

Temperature field transmitter

iTEMP FF[®] TMT 165

Universal two-channel field transmitter for resistance thermometers, thermocouples, resistance and voltage transmitters and differential measurement using FF[®] protocol



Features and benefits

- Universally programmable for various input signals using the FOUNDATION Fieldbus[®] protocol
- PC operation, visualisation and maintenance
- 2-wire technology
- High accuracy in the total ambient temperature range
- Certification EEx ia and EEx d
 - ATEX
 - FM
 - CSA
- Galvanic isolation
- 14 presettable function blocks
- 18 function block modes
- PID controller

Application areas

- Temperature head transmitter with FF[®] protocol for converting various input signals into a digital output
- Dual channel input:
 - Resistance thermometer (RTD)
 - Thermocouple (TC)
 - Resistance transmitter (Ω)
 - Voltage transmitter (mV)
- FF[®] protocol for unit operation and maintenance from the control panel using a process control software
- PID controller
- Direct control of valves etc.

Endress + Hauser

The Power of Know How



Operation and system construction

Measurement principle Electronic measurement and conversion of input signals in industrial temperature measurement.

Measurement system The iTEMP FF®TMT 165 temperature field transmitter is a 2-wire transmitter with dual channel measurement input for resistance thermometers, in 2-, 3-, or 4-wire connection, thermocouples, voltage transmitters and differential measurement. Applications are in the measurement and control areas for process monitoring. The TMT 165 is set up using the FF® protocol combined with a process control software.

Input values

Measurement value Temperature, Ohm, mV, differential measurement or dual channel measurement.

Measurement range The transmitter measures various ranges dependent on sensor connection and input signal.

Input types and accuracies

Sensor	2-, 3-, or 4-wire connection (RTD)				Differential		
Sensor	Type	Measurement range (°C)	Measurement range (F)	Accuracy (°C)	Measurement range (°C)	Measurement range (F)	Accuracy (°C)
Resistance thermometer (RTD)^I	Cu10 GE	-20 to 250	-4 to 482	±1.0	-270 to 270	-486 to 486	±2.0
	Ni 120 DIN	-50 to 270	-58 to 518	±0.1	-320 to 320	-576 to 576	±0.2
	Pt50 IEC	-200 to 850	-328 to 1562	±0.25	-1050 to 1050	-1890 to 1890	±0.5
	Pt100 IEC	-200 to 850	-328 to 1562	±0.2	-1050 to 1050	-1890 to 1890	±0.4
	Pt500 IEC	-200 to 450	-328 to 842	±0.25	-650 to 650	-1170 to 1170	±0.5
	Pt50 JIS	-200 to 600	-328 to 1112	±0.25	-850 to 850	-1440 to 1440	±0.5
	Pt100 JIS	-200 to 600	-328 to 1112	±0.25	-800 to 800	-1440 to 1440	±0.5
Thermocouple (TC)^{II}	B IEC	+100 to 1800	+212 to 3272	±0.5	-1600 to 1600	-3060 to 3060	±1.0
	E IEC	-100 to 1000	-148 to 1832	±0.2	-1100 to 1100	-1980 to 1880	±0.4
	J IEC	-150 to 750	-238 to 1382	±0.3	-900 to 900	-1620 to 1620	±0.6
	K IEC	-200 to 1350	-328 to 2462	±0.6	-1550 to 1550	-2790 to 2790	±1.2
	N IEC	-100 to 1300	-148 to 2372	±0.5	-1400 to 1400	-2520 to 2520	±1.0
	R IEC	0 to 1750	32 to 3182	±0.4	-1750 to 1750	-3150 to 3150	±0.8
	S IEC	0 to 1750	32 to 3182	±0.4	-1750 to 1750	-3150 to 3150	±0.8
	T IEC	-200 to 400	-328 to 752	±0.15	-600 to 600	-1080 to 1080	±0.8
	L DIN	-200 to 900	-328 to 1652	±0.35	-1100 to 1100	-1980 to 1980	±0.7
	U DIN	-200 to 600	-328 to 1112	±0.5	-800 to 800	-1440 to 1440	±1.0

