Data Sheet DS/TTH300-EN Rev. B

TTH300
Head mounted Temperature Transmitter

Sensor error adjustment
Sensor redundancy
Sensor drift monitoring

HART, PROFIBUS, FOUNDATION Fieldbus, Pt100 (RTD), Thermocouples, Electrical isolation

Input
- Resistance thermometers
- Thermocouples
- Resistance-type transmitters
- Voltages, mV voltages

Input functionality
- 1 or 2 sensors
- 2 x Pt100 three-wire circuit

Output
- 4 ... 20 mA, HART
- PROFIBUS PA, Profile 3.01
- FOUNDATION Fieldbus H1, ITK Version 5.1

Specific linearization
- Callendar-van Dusen coefficients
- Table of variate pairs / 32 points

Continuous sensor monitoring and self-monitoring
- Supply voltage monitoring
- Wire break and corrosion monitoring in accordance with NE 89
- Extended diagnostics in accordance with NE 107

Device safety in accordance with NE 53 and NE 79

SW write protection, HW write protection

SIL2 in accordance with IEC 61508 (for HART)

Approvals for explosion protection
- ATEX, IECEx, Zone 0
- FM / CSA
- GOST Russia

Configuration
- LCD-Anzeiger
- DTM
- EDD

Service interface

Contents

1 Specifications

1.1 Input

1.1.1 Resistance thermometers / Resistors

Resistance thermometers
Pt100 in accordance with IEC 60751, JIS C1604-81, MIL-T-24388,
Ni in accordance with DIN 43760, Cu

Resistance measurement
0 … 500 Ω
0 … 5000 Ω

Sensor connection type
Two-, three-, four-wire circuit

Connecting cable
Maximum sensor line resistance (R_W) for each line 50 Ω according to NE 89 (January 2009)
Three-wire circuit:
symmetrical sensor line resistances
Two-wire circuit:
compensation up to 100 Ω total line resistance

Measurement current
< 300 µA

Sensor short circuit
< 5 Ω (for resistance thermometer)

Sensor wire break

Measuring range: 0 ... 500 Ω	> 0.6 ... 10 kΩ
Measuring range: 0 ... 5 kΩ	> 5.3 ... 10 kΩ

Corrosion detection in accordance with NE 89

Three-wire resistance measurement	> 50 Ω
Four-wire resistance measurement	> 50 Ω

Sensor error signaling

Resistance thermometers:	Short circuit and wire break
Linear resistance measurement:	Wire break

1.1.2 Thermocouples / Voltages

Types
B, E, J, K, N, R, S, T in accordance with IEC 60584
U, L in accordance with DIN 43710
C, D in accordance with ASTM E-988

Voltages
-125 ... 125 mV
-125 ... 1,100 mV

Connecting cable
Maximum sensor line resistance (R_W) for each line: 1.5 kΩ, total: 3 kΩ

Sensor wire-break monitoring in accordance with NE 89
Pulsed with 1 µA outside measurement interval

Thermocouple measurement	5.3 ... 10 kΩ
Voltage measurement	5.3 ... 10 kΩ

Input resistance
> 10 MΩ

Internal reference point
Pt1000, IEC 60751 Cl. B
(no additional jumpers necessary)

Sensor error signaling

Thermocouple:	Wire break
Linear voltage measurement:	Wire break

1.1.3 Functionality

Freestyle characteristics and 32-point sampling table
Resistance measurement up to maximum 5 kΩ
Voltages up to maximum 1.1 V

Sensor error adjustment
Via Callendar van Dusen coefficients
Via table of 32 sampling points
Via single-point adjustment (offset adjustment)
Via two-point adjustment

Input functionality
1 sensor
2 sensors:
mean measurement,
differential measurement,
sensor redundancy,
sensor drift monitoring

1.2 Output

1.2.1 HART output

Transmission characteristics
Temperature linear
Resistance linear
Voltage linear

Output signal
Configurable 4 ... 20 mA (standard)
Configurable 20 ... 4 mA
(dynamic range: 3.8 ... 20.5 mA in accordance with NE 43)

Simulation mode
3.5 ... 23.6 mA

Induced current consumption
< 3.5 mA

Maximum output current
23.6 mA

Configurable error current signal
Override 22 mA (20.0 … 23.6 mA)
Underdrive 3.6 mA (3.5 … 4.0 mA)

1.2.2 PROFIBUS PA output

Output signal
PROFIBUS – MBP (IEC 61158-2)
baud rate 31.25 kbit/s
PA profile 3.01
FISCO-compliant (IEC 60079-27)
IDENT_ NUMBER: 0x3470 [0x9700]

Error current signal
FDE (Fault Disconnection Electronic)

Block structure
Physical block
transducer block 1 – temperature
transducer block 2 – HMI (LCD)
transducer block 3 – extended diagnostics
analog input 1 – primary value (calculated value*)
analog input 2 – SECONDARY VALUE_1 (sensor 1)
analog input 3 – SECONDARY VALUE_2 (sensor 2)
analog input 4 – SECONDARY VALUE_3 (reference point temp.)
analog output – optional HMI display (transducer block 2)
discrete input 1 – extended diagnostics 1 (transducer block 3)
discrete input 2 – extended diagnostics 2 (transducer block 3)
* Sensor 1, sensor 2, or difference, or mean

1.2.3 FOUNDATION Fieldbus output

Output signal
FOUNDATION Fieldbus H1 (IEC 611582)
Baud rate 31.25 kbit/s, ITK 5.1
FISCO-compliant (IEC 60079-27)
Device ID: 0003200125

Error current signal
FDE (Fault Disconnection Electronic)

Block structure [1)]
Resource block
Transducer block 1 – temperature
Transducer block 2 – HMI (LCD)
Transducer block 3 – extended diagnostics
Analog input 1 – PRIMARY_VALUE_1 (sensor 1)
Analog input 2 – PRIMARY_VALUE_2 (sensor 2)
Analog input 3 – PRIMARY_VALUE_3 (calculated value*)
Analog input 4 – SECONDARY_VALUE (reference point temp.)
Analog output – optional HMI display (transducer block 2)
Discrete input 1 – extended diagnostics 1 (transducer block 3)
Discrete input 2 – extended diagnostics 2 (transducer block 3)
PID – PID controller
* Sensor 1, sensor 2, or difference, or mean

LAS (Link Active Scheduler) link master functionality

1) For the block description, block index, execution times, and block class, refer to the interface description.

