HD 2047
Pt100 SIMULATOR

HD 2047 is a portable instrument specially designed for testing and calibrating instruments with Pt100 (100Ω a 0°C) type input and voltage/current outputs such as, for instance, active and passive temperature transmitters, recorders, testers and data loggers, etc

HD 2047 simulates up to 24 fixed values of a Pt100 sensor in the range from -100°C up to +500°C, with a 2, 3 or 4 -wire connections. The selection of the value to simulate is via a rotary switch placed on the front of the instrument. Whatever operating mode you choose, the Pt100 output is always active

HD 2047 can measure with high accuracy voltage/current outputs of any transmitter connected to the instrument input: -20V...+20V continuous voltage range and 0...22mA continuous current range. Eventually it can also calibrate and test the functioning of a passive transmitter by simulating the temperature input, providing power supply to the transmitter and at the same time reading the current flowing in: all this is performed without external power supply auxiliary.

The instrument is equipped with three keys:

ON/OFF switches the instrument on and off. Once switched on, HD 2047 is ready for the voltage measurement.

MODE selects in cycling the type of operation; by pressing the button in succession, you enable in order:
1. voltage measurement;
2. current measurement;
3. current measurement by 4...20mA loop power supply.

RANGE in voltage or current measurement it allows to select the more suitable full range and resolution for the measurement under process: -1.999...+1.999, -19.99...+19.99 e -199.9...+199.9.

HD 2047 is internally protected against any kind of connecting error made by the operator: it is highly recommended anyway not to exceed voltage/current limits shown in technical specifications.

The battery signal appears on the display in order to indicate that batteries are low and need to be replaced.

Operating modes

1) DC voltage input measure

The instrument measures positive and negative continuous voltages up to 20V maximum amplitude.

Procedure (see fig.1):

• select “input voltage” operating mode by pressing MODE key. The red led corresponding to “READ V” lights up;

• connect the wires to the sockets, as reported in fig.1;

• select the correct range depending on the voltage, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range.

Note: a) **For safety reasons, never apply any voltage superior to 48Vdc to the sockets**.
b) **The instrument only measures continuous voltage.**

2) DC current input measure

The instrument measures positive and negative current up to 22mA maximum amplitude.

Procedure (see fig.2):

• select “input current” operating mode by pressing MODE key. The red led corresponding to “READ mA” lights up;”

• connect the wires to the sockets, as reported in fig.2 observing the correct polarity: in order to be read, current must be from the bush +

• select the correct range depending on the current, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range.

Note: a) **The instrument measures continuous current up to a 22mA maximum amplitude.**
b) **The instrument only measures continuous current.**
c) **The instrument is provided with an internal protection circuit to limit the current within 25mA.**

3) Calibration and passive transmitters test

The instrument can power a 4...20mA loop, measure the current and simulate 24 fixed values of a Pt100 at the input of a temperature transmitter, with no external power supply required.

Procedure (see fig.3):

• select “2 WIRE” operating mode by pressing MODE key. The corresponding red led lights up

• connect the 4...20mA loop wires to the left sockets, as shown in the figure, respecting the correct polarity; the current supplied by HD 2047 is delivered through the positive (+) socket

• select the correct range depending on the current, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range

• select the temperature value by turning the rotary switch.

Note: a) **The maximum amplitude of the output current equals 25mA.**
b) **A 14Vdc voltage is supplied to the current loop.**
c) **In case of 2 or 3-wire connections, do not make jumpers on unused sockets; it is highly recommended to leave them free.**

4) Pt100 sensor simulation

The instrument can simulate 24 temperature fixed values of a Pt100 sensor (100Ω at 0°C, coefficient α=0.003850) with 2, 3 or 4-wire connections. The selection is made through a rotary switch placed on the front part of the instrument.

Procedure:

• perform the connection as reported in figures 3, 4 or 5 according to the number of wires;

• select the temperature value by turning the rotary switch.

Note: a) **In case of 2 or 3- is highly recommended to leave them free.**
b) **MODE and RANGE keys have no effects on the resistance selection.**
c) **The internal protection circuit reduces to approximately 1.2V the drop on resistances: this means the measuring current has a maximum amplitude of 20mA.**

TECHNICAL DATA (@ 20°C)

