Data Sheet
DS/TTH200-EN

Head mounted Temperature Transmitter TTH200

HART,
Pt100 (RTD), thermocouples,
electrical isolation

- **Input**
  - Resistance thermometers
  - Thermocouples
  - Resistance-type remote sensors
  - Voltages, mV-voltages
- **Output**
  - Two-wire circuit
  - 4 ... 20 mA temperature linear
  - HART signal
- **Measuring error**
  - 0.1 K
- **Sensor adjustment**
- **Continuous sensor and self-monitoring**
  - Supply voltage monitoring
  - Wire break and corrosion monitoring (NE 89)
- **Device software acc. to NE 53**
- **Approvals for explosion protection**
  - ATEX
    Ex ia (zone 0), Ex nA
  - IECEx
    Ex ia (zone 0)
  - FM/CSA
- **Configuration**
  - FDT / DTM
  - SMART VISION DSV401
  - EDD

HART COMMUNICATION PROTOCOL

ABB

Contents

1 Specifications

1.1 Input

1.1.1 Resistance

RTD resistance thermometer
Pt100 in accordance with DIN IEC 60751, JIS, MIL,
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
Max. sensor line resistance (R_W) for each line 50 Ω
according to NE 89 (March 2003)
Three-wire circuit:
symmetrical sensor line resistance
Two-wire circuit:
compensation up to 100 Ω total line resistance

Measurement current
< 300 µA

Sensor short circuit
< 5 Ω (for RTD)

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 NAMUR NE 89

3-wire resistance measurement	> 50 Ω
4-wire resistance measurement	> 50 Ω

Sensor error signaling

RTD sensor:	Short circuit and wire break
Linear resistance measurement:	Wire break

1.1.2 Thermocouples / Voltages

Types
B, E, J, K, L, N, R, S, T, U, C, D

Voltages
-125 ... 125 mV
-125 ... 1100 mV

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

Sensor wire break monitoring in accordance with NAMUR 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, DIN IEC 60751 Cl. B
(no additional jumpers necessary)

Sensor error adjustment options (sensor matching)
Via single-point adjustment (offset adjustment)
Via two-point adjustment

Sensor error signaling

Thermocouple:	Wire break
Linear voltage measurement:	Wire break

1.2 Output

Transmission characteristics
Temperature linear
Resistance linear
Voltage linear

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

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)

1.3 Power supply (polarity safe)

Two-wire circuit; power lines = signal lines

Supply voltage
Non-hazardous area with or without LCD display:
U_S = 11 ... 42 V DC
hazardous area applications with or without LCD display:
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 (08/1999) 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

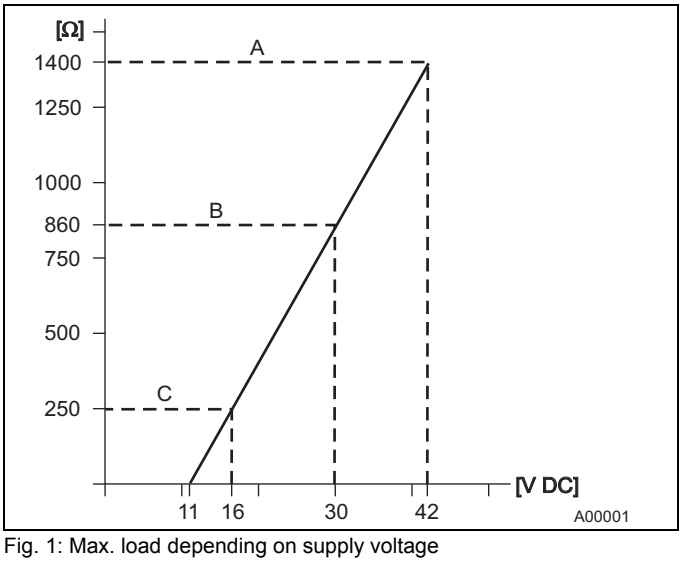

Fig. 1: Max. load depending on supply voltage
A TTH200
B TTH200 in Ex ia design
C HART communication resistance