1.3 Power supply (polarity safe)

Two-wire technology; power lines = signal lines

1.3.1 HART power supply

Supply voltage
Non ignition-proof application with or without LCD:
U_S = 11 ... 42 V DC
Ignition-proof applications with or without LCD:
U_S = 11 ... 30 V DC

Max. permissible residual ripple for supply voltage
During communication in accordance with HART FSK "Physical Layer" specification, version 8.1 (August 1999) Section 8.1

Undervoltage detection
$U_{Terminal-Mu}$ < 10 V results in I_a = 3.6 mA

Maximum load
R_{Load} = (supply voltage – 11 V) / 0.022 A

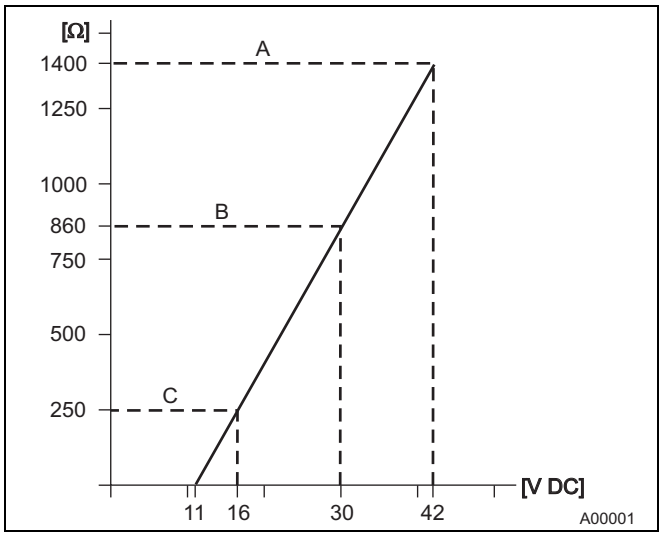


Fig. 1: Max. load depending on supply voltage
A TTH300
B TTH300 In ia hazardous area design
C HART communication resistor

Maximum power consumption
P = U_S x 0.022 A
e.g., U_S = 24 V → P_{max} = 0.528 W

1.3.2 PROFIBUS / FOUNDATION Fieldbus power supply

Supply voltage
Non ignition-proof application with or without LCD:
U_S = 9 ... 32 V DC
Ignition-proof applications with or without LCD:
U_S = 9 ... 17.5 V DC (FISCO)
U_S = 9 ... 24 V DC (Fieldbus Entity model I.S.)
Current consumption ≤ 12 mA

2 General information

CE Marking
The TTH300 meets all requirements as regards the CE Marking in accordance with Directive 2004 / 108 / EC

Electrical isolation
3.5 kV DC (approx. 2.5 kV AC) 60 s, input to output

MTBF time
28 years at 60 °C ambient temperature

Input filter
50 / 60 Hz

Switch-on delay
HART: < 10 s (I_a ≤ 3.6 mA during starting cycle)
PROFIBUS: 10 s, max. 30 s
FOUNDATION Fieldbus: < 10 s

Warm-up time
5 minutes

Ramp-up time t90
400 … 1,000 ms

Rate updated
10/s with 1 sensor, 5/s with 2 sensors, depending on sensor type and sensor circuit

Output filter
Digital filter 1st order: 0 ... 100 s

2.1 Ambient conditions

Ambient temperature
Standard: -40 … 85 °C (-40 … 185 °F)
Restricted range during operation with LCD or with hazardous area design

Transport/storage temperature
-40 … 85 °C (-40 … 185 °F)

Climate class
Cx -40 … 85 °C (-40 … 185 °F) at
5 … 95 % relative humidity, DIN EN 60654-1

Max. permissible humidity
100 % relative humidity, IEC 60068-2-30

Vibration resistance
10 … 2,000 Hz at 5 g in acc. with IEC 60068-2-6,
during operation and transport

Shock
gn = 30 in acc. with IEC 68-2-27,
during operation and transport

Ingress protection
IP 20 or IP class of the bay

2.2 Electromagnetic compatibility

Emitted interference in accordance with IEC EN 61326 (2006) and Namur NE 21 (February 2004)

2.3 EMI / RFI shielding

Interference immune in accordance with IEC 61326 (2006) and Namur NE 21 (08/2007)

Pt100: Measuring range 0 ... 100 °C (32 ... 212 °F), span 100 K

Type of test	Testing accuracy	Influence
Burst to signal/data lines	2 kV	< 0.5 %
Static discharge		
• Contact plate (indirect)	8 kV	no
• Supply terminals 1)	6 kV	no
• Sensor terminals 1)	4 kV	no
Radiated field 80 MHz ... 2 GHz	10 V/m	< 0.5 %
Coupling 150 kHz … 80 MHz	10 V	< 0.5 %
Surge		
Between the supply lines	0.5 kV	No malfunction
Line to earth	1 kV	No malfunction

1) Air discharge (at 1 mm (0.04 inch) distance)

2.4 Mechanical design

Dimensions
See Section 5, "Dimensions"

Weight
50 g

Material
Housing: polycarbonate
Color: gray RAL 9002

Installation conditions
Mounting position: no limitations
Installation options: connection heads acc. to DIN 43729 form B, field-mount housing

Electrical connection
Terminals with captive screws, incl. soldering tags
Lines up to max. 1.5 mm^2 (AWG 16)
Connection for handheld terminal

2.5 SIL functional safety

Conforms with IEC 61508 as regards use in safety-related applications, up to and including SIL 2.

Only applies to the HART version.

2.6 Measuring accuracy

Includes linearity deviation, reproducibility/hysteresis at 23 °C (73.4 °F) ± 5 K and 20 V supply voltage

Information on measuring accuracy corresponds to 3 σ (Gaussian distribution)

