Model TR32 Digital Temperature Transmitter

- HART® Protocol
- Universally programmable for
  - RTDs
  - Thermocouples
  - Resistance - sensor
  - mV - sensor
- Output linear to temperature with input signal from RTDs and Thermocouples
- Custom specific linearization with max. 32 points for sensors with Ω or mV output
- Analog output 4 … 20 mA, invertible, 2 - wire design
- Signalling individually configurable for possible errors of the sensor system
- Ex class protection, intrinsically safe
  - EEx ia IIB / IIC T4 / T5 / T6
  - EEx ib IIB / IIC T4 / T5 / T6
- EMC Conformity per
  - DIN EN 50 081-1
  - DIN EN 50 082-2
  - NAMUR NE 21
- Isolation voltage 1500 VAC between sensor and current loop
- 100 % Rh protection, moisture condensation permissible
- Increased ambient temperature
- Configurable via
  - HART® Communicator
  - PC Windows-programme
- Terminal connections with captive screws
- CE Conformity

Model TR32 Digital Temperature Transmitter

General Description

The TR32 digital temperature transmitter is designed for universal use in the process industry.

Comprehensive individual configuration properties, for example, type of sensor, measuring range and error signalling, high accuracy, galvanic isolation and excellent EMI protection characterize these transmitters. The compact head mounting case fits in almost any DIN connecting head.

During configuration, by means of a HART communicator model 275 or an FSK modem (eg VIATOR) via the RS 232-C on a standard DOS PC, any one of 15 types of sensor can be selected. Measured temperatures are from -270ºC up to 1820ºC.

The transmitters are delivered with any customized configuration within the given limits.

The following sensors can be connected:

- RTDs per EN 60 751 resp. DIN 43 760 in 2 - , 3 - and 4 - lead connection, the connection-system used is configurable and ensures an optimal lead wire compensation

- Thermocouples per IEC 584 , DIN 43 710 and ASTM E988 Cold junction compensation (CJC) is built-in, the use of an external CJC is selectable via configuration.

- Resistance-sensors up to 5 k Ω in 2 - , 3 - and 4 - lead connection, configurable compensation of the connection cable

- mV-sensors up to 1200 mV

INPUT TYPES

Sensor Type			Max Measuring Range	Min Measuring Span
RTD	Pt 100	EN 60 751	-200 … +850ºC[1)]	10 K or 3.8Ω, whichever is greater
	JPt 100	JIS Z 8710	-200… 500ºC	
	Ni 100	DIN 43760 : 1987-09	-60 …+250ºC	
Thermocouple	Type T, Cu-CuNi	IEC 584	-270 …+400ºC	50 K or 2 mV, whichever is greater
	Type E, NiCr-CuNi	IEC 584	-270 … +1000ºC	
	Type J, Fe-CuNi	IEC 584	-210 … +1200ºC	
	Type L, Fe-CuNi	DIN 43710 : 1985-12	-200 … +900ºC	
	Type K, NiCr-Ni	IEC 584	-270 … 1372ºC	
	Type N, NiCrSi-NiSi	IEC 584	-270 … +1300ºC	
	Type U, Cu-CuNi	DIN 43710 : 1985-12	-200 … +600ºC	
	Type R, PtRh-Pt	IEC 584	-50 … +1768ºC	
	Type S, PtRh-Pt	IEC 584	-50 … +1768ºC	
	Type B, PtRh-PtRh	IEC 584	0 … +1820ºC	
Resistance Sensor			0 … 700Ω / 5000Ω	4Ω / 32Ω
mV - Sensor			-400 … +1200 mV	2mV up to 32 mV

