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TEMPERATURE MEASUREMENT

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Temperature Measurement

Handheld - Overview

	HD2107.1	HD2107.2	HD2127.1	HD2127.2	HD2307.0	HD2108.1	HD2108.2	HD2128.1	HD2128.2	HD2328.0	HD2178.1	HD2178.2	HD32.7	HD32.8.8	HD32.8.16
Sensor Element	Pt100 / Pt1000					Thermocouple K - J - T - N - R -S - B - E				Thermo-couple K - J - T - E	Pt100/Pt1000 Thermocouple K - J - T - N - E		Pt100 Pt1000	Thermocouple K - J - T - N - R -S - B - E	
Number of Inputs	1	1	2	2	1	1	1	2	2	2	2	2	8	8	16
Data Logging		√		√			√		√			√	√	√	√
Pt100 Measuring Range	-250…+650 °C									-250…+650 °C					
Pt1000 Measuring Range	-250…+650 °C										-250…+650 °C		-250…+650 °C		
Thermo-couple Measuring Range						-200…+1800°C depending on the thermocouple type				-200…+1370°C depending on the thermocouple type				-200…+1800°C depending on the thermocouple type	
Resolution	0.01°C in the range ±199.99°C 0.1°C in the remaining range				0.1 °C	0.05°C in the range ±199.95°C 0.1°C in the remaing range				0.1 °C	0.1 °C	0.1 °C	0.01°C in the range ±199.99°C 0.1°C in the remai-ning range	0.05°C in the range ±199.95°C 0.1°C in the remaing range	

Overview - Transmitters

	HD788TR1	HD788TR1-I	HD786TR1	HD786TR2	HD988TR1	HD988TR1-I	HD988TR2	HD778TR1	HD978TR1	HD978TR2	HD48..	HD49..
Sensor	3 (or 2) wires Pt100							Thermocouple K - J - T - N			Pt100 NTC 10KΩ	
Output connection	2 wires passive transmitters							2 wires passive transmitters			active transmitters	2 vires passive transmitters
Measuring Range	-200...+650°C		-200...+650°C		-200...+650°C			Thermocouple K: -200...+1200°C Thermocouple J: -200...+800°C Thermocouple T: -200...+300°C Thermocouple N: -200...+1200°C			-20...+80°C (-40...+150°C extended range)	
Minimum measuring range	25°C							50°C			25°C	
Type of installation	DIN B 43760 heads		Wall mounting		35 mm DIN rail 1 module		35 mm DIN rail 2 modules	DIN B 43760 heads	35 mm DIN rail 1 module	35 mm DIN rail 2 modules	- Duct mounting (with horizontal probe) - Wall mounting (with vertical probe) - Wall mounting (remote probe connected by cable)	
Output	4...20 mA (or 20...4 mA)							4...20 mA (or 20...4 mA) two wires			4....20mA (or 20...4 mA) 0...10Vdc (or 10...0 Vdc) RS485	4...20mA or 20...4mA
Display							√			√	√ (optional)	√ (optional)
Additional parameters measured											Relative Humidity Dew Point	

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HD 2307.0

Technical specifications	
Measurement of temperature	
Pt100 measurement range	-200...+650°C
Pt1000 measurement range	-200...+650°C
Resolution	0.1°C
Accuracy	±0.05°C
Drift after 1 year	0.1°C/year
Unit of measurement	°C - °F
Power Supply	
Batteries	3 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	< 20µA
Connections	DIN45326 8 poles male connector
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	IP67
General characteristics	
Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2 rows 4½ digits plus symbols Visible area: 52x42mm

HD2307.0
Pt100 AND Pt1000 SENSORS THERMOMETER

HD2307.0 is a portable instrument equipped with large LCD display. It measures temperature by means of immersion, penetration, contact or air probes. Its sensor can be 3 or 4 wires Pt100, Pt1000.

Probes are equipped with an automatic recognition module: factory calibration data are stored inside. The Max, Min and Avg function calculate the maximum, minimum or average values.

Other functions: relative measurement REL, HOLD function and automatic switching-off system, (excludable).

The instrument has IP67 protection degree.

ORDERING CODES

HD2307.0: The kit consists of instrument HD2307.0, 3 per 1.5V alkaline batteries, instruction manual and case. Probes have to be ordered separately.

For all Pt100 probes and Pt1000 probes, see from **pag.30** onwards.

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HD2328.0

HD2328.0
TWO INPUTS THERMOCOUPLE THERMOMETER

HD2328.0 with **two inputs** is a portable instrument with a large LCD display. It measures temperature by means of immersion, penetration, contact or air probes. Its sensor can be a K, J, T or E thermocouple type.

Functions Max, Min and Avg calculate maximum, minimum and average values.

Further functions are: REL relative measure, HOLD, automatic switching-off system (excludable) and the A-B difference of the two input channels.

The instrument has IP67 protection degree.

Technical specifications	
Measurement of temperature	
TC measuring range: K	-200...+1370°C
TC measuring range: J	-100...+750°C
TC measuring range: T	-200...+400°C
TC measuring range: E	-200...+750°C
Resolution	0.1°C
Instrument accuracy Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included	
Thermocouple K	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple J	±0.1°C up to 400°C ±0.2°C over 400°C
Thermocouple T	±0.1°C
Thermocouple E	±0.1°C up to 300°C ±0.2°C over 300°C
Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year
Unit of measurement	°C - °F
Power Supply	
Batteries	3 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	< 20µA
Connections	
Probes input	2 per 2-pole female polarized standard miniature connector
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	IP67
General characteristics	
Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2 rows 4½ digits plus symbols Visible area: 52x42mm

ORDERING CODES

HD2328.0: The kit consists of two inputs instrument HD2328.0, 3 per 1.5V alkaline batteries, instruction manual, case. Probes have to be ordered separately.

For all thermocouples probes, see from **pag.36** onwards.

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HD2107.1, HD2107.2, HD2127.1, HD2127.2

HD2107.1- HD2107.2 - HD2127.1 - HD2127.2
Pt100 AND Pt1000 SENSORS THERMOMETERS

HD2107.1 and **HD2107.2** are portable instruments equipped with large LCD display fitted with one input. HD2127.1 and HD2127.2 are instruments fitted with two inputs. They measure temperature by means of immersion, penetration, contact or air probes. Their sensor can be Pt100 with 3 or 4 wires, Pt1000 with 2 wires. They have centesimal resolution in the range ± 199.99°C, decimal in the rest of the range.

Probes are equipped with an automatic recognition module: factory calibration data are stored inside.

The instruments HD2107.2 and HD2127.2 are data logger; they store up to 80.000 samples which can be transferred into a PC connected to the serial ports RS232C and USB 2.0 or into portable printer.

It is possible to configure the storage interval, the printing and the baud rate by the menu.

Functions Max, Min and Avg calculate maximum, minimum and average values.

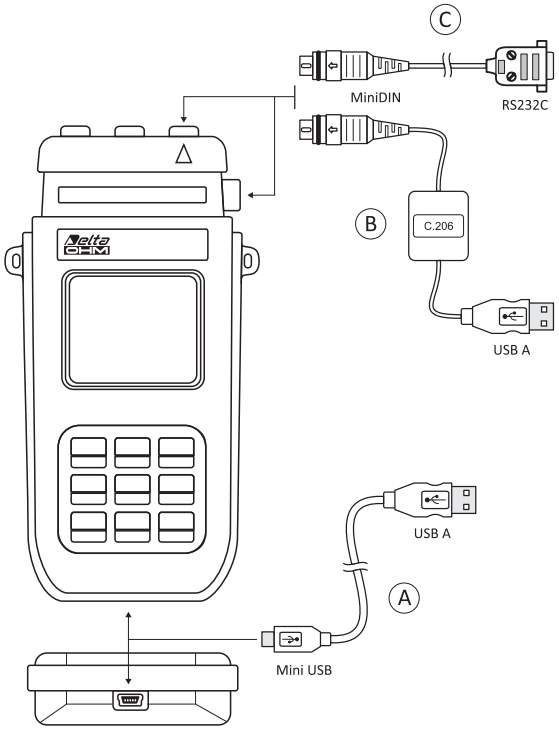
Further functions are: REL relative measure, HOLD and automatic switching-off system (excludable).

Instruments have IP66 protection degree.