I. Connection modes: 2-, 3- or 4-wire connection. On 2-wire connection cable resistance compensation is possible (0 to 30 Ω)

- Sensor cable resistance max. 30 Ω per core
- Sensor current: ≤ 0.25 mA

II. Cold junction compensation: Internal (Pt100)

Reference junction accuracy: ± 0.25°C

Sensor	Measurement range in mV	Accuracy
mV	-6 to 22	$\pm 0.02\%$ or $\pm 2 \mu\text{V}$
	-10 to 100	$\pm 0.02\%$ or $\pm 10 \mu\text{V}$
	-50 to 500	$\pm 0.02\%$ or $\pm 50 \mu\text{V}$
mV DIF.	-28 to 28	$\pm 0.1\%$ or $\pm 10 \mu\text{V}$
	-110 to 110	$\pm 0.1\%$ or $\pm 50 \mu\text{V}$
OHM	0 to 100	$\pm 0.02\%$ or $\pm 0.01 \text{ Ohm}$
	0 to 400	$\pm 0.02\%$ or $\pm 0.04 \text{ Ohm}$
	0 to 2000	$\pm 0.02\%$ or $\pm 0.20 \text{ Ohm}$
OHM DIF.	-100 to 100	$\pm 0.08\%$ or $\pm 0.04 \text{ Ohm}$
	-400 to 400	$\pm 0.1\%$ or $\pm 0.2 \text{ Ohm}$

