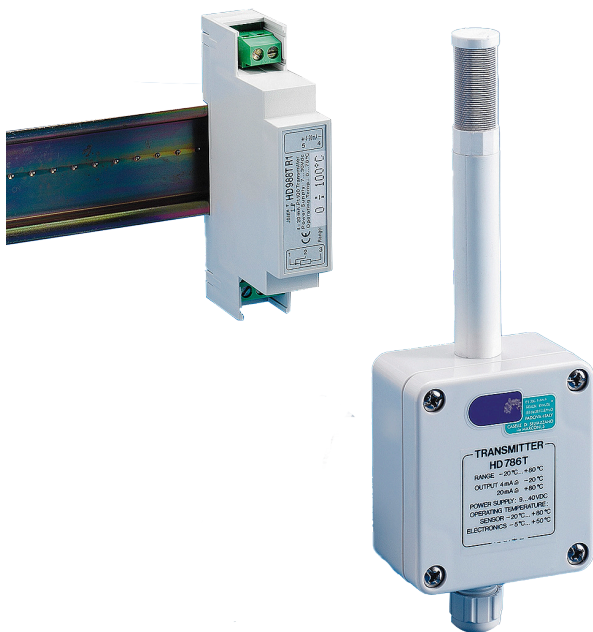## HD786TR1, HD786TR2
HD988TR1, HD988TR1-I

4...20 mA CONFIGURABLE TEMPERATURE TRANSMITTERS FOR Pt100 SENSORS

HD786TR1, HD786TR2 and HD988TR1, HD988TR1-I are 4...20 mA configurable transmitters with microprocessor for Pt100 Platinum temperature sensor.

They convert the temperature variations found with any standard Pt100 sensor (100Ω at 0 °C) into a linear current signal with two leads in the field 4...20 mA.

Linearization with a digital technique allows excellent precision and stability to be obtained.

User can set the 4...20 mA output (or 20...4 mA) in any temperature range within the field -200...+650 °C, with a minimum amplitude of 25 °C; it may be simply reprogrammed by pressing a key, without any need to regulate jumpers, potentiometers, software, etc.

A led indicates any alarm situations (temperature outside the set range, broken or short-circuiting sensor) and assists the user in the programming phase. The 4...20mA output of model HD988TR1-I is galvanically isolated from the Pt100 input. The transmitters are also protected against inversions of polarity.

The **HD988TR1, HD988TR1-I** are specifically designed for for fitting in **containers with a 35 mm DIN rail connection**.

The **HD786TR1 and HD786TR2** are indicated for **wall installation**.

Fig. 1 Range 0...100 °C, output current according to the temperature function.

Technical specifications @ 25°C and 24Vdc	
	All models
INPUT	
Sensor	Pt100 (100Ω at 0 °C)
Connection	3 (or 2) wires
Linearization	EN 60751, IEC 751 BS 1904 (α=0.00385)
Current into sensor	<1 mA
Measuring range	-200...+650 °C
Default range	0...100 °C
Minimum measuring amplitude	25 °C
Influence of the connecting leads	Negligible with coupled lead
Conversion speed	2 measurements per second
Accuracy	±0.1°C ±0.1% of the reading (-100...+500 °C) ±0.2°C ±0.02% of the reading (-200...+650 °C)
Sensibility to variations of env. temperature	0.01 °C/°C
Electronics operating temperature	-20...70 °C
Storage temperature	-40...+80 °C
OUTPUT	
Output	4...20 mA (or 20...4 mA) 22 mA in case of incorrect programming or temperature out of range (note 1).
Resolution	Analog ouput 4 µA
Power supply voltage	7...30 Vdc (protection against inversions of polarity)
Sensibility to variations of the feeding voltage Vdc	0.4 µA / V
Load resistance	$R_{LMax} = \dfrac{Vdc-7}{0.022}$ => R_{LMax} = 770 Ω @ Vdc = 24 Vdc
Red led	It switches on while programming and when the measured temperature is out of the set range
Input-Output isolation	500 Vdc Only for HD988TR1-I