	HD2107.1	HD2107.2	HD2127.1	HD2127.2
TC input:	1	1	2	2
Storage capacity	----	76000 samples	----	38000 couples of temperatures
PC interface	RS232C	RS232C + USB2.0	RS232C	RS232C + USB2.0
Data logger	NO	YES	NO	YES
A-B function	NO	NO	YES	YES

Technical specifications	
Measurement of temperature	
Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.01°C in the range ±199.99°C 0.1°C in the remaining range
Instrument Accuracy	±0.01°C
Drift after 1 year	0.1°C/year
Unit of measurement	°C - °F - K
Measured values storage model HD2107.2	
Type	2000 pages containing 40 samples each
Quantity	Total of 80000 samples
Storage interval can be selected among	1,5,10,15,30 s 1,2,5,10,15,20,30 min.; 1 hour
Measured values storage model HD2127.2	
Type	2000 pages containing 16 pairs of samples each
Quantity	Total of 32000 samples (channel A + channel B)
Storage interval can be selected among	1,5,10,15,30 s, 1,2,5,10,15,20,30 min.; 1 hour
Security of stored data	Unlimited, independent of battery charge conditions
Power Supply	
Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Main	12Vdc / 1000mA Output mains adapter
Serial interface RS232C	
Type	RS232C galvanically isolated
Baud rate	can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Print interval	Immediate or selectable among: 1,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
USB interface - model HD2107.2, HD2127.2	
Type	1.1 - 2.0 galvanically isolated
Connections	
Input for the probes	8-pole male DIN45326 connector
RS232C serial interface	8-pole MiniDin connector
USB interface	Type B MiniUSB connector
Mains adapter	2-pole connector (positive at centre)
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90%RH, no condensation

Protection degree	IP66
General characteristics	
Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2 rows 4½ digits plus symbols Visible area: 52x42mm
Time	
Date and time	In real time
Accuracy	1min/month max drift



A The portable data loggers HD2107.2 HD2127.2 are equipped with HID (Human Interface device) type USB port with mini USB connector.

For the connection to a PC with the CP23 cable it is not necessary to load any USB driver.

B For the connection of the models HD21071 HD2127.1 to the USB port of a PC, is necessary the USB/serial converter C.206. The converter is supplied with its own drivers which must be installed before the connection of the converter to the PC.

C The port with the miniDin connector is a serial port type RS232C. The serial port RS232C of a PC or the printer HD40.1 can be connected by the cable HD2110CSNM.

ORDERING CODES

HD2107.1: The kit consists of instrument HD2107.1, 4 per 1.5V alkaline batteries, instruction manual, case and Deltalog9 software downloadable from Delta OHM website. Probes and cables have to be ordered separately.

HD2107.2: The kit consists of instrument HD2107.2 data logger, 4 per 1.5V alkaline batteries, instruction manual, CP23 USB cable, case and Deltalog9 software downloadable from Delta OHM website. Probes have to be ordered separately.

HD2127.1: The kit consists of instrument HD2127.1, 4 per 1.5V alkaline batteries, instruction manual, case and Deltalog9 software downloadable from Delta OHM website. Probes and cables have to be ordered separately.

HD2127.2: The kit consists of instrument HD2127.2 data logger, 4 per 1.5V alkaline batteries, instruction manual, CP23 USB cable, case and Deltalog9 software downloadable from Delta OHM website. Probes have to be ordered separately.

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the series HD21...**1** to connect to USB input of PC.

SWD10: Stabilized 230Vac/12Vdc-1000mA mains adapter.

HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width. Use cable HD2110CSNM (option).

For all Pt100 and Pt1000 probes, see from **pag.30** onwards.

HD2107

HD2127

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HD2108.1, HD2108.2, HD2128.1, HD2128.2

HD2108.1, HD2108.2, HD2128.1, HD2128.2
THERMOCOUPLE THERMOMETERS: K, J, T, N, R, S, B, E

The **HD2108.1 and HD2108.2 with one input** and the **HD2128.1 and HD2128.2 with two inputs** are portable instruments with a large LCD display. They measure the temperature using immersion, penetration, air or contact probes. The sensor may be a thermocouple of type K, J, T, N, R, S, B or E.

Instruments HD2108.2 and HD2128.2 are data loggers, they store up to 76.000 samples the first and 38.000 couples of values the second. These data can be transferred into a PC connected to the instrument through the serial ports RS232C and USB 2.0. It is possible to configure the storage interval, the printing and the baud rate by the menu.

Functions Max, Min and Avg calculate maximum, minimum and average values.

Further functions are: REL relative measure, HOLD and automatic switching-off system (excludable). HD2128.1 and HD2128.2 calculate A-B difference of the temperatures acquired by the two input channels.

Instruments have IP66 protection degree.

	HD2108.1	HD2108.2	HD2128.1	HD2128.2
TC input:	1	1	2	2
Storage capacity	----	76000 samples	----	38000 couples of temperatures
PC interface	RS232C	RS232C + USB2.0	RS232C	RS232C + USB2.0
Data logger	NO	YES	NO	YES
A-B function	NO	NO	YES	YES

Technical specifications	
Measurement of temperature by instrument	
TC measuring range: K	-200…+1370°C
TC measuring range: J	-100…+750°C
TC measuring range: T	-200…+400°C
TC measuring range: N	-200…+1300°C
TC measuring range: R	+200…+1480°C
TC measuring range: S	+200…+1480°C
TC measuring range: B	+200…+1800°C
TC measuring range: E	-200…+750°C
Resolution	**0.05°C in the range ±199.95°C 0.1°C in the remaing range**
Instrument accuracy Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included.	
Thermocouple K	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple J	±0.05°C up to 400°C ±0.1°C over 400°C
Thermocouple T	±0.1°C
Thermocouple N	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple R	±0.25°C
Thermocouple S	±0.3°C
Thermocouple B	±0.35°C
Thermocouple E	±0.1°C up to 300°C ±0.15°C over 300°C
Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year
Unit of measurement	°C - °F - K - mV - mV*C
Measured values storage	
Model HD2108.2	2000 pages each one containing 38 samples, 76000 samples in total
Model HD2128.2	2000 pages each one containing 19 samples, 38000 samples in total
Storage interval can be selected among	1,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
Security of stored data	Unlimited, independent of battery charge conditions.
Power Supply	
Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Main	12Vdc / 1000mA Output main adapter
Serial interface RS232C	
Type	RS232C galvanically isolated
Baud rate	can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable lenght	Max 15m

Print interval	Immediate or selectable among: 1,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
USB interface model HD2108.2 and HD2128.2	
Type	1.1 - 2.0 galvanically isolated
Connections	
Probes input	2-pole female polarized standard miniatur connector
Serial interface	8-pole MiniDin connector
USB interface	Type B Mini USB connector
Mains adapter	2-pole connector (positive at centre)
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90%RH, no condensation
Protection degree	IP66
General characteristics	
Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2 rows 4½ digits plus symbols Visible area: 52x42mm
Time	
Date and time	in real time
Accuracy	1min/month max drift

ORDERING CODES

HD2108.1: The kit consists of one input instrument HD2108.1, 4 per 1.5V alkaline batteries, instruction manual, case and Deltalog9 software downloadable from Delta OHM website. Probes and cables have to be ordered separately.

HD2108.2: The kit consists of one input instrument HD2108.2, data logger, 4 per 1.5V alkaline batteries, instruction manual, CP23 USB cable, case and Deltalog9 software downloadable from Delta OHM website. Probes have to be ordered separately.

HD2128.1: The kit consists of two inputs instrument HD2128.1, 4 per 1.5V alkaline batteries, instruction manual, case and Deltalog9 software downloadable from Delta OHM website. Probes and cables have to be ordered separately.

HD2128.2: The kit consists of two inputs instrument HD2128.2, data logger, 4 per 1.5V alkaline batteries, instruction manual, CP23 USB cable, case and Deltalog9 software downloadable from Delta OHM website. Probes have to be ordered separately.

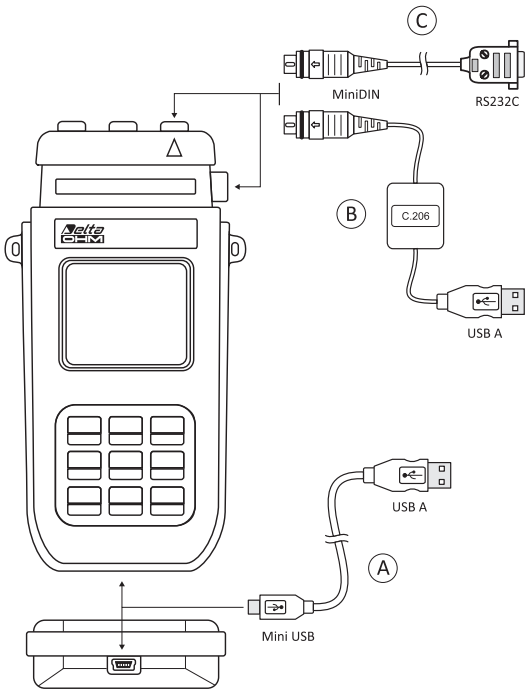
HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the series HD21...**1** to connect to USB input of PC.