INPUT SPECIFICATION

RTD / Resistance Sensor	Measuring deviation per DIN IEC 770, 23ºC ± 5	RTD	± 0.08 K
		Resistance Sensor	± 0.03 Ω or ±0.006% FS in Ω, whichever is greater
	Sensor current		Approximately 0.2 mA
	Temperature coefficient T_C	RTD	± (0.02% FS + 0.09) K / 10 K_{Tamb}
		Resistance Sensor	± (0.02% FS + 0.01) K / 10 Ω_{Tamb}
	Lead wire connection		Configurable: 2, 3 or 4 lead
	Connection Leads	Effect	± 0.02Ω / 10Ω
		Max permissible resistance	30Ω each lead, 3-lead symmetric
	Signalling of sensor error		Configurable
Thermocouples	Measuring deviation [2)] per DIN IEC 770, 23ºC ± 5 K		± 0.3 K or ± 5 µV, whichever is greater
	Cold junction compensation at 23ºC ± 5 K		± 0.8 K
	Temperature coefficient T_C of cold junction compensation		± 0.1 K / 10 K_{Tamb}
	Temperature coefficient T_C	Type T, E, J, L, K, N, U	± (0.03% FS + 0.07) K / 10 K_{Tamb}
		Type R, S, B	± (0.03% FS + 0.40) K / 10 K_{Tamb}
	Connection Leads	Effect	± 0.1 µV / 10 Ω
		Max permissible resistance	250 Ω
	Signalling of sensor error		Configurable
mV-Sensor	Measuring deviation per DIN IEC 770, 23ºC ± 5 K		± 5 µV or ±0.006% FS in mV, whichever is greater
	Temperature coefficient T_C		± (0.03% FS + 0.002) mV / 10 K_{Tamb}
	Connection Leads	Effect	± 0.1 µV / 10 Ω
		Max permissible resistance	250 Ω

OUTPUT SPECIFICATION

RTD		Linear to temperature per EN 60 751 / DIN 43 760 : 1987-09
Thermocouple		Linear to temperature per IEC 584 / DIN 43 710 : 1985-12
Simulation mode		Independent from input signal, simulation value configurable from 3.5 mA up to 22.5 mA
Output Limits	**Application Specification**	Lower Limit: from 3.6 mA to 4.0 mA, Upper Limit: from 20.0 mA to 21.5 mA
	NAMUR NE 43	Lower Limit: 3.8 mA, Upper Limit: 20.5 mA
	Not Active	Lower Limit: 3.6 mA, Upper Limit: 21.5 mA
Load R_A		$R_A \leq (U_B - 12V) / 0.022$ A with R_A in Ω and U_B in V
Load Effect		No measurable effect
Measuring deviation per DIN IEC 770, 23 ºC ± 5 K		± 0.04% of measuring span
Temperature coefficient T_C		± 0.1% of measuring span / 10 K_{Tamb}
Damping		Configurable: minimum 0.5s, 1s up to 60s
Measured value update		Approximately 3/s
Power supply effect		No measurable effect

1) Increased up to 1000ºC
2) Valid only for configured measuring range beginning ≥ -150ºC

FS - full scale value of configured measuring range

R_A - load
T_C - temperature coefficient
T_{amb} - ambient temperature

TOTAL MEASURING DEVIATION

Sum of input and output per DIN IEC 770, 23ºC ± 5 K

SIGNALLING – analogue output with sensor error or internal malfunction

NAMUR NE43	**Up-scale**	> 21.0 mA
	Down-scale	< 3.6 mA
Configurable	**Up-scale**	12 mA up to 22.5 mA
	Down-scale	3.5 mA up to 12 mA

POWER SUPPLY U_B

Model TR32 without Ex-protection	DC 12 … 42 V
Model TR32 with Ex-protection	DC 12 … 30 V
Input power supply protection	Reverse polarity

Ex - PROTECTION EC Type Test DMT 98 ATEX E 007 X

Model TR32.10.002	II 1 G EEx ia IIB / IIC T4/T5/T6			
Model TR32.10.004	II 2 G EEx ib IIB / IIC T4/T5/T6			
Permissible ambient temperature	-50ºC … +85ºC with T4 -50ºC … +75ºC with T5 -50ºC … +60ºC with T6			
Maximum values for connection of the current loop circuit (connections + / -)	U_i = 30 V	I_i = 130 mA	P_i = 800 mW	C_i = 7.8 nF L_i = 100 µH
Maximum values for connection of the sensor circuit (connections 1 – 4)	U_0 = 11.5 V Group IIB: Group IIC:	I_0 = 5.2 mA C_0 = 11 µF C_0 = 1.6 µF		P_0 = 15 mW L_0 = 1 mH L_0 = 1 mH