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

2 General information

CE mark
The TTH200 meets all requirements for the CE mark in accordance with IEC 61326 (2006)
Electrical isolation
3.5 kV DC (approx. 2.5 KV AC) 60 s, input to output
MTBF time
28 years at 60 °C (140 °F) ambient temperature
Input filter
50/60 Hz
Switch-on delay
< 10 s (I_a ≤ 3.6 mA during starting cycle)
Warm-up time
5 minutes
Ramp-up time t90
400 … 1000 ms
Rate updated
10/s, independent of 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)
Optional: -50 … 85 °C (-58 … 185 °F)
Restricted range during operation with HMI LCD display and with explosion proof 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 … 2000 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 separate housing

2.2 Electromagnetic compatibility

Emitted interference in accordance with IEC 61326 (2006) and Namur NE 21 (02/2004)

2.3 EMI/RFI shielding

Interference immune in accordance with IEC 61326 (2006) and Namur NE 21 (02/2004)
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 chapter 5 “Dimensions“
Weight
50 g
Material
Housing: Polycarbonate
Color: gray RAL9002
Sealing compound: Polyurethane
Installation conditions
Mounting orientation: No limitations
Installation options: Connection heads acc. to DIN 43729 form B, field-mount housing
Electrical connection
Terminals (captive screws) incl. soldering tags
Cables up to a maximum of 1.5 mm² (16 AWG)
Connection for HART-Hand-held terminal

2.5 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 thermometers / potentiometer					
DIN IEC 60 751	RTD Pt10 (a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	RTD Pt50 (a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	RTD Pt100 (a=0.003850) [2]	**-200 ... 850 °C (-328 ... 1562 °F)**	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	RTD Pt200 (a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.24 °C (± 0.43 °F)	± 0.05 %
	RTD Pt500 (a=0.003850)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	RTD 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	RTD Pt10 (a=0.003916)	-200 ... 645 °C (-328 ... 1193 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	RTD Pt50 (a=0.003916)	-200 ... 645 °C (-328 ... 1193 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	RTD 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	RTD Pt10 (a=0.003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	RTD Pt50 (a=0.003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	RTD Pt100 (a=0.003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	RTD Pt200 (a=0.003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.24 °C (± 0.43 °F)	± 0.05 %
	RTD Pt1000 (a=0.003920)	-200 ... 850 °C (-328 ... 1562 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
DIN 43760	RTD Ni50 (a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.16 °C (± 0.29 °F)	± 0.05 %
	RTD Ni100 (a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	RTD Ni120 (a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	RTD Ni1000 (a=0.006180)	-60 ... 250 °C (-76 ... 482 °F)	10 °C (18 °F)	± 0.08 °C (± 0.14 °F)	± 0.05 %
	RTD Cu10 (a=0.004270)	-50 ... 200 °C (-58 ... 392 °F)	10 °C (18 °F)	± 0.80 °C (± 1.44 °F)	± 0.05 %
	RTD 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 584	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 %

Total accuracy = digital measuring accuracy [°C (°F)] + (D/A measuring accuracy [%] x I conf. measuring span [°C (°F)] I /100%)
(refer to block diagram Fig. 2)

Example 1:
Pt100 (IEC 60751), conf. measuring range 0 ... 100 °C (32 ... 212 °F), conf. measuring span = measuring end - measuring start = 100 °C (212 °F)

Digital measuring accuracy:	± 0.08 °C (± 0.14 °F)
D/A – measuring accuracy:	± 0.05 % x (100 °C (180 °F) / 100 %) = ± 0.05 °C (± 0.09 °F)
Total accuracy:	Digital accuracy + D/A accuracy; ± 0.08 °C (± 0.14 °F) + (± 0.05 °C (± 0.09 °F)) = ± 0.13 °C (± 0.23 °F)

Example 2:
Thermocouple type K, conf. measuring range 0 ... 1000 °C (32 ... 1832 °F), conf. measuring span = measuring end – measuring start = 1000 °C (1800 °F)