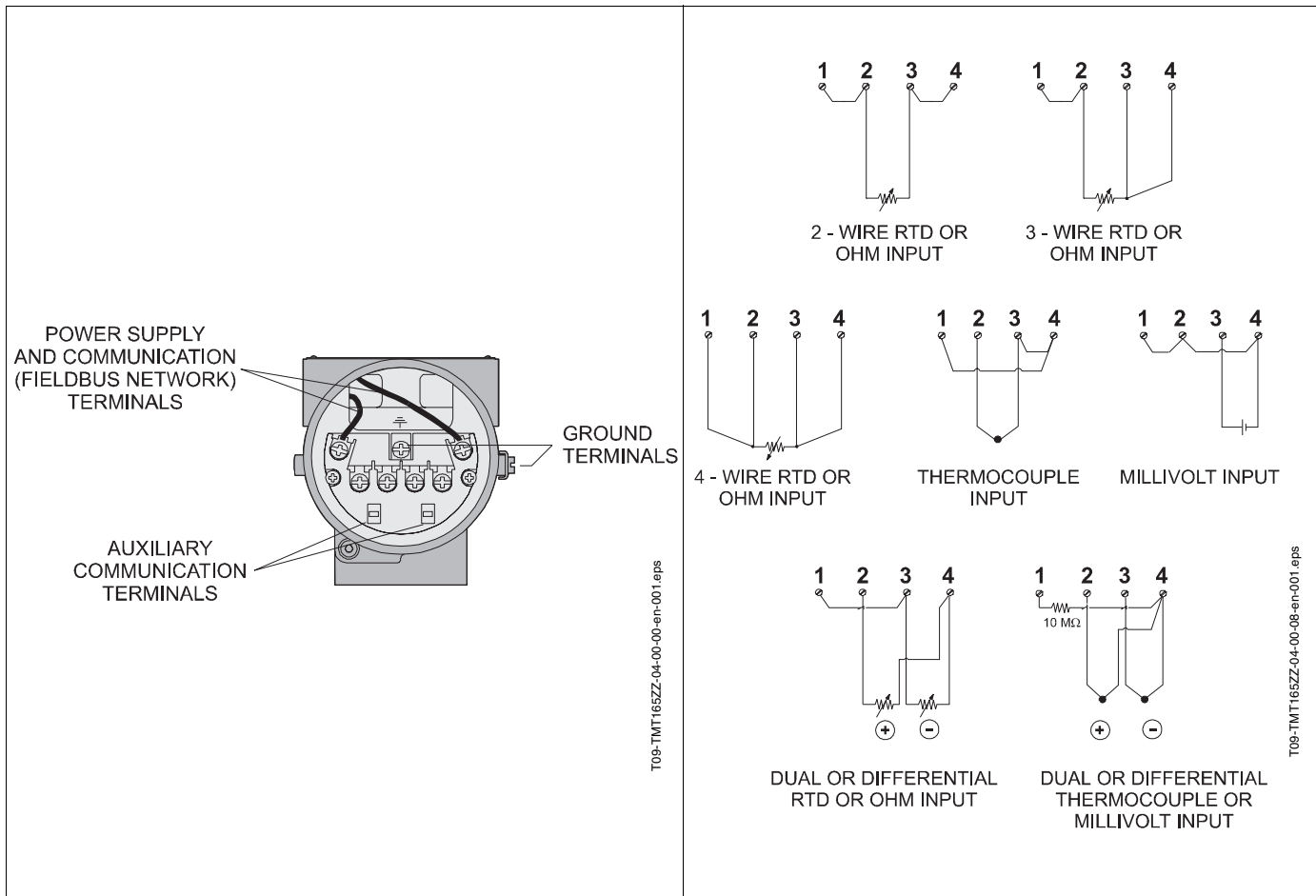
Output values

Function blocks	RESOURCE, TRANSDUCER BLOCK, DISPLAY TRANSDUCER, DIAGNOSTICS TRANSDUCER, ANALOG INPUT, PID CONTROL, ENHANCED PID, ARITHMETIC, INTEGRATOR, INPUT SELECTOR, SIGNAL CHARACTERIZER, SPLITTER, ANALOG ALARM, SETPOINT RAMP GENERATOR, TIMER, LEAD-LAG, OUTPUT SELECTOR / DYNAMIC LIMITER, CONSTANT
Output signal	Physical data transmission (Physical Layer Type): <ul style="list-style-type: none"> • Fieldbus interface in accordance to IEC 61158-2 • Integrated polarity protection
Failure signal	Status message according to the FOUNDATION Fieldbus specification
Power up current	max. 12 mA
Filter	Digital filter
Current consumption	12 mA
Power up delay	~10 s
Data transmission speed	31.25 kBit/s, voltage mode
Signal code	Manchester II.
Galvanic isolation	> 1500 V _{DC}

Auxiliary energy

Electrical connection

Field transmitter terminal layout



Supply voltage

$U_b = 9 \text{ to } 32 \text{ V}_{DC}$, polarity protected

Residual ripple

Allowable ripple: $U_{SS} \leq 16 \text{ mV}$ at 7.8 kHz to 39 kHz
 $U_{SS} \leq 2 \text{ V}$ at 47 Hz to 63 Hz non-Ex, and $U_{SS} \leq 0.2 \text{ V}$ on Ex applications
 $U_{SS} \leq 1,6 \text{ V}$ at 3.9 MHz to 125 MHz

Accuracy

Response time

~0.5 s

Reference conditions

Calibration temperature: $+23^\circ\text{C} \pm 5^\circ\text{C}$

Measurement deviation

For measurement deviation for various input ranges please see "Inputs and accuracy" under heading "Input".

Influence of ambient temperature (temperature drift at 10 °C deviation)

mV (-6 to 22 mV), TC (NBS: B, R, S, T):
 $\pm 0.03\%$ FSD or 0.002 mV, the highest value is valid.

mV (-10 to 100 mV), TC (NBS: E, J, K, N; DIN: L, U):
 $\pm 0.03\%$ FSD or 0.01 mV, the highest value is valid.

mV (-50 to 500 mV):
 $\pm 0.03\%$ FSD or 0.05 mV, the highest value is valid.