ELECTROMAGNETIC COMPATIBILITY (EMC)

CE – Conformity per DIN EN 50081-1 (March 93) and DIN EN 50082-2 (February 96) NAMUR NE 21 (May 93)

SPECIAL FEATURES

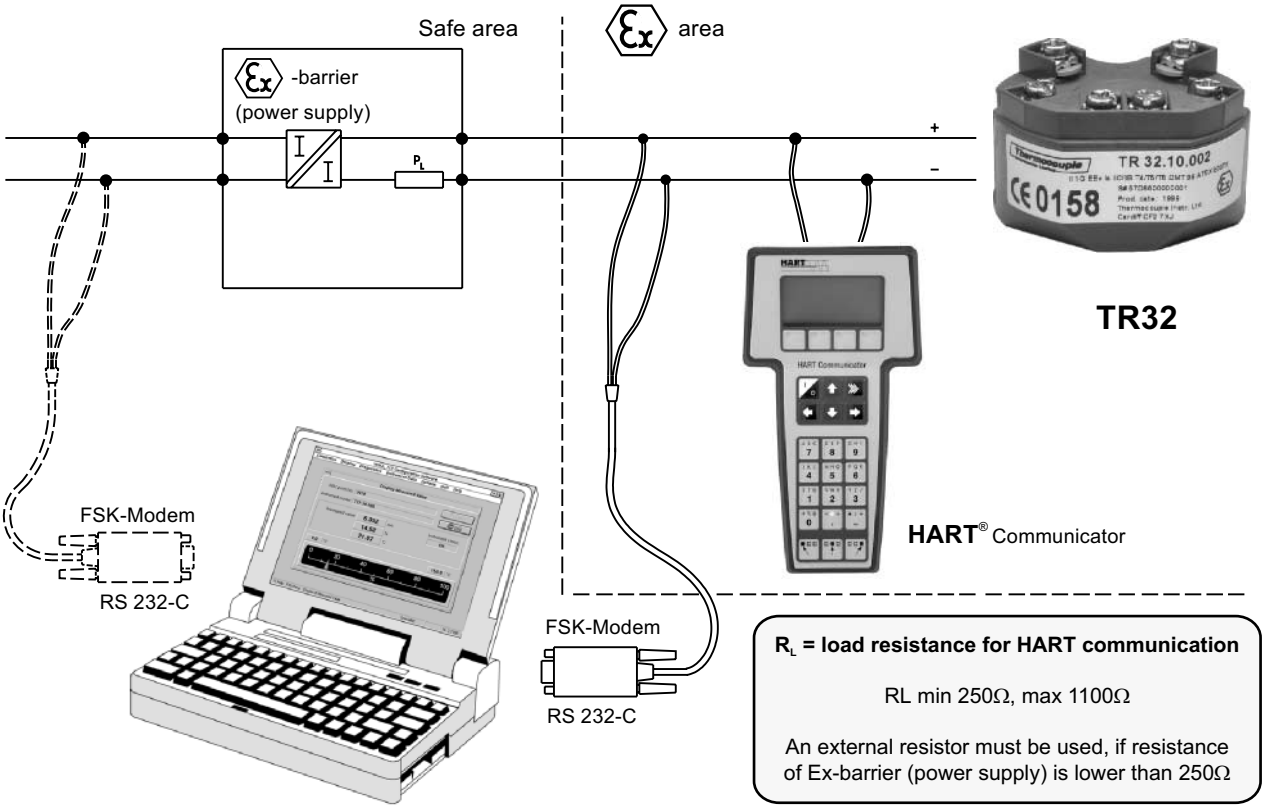
Isolation voltage (input versus analogue output)		1500 VAC, 60s
Ambient and storage temperature	**Standard**	-40 … +85ºC
	Optional	-50ºC … +105ºC [1)]
Climate application class		GPA DIN 40040
Maximum permissible humidity		100% relative humidity (unlimited with isolated sensor connection wires), moisture condensation permissible DIN IEC 68 2-30 Var.2
Vibration		10 … 2000 Hz 5g DIN IEC 68 2-6
Shock		DIN IEC 68 2-27 g_N = 30
Salt fog		DIN IEC 68 2-11
Configuration and calibration data		Permanently stored in EEPROM
Testing current to monitor sensor		nom. 1 µA during testing cycle, otherwise 0 µA
Self-monitoring		Automatic execution of initial test after connection to power supply, thereafter monitoring due to internal malfunction
Warm-up time		Approximately 5 min
Communication		HART protocol
Guarantee		5 years for performance with standard range of ambient temperature, legal warranty with increased range of ambient temperature