Digital measuring accuracy:	± 0.35 °C (± 0.63 °F)
D/A – measuring accuracy:	± 0.05 % x (1000 °C (1800 °F) / 100 %) = ± 0.50 °C (± 0.9 °F)
Total accuracy [4]:	Digital accuracy + D/A accuracy; ± 0.35 °C (± 0.63 °F) + (± 0.50 °C (± 0.9 °F)) = ± 0.85 °C (± 1.53 °F)

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
2) Standard sensor type
3) Include the internal reference junction error for digital accuracy: Pt1000, DIN IEC 60751 Cl. B
4) Without reference junction error

2.5.1 Block diagram

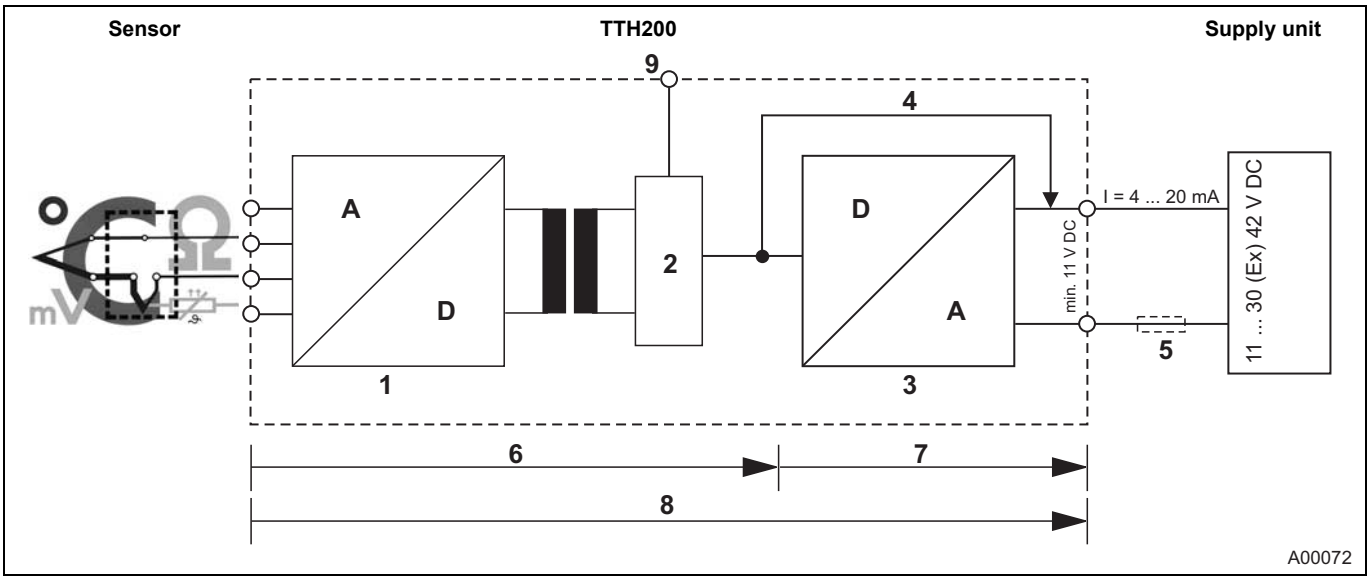

Fig. 2

1 24-bit A/D converter
2 Microcontroller
3 16-bit D/A converter
4 HART signal
5 Load (observe voltage drop, refer to Fig. 1)
6 Digital measuring accuracy
7 D/A measuring accuracy
8 Overall measuring accuracy
9 HMI LCD display interface for type AS
(not suitable for HMI LCD display type A)