SWD10: Stabilized 230Vac/12Vdc-1000mA mains adapter.

HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width. Use cable HD2110CSNM (option).

For all thermocouples probes, see from **pag.36** onwards.



A The portable data loggers HD2108.2 HD2128.2 are equipped with HID (Human Interface device) type USB port with mini USB connector.

For the connection to a PC with the CP23 cable it is not necessary to load any USB driver.

B For the connection of the models HD2108.1 HD2128.1 to the USB port of a PC, is necessary the USB/serial converter C.206. The converter is supplied with its own drivers which must be installed before the connection of the converter to the PC (see details in the Cd-Rom supplied with the converter).

C The port with the miniDin connector is a serial port type RS232C. The serial port RS232C of a PC or the printer HD40.1 can be connected by the cable HD2110CSNM.

HD2108

HD2128

Member of GHM GROUP

HD2178.1, HD2178.2

HD2178.1 AND HD2178.2
Pt100 AND TC INPUT THERMOMETERS

HD2178.1 and **HD2178.2** are portable instruments with a large LCD display. These instruments measure temperature by means of immersion, penetration, contact or air probes with Pt100, Pt1000 or thermocouple probes.

You can connect a 3 or 4 wires Pt100 sensor or a 2 wires Pt1000 sensor to B input, a K, J, T, N, E type thermocouple to input A. Probes to B input, a 8-poles DIN45326 connector, are equipped with an automatic detection module, with the factory calibration settings already being memorized inside. A input is equipped with a miniature female polarized connector for thermocouple probes.

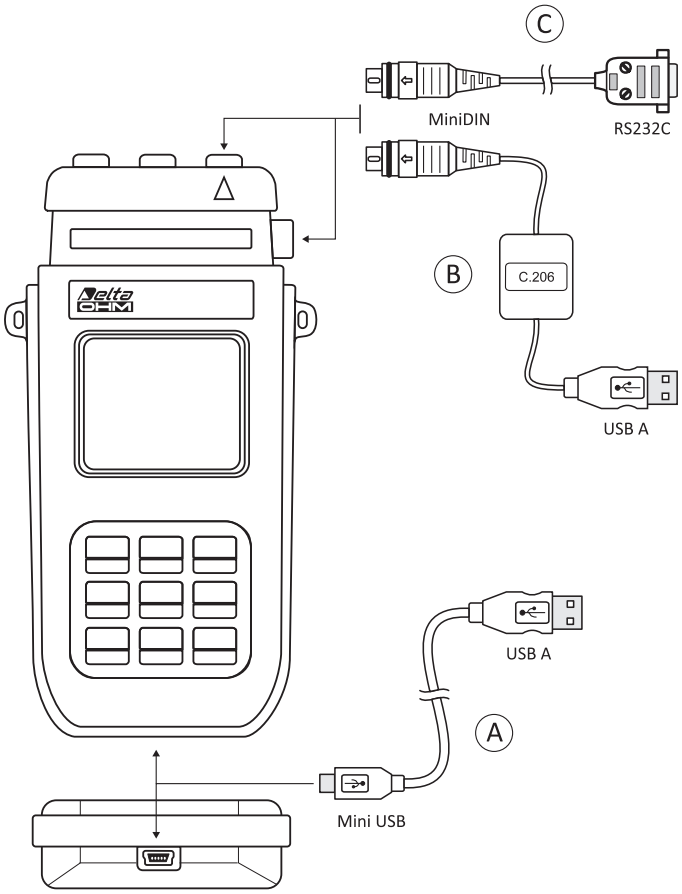
The instrument HD2178.2 is a data logger; it stores up to 80.000 samples that can be transferred to a PC when connected to the instrument through a RS232C serial port or a USB 2.0 port. It is possible to configure the storage interval, the printing and the baud rate or to a portable printer by the menu.

Functions Max, Min and Avg calculate maximum, minimum and average values. Further functions are: REL relative measure, HOLD and automatic switching-off system (excludable).

Instruments have IP66 protection degree.

Technical specifications	
Temperature measurement - RTD sensors	
Pt100 Measuring range	-200…+650°C
Pt1000 Measuring range	-200…+650°C
Accuracy	±0.05°C
Temperature measurement - Tc	
TC measuring range: K	-200…+1370°C
TC measuring range: J	-100…+750°C
TC measuring range: T	-200…+400°C
TC measuring range: N	-200…+1300°C
TC measuring range: E	-200…+750°C
Instrument accuracy	
Thermocouple K	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple J	±0.1°C up to 400°C ±0.2°C over 400°C
Thermocouple T	±0.1°C
Thermocouple N	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple E	±0.1°C up to 300°C ±0.2°C over 300°C
Accuracy is referred to the instrument only; error due to sensors is not included.	
Resolution	0.1°C
Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year
Unit of measurement	°C - °F
Measured values storage - model HD2178.2	
Type	2000 pages each one containing 40 samples
Quantity	80000 samples in total
Storage interval can be selected among	1,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
Security of stored data	Unlimited, independent of battery charge conditions
Power Supply	
Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Mains	12Vdc / 1000mA Output mains adapter
Serial interface RS232C	
Type	RS232C galvanically isolated
Baud rate	can be set up from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow control	Xon/Xoff
Serial cable lenght	Max 15m
Print interval	Immediate or selectable among: 1,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
USB interface - model HD2178.2	
Type	1.1 - 2.0 galvanically isolated
Connections	
Input for RTD probes	8 pole male DIN45326 connector
Input for TC probes	2-pole female polarized standard miniature connector
RS232C serial interface	8-pole MiniDin connector
USB interface	Type B MiniUSB connector
Mains adapter	2-pole connector (positive at centre)

Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	IP66
General characteristics	
Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2 rows 4½ digits plus symbols Visible area: 52x42mm
Time	
Date and time	In real time
Accuracy	1min/month max drift



A The portable data logger HD2178.2 is equipped with HID (Human Interface device) type USB port with mini USB connector.

For the connection to a PC with the CP23 cable it is not necessary to load any USB driver.

B For the connection of the model HD2178.1 to the USB port of a PC, is necessary the USB/serial converter C.206. The converter is supplied with its own drivers which must be installed before the connection of the converter to the PC.

C The port with the miniDin connector is a serial port type RS232C. The serial port RS232C of a PC or the printer HD40.1 can be connected by the cable HD2110CSNM.

ORDERING CODES

HD2178.1: The kit consists of instrument HD2178.1, 4 per 1.5V alkaline batteries, instruction manual and case, software Deltalog9 downloadable from Delta OHM website. Probes and cables have to be ordered separately

HD2178.2: The kit consists of instrument data logger HD2178.2, 4 per 1.5V alkaline batteries, instruction manual and case, CP23 USB cable, software Deltalog9 downloadable from Delta OHM website. Probes have to be ordered separately

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the serie HD21**...1** to connect directly to USB input of PC.

SWD10: Stabilized at 230Vac/12Vdc-1000mA mains .

HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width. Use cable HD 2110 CSNM (option).

For all Pt100, Pt1000 and thermocouple probes, see from **pag.30** onwards

HD2178

SWD10

Member of GHM GROUP

HD32.7, HD32.8.8, HD32.8.16

HD32.7 - 8 INPUTS DATA LOGGER FOR Pt100 Pt1000 SENSOR PROBES

The **HD32.7** is a data logger that can capture, log and then send to a PC or serial printer the data coming from 8 temperature probes connected to the inputs. All 8 inputs are simoultaneosly displayed. The probes can be Pt100 with SICRAM module, direct 4-wire Pt100 or direct 2-wire Pt1000. All the connected probes must be of the same type.

The captured data can be displayed and processed on the PC using the DeltaLog9 software. The instrument has a total capacity of 96.000 acquisitions for each one of the 8 inputs. Storage can be managed in two ways: when the available memory is full, data are overwritten by starting from the oldest ones (circular memory), otherwise storage stops when the available memory is full. Maximum, minimum or average of the stored values are calculated.

