sensor 2	*
62	Sensor 2 corrosion	Monitor sensor 2	*
63	Outside sensor range	Incorrect sensor type 2 for application	*
70	Drift alarm	Drift limit exceeded, check sensor	F
81	Alarm: measuring range undershoot	Measuring range poss. set too small	F
82	Alarm: measuring range overshoot	Measuring range poss. set too small	F
106	Warning: Up/download active	-	C
107	Warning: Output simulation active	Deactivate output simulation	C
201	Warning: Measured value too small	PV change lower range starting point	M

Fault Code	Cause	Action/Remedy	Mode (a)
202	Warning: Measured value too high	PV change upper range end point	M
203	Warning: Ambient temperature limit exceeded	Electronics possibly damaged due to exceeding the ambient temperature range, return electronics to manufacturer for check	0
204	Drift warning	Drift limit exceeded, check sensor	M
205	Warning: Sensor backup activated	Monitor sensor	M
206	Warning: Sensor 1 corrosion	Monitor sensor 1	M
207	Warning: Sensor 2 corrosion	Monitor sensor 2	M
208	Unit reset to factory default values	-	0
209	Device initialization	-	0
+1000	Other faults active	Remove displayed faults	

(a) The modes have the following meaning: F: Fault, C: Device in service mode, M: Maintenance required, S: Out of specification, *: depends on mode (F or M).

— NOTE

If more than one fault is active, then the fault with the highest priority will be displayed. Once this fault has been remedied the next fault is displayed! Multiple fault occurances can be recognized by an "Offset" of 1000.

Table 6. Unit Reaction To Sensor Faults

	PV = SV1 (2 Sensor Inputs)	PV = SV1 - SV2 (Differential)	PV = (SV1+SV2)/2 (Average value)	PV = SV1 (or SV2) (Sensor Back-up)
S1 Defective	Fault	Fault	Fault	Warning
S2 Defective	Warning	Fault	Fault	Warning
S1 and S2 Defective	Fault	Fault	Fault	Fault
Drift Alarm (IS1-S2I > Limit Value)	-	Fault	Fault	Fault
Drift warning (IS1-S2I > limit value)	-	Warning	Warning	Warning

The icon "Warning" and error code appear in the display on warnings and errors. On error, the bargraph in the display also flashes - instead of the measured value only the error code is displayed.

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 2 different steps selectable dependent on the application requirements:

- **off** (warning output just before reaching the alarm set point. This allows preventative maintenance/trouble-shooting to be done).
- **on** (no warning. immediate alarm).

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

RTD[(a)]	< ≈ 2 kΩ	2 kΩ ≈ < x < ≈ 3 kΩ	> ≈ 3 kΩ
off	---	WARNING	ALARM
on	---	ALARM	ALARM

(a) Pt100 = 100 Ω at 0°C (32°F), Pt1000 = 1000 Ω at 0°C (32°F)

TC[(a)]	< ≈ 10 kΩ	10 kΩ ≈ < x < ≈ 15 kΩ	> ≈ 15 kΩ
off	---	WARNING	ALARM
on	---	ALARM	ALARM

(a) On very high ambient temperatures a 3 x measured value deviation from the specification is possible.

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.

Monitoring the Supply Voltage

If the required supply voltage is undershot, the analog output value drops ≤ 3.6 mA for approximately 3 seconds. Error code 19 appears on the display. Afterwards, the device tries to output the normal analog output value again. If the supply voltage remains too low, the analog output value drops again to ≤ 3.6 mA. This prevents the device from continuously outputting an incorrect analog output value.

Application Errors Without Messages

General Application Errors

Error	Cause	Action/Remedy
No communication	No power supply on the 2-wire circuit	Connect the cables correctly according to the connection schematic (polarity)
	250 Ω communication resistor is missing	See “Loop Wiring” on page 12.
	Power supply too low (<10.5 V or 8 V without display with jumper J3)	Check power supply
	Defective interface cable	Check interface cable
	Defective interface	Check PC interface
	Defective device	Replace device

Application Errors for RTD Connection

NOTE

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

Error	Cause	Action/Remedy
Fault current (≤ 3.6 mA or ≥ 21.0 mA)	Defective sensor	Check sensor
	Incorrect connection of RTD	Connect cables correctly to terminal schematic
	Incorrect connection of the 2-wire cable	Connect cables correctly to terminal schematic (polarity)
	Faulty setup of the device (number of wire connections)	Change device function **SENSOR CONNECTION**
	Setup	Incorrect sensor type set up under device function **SENSOR TYPE**; correct setup to correct type
	Defective device	Replace device

Error	Cause	Action/Remedy
Measured value incorrect/inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Take note of sensor installation point
	Transmitter setup faulty (number of wires)	Change device function **SENSOR CONNECTION**
	Transmitter setup faulty (scale)	Change scale
	Incorrect RTD set up	Change device function **SENSOR TYPE**
	Sensor connection (2-wire)	Check sensor connection
	Sensor cable resistance (2-wire) not compensated	Compensate cable resistance
	Offset incorrectly set	Check offset

Application Errors for TC Connection

Error	Cause	Action/Remedy
Fault current (≤ 3.6 mA or ≥ 21 mA)	Incorrect connection of sensor	Connect cables correctly to terminal schematic (polarity)
	Defective sensor	Check sensor
	Setup	Incorrect sensor type set up under device function **SENSOR TYPE**; set up correct thermocouple
	Defective device	Replace device

Error	Cause	Action/Remedy
Measured value incorrect/inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Take note of sensor installation point
	Transmitter setup faulty (scale)	Change scale
	Incorrect TC setup	Change device function **SENSOR TYPE**
	Incorrect cold junction setup	See “Operation Using a HART Communicator” on page 16.
	Incorrect offset setup	Check offset

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