2.6 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 VDC

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

Sensor	Ambient temperature influence for 1 °C (1.8 °F) deviation to 23 °C (73.4 °F) for digital measurement	Ambient temperature influence [1] for 1 °C (1.8 °F) deviation to 23 °C (73.4 °F) for D/A converter
Two-, Three-, Four-wire circuit RTD Pt10 IEC, JIS, MIL RTD Pt50 IEC, JIS, MIL RTD Pt100 IEC, JIS, MIL RTD Pt200 IEC, MIL RTD Pt1000 IEC, MIL	 ± 0.04 °C (± 0.072 °F) ± 0.008 °C (± 0.014 °F) ± 0.004 °C (± 0.007 °F) ± 0.02 °C (± 0.036 °F) ± 0.004 °C (± 0.007 °F)	 ± 0.003 % ± 0.003 % ± 0.003 % ± 0.003 % ± 0.003 %
RTD Ni50 DIN 43760 RTD Ni100 DIN 43760 RTD Ni120 DIN 43760 RTD Ni1000 DIN 43760	± 0.008 °C (± 0.014 °F) ± 0.004 °C (± 0.007 °F) ± 0.003 °C (± 0.005 °F) ± 0.004 °C (± 0.007 °F)	± 0.003 % ± 0.003 % ± 0.003 % ± 0.003 %
Resistance measurement 0 ... 500 Ω 0 ... 5000 Ω	 ± 0.002 Ω ± 0.02 Ω	 ± 0.003 % ± 0.003 %
Thermocouple, for all defined types	± [(0.001 % x (ME[mV] / MS[mV]) + (100 % x (0,009 °C / MS [°C]))] [2]	± 0.003 %
Voltage measurement -125 ... 125 mV -125 ... 1100 mV	 ± 1.5 µV ± 15 µV	 ± 0.003 % ± 0.003 %

1) Percentages refer to the configured measuring span
2) ME - Measuring end, MS - Measuring span

Example 1

Pt100 configured measuring range 0 ... 100 °C (32 ... 212 °F), (measuring span 100 °C (180 °F)), ambient temperature 33 °C (91.4 °F)
Dev. from standard temperature: 33 … 23 °C (91.4 … 73.4 °F) (reference temperature) = 10 °C (18 °F)

Effect of ambient temperature on digital measurement:
10 °C x ± 0.004 °C / °C = ± 0.04 °C (18 °F x ± 0.007 °F / 1.8 °F = ± 0.07 °F)

Effect of ambient temperature on D/A converter:
10 °C x (± 0.003 % / °C) x (100 °C / 100 %) = ± 0.03 °C (18 °F x (± 0.003 % / 1.8 °F) x (180 °F / 100 %) = ± 0.054 °F)

Example 2

TC type K configured measuring range 0 ... 1000 °C (32 ... 1832 °F), (measuring span 1000 °C (1800 °F)), ambient temperature 33 °C (91.4 °F)
Measuring start 0 °C (32 °F) corresponds to 0.0 mV; measuring end = 1000 °C (1832 °F) corresponds to 41.6 mV; measuring span = 1000 °C (1800 °F) or 41.6 mV
Dev. from standard temperature: 33 … 23 °C (91.4 … 73.4 °F) (reference temperature) = 10 °C (18 °F)

Effect of ambient temperature on digital measurement:
10 °C x [(± 0.001 % x 41.6 mV / 41.6 mV) + (100 % x ± 0.009 °C / 1000 °C)] x (1000 °C / 100 %)] / °C = ± 0.19 °C
(18 °F x [(± 0.001 % x 41.6 mV / 41.6 mV) + (100 % x ± 0.016 °F / 1800 °F)] x (1800 °F / 100 %)] / 1.8 °F = ± 0.34 °F)

Effect of ambient temperature on D/A converter:
10 °C x [± 0.003 % x 1000 °C / 100 %] / °C = ± 0.3 °C (18 °F x [± 0.003 % x 1800 °F / 100 %] / 1.8 °F = ± 0.54 °F)

Worst case total error analysis

Max. possible total error = SQR [(digital measuring accuracy)^2 + (D/A measuring accuracy)^2 + (digital value temp. influence)^2 + (D/A temp. influence)^2]

Example 1

Pt100, 0 ... 100 °C (32 ... 212 °F) at 33 °C (91.4 °F)

Ambient temperature = $\sqrt{(0.08\,°C)^2 + (0.05\,°C)^2 + (0.04\,°C)^2 + (0.03\,°C)^2} = 0.10\,°C$ $\sqrt{(0.14\,°F)^2 + (0.09\,°F)^2 + (0.07\,°F)^2 + (0.05\,°F)^2} = 0.18\,°F$

Example 2

Thermocouple type K, 0 ... 1000 °C (32 ... 1832 °F) at 33 °C (91.4 °F)

Ambient temperature = (without reference junction error) $\sqrt{(0.35\,°C)^2 + (0.50\,°C)^2 + (0.19\,°C)^2 + (0.3\,°C)^2} = 0.70\,°C$ $\sqrt{(0.63\,°F)^2 + (0.90\,°F)^2 + (0.34\,°F)^2 + (0.54\,°F)^2} = 1.27\,°F$

3 Communication

HART protocol Rev. 5

The system is listed with the HART Communication Foundation.