12 Vdc 1A | USB 1.1 - 2.0 | RS232C

Technical specifications	
Measuring Range	-200°C...+650°C
Resolution	0.01°C (in the range ±199.99°C) 0.1°C in the remaing range
Internal clock accuracy	1min/month max drift
Unit of measurement	°C - °F - K configurable
Memory capacity	96,000 storages for each one of the inputs, max 64 logging session
Data Logging	istantaneous or delayed, with the possibility of selecting the storage start and end time
Storage interval can be selected among	2,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
Data download	RS232C from 1,200 to 38,400 baud, galvanically isolated. Sub D 9-pole male connector. USB 1.1 - 2.0 galvanically isolated.
Security of stored data	unlimited
Instrument accuracy when storing	±0.01°C ±1 digit (in the range ±199.99°C) ±0.1°C ±1 digit in the remaining range
Power Supply	4 per 1.5V alkaline batteries type C-BABY External 12Vdc-1A power supply. Connector, external Ø 5.5mm, internal Ø 2.1mm
Current consumption @6Vdc	<60µA when the instrumen is off <60µA in sleep mode with 8 probes connected <40mA during data logging with 8 probes connected
Autonomy	200 hours with 7800mAh alkaline batteries and 8 probes connected
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90%RH, no condensation
Protection degree	IP64
General characteristics	
Dimensions (Length x Width x Height)	220x180x50mm
Weight	1100 g (complete with batteries)
Materials	ABS, polycarbonate and aluminium
Display	Backlit graphic LCD 128x64 pixel
Keyboard	15 keys configurable also without PC. Security password for keyboard locking

All Delta OHM Pt100 probes equipped with SICRAM module belonging to the series TP47..., TP49..., TP87 4 wires Pt100 or 2 wires Pt1000 sensor probes can be connected. Probes of different form can be supplied upon request.

ORDERING CODES

HD32.7: Data logger with 8 inputs for temperature Pt100 sensor probes equipped with SICRAM module, 4 wires Pt100 and 2 wires Pt1000 probes. The kit consists of instrument HD32.7, 4 per 1.5Vdc alkaline C-Baby type batteries, instruction manual, software Deltalog9 downloadable from Delta OHM website and support/transport strap. Probes, tripod, carrying case and cables have to be ordered separately.

9CPRS232: Connection cable with Sub D 9-pole female connectors for RS232C (null modem)

CP22: Connection cable USB 2.0 connector type A - connector type B.

BAG32.2: Carrying case for the HD32.7 instrument and accessories.

HD32CS: Support and transport strap

SWD10: 100-240VAC/12VDC-1A stabilized mains power supply

VTRAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K

HD3218K: Clamp shaft for a further probe.

HD32.8.8 - HD32.8.16

8 or 16 INPUTS DATA LOGGER FOR THERMOCOUPLES

The **HD32.8.8** and **HD32.8.16** are two robusts data loggers with 8 inputs (HD32.8.8) or 16 inputs (HD32.8.16) for K, J, T, N, R, S, B and E type thermocouple with miniature connector temperature probes. During the measuring phase, the connected probes must be of the same type.

The captured data can be displayed and processed on the PC using the DeltaLog9 software. The instrument has a total capacity of 800,000 acquisitions to be divided among all the present inputs. Storage can be managed in two ways: when the available memory is full, data are overwritten by starting from the oldest ones (circular memory), otherwise storage stops when the available memory is full. Maximum, minimum or average of the stored values are calculated.

Technical specifications	
Number of inputs	8 for HD32.8.8 16 for HD32.8.16
Measuring range and accuracy of the instrument Accuracy is referred to the instrument only, error due to the thermocouple or the cold junction reference sensor is not included	
Thermocouple K	-200...+1370°C ±0.1°C up to 600°C / ±0.2°C over 600°C
Thermocouple J	-100...+750°C ±0.1°C up to 400°C / ±0.2°C over 400°C
Thermocouple T	-200...+400°C ±0.1°C
Thermocouple N	-200...+1300°C ±0.1°C up to 600°C / ±0.2°C over 600°C
Thermocouple R	+200...+1480°C ±0.3°C
Thermocouple S	+200...+1480°C ±0.3°C
Thermocouple B	+200...+1800°C ±0.4°C
Thermocouple E	-200...+750°C ±0.1°C up to 300°C / ±0.2°C over 300°C
Resolution	0.05°C (in the range ±199.99°C) 0.1°C in the remaing range
Drift in temperature @20°C	0.02% / °C
Drift after 1 year	0.1°C / year
Internal watch accuracy	1min/month max drift
Unit of measurement	°C - °F - K configurable
Memory capacity	up to 800,000 acqusitions to be divided among all the present inputs max 64 logging session (e.g. 1 probe connected = 800,000 acquistions, 8 probes connected = 96,000 acquisitions each probe)
Data Logging	istantaneous or delayed, with the possibility of selecting the storage start and end time.
Storage interval can be selected among	2,5,10,15,30 s; 1,2,5,10,15,20,30 min.; 1 hour
Data download	RS232C from 1200 to 38,400 baud, galvanically isolated. Sub D 9-pole male connector. USB 1.1 - 2.0 galvanically isolated.
Security of stored data	unlimited
Power Supply	4 per 1.5V alkaline batteries type C-BABY External 12Vdc-1A power supply. Connector, external Ø 5.5mm, internal Ø 2.1mm. Power supply via the PC USB port.
Current consumption @6Vdc	<60µA when the instrumen is off <60µA in sleep mode with all probes connected <40mA during data logging with all probes connected
Voltage insulation	60 V between inputs 500V between inputs and power supply
Autonomy	200 hours with 7800mAh alkaline batteries and all probes connected
Connection	Miniature female socket for thermocouple
Operating conditions	
Operating Temperature	-5...50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90%RH, no condensation
Protection degree	IP64
General characteristics	
Dimensions (Length x Width x Height)	220x180x50mm
Weight	1100 g (complete with batteries)
Materials	ABS, polycarbonate and aluminium
Display	Backlit graphic LCD 128x64 pixel
Keyboard	15 keys, configurable also without PC. Security password for keyboard locking

All thermocouples K, J. T, N, R, S, B and E type probes with male miniature connector can be connected. Further to K probes available on the catalogue For all K thermocouples probes, see from **pag.36** onwards. Probes of different form can be supplied upon request.

ORDERING CODES

HD32.8.16: Data logger with 16 inputs for thermocouples K, J, T, N, R, S, B and E type temperature probes. The kit consists of instrument HD32.8.16, 4 per 1.5Vdc alkaline C-Baby type batteries, instruction manual, software Deltalog9 downloadable from Delta OHM website, support/transport strap. Probes, tripod, carrying case and cables have to be ordered separately.

9CPRS232: Connection cable with Sub D 9-pole female connector for RS232C (null modem).

CP22: Connection cable USB 2.0 connector type A - connector type B.

BAG32.2: Carrying case for the HD32.8 instrument and accessories.

HD32CS: Support and transport strap.

SWD10: 100-240VAC/12VDC-1A stabilized mains power supply.

VTRAP32: Tripod equipped with 6 input head and 5 probe holders code HD3218K.

HD3218K: Clamp shaft for a further probe.

HD32.8.8

HD32.8.16

Member of GHM GROUP

HD788TR1, HD788TR1-I, HD786TR1, HD786TR2 HD988TR1, HD988TR1-I, HD988TR2

HD788TR1, HD788TR1-I, HD786TR1, HD786TR2, HD988TR1, HD988TR1-I, HD988TR2
4÷20 CONFIGURABLE TEMPERATURE TRANSMITTERS FOR Pt100 mA SENSORS

HD788TR1, HD788TR1-I, HD786TR1, HD786TR2, HD988TR1, HD988TR1-I and **HD988TR2** 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 models HD788TR1-I and HD988TR1-I is galvanically isolated from the Pt100 input. The transmitters are also protected against inversions of polarity.

The HD788TR1, HD788TR1-I are specifically designed for installing in type DIN B connecting heads, while the HD988TR1, HD988TR1-I and HD988TR2 are suitable for fitting in containers with a 35 mm DIN rail connection. As well as the 4÷20 mA output, the HD988TR2 has a convenient 3 and 1/2 digit display (height 10 mm) which allows the display of the measured temperature. The HD786TR1 and HD786TR2 are indicated for wall installation.