Note 1 - If the measured temperature T is out of the set range T1...T2 (T1<T2), HD988TR1, HD988TR1-I maintain 4 mA for T<T1 and 20 mA for T>T2 for a dead band of 10°C before going into error status at 22 mA.
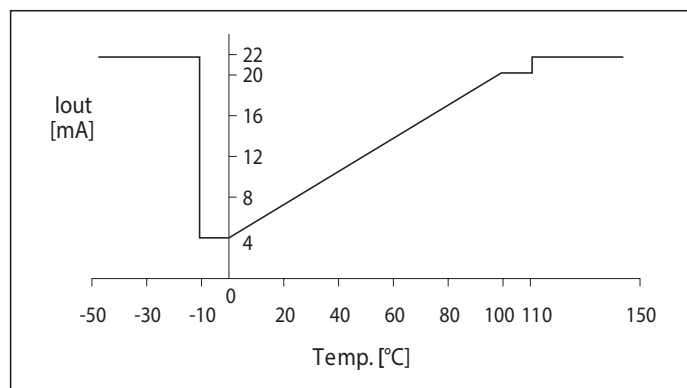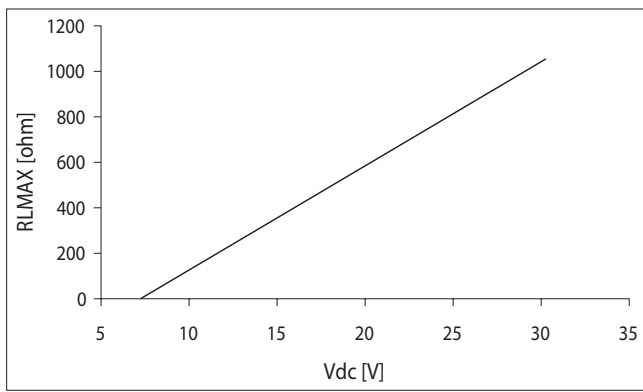
Fig. 2 Load with relation to the supply voltage.

PROGRAMMING

All transmitters are supplied by default with a range 0…100 °C, anyway user can set a different range by using the following accessories:

- continuous 7…30 Vdc power source,

- Pt100 calibrator or set of precision resistors,

- precision ammeter with minimum range 0…25 mA,

and by following this procedure:

1. Connect the transmitter as shown in Fig. 3 and set the Pt100 calibrator at the required temperature suitable for 4 mA (for example, assuming that you want to set the range -50…+200 °C, you will set the calibrator to -50 °C or equivalently you will connect a resistance of 80,31Ω between terminals 1 and 3 while 1 and 2 shorted).

2. Wait 10 seconds until the measurement becomes settled, then keep pressed the programming key for at least 4 seconds, until the LED flashes once and remains lit. When the key is released the LED flashes.

3. Set the Pt100 calibrator at the required temperature for 20 mA (according to the above example, set the calibrator at +200 °C, or alternatively connect 175.86Ω resistance between terminals 1 and 3 with 1 and 2 shorted).

4. Wait 10 seconds until the measurement becomes settled, then press the programming key for at least 4 seconds, until the LED stops flashing. Now release the key and the LED flashes twice. At this point the setting procedure is completed.

5. Verify that the setting complies with the required specifications, setting the calibrator (or connecting the precision resistances) at the values corresponding to 4 and 20 mA and checking the current on the ammeter.

The temperature range programming can be performed by using some precision resistances of fixed value that simulate a Pt100 sensor value. For example, the resistance values corresponding to some temperature values are reported (see table below).