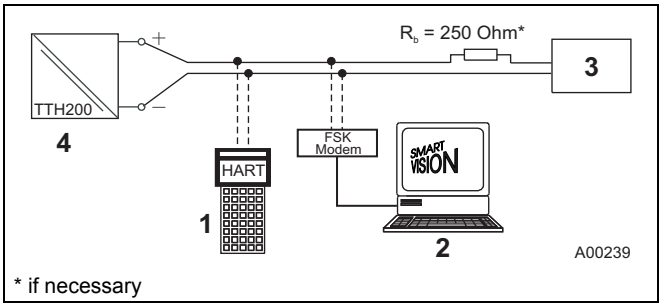

Fig. 3

1 HART-Hand-held terminal
2 FDT / DTM technology
3 Power supply (process interface)
4 Transmitter

Operating modes

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

Configuration options and tools

FDT/DTM technology – via TTX200 DTM driver
DSV401 (SMART VISION)
EDD - via TTX200 EDD driver

Configuration parameters

Measurement type

Sensor type, connection type
Fault signalling
Measuring range
General information, e. g., TAG number
Damping
Signal simulation of output
See Section 9 “Order form configuration“

Write protection

Software write protection

Diagnostic information (NE 107)

Sensor error (wire break or short circuit)
Device error
Over/under alarm limits
Over/under measuring range
Simulation activated

Diagnostic signalling

Over- / underdrive acc. to NE 43
HART diagnostics

4 Electrical connections

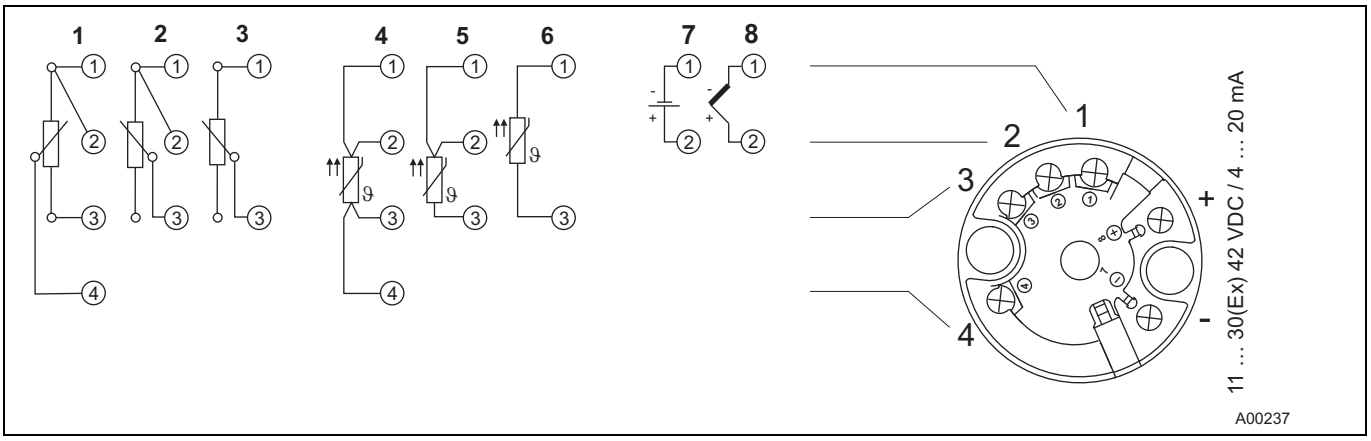

Fig. 4

1 Potentiometer, Four-wire circuit
2 Potentiometer, Three-wire circuit
3 Potentiometer, Two-wire circuit
4 RTD, Four-wire circuit
5 RTD, Three-wire circuit
6 RTD, Two-wire circuit
7 Voltage measurement
8 Thermocouple