CASE

Material		Plastic
Degree of protection	**Case**	IP 66 EN 60529 / IEC 529
	Terminal connections	IP 00 EN 60529 / IEC 529
Cross section of terminal connections		max 1.5 mm^2, screws captive
Weight		Approximately 70g
Dimensions		See drawing

1) HART Communication up to 100ºC

Wiring Scheme

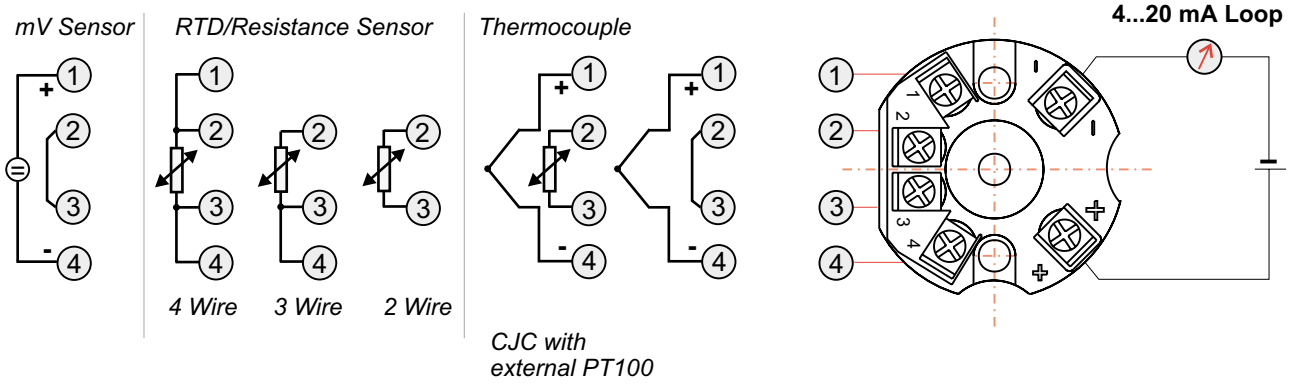


R_L = load resistance for HART communication

RL min 250Ω, max 1100Ω

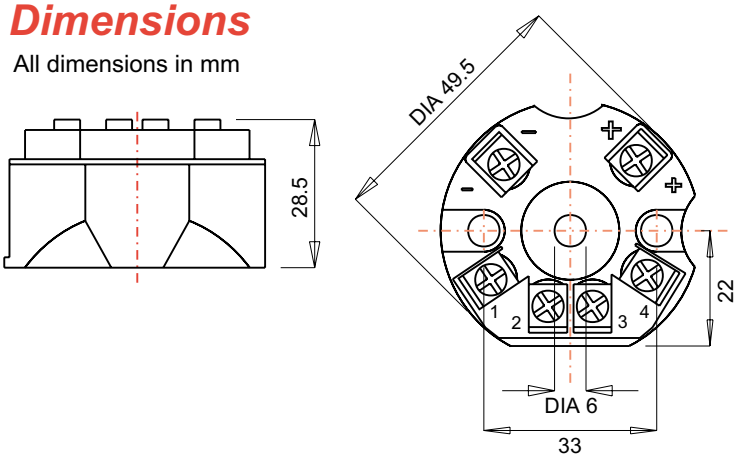
An external resistor must be used, if resistance of Ex-barrier (power supply) is lower than 250Ω

Designation of Terminal Connectors



Dimensions

All dimensions in mm



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