Technical specifications (20°C and 24Vdc)		
	HD788TR1 HD788TR1-I HD786TR1 HD786TR2 HD988TR1 HD988TR1-I	HD988TR2
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	4 µA	Analogue output: 4 µA Display: 0,1°C up to 200°C 1°C over 200°C
Power supply voltage	7…30Vdc (protection against inversions of polarity)	
Sensibility to variations of the feeding voltage Vcc	0.4 µA/V	
Load resistance	$R_{LMax} = \frac{Vdc-7}{0.022}$ => 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 for models HD788TR1-I and HD988TR1-I	500 Vdc	-

Note 1 - If the measured temperature T is out of the set range T1…T2 (T1<T2), HD788TR1, HD788TR1-I, HD988TR1, HD988TR1-I and HD988TR2 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. 1 Range 0...100°C, output current according to the temperature function.

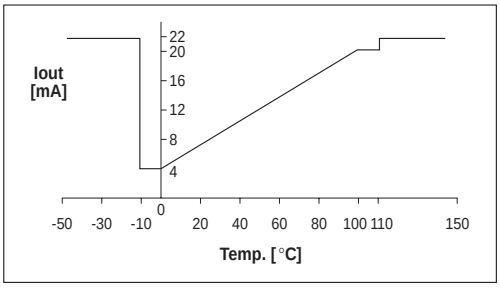
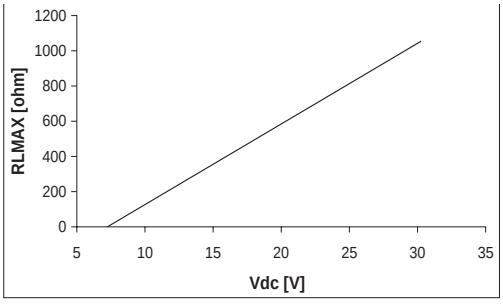


Fig. 2 Load with relation to the supply voltage.



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.

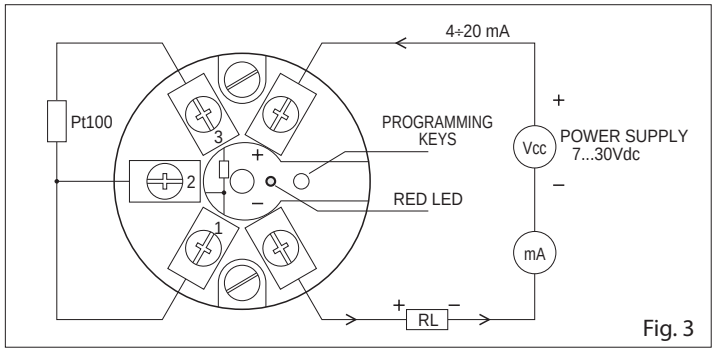


Fig. 3

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.


Fig. 4

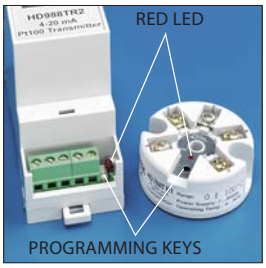


Fig.5

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		

ORDERING CODES

HD788TR1: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container **for DIN B 43760 heads**.

HD788TR1-I: 4÷20 mA/20÷4 mA temperature **isolated** transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container **for DIN B 43760 heads**.

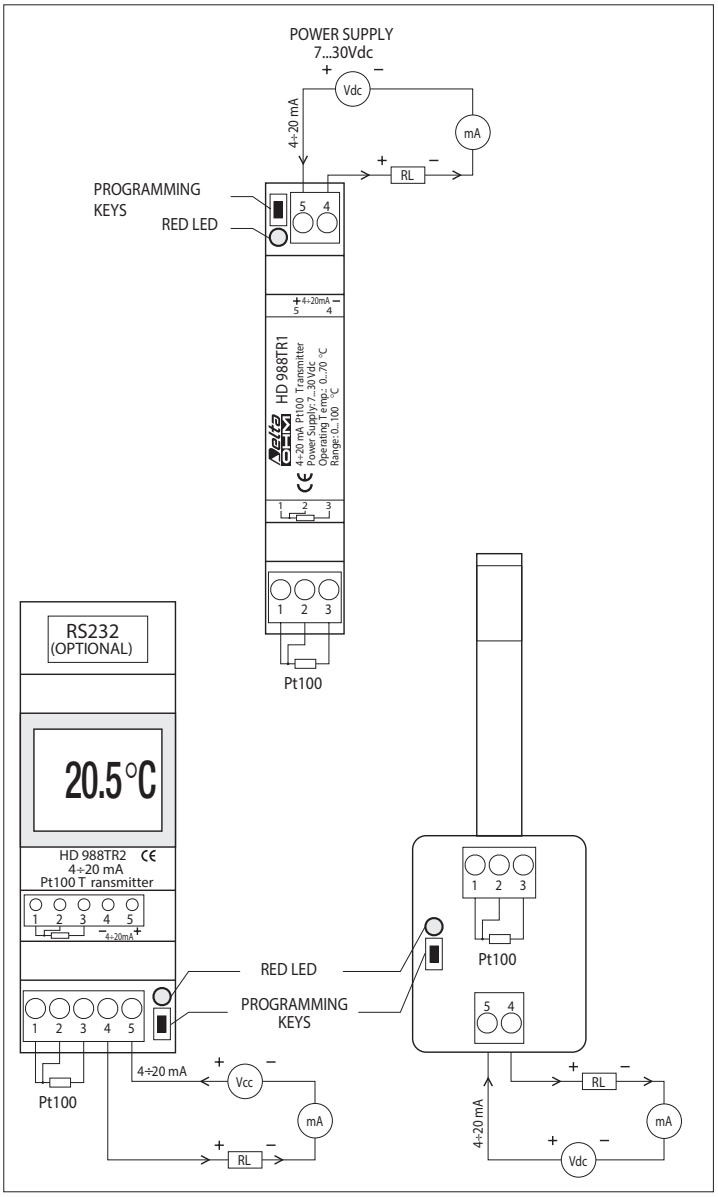
HD786TR1: 4÷20 mA/20÷4 mA temperature transmitter for 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C. Suitable **for wall mounting,** complete with **Pt100 Ø14 L=90mm**.

HD786TR2: 4÷20 mA/20÷4 mA temperature transmitter for 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C. Suitable f**or wall mounting**, complete with **Pt100 probe Ø 3 L=55mm**.

HD988TR1: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a **container for 35 mm DIN rail connection**, **dimension 1 module**.

HD988TR1-I: 4÷20 mA/20÷4 mA temperature **isolated** transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a c**ontainer for 35 mm DIN rail connection, dimension 1 module**.

HD988TR2: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a **container for 35 mm DIN rail connection, dimension 2 modules, with 3½ digit LCD**, height 10 mm.



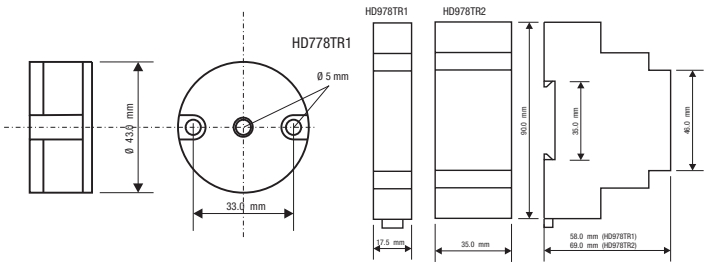
Member of GHM GROUP

HD778TR1, HD978TR1, HD978TR2, HD778-TCAL

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

HD778TR1, **HD978TR1** and **HD978TR2** 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 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 output into any temperature range 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 rails. Beyond 4…20mA output, HD978TR2 has a 3½ digit (height 10 mm) display which allows displaying the measured temperature.

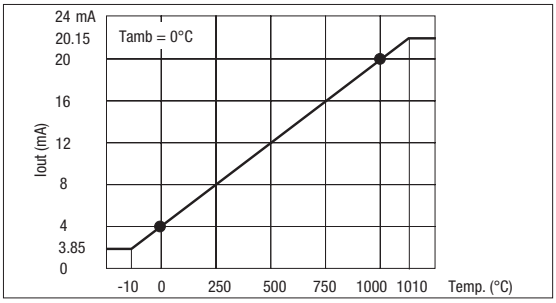
Fig.1 Mechanical dimensions.



Technical specifications @ 25°C and 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...30Vdc (protection against polarity inversion)		
Sensitivity to Vdc power voltage variations	0,4 µA/V		
Load resistance	R_L Max = (Vdc-9)/0.022 R_L Max = 680Ω with Vcc = 24 Vdc		
Input/output galvanically insulation	50Vdc (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 fig.2).