5 Dimensions

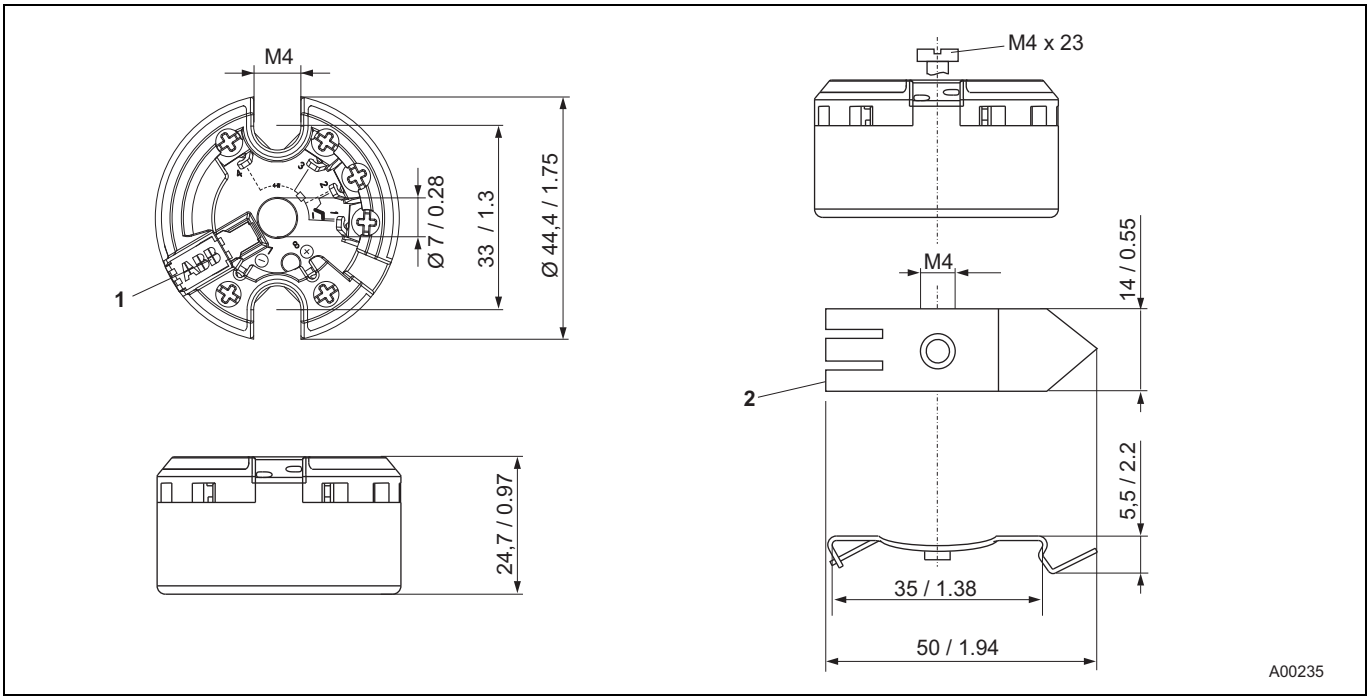

Fig. 5: Dimensions in mm/inch

1 Display interface for HMI LCD display type AS (not suitable for HMI LCD display type A)
2 Latching base for 35 mm (1.38 inch) rail mounting acc. to EN 60175