Input element			Measuring range limits	Minimum span	Digital measuring accuracy (24-bit A/D converter)	D/A measuring accuracy [1] (16-bit DA)
Standard	**Sensor**					
Resistance thermometer / resistor						
IEC 60751	Pt10	(a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	Pt50	(a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	Pt100	(a=0.003850) [2]	**-200 ... 850 °C (-328 ... 1562 °F)**	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	Pt200	(a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.24 °C (± 0.43 °F)	± 0.05 %
	Pt500	(a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	Pt1000	(a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
JIS C1604-81	Pt10	(a=0.003916)	-200 ... 645 °C (-328 ... 1193 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	Pt50	(a=0.003916)	-200 ... 645 °C (-328 ... 1193 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	Pt100	(a=0.003916)	-200 ... 645 °C (-328 ... 1193 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
MIL-T-24388	Pt10	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,80 °C (± 1,44 °F)	± 0,05 %
	Pt50	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,16 °C (± 0,29 °F)	± 0,05 %
	Pt100	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,08 °C (± 0,14 °F)	± 0,05 %
	Pt200	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,24 °C (± 0,43 °F)	± 0,05 %
	Pt500	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,16 °C (± 0,29 °F)	± 0,05 %
	Pt1000	(a=0,003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0,08 °C (± 0,14 °F)	± 0,05 %
DIN 43760	Ni50	(a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	Ni100	(a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	Ni120	(a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	Ni1000	(a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	Cu10	(a=0.004270)	-50 ... 200 °C (-58 ... 392 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	Cu100	(a=0.004270)	-50 ... 200 °C (-58 ... 392 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	Resistance measurement		0 ... 500 Ω	4 Ω	± 32 mΩ	± 0.05 %
	Resistance measurement		0 ... 5000 Ω	40 Ω	± 320 mΩ	± 0.05 %
Thermocouples [3] / voltages						
IEC 60584	Type K	(Ni10Cr-Ni5)	-270 ... 1372 °C (-454 ... 2502 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type J	(Fe-Cu45Ni)	-210 ... 1200 °C (-346 ... 2192 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type N	(Ni14CrSi-NiSi)	-270 ... 1300 °C (-454 ... 2372 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type T	(Cu-Cu45Ni)	-270 ... 400 °C (-454 ... 752 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type E	(Ni10Cr-Cu45Ni)	-270 ... 1000 °C (-454 ... 1832 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type R	(Pt13Rh-Pt)	-50 ... 1768 °C (-58 ... 3215 °F)	100 °C (180 °F)	± 0.95 °C (± 1.71 °F)	± 0.05 %
	Type S	(Pt10Rh-Pt)	-50 ... 1768 °C (-58 ... 3215 °F)	100 °C (180 °F)	± 0.95 °C (± 1.71 °F)	± 0.05 %
	Type B	(Pt30Rh-Pt6Rh)	-0 ... 1820 °C (32 ... 3308 °F)	100 °C (180 °F)	± 0.95 °C (± 1.71 °F)	± 0.05 %
DIN 43710	Type L	(Fe-CuNi)	-200 ... 900 °C (-328 ... 1652 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
	Type U	(Cu-CuNi)	-200 ... 600 °C (-328 ... 1112 °F)	50 °C (90 °F)	± 0.35 °C (± 0.63 °F)	± 0.05 %
ASTM E-988	Type C		-0 ... 2315 °C (32 ... 4200 °F)	100 °C (180 °F)	± 1.35 °C (± 2.43 °F)	± 0.05 %
	Type D		-0 ... 2315 °C (32 ... 4200 °F)	100 °C (180 °F)	± 1.35 °C (± 2.43 °F)	± 0.05 %
	Voltage measurement		-125 ... 125 mV	2 mV	± 12 µV	± 0.05 %
	Voltage measurement		-125 ... 1100 mV	20 mV	± 120 µV	± 0.05 %

Long-term drift

± 0.05 °C (± 0.09 °F) or ± 0.05 % [1] per year. the larger value applies.

1) Percentages refer to the configured measuring span. omitted for PROFIBUS and FOUNDATION Fieldbus
2) Standard model
3) Include the internal reference point error for digital measuring accuracy: Pt1000. IEC 60751 Cl. B
4) Without reference point error

2.7 Operating influences

The percentages refer to the configured measuring span.

Supply voltage influence / load influence: within the specified limits for the voltage/load. the total influence is less than 0.001 % per volt

Common-mode interference: no influence up to 100 V_{eff} (50 Hz) or 50 V DC

Ambient temperature influence: based on 23 °C (73.4 °F) for ambient temperature range -40 ... 85 °C (-40 ... 185 °F) [4)]

Sensor	**Ambient temperature influence for 1 °C (1.8 °F) deviation to 23 °C (73.4 °F) for digital measurement**	**Ambient temperature influence [1) 2)] for 1 °C (1.8 °F) deviation to 23 °C (73.4 °F) for D/A converter**
Resistance thermometers for two-. three-. four-wire circuits		
Pt10 IEC. JIS. MIL	± 0.04 °C (± 0.072 °F)	± 0.003 %
Pt50 IEC. JIS. MIL	± 0.008 °C (± 0.014 °F)	± 0.003 %
Pt100 IEC. JIS. MIL	± 0.004 °C (± 0.007 °F)	± 0.003 %
Pt200 IEC. MIL	± 0.02 °C (± 0.036 °F)	± 0.003 %
Pt500 IEC, MIL	± 0,008 °C (± 0,014 °F)	± 0,003 %
Pt1000 IEC. MIL	± 0.004 °C (± 0.007 °F)	± 0.003 %
Ni50 DIN 43760	± 0.008 °C (± 0.014 °F)	± 0.003 %
Ni100 DIN 43760	± 0.004 °C (± 0.007 °F)	± 0.003 %
Ni120 DIN 43760	± 0.003 °C (± 0.005 °F)	± 0.003 %
Ni1000 DIN 43760	± 0.004 °C (± 0.007 °F)	± 0.003 %
Cu10	± 0,04 °C (± 0,072 °F)	± 0,003 %
Cu100	± 0,004 °C (± 0,007 °F)	± 0,003 %
Resistance measurement		
0 ... 500 Ω	± 0.002 Ω	± 0.003 %
0 ... 5000 Ω	± 0.02 Ω	± 0.003 %
Thermocouple. for all defined types	± [(0.001 % x (ME[mV] / MS[mv]) + (100 % x (0.009 °C / MS [°C])] [3)]	± 0.003 %
Voltage measurement		
-125 ... 125 mV	± 1.5 µV	± 0.003 %
-125 ... 1100 mV	± 15 µV	± 0.003 %

1) Percentages refer to the configured measuring span of the analog output signal
2) Influence of the D/A converter omitted for PROFIBUS PA and FOUNDATION Fieldbus H1
3) ME = voltage value of the thermocouple at the end of the measuring range in accordance with the standard
MA = voltage value of the thermocouple at the start of the measuring range in accordance with the standard
MS = voltage value of the thermocouple over the measuring span in accordance with the standard. MS = (ME - MA)
4) In the case of the option to expand the ambient temperature range up to -50 °C (-58 °F), the causal variables are doubled in the range between -50 ... -40 °C (-58 ... -40 °F)

3 Communication

3.1 Configuration parameters

Measurement type

Sensor type, connection type
Error signaling
Measuring range
General information, e.g., TAG number
Damping
Warning and alarm limits
Signal simulation of output
For additional information, see Section 9, "Order form configuration"

Write protection

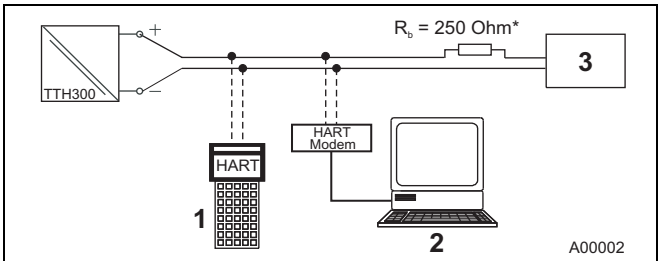
Software write protection

Diagnostic information in accordance with NE 107

Standard:
Sensor error (wire break or short circuit)
Device error
Over / under alarm limits
Over / under measuring range
Simulation activated
Advanced:
Redundancy / sensor backup active (in case sensor fails) with configurable analog alarm pulse signaling
Drift monitoring with configurable alarm pulse signaling
Sensor / sensor line corrosion
Supply voltage undershoot
Drag indicator for sensor 1, sensor 2, and ambient temperature
Ambient temperature overshoot
Ambient temperature undershoot
Operating hours counter

3.2 HART

The device is listed with the HART Communication Foundation.