Ohm (0 to 100), RTD (GE: Cu10) :
 $\pm 0.03\%$ FSD or 0.01, the highest value is valid.

Ohm (0 to 400), RTD (DIN: Ni120; IEC: Pt50, Pt100; JIS: Pt50, Pt100):
 $\pm 0.03\%$ FSD or 0.04, the highest value is valid.

Ohm (0 to 2000), RTD (IEC: Pt500):
 $\pm 0.03\%$ FSD or 0.2, the highest value is valid.

Long-term stability RTD: $\leq 0.1\text{K}/24$ months¹ or $\leq 0.1\%/24$ months
 TC: $\leq 0.1\text{K}/12$ months¹ or $\leq 0.1\%/12$ months

Accuracy of reference junction $\pm 0.25^\circ\text{C}$ (internal reference junction on thermocouples TC)

Application conditions (installation conditions)

Installation hints • Installation angle:
 no limitations

Application conditions (ambient conditions)

Ambient temperature Without display: -40 to $+85^\circ\text{C}$ (-40 to $+185^\circ\text{F}$) (for hazardous areas see Ex certificate)
 With display: -10 to $+60^\circ\text{C}$ (-14 to $+140^\circ\text{F}$) in operation
 $+60$ to $+85^\circ\text{C}$ ($+140^\circ\text{F}$ to $+185^\circ\text{F}$) operation without defects, no display function

Storage temperature Without display: -40 to $+120^\circ\text{C}$ (-40 to $+250^\circ\text{F}$)
 With display: -40 to $+85^\circ\text{C}$ (-40 to $+185^\circ\text{F}$)

Condensation 10 to 100% RH

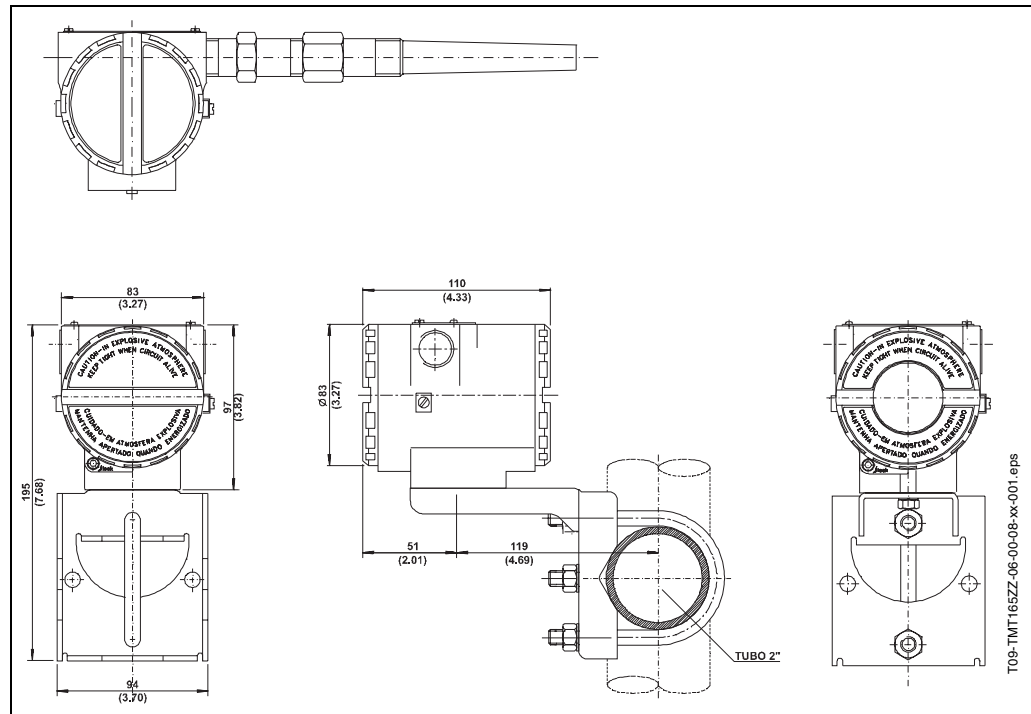
Ingress protection NEMA 4X, IP 67

Electromagnetic compatibility (EMC) Interference immunity and emission according to EN 61 326-1

