

# Model TR12 Digital Temperature Transmitter

**ATEX APPROVED**

- **Universally programmable for**
  - RTDs
  - Thermocouples
  - Resistance - sensor
  - mV - sensor
- **Output linear to temperature with input signal from RTDs and Thermocouples**
- **Analog output 4 ... 20 mA, invertible, 2 - wire design**
- **Signalling configurable for sensor burnout and sensor short circuiting**
- **Ex class protection, intrinsically safe ATEX Approved**
  - EEx ia IIC T4 / T5 / T6
  - EExnA
  - EExd (when fitted in H70 connection head)
- **EMC Conformity per**
  - EN 61326:1997/P1:1998/P2:2001
  - NAMUR NE 21
- **Galvanic isolation**
- **100% Rh protection, moisture condensation permissible**
- **Increased ambient temperature**
- **PC configurable, Windows® programme**
- **CE Conformity**



Model TR12 Digital Temperature Transmitter

## General Description

The digital temperature transmitter TR12 range is designed for universal industrial use.

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

During configuration any one of 17 input signals can be selected. Measured temperatures are from - 200 °C up to + 2300 °C.

The following sensors can be connected:

- RTDs per EN60751, JIS C 1606, 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.

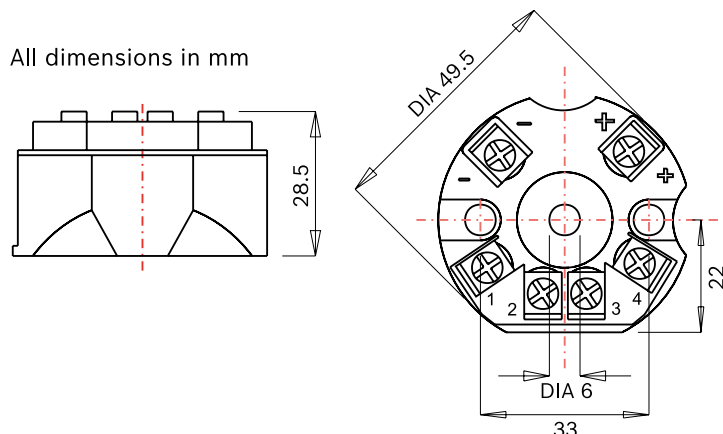
- Resistance-sensors up to 5 k Ω in 2 - , 3 - and 4 - lead connection, configurable compensation of the connection cable
- mV-sensors up to 800 mV

Configuration is carried out by means of a standard DOS PC using the Configuration set. With the Configuration Software the required parameters are defined. Data to the TR12 is down-loaded using a Communication-Interface (Programming Unit). The bi-directional communication enables display of the measured values on the PC.

Configuration can be effected whilst the transmitter is mounted in the field. The Communication-Interface has an integral isolation barrier which allows configuration whilst the transmitter is within hazardous areas, and acts to protect the PC. Configuration sets are available as an optional extra.

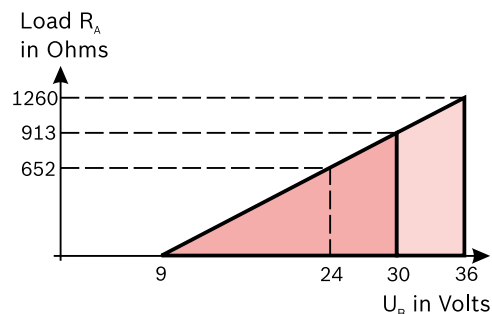
The transmitters are delivered with any customized configuration within the given limits.

## TR12 Dimensions



## Load Diagram

The permissible load is dependant upon the loop power supply voltage



# Model TR12 Din Rail Mounting Temperature Transmitters

**Ex** ATEX APPROVED

- **Universally programmable for**
  - RTDs
  - Thermocouples
  - Resistance - sensor
  - mV - sensor
- **Output linear to temperature with input signal from RTDs and Thermocouples**
- **Analog output 4 ... 20 mA, invertible, 2 - wire design**
- **Signalling configurable for sensor burnout and sensor short circuiting**
- **Ex class protection, intrinsically safe, ATEX approved**
  - EEx ia 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**
- **PC - configurable, Windows® programme**
- **CE Conformity**