* If necessary

Fig. 2: Example for HART interface connection

1 Handheld terminal
2 FDT / DTM technology
3 Power unit (process interface)

Manufacturer ID:	0x1A
Device ID:	0x0A
Profile:	HART 5.1
Configuration:	On device using LCD DTM EDD
Transmission signal:	BELL Standard 202

Operating modes

Point-to-point communication mode: standard (general address 0)
Multidrop mode (addressing 1 ... 15)
Burst mode

Configuration options and tools

Driver-independent:
HMI LCD with configuration function
Driver-dependent:
Device management/asset management tools
FDT / DTM technology – via TTX300 DTM driver
EDD - via TTX300 EDD driver

Diagnostic signaling

Over / underdrive in accordance with NE 43
HART diagnostics

3.3 PROFIBUS PA

The interface conforms to profile 3.01 (PROFIBUS standard, EN 50170, DIN 1924 [PRO91]).

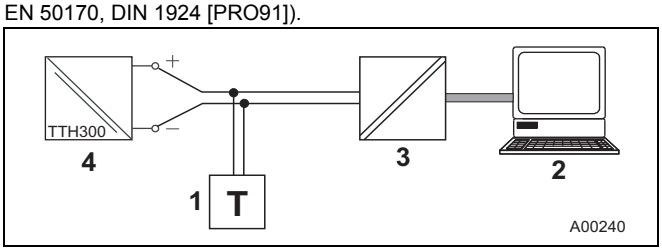


Fig. 3: Example for PROFIBUS PA interface connection

1 Bus termination
2 PC / DCS
3 Segment coupler
4 Transmitter

Manufacturer ID:	0x1A
IDENT_NUMBER:	0x3470 [0x9700]
Profile:	PA 3.01
Configuration:	On device using LCD DTM EDD GSD
Transmission signal:	IEC 61158-2

Voltage / current consumption

Average current consumption: 12 mA.
In the event of an error, the FDE (= Fault Disconnection Electronic) function integrated in the device ensures that the current consumption can rise to a maximum of 20 mA.

3.4 FOUNDATION Fieldbus

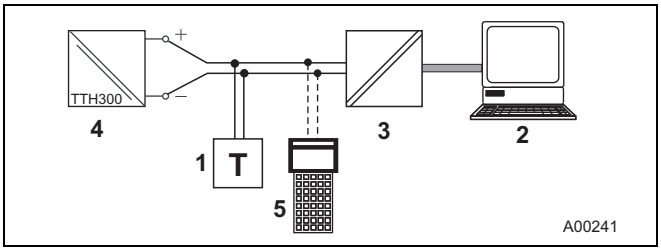


Fig. 4: Example for FOUNDATION Fieldbus interface connection

1 Bus termination
2 PC / DCS
3 Linking device
4 Transmitter
5 Handheld

DEVICE ID:	0003200125
ITK:	5.1
Configuration:	On device using LCD EDD
Transmission signal:	IEC 61158-2

Voltage / current consumption

Average current consumption: 12 mA.
In the event of an error, the FDE (= Fault Disconnection Electronic) function integrated in the device ensures that the current consumption can rise to a maximum of 20 mA.

4 Electrical connections

Resistance thermometers (RTD) / resistors (potentiometers)

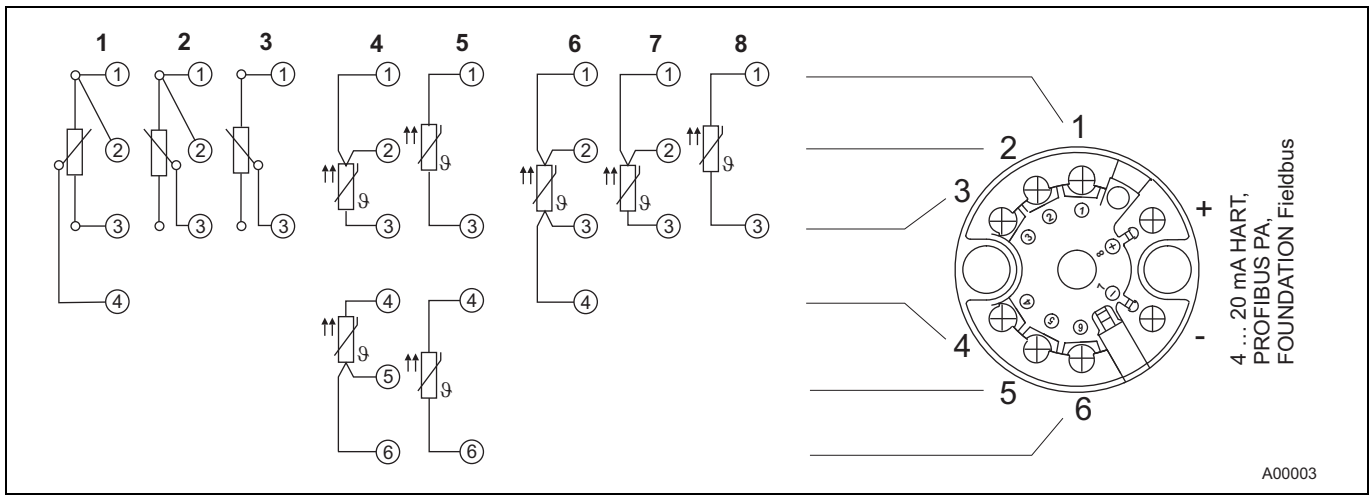


Fig. 5

1 Potentiometer, four-wire circuit
2 Potentiometer, three-wire circuit
3 Potentiometer, two-wire circuit
4 2 x RTD, three-wire circuit [1)]
5 2 x RTD, two-wire circuit [1)]
6 RTD, four-wire circuit
7 RTD, three-wire circuit
8 RTD, two-wire circuit