6 Ordering information

	Main catalog no.				Additional catalog no.
Variant digit no.	1 - 6	7	8	9	XX
TTH200 Head Mounted Temperature Transmitter, HART, Pt100 (RTD), Thermocouples, Electrical Isolation	**TTH200**	**X**	**X**	**X**	XX
Explosion Protection					
Without Explosion Protection		**Y**	**0**		
ATEX Intrinsic Safety: zone 0: II 1 G EEx ia IIC T6 zone 1 (0): II 2 (1) G EEx [ia] ib IIC T6, zone 1(20): II 2 G (1D) Ex [iaD] ib IIC T6		E	1		
ATEX Non-Incendive (nA): zone 2: II 3 G EEx nA II T6		E	2		
IECEx Intrinsic Safety: zone 0: Ex ia IIC T6, zone 1 (0): Ex [ia] ib IIC T6, zone 1(20): Ex [iaD] ib IIC T6		H	1		
FM Intrinsically Safe: Class I, Div.1+2, Groups A,B,C,D Class I, Zone 0, AEx ia IIC T6		L	1		
FM Non-Incendive: Class I, Div.2, Groups A,B,C,D		L	2		
CSA Intrinsically Safe: Class I, Div.1+2, Groups A,B,C,D		R	1		
CSA Non-Incendive: Class I, Div.2, Groups A,B,C,D		R	2		
Communication Protocol					
HART				**H**	
Configuration					
Customer-specific configuration with report					BF
Calibration Certificate					
With 5-point works calibration certificate					EM
Expanded Ambient Temperature Range					
-50 ... 85 °C (-58 ... 185 °F)				1)	SE

1) Not available with Explosion Protection FM / CSA

7 Ex relevant specifications

7.1 TTH200-E1, Intrinsic Safety ATEX

Explosion protection

The TTH200 complies with the requirements of ATEX directive 94/9/EC
Approved for use in Zone 0

Designation

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

EC type-examination certificate PTB 05 ATEX 2017 X

7.2 TTH200-H1, Intrinsic Safety IECEx

Explosion protection

Approved for use in Zone 0.

Designation

Ex ia IIC T6 (Zone 0)
Ex [ia] ib IIC T6 (Zone 1 [0])
Ex [iaD] ib IIC T6 (Zone 1 [20])

For further information, see certificate

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)

Protection type Intrinsic Safety Ex ia IIC (Part 1)

	Supply circuit	Measurement current circuit / passive transducer (RTD)
Max. voltage	U_i = 30 V	U_o = 6.5 V
Short circuit current	I_i = 130 mA	I_o = 25 mA
Max. power	P_i = 0.8 W	P_o = 38 mW
Internal inductance	L_i = 0.5 mH	L_i = 0 mH
Internal capacitance	C_i = 5 nF	C_i = 49 nF
Maximum permissible external inductance		L_o= 5 mH
Maximum permissible external capacitance		C_o= 1.55 µF

Protection type Intrinsic Safety Ex ia IIC (Part 2)

	Measurement current circuit / active transducer (TC)	Display interface
Max. voltage	U_o = 1,2 V	U_o = 6,2 V
Short circuit current	I_o = 50 mA	I_o = 65.2 mA
Max. power	P_o = 60 mW	P_o = 101 mW
Internal inductance	L_i = 0 mH	L_i = 0 mH
Internal capacitance	C_i = 49 nF	C_i = 0 nF
Maximum permissible external inductance	L_o = 5 mH	L_o= 5 mH
Maximum permissible external capacitance	C_o= 1.05 µF	C_o= 1.4 µF

7.4 TTH200-E2, Non-Sparking ATEX

Explosion protection

The TTH200 complies with the requirements of ATEX directive 94/9/EC
Approved for use in Zone 2.

Designation

II 3G EEx nA II T6

ABB manufacturer's declaration in accordance with ATEX directive

Temperature table

Temperature class	Device category 2 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 TTH200-L1, Intrinsically Safe FM

Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, AEx ia IIC T6
Control drawing: TTH200-L1H

7.6 TTH200-L2, Non-Incendive FM

Class I, Div. 2, Groups A, B, C, D
Control drawing: TTH200-L2H

7.7 TTH200-R1, Intrinsically Safe CSA

Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, Ex ia Group IIC T6
Control drawing: TTH200-R1H

7.8 TTH200-R2, Non-Incendive CSA

Class I, Div. 2, Groups A, B, C, D
Control drawing: TTH200-R2H (1)
Control drawing: TTH200-R2H (2) (no conduit)

8 HMI LCD display type AS

Can only be ordered in conjunction with temperature sensors

CE mark

The HMI type AS LCD display meets all requirements for the CE mark in accordance with IEC 61326 (2006)