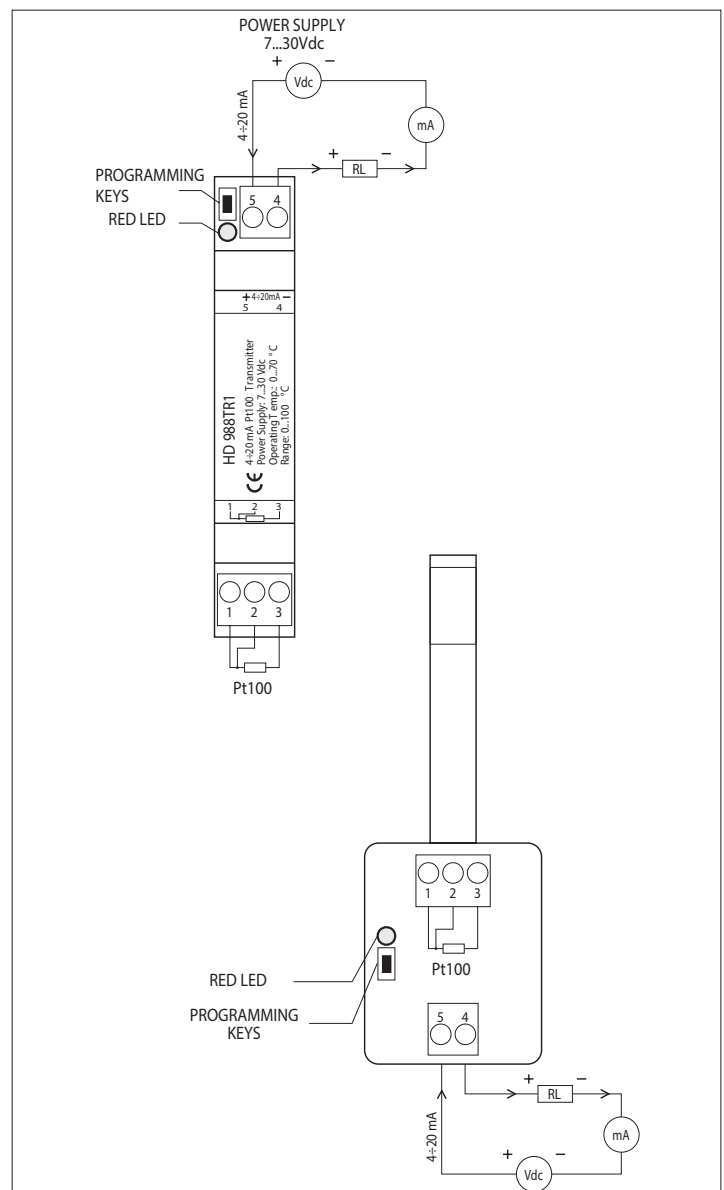| °C	Ω	°C	Ω	°C	Ω
-200	18.52	70	127.08	200	175.86
-100	60.26	80	130.90	220	183.19
-50	80.31	90	134.71	250	194.10
-30	88.22	100	138.51	280	204.90
-20	92.16	110	142.29	300	212.05
-10	96.09	120	146.07	350	229.72
0	100.00	130	149.83	400	247.09
10	103.90	140	153.58	450	264.18
20	107.79	150	157.33	500	280.98
30	111.67	160	161.05	550	297.49
40	115.54	170	164.77	600	313.71
50	119.40	180	168.48	650	329.64
60	123.24	190	172.17		

Fig. 3 reports the connection diagrams for the transmitters in the current loop. In order to obtain the maximum precision, the connection to the Pt100 should be performed with 3 wires and with wires having the same diameter so to grant the same impedance in each connection. The symbol RL (load) represents any device in the current loop that is to say an indicator, a controller, a data logger or a recorder.

ORDERING CODES

HD988TR1: Configurable temperature transmitter with 4...20 mA output. Measuring range -200...+650 °C, minimum range 25 °C. Standard configuration 0...100 °C. 2 or 3 wires Pt100 sensor. Electronics operating temperature -20...+70 °C. **Case for DIN rail 35 mm, 1 module (17.5 mm).**

HD988TR1-I: Configurable **opto insulated** temperature transmitter with 4...20 mA output. Measuring range -200...+650 °C, minimum range 25 °C. Standard configuration 0...100 °C. 2 or 3 wires Pt100 sensor. Electronics operating temperature -20...+70 °C. **Case for DIN rail 35 mm, 1 module (17.5 mm).**

HD786TR1: Configurable temperature transmitter with output 4...20 mA. Measuring range -200...+650 °C, minimum range 25 °C. Standard configuration 0...100 °C. Electronics operating temperature -20...+70 °C. Container 65 x 58 x 35 mm. **Wall mounting, complete with Pt100 probe Ø14, L = 90 mm.**

HD786TR2: Configurable temperature transmitter with output 4...20 mA. Measuring range -200...+650 °C, minimum range 25 °C. Standard configuration 0...100 °C. Electronics operating temperature -20...+70 °C. Container 65 x 58 x 35 mm. **Wall mounting, complete with Pt100 probe Ø3, L = 55 mm.**

WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages. The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased. We reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION

Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.