1) Sensor backup/redundancy, sensor drift monitoring, mean measurement or differential measurement

Thermocouple / voltage and resistance thermometer (RTD) / thermocouple combinations

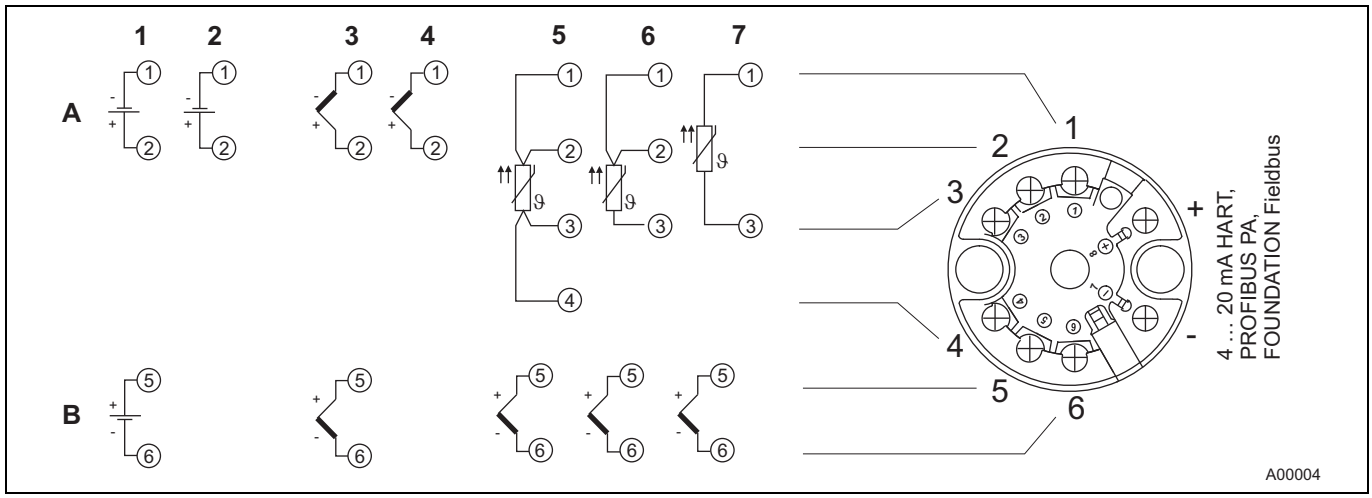


Fig. 6

A Sensor 1
B Sensor 2
1 2 x voltage measurement [1)]
2 1 x voltage measurement
3 2 x thermocouple [1)]
4 1 x thermocouple
5 1 x RTD, four-wire circuit and 1 x thermocouple [1)]
6 1 x RTD, three-wire circuit and 1 x thermocouple [1)]
7 1 x RTD, two-wire circuit and 1 x thermocouple [1)]

1) Sensor backup/redundancy, sensor drift monitoring, mean measurement or differential temperature measurement

5 Dimensions

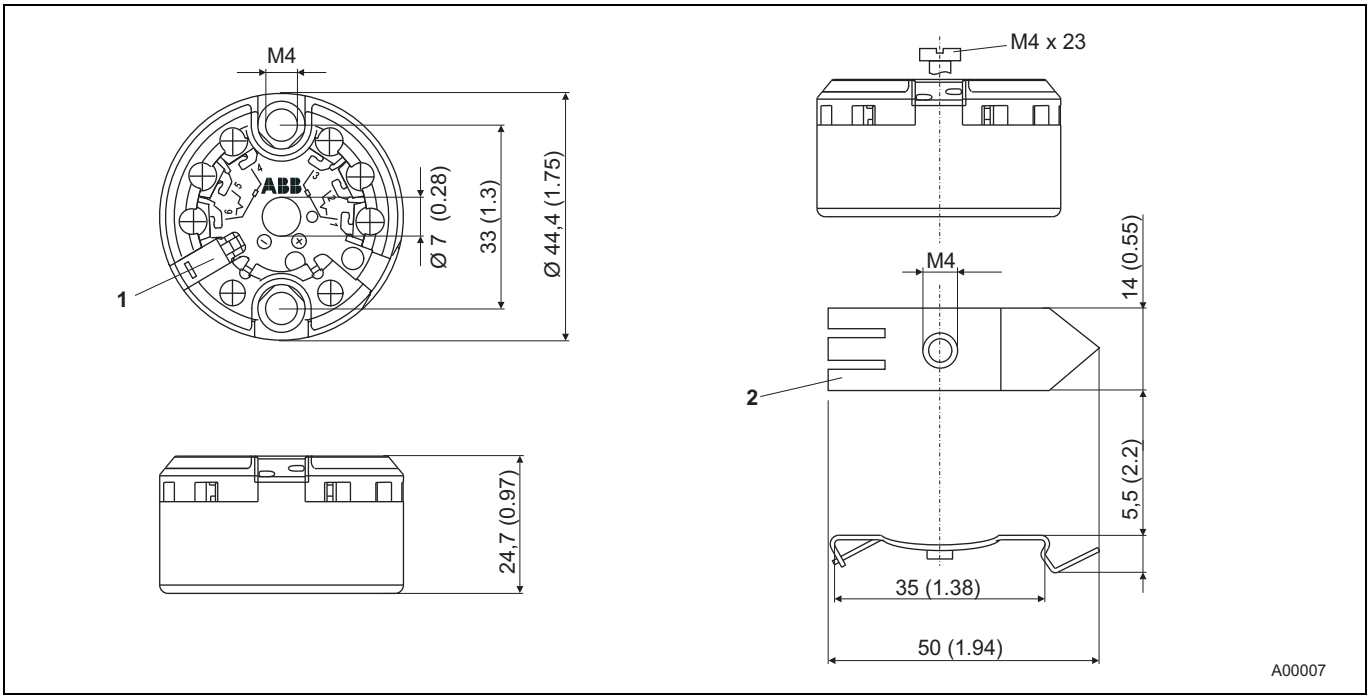


Fig. 7: Dimensions in mm / inch
1 Interface for LCD and service
2 Latching base for 35 mm (1.38 inch) rail mounting in accordance with EN 60175