8.1 Features

Transmitter-controlled graphic LCD display without key functions

Sign, 4 digits, 2 decimal places
Rotatable in 12 increments of 30°

Display

Process data of sensor

Bar graph display

Output %

Display diagnostic informations related to transmitter and sensor status

8.2 Specifications

Temperature range

-20 … 70 °C (-4 … 158 °F)
Restricted display function in range:
-50 … -20 °C (-58 … -4 °F) 1)
or
70 … 85 °C (158 … 185 °F)

Humidity

0 … 100 %, condensation permitted

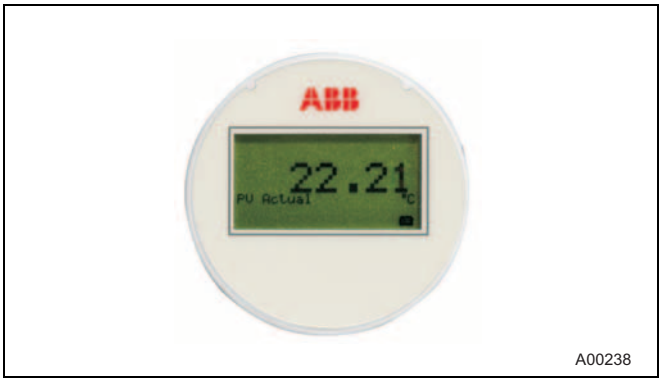

Fig. 6

1) Additional mechanical protection is required for this range

8.3 Ex relevant specifications

8.3.1 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

8.3.2 Intrinsic Safety IECEx

Explosion protection

Approved for use in Zone 0.

Designation

Ex ia IIC T6

For further information, see certificate

8.3.3 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 nF

8.3.4 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

8.3.5 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

8.3.6 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_214 799

8.3.7 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

Information on customer-specific configuration of temperature transmitter TTH200.

Configuration		**Selection**
DIN IEC 60 751	RTD	☐ Pt10 ☐ Pt50 ☐ **Pt100** (standard) ☐ Pt200 ☐ Pt500 ☐ Pt1000
JIS C1604-81		☐ Pt10 ☐ Pt50 ☐ Pt100
MIL-T-24388		☐ Pt10 ☐ Pt50 ☐ Pt100 ☐ Pt200 ☐ Pt1000
DIN 43760		☐ Ni50 ☐ Ni100 ☐ Ni120 ☐ Ni1000
Cu		☐ Cu10 ☐ Cu100
	Linear resistance measurement	☐ 0 … 500 Ω ☐ 0 … 5000 Ω
IEC 584	Thermocouple	☐ Type K ☐ Type J ☐ Type N ☐ Type R ☐ Type S ☐ Type T ☐ Type E ☐ Type B
DIN 43710		☐ Type L ☐ Type U
ASTME 988		☐ Type C ☐ Type D
	Linear voltage measurement	☐ -125 … 125 mV ☐ -125 … 1100 mV
Sensor circuit (for RTD + resistance measurement only)		☐ Two-wire ☐ **Three-wire** (standard) ☐ Four-wire Two-wire circuit: Compensation of sensor-wire resistance max. 100 Ω ☐ .....Ω
Reference junction (for thermocouples only)		☐ Internal (for standard thermocouple, except type B) ☐ No (TC type B) ☐ External/temp.:.....°C
Measuring range		☐ Measuring start: ..... (Standard: **0**) ☐ Measuring end: ..... (Standard: **100**)
Unit		☐ **Celsius** (standard) ☐ Fahrenheit ☐ Rankine ☐ Kelvin
Characteristic behavior		☐ **Rising 4 ... 20mA** (standard) ☐ Falling 20 ... 4mA
Output behavior for error		☐ **Override/22 mA** (standard) ☐ Underdrive/3.6 mA
Output attenuation (T_{63})		☐ **Off** (standard) ☐ ..... seconds (1 … 100 s)
TAG number		☐ ..... (max. 8 characters)
Software write protection		☐ **Off** (standard) ☐ On

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