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



Installation and connection

Fig. 1 shows the mechanical dimensions of the HD778TR1 HD978TR1 HD978TR2 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.

The width of the HD978TR1 is one DIN (17,5 mm) module, the HD978TR2 is a 2 DIN (35mm) modules. The working temperature should be whitin the operating temperature declared. **Fig. 4 and 5** report the wiring diagrams of 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 the 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.

HD778TR1 and HD978TR1

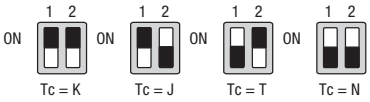
Giving power to the transmitter, the led flashes for a number of times equal to the type of thermocouple previously configured.
In order to change the setting, remove and reapply supply to the transmitter by keeping the button pressed.
This way you enter the programming for choosing the type of thermocouple: if you chose the thermocouple K, the led flashes once.
If you release the button and press it again within 10 seconds, the led flashes twice: thermocouple J has been chosen.
If you press the button within 10 seconds, the led flashes 3 times: thermocouple T has been chosen.
If you press the button within 10 seconds, the led flashes 4 times: thermocouple N has been chosen.
If you press the button within 10 seconds again, the led flashes once indicating that you chose thermocouple K again and the cycle re-starts.
In order to save the selected type of thermocouple, wait for 15 seconds without touching any key: the transmitter saves the type of thermocouple and exits programming, the led flashes for the number of times equal to the type of thermocouple selected.
If you changed the type of thermocouple, you have to re-programme the operating range: see paragraph "Programming of the operating range".

HD978TR2

This transmitter has a double dip-switch for selecting the type of thermocouple. The selection must be set before powering the transmitter and is acquired when the instrument is on: a change in the dip-switch when the instrument is powered has no effect until the next power cycle.

Procedure:

when the instrument is off, select the type of thermocouple by setting the switches as shown in the figure below.

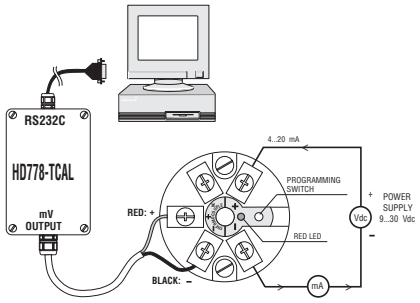


By powering the transmitter, the led flashes for a number of times equal to the type of thermocouple selected.
If you changed the type of thermocouple, you have to re-programme the operating range: see paragraph "Programming the operating range".

Programming of the operating range

Transmitters HD778TR1, HD978TR1 and HD978TR2 are supplied by default with K type thermocouple and range 0...1000°C. The user can set a different range according to his requirements with a minimum span of 50°C. The correspondence between the read temperature and the output current can be direct (e.g. 4mA = 0°C and 20mA = 1000°C) or inverse (e.g. 4mA = 1000°C and 20mA = 0°C).
Acquire the following tools for programming:

- 9…30 Vdc direct current power source,
- thermocouple calibrator,
- copper connection cables
- precision ammeter with 0...25 mA minimum range.



Instead of the thermocouple calibrator, you can use the Delta OHM HD778-TCAL: this instrument has to be connected to a serial port of the PC and, by means of a proper software, automates all the steps described below for programming the operating range.

If you have a thermocouple calibrator, the steps are:

- in order to set the type of thermocouple, proceed as described in the paragraph 'Choice of Type of thermocouple' in the previous page.
- The voltage values generated by the calibrator must be uncompensated.
- The setting must be done with the instrument already powered.
- Set the calibrator with the output of the desired type of thermocouple (K, J, T o N), connect the calibrator to the transmitter thermocouple input Paing attention to polarity.
- Set the calibrator so that it generates the voltage corresponding to the temperature at 4mA, wait for 30 seconds for the voltage to stabilise.
- Press and hold the button until the led flashes. Release the button. The instrument has acquired the first value of the transmitter working range, the led keeps on flashing. The instrument is now awaiting the value of the full scale range.
- Set the calibrator in order to generate a voltage corresponding to the temperature at 20mA.
- Press and hold the button until the led stops flashing.
- Release the button and wait 20 seconds, without changing the calibrator's data, so that the transmitter saves the calibration data and is ready for working normally. The operation ends with a flashing of the led.
- The instrument has acquired the second point corresponding to the range you want to set and is working normally.
- The minimum span accepted by the instrument is 50°C. If the user tries to insert a second value T2 with (T2-T1)<50, after entering the first value T1 of the range, the instrument does not accept it and remains in standby while the led flashing continuously.

The HD778-TCAL is supplied with its software. Connected to the HD778-TCAL serial output of a PC, the user can configure the transmitter by following the instructions on the screen.

ORDERING CODES

HD778TR1: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, **in a container for DIN B 43760 heads**.

HD978TR1: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, **in a container for 17,5 mm DIN rail connection, dimension 1 module.**

HD978TR2: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, **in a container for 35 mm DIN rail connection dimension 2 modules, with 3½ digit display,** height 10 mm.

HD778-TCAL: power generator in the range -60mV…+60mV, regulated by PC through RS232C serial port, DeltaLog7 software downloadable from Delta OHM website for setting K, J, T and N thermocouple transmitters.

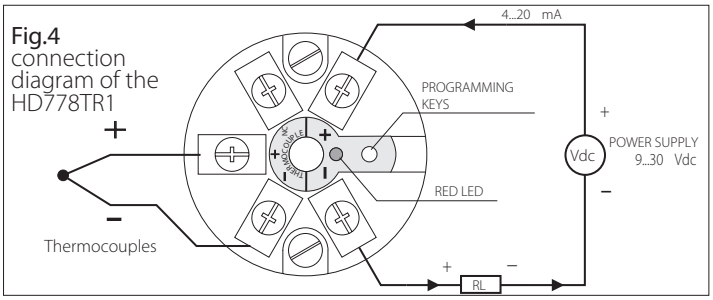


Fig.4
connection diagram of the HD778TR1

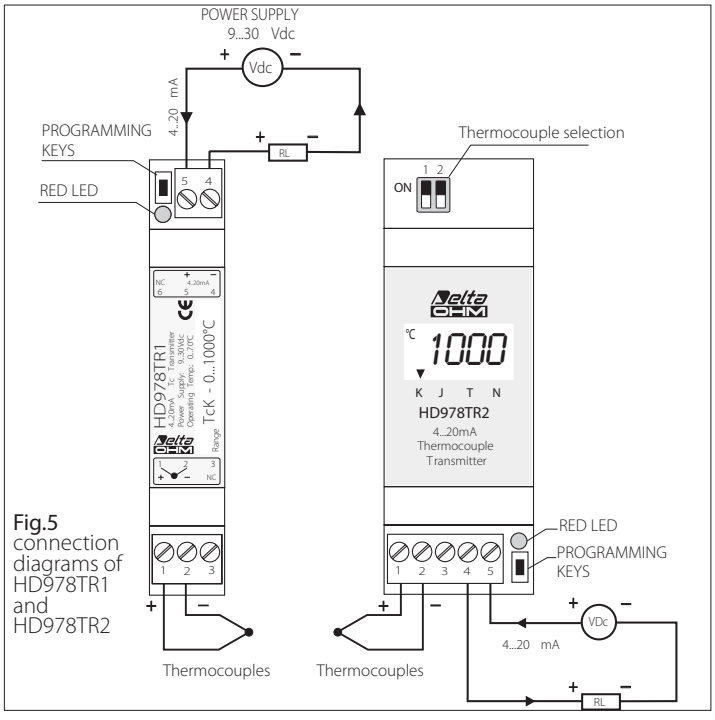


Fig.5
connection diagrams of HD978TR1 and HD978TR2

Member of GHM GROUP

HD978TR3, HD978TR4, HD978TR5, HD978TR6

HD978TR3, HD978TR4, HD978TR5, HD978TR6
SIGNAL CONVERTERS / AMPLIFIERS WITH 4÷20mA OR 0÷10Vcc OUTPUT CONFIGURABLE WITH HD788-TCAL BY PC THROUGH RS232C

HD978TR3, HD978TR4, HD978TR5 and **HD978TR6** are configurable signal converters/amplifiers configurable with mV input. The mV input signal range can be configured from -10mV to +60mV through a button, by using the HD778-TCAL simulator and DeltaLog7 software downloadable from Delta OHM website or a voltage calibrator with mV output. HD978TR3 and HD978TR5 have 4…20mA current output. HD978TR4 and HD978TR6 have 0…10Vdc voltage output.