GENERAL	
Power supply	4 batteries 1.5V, AA size (the input for the 9Vdc external supplier is provided only upon request)
Autonomy with 1.5V Batteries and 2250mAh capacity	160 h (in "V READ" and "mA READ" operating mode)
	30 h @ loop current = 12mA (in "2 WIRE" operating mode)
Low batteries signal	The battery sign lights up with a battery voltage of about 3.6V
Operating temperature	-5...+50°C
Operating relative humidity	0...90%RH (no condensation)
Weight/dimensions	580 g (without Batteries) / 23x70x230 mm
CONTINUOUS VOLTAGE MEASURE	
Measuring range	-1.999V...+1.999V: resolution 1mV -19.99V...+19.99V: resolution 10mV
Accuracy	±1mV: in the range -1.999V...+1.999V ±10mV: in the range -19.99V...+19.99V
Input resistance	1MΩ
Maximum voltage applied to terminals	48Vcc
CONTINUOUS CURRENT MEASURE	
Measuring range	0.00mA...19.99mA: resolution 10µA 0.0...22.0mA: resolution 100µA
Accuracy	±(0.01mA+0.05% of the range): in the range 0.00mA...19.99mA ±0.1mA: in the range 0.0mA...22.0mA
Shunt resistance	20Ω
Overload protection	Current limit: 25mA
PASSIVE TRANSMITTERS: POWER SUPPLY/ MEASURE	
Measuring range	0.00mA...19.99mA: resolution 10µA 0.0...22.0mA: resolution 100µA
Accuracy	±(0.01mA+0.05% of the range): in the range 0.00mA...19.99mA ±0.1mA: in the range 0.0mA...22.0mA
Shunt resistance	20Ω
Overload protection	Current limit: 25mA
Maximum load @20mA	700Ω
Applied voltage	14Vdc
SIMULATING A Pt100	
Type of RTD	Pt100 (100Ω a 0°C, α=0.003850, EN60751, IEC751, BS1904)
Temperature values	24 fixed values from -100 to +500°C
Precision	±0.05% of the simulated value
Room temperature effect	±5ppm / °C
Maximum power loss	125mW
Maximum load current	20mA

ORDERING CODES

HD 2047: Pt100 Simulator measures current loop and voltage signals coming from transmitters. The kit consists of instrument equipped with batteries, 2 connection cables L=600 mm, one is a 4 wires, the other is a 2 wires.

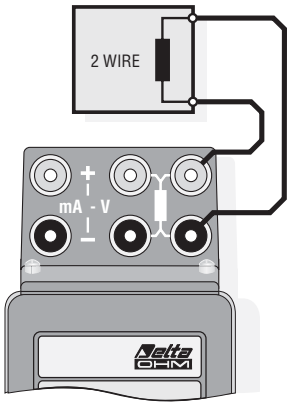

Fig. 5 Pt100 2-wire Simulator

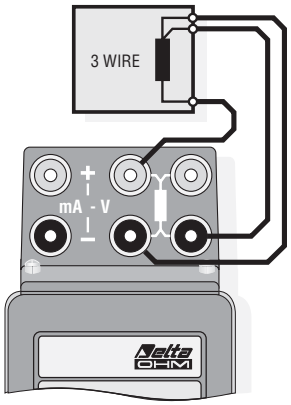

Fig. 4 Pt100 3-wire Simulator

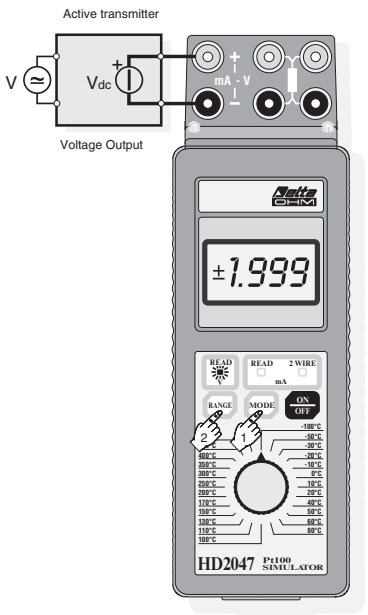

Fig. 1 Continuous voltage measurement

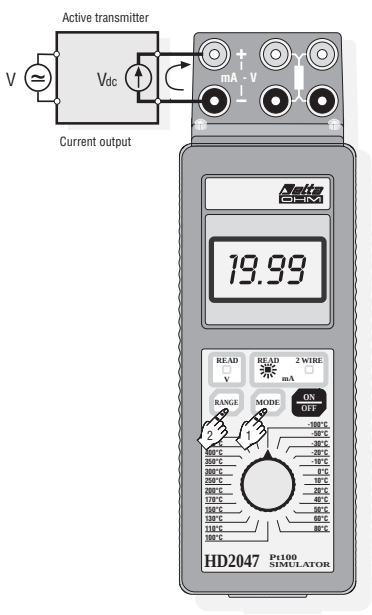

Fig. 2 Continuous current measurement

Fig. 3 Testing a Pt100 input passive transmitter

HD 778TR1
HD 978TR1
HD 978TR2
HD 778-TCAL

HD778TR1, HD978TR1, HD978TR2, HD778-TCAL
4÷20mA CONFIGURABLE TEMPERATURE TRANSMITTERS FOR K-J-T-N TYPE THERMOCOUPLE. THERMOCOUPLE GENERATOR MANAGED BY PC THROUGH RS232C HD778-TCAL

HD 778TR1, HD 978TR1 and HD 978TR2 are 4…20mA two-wired configurable passive transmitters with microprocessor for **K, J, T** and **N** type thermocouple sensors. They convert the voltage value generated by the thermocouple into a linear current signal included in the range 4…20mA. The use of digital devices allows obtaining an excellent precision and stability in time. User can set the 4…20mA (or 20…4mA) output into any temperature range in the measuring range included in the measuring range of the single thermocouple with **a minimum range of 50°C**. The range and type of thermocouple are set by simply using one button. A led indicates the alarm situation (broken or not connected sensor) and it helps user during the programming. Moreover, transmitters are protected against polarity inversions. HD778TR1 is specifically designed to be installed in DIN B type connection heads, HD978TR1 and HD978TR2 are suitable for mounting on 35 mm DIN bars. Beyond 4…20mA output, HD978TR2 has a 3½ digit (Height 10 mm) display which allows displaying the measured temperature.