6 Ordering information

	Main order number				Additional order no.
Version number	1 - 6	7	8	9	XX
TTH300 head-mounted temperature transmitter, Pt100 (RTD), thermocouples, electrical isolation	**TTH300**	**X**	**X**	**X**	XX
Explosion protection					
Without explosion protection		**Y**	**0**		
ATEX intrinsic safety type of protection:		E	1		
Zone 0: II 1 G Ex ia IIC T6, Zone 1 (0): II 2 (1) G Ex [ia] ib IIC T6, Zone 1 (20): II 2 G (1D) Ex [iaD] ib IIC T6					
ATEX non-sparking type of protection:		E	2		
Zone 2: II 3 G Ex nA II T6					
IECEx intrinsic safety:		H	1		
Zone 0: II 1 G Ex ia IIC T6 Zone 1 (0): II 2(1) G Ex [ia]ib IIC T6 Zone 1 (20): II 2 G (1D) Ex [iaD] ib IIC T6					
FM intrinsically safe (IS):		L	1		
Class I, Div. 1+2, Groups A, B, C, D, Class I, Zone 0, AEx ia IIC T6					
FM non-incendive:		L	2		
Class I, Div. 2, Groups A, B, C, D					
CSA intrinsically safe (IS):		R	1		
Class I, Div. 1+2, Groups A, B, C, D					
CSA non-incendive (NI):		R	2		
Class I, Div. 2, Groups A, B, C, D					
Communication protocol					
HART				H	
PROFIBUS PA				P	
FOUNDATION Fieldbus				F	
Configuration					
Customer-specific configuration with report, no specific user characteristics				1)	BF
Customer-specific configuration with report, with specific user characteristics					BG
Certificates					
SIL2 declaration of conformity				2)	CS
Declaration of conformity (2.1) with the order in accordance with EN 10204					C4
Calibration certificates					
With 5-point factory calibration certificate					EM
Expanded ambient temperature range					
-50 ... 85 °C (-58 ... 185 °F)				3)	SE
Customer-specific design					
(Please provide)					Z9
Language of documentation					
German					M1
English					M5
Western Europe, Scandinavia language package (DE, EN, FR, ES, DA, IT, NL, PT, SV, FI)					MW
Eastern Europe language package (DE, EL, CS, ET, HU, LT, LV, PL, SK, SL, RO, BG)					ME

1) For example, measuring range, TAG number, etc.
2) Only available for communication protocol code H (HART)
3) Not for explosion protection code L1, L2, R1, R2

6.1 Accessories

Description	Order number
TTH300 latching base set (10 pieces per packing unit), for 35 mm (1.38 inch) rail in accordance with EN 60175 (incl. fixing screws)	3KXT231310L0001
TTH300 latching base set (1 pieces per packing unit), for 35 mm (1.38 inch) rail in accordance with EN 60175 (incl. fixing screws)	3KXT231310L0002

7 Ex relevant specifications

7.1 TTH300-E1X, intrinsic safety ATEX

Explosion protection

The TTH300 complies with the requirements of the ATEX Directive 94/9/EC
Approved for use in Zone 0, 1, and 2

Designation

II 1G Ex ia IIC T6 (Zone 0)
II 2(1)G Ex [ia] ib IIC T6 (Zone 1 [0])
II 2G(1D) Ex [iaD] ib IIC T6 (Zone 1 [20])

TTH300-E1H:
EC type-examination test certificate PTB 05 ATEX 2017 X
TTH300-E1P/E1F:
EC type-examination test certificate PTB 09 ATEX 2016 X

7.2 TTH300-H1X, intrinsic safety IECEx

Designation

Ex ia IIC T6
Ex [ia] ib IIC T6
Ex [iaD] ib IIC T6

TTH300-H1H:
IECEx certificate of conformity IECEx PTB 09.0014X
TTH300- H1P/H1F:
IECEx certificate of conformity

7.3 Safety specifications for Intrinsic Safety ATEX / IECEx

Temperature table

Temperature class	Permissible ambient temperature range	
	Device category 1 use	Device category 2 use
T6	-50 … 44 °C (-58 ... 111.2 °F)	-50 … 56 °C (-58 ... 132.8 °F)
T5	-50 … 56 °C (-58 ... 132.8 °F)	-50 … 71 °C (-58 ... 159.8 °F)
T4, T3, T2, T1	-50 … 60 °C (-58 ... 140.0 °F)	-50 … 85 °C (-58 ... 185.0 °F)

Type of protection intrinsic safety Ex ia IIC (Part 1)

	TTH300-E1H TTH300-H1H Supply circuit	TTH300-E1P/-H1P TTH300-E1F/-H1F Supply circuit 1)	
		FISCO	ENTITY
Max. voltage	U_i = 30 V	$U_i \leq$ 17.5 V	$U_i \leq$ 24.0 V
Short circuit current	I_i = 130 mA	$I_i \leq$ 183 mA 2)	$I_i \leq$ 250 mA
Max. power	P_i = 0.8 W	$P_i \leq$ 2.56 W 2)	$P_i \leq$ 1.2 W
Internal inductance	L_i = 0.5 mH	$L_i \leq$ 10 µH	$L_i \leq$ 10 µH
Internal capacitance	C_i = 5 nF	$C_i \leq$ 5 nF	$C_i \leq$ 5 nF

1) FISCO in accordance with 60079-27
2) II B FISCO: $I_i \leq$ 380 mA, $P_i \leq$ 5.32 W

Type of protection intrinsic safety Ex ia IIC (Part 2)

	Measurement current circuit: resistance thermometers, resistors	Measurement current circuit: thermocouples, voltages
Max. voltage	U_o = 6.5 V	U_o = 1.2 V
Short circuit current	I_o = 25 mA	I_o = 50 mA
Max. power	P_o = 38 mW	P_o = 60 mW
Internal inductance	L_i = 0 mH	L_i = 0 mH
Internal capacitance	C_i = 49 nF	C_i = 49 nF
Maximum permissible external inductance	L_o = 5 mH	L_o = 5 mH
Maximum permissible external capacitance	C_o = 1.55 µF	C_o = 1.05 µF

Type of protection intrinsic safety Ex ia IIC (Part 3)

	LCD interface
Max. voltage	U_o = 6.2 V
Short circuit current	I_o = 65.2 mA
Max. power	P_o = 101 mW
Internal inductance	L_i = 0 mH
Internal capacitance	C_i = 0 nF
Maximum permissible external inductance	L_o = 5 mH
Maximum permissible external capacitance	C_o = 1.4 µF

7.4 TTH300-E2X, non-sparking ATEX

Explosion protection

The TTH300 complies with the requirements of
ATEX Directive 94/9/EC
Approved for use in Zone 2

Designation

II 3 G Ex nA II T6

ABB manufacturer's declaration in accordance with ATEX Directive

Temperature table

Temperature class	Device category 3 use
T6	-50 … 56 °C (-58 ... 132.8 °F)
T5	-50 … 71 °C (-58 ... 159.8 °F)
T4	-50 … 85 °C (-58 ... 185.0 °F)