## General Description

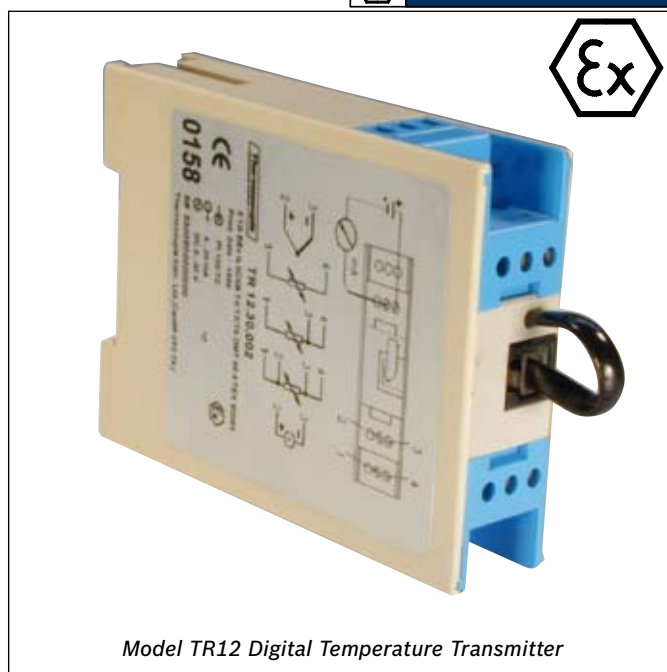
The digital temperature transmitter TR12 range is designed for universal industrial use.

Comprehensive configuration possibilities, for example, type of sensor, measuring range and error signalling, high accuracy, galvanic isolation and EMI protection characterize these transmitters. The rail mounting case fits to any standard rail per DIN EN 50 022-35.

During configuration any one of 17 input signals can be selected. Measured temperatures are from - 200 °C up to + 2300 °C.

The following sensors can be connected:

- RTDs per DIN IEC 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.



Model TR12 Digital Temperature Transmitter

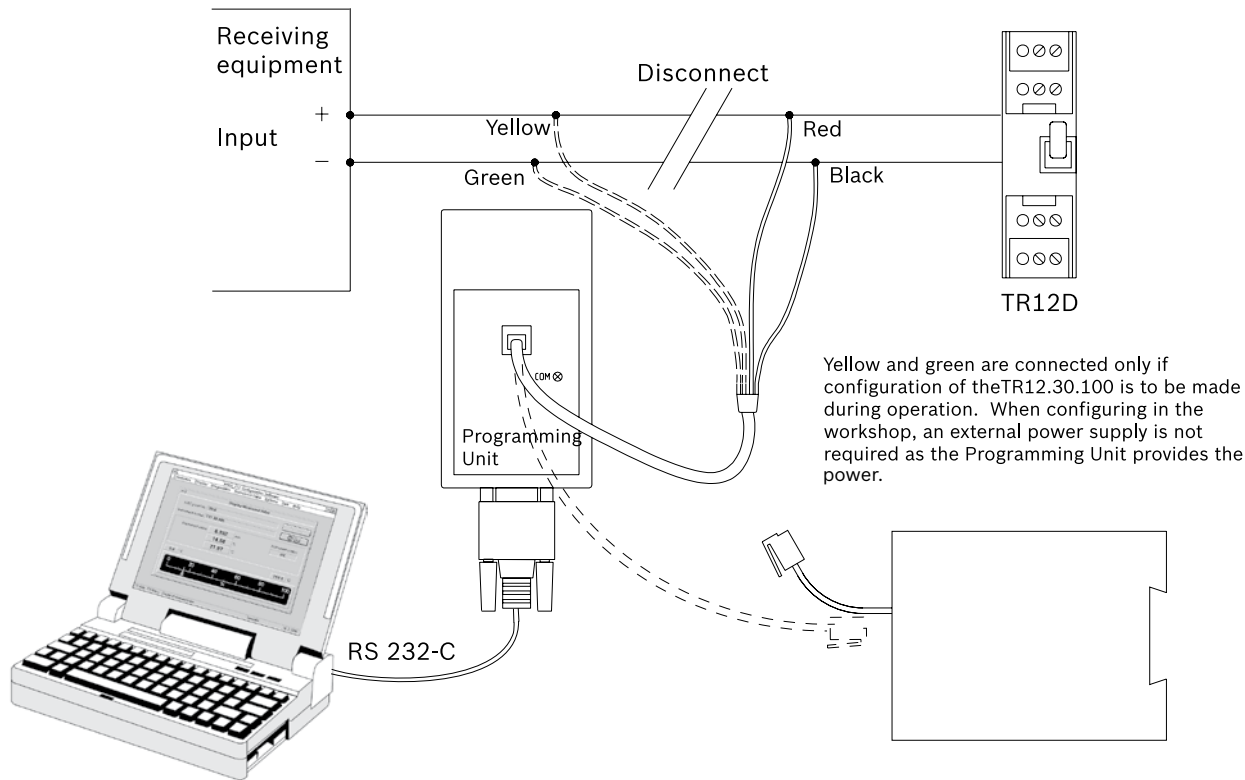
- Resistance sensors up to 5 k  $\Omega$  in 2 - , 3 - and 4 - lead connection, configurable compensation of the connection cable
- mV-sensors up to 800 mV