0…1Vdc, 0…5Vdc and 1…5Vdc outputs are available on request.
A led indicates the alarm situation and it helps user during the programming. The instrument is also protected against polarity inversions. Input and output are galvanically isolated: this is necessary to eliminate problems due to the mutual influence of the devices caused by the different ground paths.

The instrument is housed in a 2 modules DIN (Width 35mm) container with standard connection for 35mm rail for the models HD978TR3 and HD978TR4; a wall mount container for the models HD978TR5 and HD978TR6.
The 4…20mA current output of HD978TR3 and HD978TR5 is passive two-wire.

Technical Specifications @25°C and 24Vdc		
INPUT	HD978TR3 - HD978TR5	HD978TR4 - HD978TR6
Measuring range	-10mV … +60mV configurable	
Default range	0…20mV	
Minimum measuring range	2mV	
Input impedance	> 1 Mohm	
Conversion speed	2 measures per second	
Accuracy	±0.04%F.S. ±20µV	
Operating temperature	-30 … +70°C	
Storage temperature	-40...+80°C	
Relative humidity	0…90%RH (without condensation)	
OUTPUT	HD978TR3 - HD978TR5	HD978TR4 - HD978TR6
Type of output (note 1)	4...20 mA (or 20...4 mA) two-wired 22 mA, in case of unconnected input	0 … 10Vdc (0…1Vcc, 0…5Vdc, 1…5Vdc upon request)
Resolution	4 µA	20 µV
Power supply	9...30Vdc for the 4…20mA current output	15…30Vdc (4mA) for the 0 … 10Vcc current output, 10…30Vdc (4mA) for the other outputs
Protection against polarity inversion	40Vmax	
Sensitivity to Vdc power voltage variations	0.4 µA//V	2µA/V
Load resistance	R_LMax = (Vcc-9)/0.022 R_LMax = 680Ω with Vdc = 24 Vdc	> 10kΩ
Input/output galvanically isolation	50Vcc (verified at 250V)	
Red led	It turns on while programming, when the probe is broken or not connected	
Heating time	2 minutes	
Thermal drift	0.02% F.S./°C	

Note 1 - If the measured voltage V goes out of the V1...V2 (V1<V2) set range, the transmitters linearly regulate the output for V<V1 and V>V2 for an interval of 0.1mV. (See the diagrams of the outputs).

Installation and connection

Fig.1 shows the mechanical dimensions of the HD978TR3 and TR4: the width of the container is a 2 modules DIN (35mm). Fig.5 reports the wiring diagrams of the HD978TR3 and a Delta OHM pyranometer. Fig.6 indicates the typical connection of the HD978TR4.

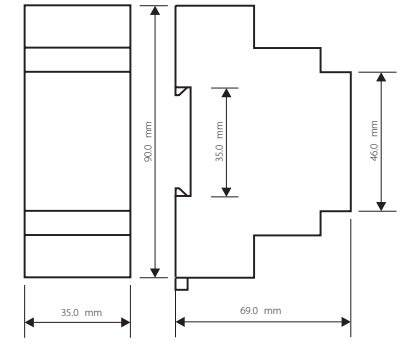


Fig. 1 Dimensions

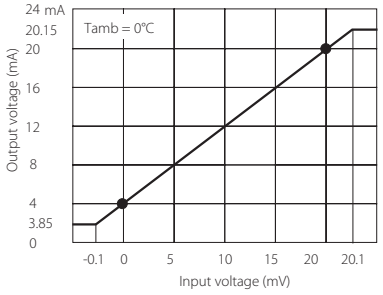


Fig. 2 HD978TR3 and HD978TR5 continuous current measure

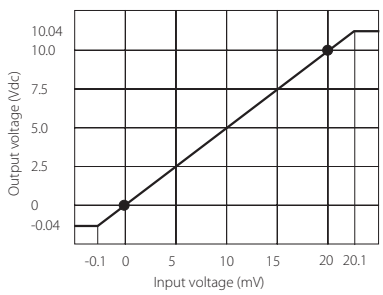


Fig. 3 HD978TR4 and HD978TR6 continuous voltage measure

In order to obtain the maximum precision, the connection to the thermocouple should not exceed 3 meters long and should be performed with a shielded cable. It is also recommended not to pass wiring near cable for power signals (electric motors, induction furnaces, inverter etc.). The working temperature should be within the declared operating temperature.

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. The two terminals reporting ground are connected internally between them and they are necessary to connect the ground terminal coming, for instance, by a pyranometer to the grounded, as you can see from the diagrams.

The response curves of the instruments are reported in figures 2 (current output of HD978TR3 and HD978TR5) and 3 (voltage output of HD978TR4 and HD978TR6).

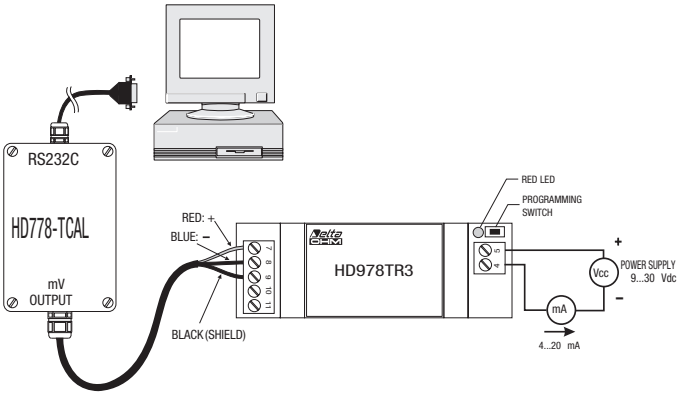
Fig.7 reports, as an example, the connection to be performed for reading the voltage measured on a shunt DC: the converter assures the galvanic isolation between device and voltage or current output; also configurability allows to obtain the best correlation between read and amplified output voltage. We recommend that you pick up the signal by using a shielded cable and by connecting the shield to terminal 9.

Programming of the operating range

Converters HD978TR3, HD978TR4, HD978TR5 and HD978TR6 are supplied by default with range 0…20mV. The user can set a different range according to his requirements with a minimum span of 2mV. The correspondence between the read voltage and current or voltage output can be directed (for ex. 0mV / 4mA and 20mV / 20mA) or reverse (for ex. 20mV / 4mA and 0mV / 20mA).

Acquire the following tools for programming:

- DC Power source (please see the specifications table),
- calibrator with mV output,
- connection cables,
- precision ammeter with 0...25 mA minimum range or 0…10Vdc voltmeter.



The setting must be done with the instrument already powered.

Set the calibrator so that it generates the voltage corresponding to the output of the initial scale of the converter (4mA or 0V according to the model), **by paying attention to polarity.** Wait 30 seconds for the voltage to stabilize.

Press and hold the button until the led starts flashing. Release the button. The instrument has acquired the first value of the transmitter working range, the led keeps on flashing. The instrument is now awaiting the value of the full scale range.

Set the calibrator in order to generate a voltage corresponding to the output of the full scale (20mA or 10Vdc).

Press and hold the button until the led stops flashing.

Release the button and wait 20 seconds, without changing the calibrator's data, so that the converter saves the calibration data and is ready for working normally. The operation ends with a flashing of the led.

The instrument has acquired the second point corresponding to the range you want to set and is working normally.

The minimum value accepted by the instrument is 2mV. If after having inserted the first range value V1 the user tries to insert a second value V2 with: V2-V1 lower than 2mV, the instrument does not accept it and remains in standby while the led flashing continuously.

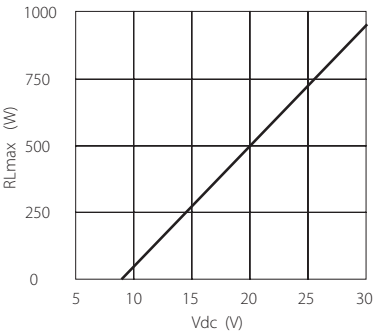


Fig.4 Load resistance according to power supply (output 4…20mA)

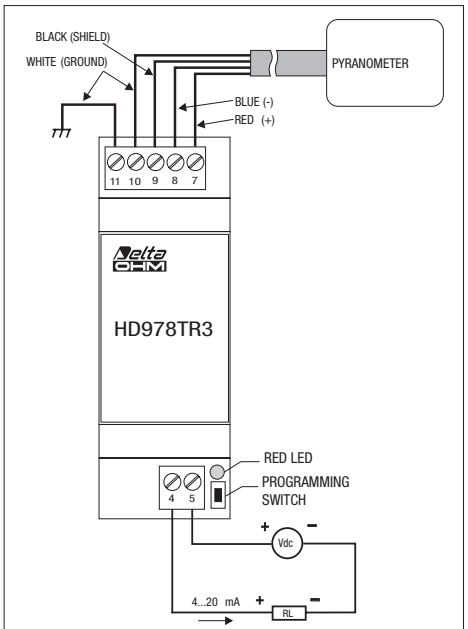


Fig.5 Connection diagram of HD978TR3 to a pyranometer.