7.5 TTH300-L1X, intrinsically safe FM

Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, AEx ia IIC T6
TTH300-L1H: control drawing: SAP_214829
TTH300-L1P: control drawing: TTH300-L1P (IS)
TTH300-L1F: control drawing: TTH300-L1F (IS)

7.6 TTH300-L2X, non-incendive FM

Class I, Div. 2, Groups A, B, C, D
TTH300-L2H:
Control drawing: 214830 (non-incendive)
Control drawing: 214831 (non-incendive)
TTH300-L2P:
Control drawing: TTH300-L2P (NI_PS), TTH300-L2P (NI_AA)
TTH300-L2F:
Control drawing: TTH300-L2F (NI_PS), TTH300-L2F (NI_AA)

7.7 TTH300-R1X, intrinsically safe CSA

Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, Ex ia Group IIC T6
TTH300-R1H: control drawing: 214826
TTH300-R1P: control drawing: TTH300-R1P (IS)
TTH300-R1F: control drawing: TTH300-R2F (IS)

7.8 TTH300-R2X, non-incendive CSA

Class I, Div. 2, Groups A, B, C, D
TTH300-R2H:
Control drawing: SAP_214824 (non-incendive)
Control drawing: SAP_214896 (non-incendive)
TTH300-R2P:
Control drawing: TTH300-R2P (NI_PS), TTH300-R2P (NI_AA)
TTH300-R2F:
Control drawing: TTH300-R2F (NI_PS), TTH300-R2F (NI_AA)

8 Type A and type AS LCD indicator

The type A LCD can be used to carry out configuration functions, while the type AS LCD only has a display function. Both LCDs can only be ordered in conjunction with temperature sensors.

CE Marking

The type A and type AS LCD meets all requirements as regards the CE Marking in accordance with IEC 61326 (2006).

8.1 Features

Transmitter-controlled graphic (alphanumeric) LCD

Character height, mode-dependent
Sign, 4 digits, 2 decimal places
Bar graph display
Rotatable in 12 increments of 30°

Display options

Sensor 1 process data
Sensor 2 process data
Electronics/ambient temperature
Output value
Output %

Display diagnostic information related to transmitter and sensor status

8.2 Specifications

Temperature range

-20 … 70 °C (-4 … 158 °F)
Restricted display function (contrast, reaction time) in the temperature ranges:
-50 … -20 °C (-58 … -4 °F) [1)]
or
70 … 85 °C (158 … 185 °F)

Humidity

0 … 100 %, condensation permitted

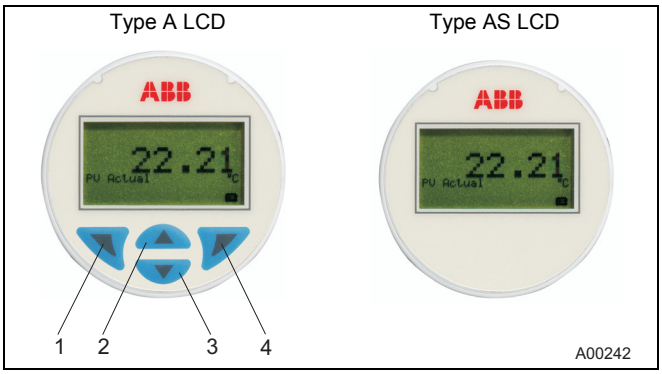


Fig. 8

1 Exit / Cancel
2 Scroll back
3 Scroll forward
4 Select

1) Additional mechanical protection is required for this range

8.3 Type A LCD configuration function

Sensor configuration for standard sensors
Measuring range
Behavior in the event of a fault (HART)
Software write protection for configuration data
Device address for HART and PROFIBUS PA

8.4 Ex relevant specifications

8.4.1 Intrinsic Safety ATEX

Explosion protection

Approved for use in Zone 0.

Designation

II 1G Ex ia IIC T6

EC type-examination certificate PTB 05 ATEX 2079 X

8.4.2 Intrinsic Safety IECEx

Explosion protection

Approved for use in Zone 0.

Designation

Ex ia IIC T6

For further information, see certificate

8.4.3 Safety specifications for Intrinsic Safety ATEX / IECEx

Temperature table

Temperature class	Permissible ambient temperature range	
	Device category 1 use	Device category 2 use
T6	-40 … 44 °C (-40 … 111.2 °F)	-40 … 56 °C (-40 … 132.8 °F)
T5	-40 … 56 °C (-40 … 132.8 °F)	-40 … 71 °C (-40 … 159.8 °F)
T4	-40 … 60 °C (-40 … 140 °F)	-40 … 85 °C (-40 … 185 °F)

Protection type intrinsic safety Ex ia IIC

	Supply circuit
Max. voltage	U_i = 9 V
Short circuit current	I_i = 65.2 mA
Max. power	P_i = 101 W
Internal inductance	L_i = 0 mH
Internal capacitance	C_i = 0.4 nF

8.4.4 Intrinsically Safe FM

I.S. Class I Div 1 and Div 2, Group: A, B, C, D or
I.S. Class I Zone 0 AEx ia IIC T*
Temp. Ident: T6 T_{amb} 56 °C, T4 T_{amb} 85 °C
U_i / V_{max} = 9V, I_i / I_{max} < 65.2 mA, P_i = 101 mW
C_i = 0.4 µF; L_i = 0
Control Drawing: SAP_214 748

8.4.5 Non-Incendive FM

N.I. Class I Div 2, Group: A, B, C, D or
Ex nL IIC T*, Class I Zone 2
Temp. Ident: T6 T_{amb} 60 °C, T4 T_{amb} 85 °C
U_i / V_{max} = 9V, I_i / I_{max} < 65.2 mA, P_i = 101 mW
C_i = 0.4 µF; L_i = 0
Control Drawing: SAP_214 751

8.4.6 Intrinsically Safe CSA

I.S. Class I Div 1 and Div 2; Group: A, B, C, D or
I.S Zone 0 Ex ia IIC T*
*Temp. Ident T6 T_{amb} 56 C, T4 T_{amb} 85 °C
U_i / V_{max} = 9V, I_i / I_{max} < 65,2 mA; P_i = 101 mW
C_i < 0,4 $F_µ$, L_i = 0
Control Drawing: SAP_214 749

8.4.7 Non-Incendive CSA

N.I. Class I Div 2, Group: A, B, C, D or
Ex nL IIC T*, Class I Zone 2
*Temp. Ident T6, T_{amb} 60 °C, T4 T_{amb} 85 °C
U_i / V_{max} = 9V, I_i / I_{max} < 65.2 mA, P_i = 101 mW
C_i < 0.4 µF, L_i = 0
Control Drawing: SAP_214 750