Configuration is carried out by means of a standard DOS PC using the Configuration set. With the Configuration Software the required parameters are defined. Data to the TR12 is down-loaded using a Communication-Interface (Programming Unit). The bi-directional communication enables display of the measured values on the PC.

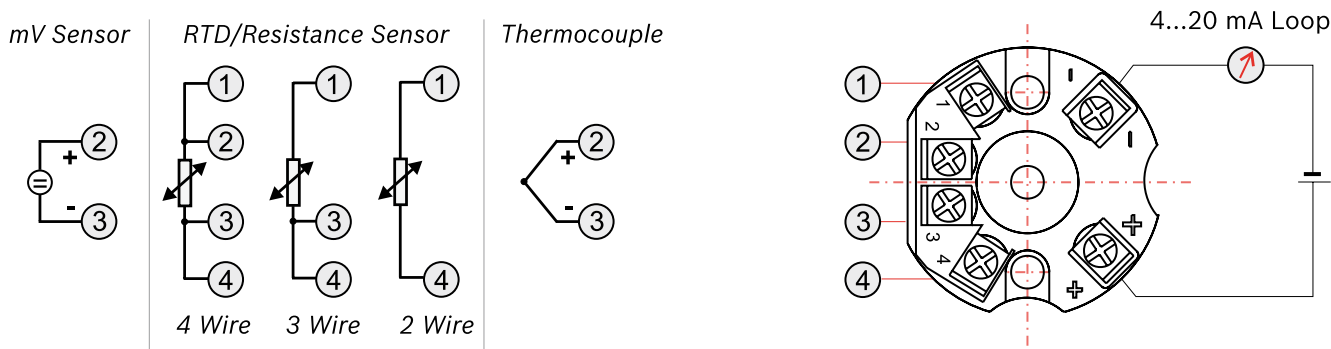
Configuration can be effected whilst the transmitter is mounted in the field. The communications interface has an integral isolation barrier which allows configuration whilst the transmitter is within hazardous areas, and acts to protect the PC. Configuration sets are available as an optional extra.