1. Under reference conditions

Mechanical construction

Dimensions



Field transmitter dimensions in mm (inch)

Weight	Aluminium housing approx. 800 g (without display), approx. 930 g (with display), approx. 1530 g (with display and mounting kit)
Materials	Transmitter housing: Aluminium with polyester coating or 316 stainless steel
Terminals	Cable up to max. 2.5 mm ² (secured screws)

Display and operating system

LC display	4½ digit numeric and 5 digit alphanumeric
Remote operation	Operation using FOUNDATION Fieldbus and a suitable configuration or operating software.

Certification

Ex certification	For further details on the available Ex versions (ATEX, FM, CSA, usw.) please contact your respective E+H sales organisation. All relevant data for explosion hazardous area can be found in separate Ex documentation. If required please request copies from us or your E+H sales organisation.
CE mark	The measurement system fulfills the requirements demanded by the EU regulations. Endress+Hauser acknowledges successful unit testing by adding the CE mark.

FOUNDATION Fieldbus certification

The TMT 165 temperature field transmitter has successfully completed all the test procedures run and is both certified and registered by the Fieldbus FOUNDATION. The measurement unit therefore fulfills all the requirements for the following specifications:

- Certified to the fieldbus specification, Revision ITK 4.0
- The measurement unit fulfills all specifications of the FOUNDATION Fieldbus H1.

The measurement unit can also operate together with certified units from other manufacturers (inter-operability).

How to order

Order structure

Field transmitter iTEMP FF® TMT 165						
FOUNDATION Fieldbus temperature transmitter, dual channel, input for RTDs,TCs, Ohm, mV and differential measurement. Power supply and communication using 2-wire technology according to IEC 1158-2. Field installation NEMA 4X, IP67.						
Certification						
A	Version for non hazardous areas					
B	ATEX II 2 G EEx ia IIC T4/T5/T6					
C	FM IS, Class I, II, III, Div. 1+2, Group ABCDEFG					
D	CSA IS, Class I, II, III, Div. 1+2, Group ABCDEFG					
E	ATEX Intrinsic safety and Explosion-Proof					
F	FM IS Intrinsic safety and Explosion-Proof					
G	CSA Intrinsic safety and Explosion-Proof					
Housing, display						
1	Aluminium housing					
2	Aluminium housing including display					
3	Housing stainless steel 316					
4	Housing stainless steel 316 incl. display					
Cable entry						
1	2x NPT ½ cable entries					
2	2x M20x1.5 cable entries					
3	2x Pg 13.5 cable entries					
4	2x M20x1.5 cable glands					
5	2x Pg 13.5 cable glands					
6	NPT ½ cable entry and 7/8" bus plug					
7	M20x1.5 cable gland and 7/8" bus plug					
8	Pg 13.5 cable gland and 7/8" bus plug					
Additional equipment						
1	without accessories					
2	Mounting bracket stainless steel 316 for 2" pipe					
Setup						
A	Factory default					
Model						
A	Standard model					
TMT 165-					A	A ← Order code

Further documentation

- System Information FF (SI 042F/00/en)
- Operating manual iTEMP FF[®]TMT 165 (BA 114R/09/a2)
- Ex additional documentation: ATEX (XA 009R/09/a3), FM, CSA, etc.

United Kingdom

Endress+Hauser Ltd.
Floats Road
Manchester
M23 9NF

Tel. (0161) 286 5000
Fax (0161) 998 1841
<http://www.endress.com>

Export Division

Endress+Hauser GmbH + Co
Instruments International
P. O. Box 2222
D-79574 Weil am Rhein
Germany

Tel.(07621) 975-02
Tx 773926
Fax (07621) 975-345
<http://www.endress.com>
info@il.endress.com

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