9 Order form configuration

9.1 HART device design: Data relating to customer-specific configuration

Configuration		Selection
Number of sensors		☐ **1 senso**r (standard) ☐ 2 sensors
Measurement type (for 2-sensor selection only)		☐ Redundancy / sensor backup ☐ Sensor drift monitoring .....°C / K Sensor drift differential ....s time limit for drift overshoot ☐ Differential measurement: Zero point where Ia = 4 mA ☐ Differential measurement: Zero point where Ia = 12 mA ☐ Mean measurement
IEC 60751 JIS C1604-81 MIL-T-24388 DIN 43760 Cu	Resistance thermometer	☐ Pt10 ☐ Pt50 ☐ **Pt100** (standard) ☐ Pt200 ☐ Pt500 ☐ Pt1000 ☐ Pt10 ☐ Pt50 ☐ Pt100 ☐ Pt10 ☐ Pt50 ☐ Pt100 ☐ Pt200 ☐ Pt500 ☐ Pt1000 ☐ Ni50 ☐ Ni100 ☐ Ni120 ☐ Ni1000 ☐ Cu10 ☐ Cu100
	Resistance measurement	☐ 0 … 500 Ω ☐ 0 … 5000 Ω
IEC 60584 DIN 43710 ASTM E-988	Thermocouple	☐ Type K☐ Type J ☐ Type N☐ Type R☐ Type S☐ Type T ☐ Type E☐ Type B ☐ Type L ☐ Type U ☐ Type C☐ Type D
	Voltage measurement	☐ -125 … 125 mV ☐ -125 … 1,100 mV
Sensor circuit (for resistance thermometer and resistance measurement only)		☐ Two-wire ☐ **Three-wire** (standard) ☐ Four-wire Two-wire circuit: Compensation of sensor line resistance max. 100 Ω ☐ Sensor 1: ..... Ω ☐ Sensor 2: ..... Ω
Reference point (for thermocouples only)		☐ Internal (for standard thermocouples except type B) ☐ None (type B) ☐ External / temperature: ..... °C
Measuring range		☐ Measuring start: ..... (Standard: **0**) ☐ Measuring end: ..... (Standard: **100**)
Unit		☐ **Celsius** (standard) U☐ Fahrenheit ☐ Rankine ☐ Kelvin
Characteristic behavior		☐ **Rising 4 ... 20 mA** (standard) ☐ Falling 20 ... 4 mA
Output behavior for error		☐ **Override / 22 mA** (standard) ☐ Underdrive / 3.6 mA
Output attenuation (T_{63})		☐ **Off** (standard) ☐ ..... seconds (1 … 100 s)
Sensor number		☐ Sensor 1..... ☐ Sensor 2.....
Resistor value at 0 °C / R_o Callendar-Van Dusen coefficient A Callendar-Van Dusen coefficient B Callendar-Van Dusen coefficient C (optional, for resistance thermometers only)		Sensor 1: R_o: ..... Sensor 2: R_o: ..... A: ..... A: ..... B: ..... B: ..... C: ..... C: .....
User characteristics based on linearization table		☐ Based on attached table of variate pairs
TAG number		☐ .....
Software write protection		☐ **Off** (standard) ☐ On
"Maintenance required" alarm pulse or continuous signaling in accordance with NE 107		☐ **Off** (standard) pulse width .....s (0.5 .... 59.5 s increment 0.5 s) ☐ Continuous signal

9.2 PROFIBUS PA / FOUNDATION Fieldbus device design

Configuration		Selection
Number of sensors		☐ **1 senso**r (standard) ☐ 2 sensors
Measurement type (for 2-sensor selection only)		☐ Redundancy / sensor backup ☐ Sensor drift monitoring .....°C / K Sensor drift differential ....s time limit for drift overshoot ☐ Differential measurement: Zero point where Ia = 4 mA ☐ Differential measurement: Zero point where Ia = 12 mA ☐ Mean measurement
IEC 60751 JIS C1604-81 MIL-T-24388 DIN 43760 Cu	Resistance thermometer	☐ Pt10 ☐ Pt50 ☐ **Pt100** (standard) ☐ Pt200 ☐ Pt500 ☐ Pt1000 ☐ Pt10 ☐ Pt50 ☐ Pt100 ☐ Pt10 ☐ Pt50 ☐ Pt100 ☐ Pt200 ☐ Pt500 ☐ Pt1000 ☐ Ni50 ☐ Ni100 ☐ Ni120 ☐ Ni1000 ☐ Cu10 ☐ Cu100
	Resistance measurement	☐ 0 … 500 Ω ☐ 0 … 5000 Ω
IEC 60584 DIN 43710 ASTM E-988	Thermocouple	☐ Type K☐ Type J ☐ Type N☐ Type R☐ Type S☐ Type T ☐ Type E☐ Type B ☐ Type L ☐ Type U ☐ Type C☐ Type D
	Voltage measurement	☐ -125 … 125 mV ☐ -125 … 1,100 mV
Sensor circuit (for resistance thermometer and resistance measurement only)		☐ Two-wire ☐ **Three-wire** (standard) ☐ Four-wire Two-wire circuit: Compensation of sensor line resistance max. 100 Ω ☐ Sensor 1: ..... Ω ☐ Sensor 2: ..... Ω
Reference point (for thermocouples only)		☐ Internal (for standard thermocouples except type B) ☐ None (type B) ☐ External / temperature: ..... °C
Unit		☐ **Celsius** (standard) ☐ Fahrenheit ☐ Rankine ☐ Kelvin
Resistor value at 0 °C / R_o Callendar-Van Dusen coefficient A Callendar-Van Dusen coefficient B Callendar-Van Dusen coefficient C (optional, for resistance thermometers only)		Sensor 1: R_o: ..... A: ..... B: ..... C: ..... Sensor 2: R_o: ..... A: ..... B: ..... C: .....
IDENT_number (PROFIBUS)		☐ Device-specific 0x3470 (standard) ☐ Profile 0x9700 (1 AI block)
Bus address (PROFIBUS)		☐ 0 ... 125 ☐ 126 standard
TAG number		☐ .....
Software write protection		☐ **Off** (standard) ☐ On

Contact us

ABB Ltd.
Salterbeck Trading Estate
Workington, Cumbria
CA14 5DS
UK
Phone: +44 (0)1946 830 611
Fax: +44 (0)1946 832 661

ABB Inc.
125 E. County Line Road
Warminster PA 18974
USA
Phone: +1 215 674 6000
Fax: +1 215 674 7183

ABB Automation Products GmbH
Schillerstr. 72
32425 Minden
Germany
Phone: +49 551 905-534
Fax: +49 551 905-555

www.abb.com

DS/TTH300-EN Rev. B 12.2010 | 3KXT231001R1001

Power and productivity
for a better world™