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

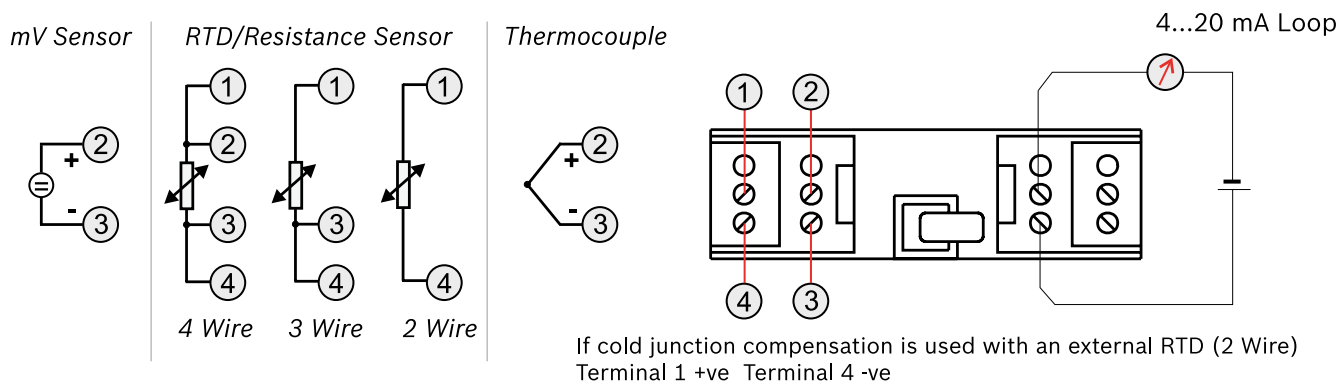
### TR12 Wiring Scheme



### TR12 Designation of Terminal Connectors



### TR12 (DIN Rail Mounted Version) Designation of Terminal Connectors



## TR12 - Input Types

Sensor Type			Max. Measuring Range	Min Measuring Span <sup>(1)</sup>
RTD	PT 100	EN60751	-200 to +850°C	25 K
	JPt 100	JIS C 1606	-200 to +500°C	25 K
	Ni 100	DIN 43760 : 1987-09	-60 to +500°C	25 K
Thermocouple	Type T Cu-CuNi	IEC 584	-200 to +400°C	50 K
	Type E NiCr-CuNi	IEC 584	-100 to +1000°C	50 K
	Type J Fe-CuNi	IEC 584	-100 to +1200°C	50 K
	Type L Fe-CuNi	DIN 43710 : 1985-12	-100 to +900°C	50 K
	Type K NiCr-Ni	IEC 584	-180 to +1372°C	50 K
	Type N NiCrSi-NiSi	IEC 584	-180 to +1300°C	100 K
	Type U Cu-CuNi	DIN 43710 : 1985-12	-200 to +600°C	75 K
	Type R PtRh-Pt	IEC 584	-50 to +1760°C	200 K
	Type S PtRh-Pt	IEC 584	-50 to +1760°C	200 K
	Type B PtRh-PtRh	IEC 584	+400 to +1820°C <sup>(2)</sup>	200 K
	Type W3, W3Re/W25Re	ASTM E988	0 to +2300°C	200 K
Type W5, W5Re/W26Re	ASTM E988	0 to +2300°C	200 K	
Resistance Sensor			0 to +5 kOhm	30 Ohm
mV Sensor			-10 to +800 mV	5 mV

## TR12 - Input Specification

RTD/Resistance Sensor	Measuring deviation per DIN IEC 770, 23°C ±5K	RTD	± 0.2 K or <sup>(3)</sup> ±(0.025% FS + 0.1) K
		Resistance Sensor	± 0.07 Ω or <sup>(3)</sup> ± 0.03% FS in Ω
	Sensor current		Approx. 0.2 mA
	Temperature coefficient T <sub>c</sub>	RTD	± (0.025% FS + 0.09) K/10 K <sub>Tamb</sub>
		Resistance Sensor	± (0.025% FS + 0.01) Ω / 10 K <sub>Tamb</sub>
	Lead wire connection		Configurable: 2=lead, 3=lead, 4=lead
	Connection Leads	Max. resistance	30 Ω each lead, 3-lead symmetric
Effect		±0.02 Ω / 10 Ω	
Signalling of sensor error		Configurable	
Thermocouple	Measuring deviation <sup>(4)</sup> per DIN IEC 770, 23°C ± 5K		± 0.5 K or <sup>(3)</sup> ± 10 μV or <sup>(3)</sup> ±0.05%
	Cold junction compensation		± 1.0 K
	Temperature coefficient T <sub>c</sub>	T, E, J, L, K, N, U	± (0.05% FS + 0.1) K / 10 K <sub>Tamb</sub> or <sup>(3)</sup> ± 0.5 K / 10 K <sub>Tamb</sub>
		R, S, B, W3, W5	± 2 K / 10 K <sub>Tamb</sub>
	Connection Leads	Max. resistance	250 Ω
		Effect	± 0.5 μV / 10 Ω
Signalling of sensor error		Configurable	
mV Sensor	Measuring deviation per DIN IEC 770, 23°C ± 5K		± 10 μV or <sup>(3)</sup> ± 0.05% FS in mV
	Temperature coefficient T <sub>c</sub>		± (0.05% FS + 0.02) mV / 10 K <sub>Tamb</sub>
	Connection Leads	Max. resistance	250 Ω
Effect		± 0.5 μV / 10 Ω	