TECHNICAL DATA @ 25°C e 24Vdc

INPUT	HD778TR1	HD978TR1	HD978TR2
Sensor	Thermocouple type K, J, T and N		
Connection	2 wires passive transmitter		
Measuring range	Thermocouple K: -200°C … +1200°C Thermocouple J: -200°C … +800°C Thermocouple T: -200°C … +300°C Thermocouple N: -200°C … +1200°C		
Linearization	EN 60584-1-2 ASTM E 230 - ANSI (MC96-1)		
Default range	Tc = K - Range = 0...1000°C		
Minimum measuring range	50°C		
Conversion speed	2 measures per second		
Accuracy	±0,04%FS±0,04% of the reading or 0.5°C (the greater of the two values)		
Operating temperature of the cold junction	-30 … +80°C	0 … +70°C	
Operating temperature	-30 … +80°C	0 … +70°C	
Storage temperature	-40...+80°C		
OUPUT			
Type of ouput (note 1)	4...20 mA (or 20...4 mA) two wires 22 mA if sensor is broken or not connected		
Resolution	4 µA		4 µA Display: 0,1°C T<200°C 1°C T>200°C
Power voltage	9...30V cc (protection against polarity inversion)		
Sensitivity to Vdc power voltage variations	0,4 µA/V		
Load resistance	R_LMax = (Vdc-9)/0.022 R_LMax = 625Ω with Vcc = 24 Vdc		
Input/output galvanic insulation	50Vcc (verified at 250V)		
Red led	It turns on while programming, when the probe is broken or not connected		
Heating time	2 minutes		

Note 1) If the measured temperature T goes out of the T1...T2 (T1<T2) set range, the transmitters linearly regulate the current for T<T1 and T>T2 for an interval of 10°C. (See the current diagram).

Installation and connection
Fig. 1 shows the mechanical dimensions of the HD778TR1 transmitter and highlights the holes of 5 mm diameter for fastening the DIN head and the central hole for the entrance of the wires in the thermocouple. Fig. 1 reports the mechanical dimensions of the HD978TR1 and of the HD978TR2.
The width of the HD978TR1 is a DIN (17,5 mm) module, the HD978TR2 is a 2 DIN (35mm) modules. The working temperature should be included in operating temperature declared. Fig. 4 and 5 report the wiring diagrams of the HD778TR1, HD978TR1 and HD978TR2. In order to obtain the maximum precision, the connection to the thermocouple should not exceed 3 meters long. In the diagrams reported, the RL (Load) symbol represents any device introduced in the current loop, that is to say any indicator, controller, data logger or recorder.

CHOICE OF TYPE OF THERMOCOUPLE
The transmitter accepts four types of thermocouple. The thermocouple set is highlighted by the number of flashes of the led when power is supplied.

N° of led flashes	Type ofthermocouple
1	K
2	J
3	T
4	N

Transmitters come with the default set K thermocouple and range 4…20mA = 0…1000°C.
User can change the thermocouple type and the operating range according to the following procedure.
Note: after changing the thermocouple type the operating range should be programmed.

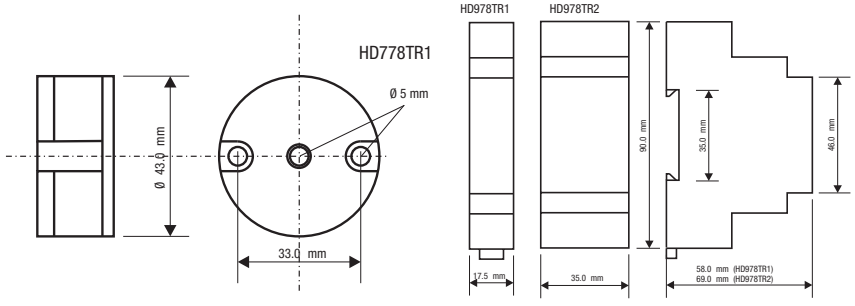

Fig.1 Mechanical dimensions.

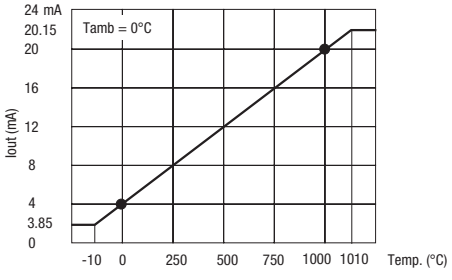

Fig. 2 0… 1000°C current output according to temperature