## TR12 - Output Specification

RTD	Linear to temperature per EN60751 / JIS C 1606 / DIN 43 760 : 1987-09	
Thermocouple	Linear to temperature per DIN IEC 584 / DIN 43 710 : 1985-12 / ASTM E988	
Simulation Mode	Independant from input signal, simulation value configurable from 3.5 mA up to 23 mA	
Output Limits	Application specification	Configurable from 3.6 mA up 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 <sub>A</sub>	$R_A \leq (U_B - 9V) / 0.023 \text{ A}$ with R <sub>A</sub> in Ohm and U <sub>B</sub> in Volt	
Load effect	< ± 0.01% of measuring span / 100 Ω	
Measuring deviation per DIN IEC 770, 23°, ± 5 K	< ± 0.05% or measuring span	
Temperature coefficient	< ± 0.1 % of measuring span / 10 K <sub>Tamb</sub>	
Damping	Configurable: minimal 0.5 s , 1 s up to 60 s	
Measured value update	Approx. 2/s	
Power supply effect	< 0.005 % of measuring span / V	

**TR12 - Power Supply  $U_B$** 

Model TR12 without Ex-protection	DC 9 ... 36 V
Model TR12 with Ex-protection	DC 9 ... 30 V

**Ex Protection EC Type Test**

Model TR12.10.002	II 1G EEx ia IIB / IIC T4/T5/T6	Certificate No. : DMT 00 ATEX E014X
Model TR12.10.009	EExnA IIC T4/T5/T6	Certificate No. : DMT 00 ATEX E080X
Permissible ambient temperature	-20 °C ... +70 °C with T4 -20 °C ... +70 °C with T5 -20 °C ... +60 °C with T6	
Maximum values for connection of the sensor circuit (connections + and -)	$U_i = 30V$ $I_i = 100mA$ $P_i = 705mW$ $L_i = 0.65mH$ $C_i = 25nF$	
Maximum values for connection of the sensor circuit (connections 1- 4)	$U_o = 11.5V$ $I_o = 31mA$ $P_o = 87mW$ $L_o = 0.65mH$ $C_o = 125nF$ Group IIB: $C_o = 11 \mu F$ $L_o = 8.6mH$ Group IIC: $C_o = 1.5 \mu F$ $L_o = 8.6mH$	

**TR12 - Total Measuring Deviation**

Sum of input and output per DIN IEC 770, 23°C ±5K
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**TR12 - Signalling - analogue output with sensor error or internal malfunction**

Substitute value	Configurable from 3.5 mA up to 23.0 mA
Up-scale NAMUR NE 43	> 21.0 mA
Down-scale NAMUR NE 43	< 3.6 mA

**TR12 - Case for head mounting**

Material	Plastic
Cross section of terminal connections	max. 1.5 mm <sup>2</sup> , screws captive
Weight	Approx. 70 g
Dimensions	see drawings (page 10)

**TR12 - Case for rail mounting per DIN EN 50 022-35**

Material	Plastic	
Degree of protection	Case	IP56 IEC 529 / EN 60529
	Terminal Connections	IP20 IEC 529 / EN 60529
Cross section of terminal connections	0.25 mm <sup>2</sup> up to 2.5 mm <sup>2</sup>	
Weight	Max. 0.2 kg	
Dimensions	see drawings (page 11)	

**TR12 - Special Features**

Isolation Voltage (input versus analog output)	1500 VAC, 60 s	
Electric protection	Protected against reverse polarity	
Ambient and storage temperature	Standard	-40 ... +85 °C
	Optional	Min. -50 °C max. +105 °C
Humidity	100 % relative humidity (unlimited with isolated sensor connection wires), moisture condensation permissible IEC 68 2-30 Var. 2	
Vibration	10 ... 2000 Hz 5 g 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	
Self-monitoring	Automatic execution of initial test after connection to power supply, thereafter monitoring due to internal malfunction	
Warm-up time	Approx. 5 Min.	
Power consumption with $U_B$ 24 V	Max. 552 mW	
Electromagnetic Compatibility	EMC Directive 89/336/EEC. EN61326:1997/A1:1998/A2:2001	
Communication-interface	Programming Unit (part of the configuration-set available as an accessory)	
Guarantee	5 years when used within standard ambient range. Rotherm standard terms of warranty apply.	

- 1) Beginning of measuring range maximum 50% of end of measuring range
- 2) Technical data only valid only for configured measuring range  $\geq 400^\circ C$
- 3) Whichever is greater
- 4) Valid only for configured measuring range beginning  $\geq -150^\circ C$

FS	- full scale value of configured measuring range
$U_B$	- loop power supply voltage, see power supply
$R_A$	- load
$T_c$	- temperature coefficient
$T_{amb}$	- ambient temperature



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