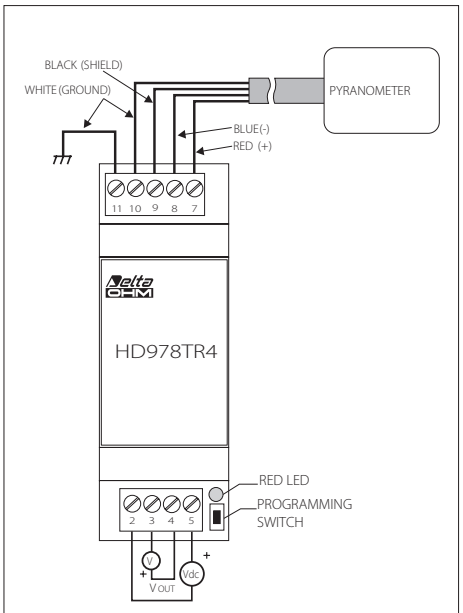


Fig.6 Connection diagram of HD978TR4 to a pyranometer

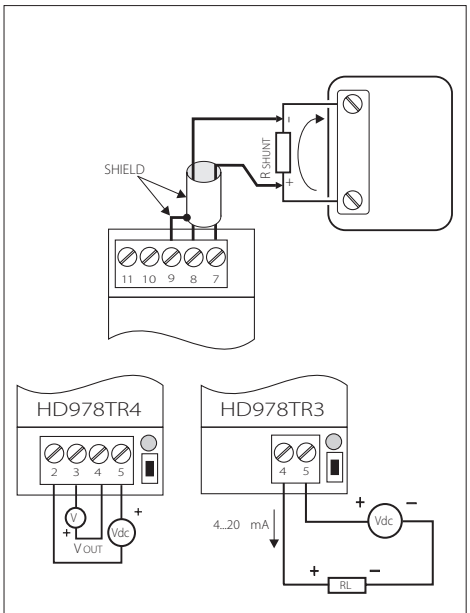


Fig.7 Connection diagram of HD978TR3 and HD978TR4 to a SHUNT

Note: in place of the current/voltage calibrator, you can use the Delta OHM HD778-TCAL. This instrument has to be connected to a serial port of the PC and, by means of the DeltaLog7 software downloadable from Delta OHM website, automates all the steps described above for programming the operating range.

The HD778-TCAL is supplied with its software. Connected to the HD778-TCAL serial output of a PC, the user can configure the HD978TR3 and HD978TR5 (4…20mA or 20…4mA current) or the HD978TR4 and HD978TR6 (0…10Vdc or 10…0Vdc voltage) by following the instructions on the screen.

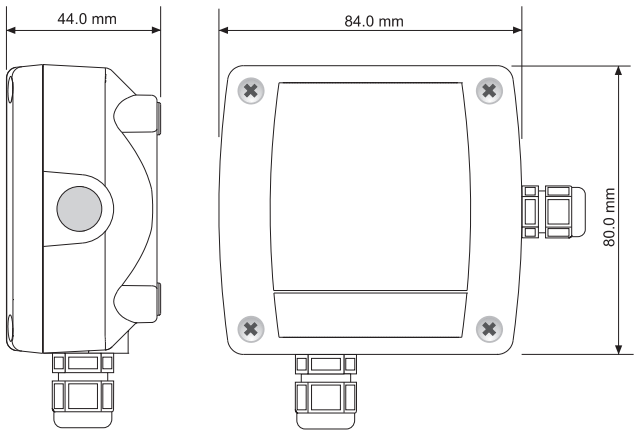


Fig. 8 Dimensions HD978TR5 and HD978TR6

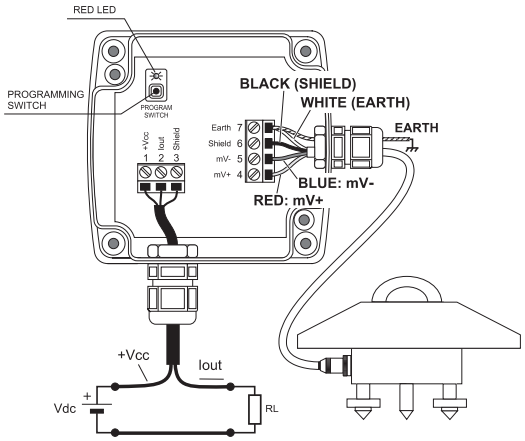


Fig. 9 Connection diagram of HD978TR5 to a pyranometer

ORDERING CODES

HD978TR3: Configurable signal converter amplifier with **4÷20mA (20÷4mA) output, for DIN rail.** Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

HD978TR4: Configurable signal converter amplifier with **0÷10Vdc (10÷0Vdc) output, for DIN rail.** Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

HD978TR5: Wall mounting configurable signal converter amplifier with **4÷20mA (20÷4mA) output**. Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

HD978TR6: Wall mounting configurable signal converter amplifier with **0÷10Vdc (10÷0Vdc) output**. Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

HD778-TCAL: power generator in the range -60mV…+60mV, regulated by PC through RS232C serial port, DeltaLog7 software downloadable from Delta OHM website for setting K, J, T and N thermocouple transmitters.

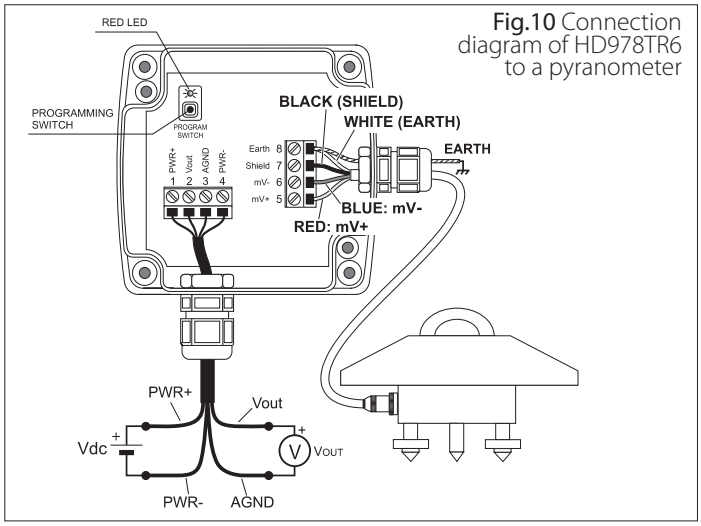


Fig.10 Connection diagram of HD978TR6 to a pyranometer

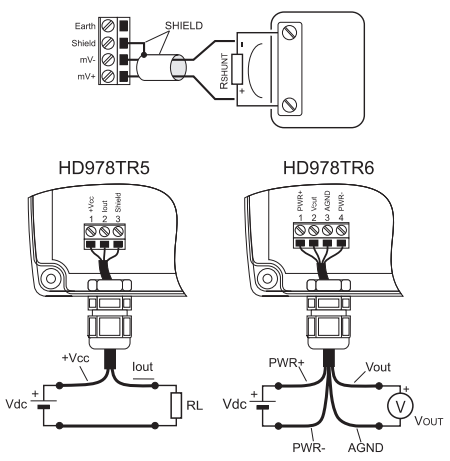


Fig. 11 Connection diagram of HD978TR5 and HD978TR6 to a SHUNT

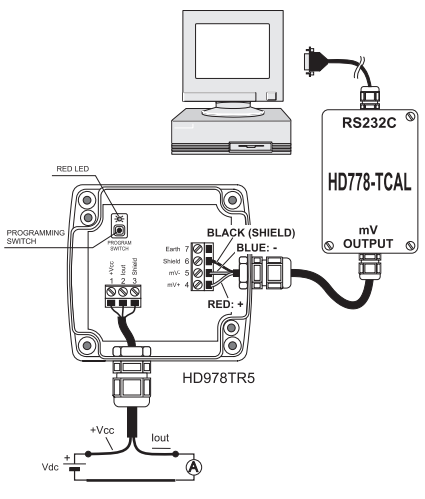


Fig. 12 Connection diagram for programming HD978TR5 with HD778-TCAL

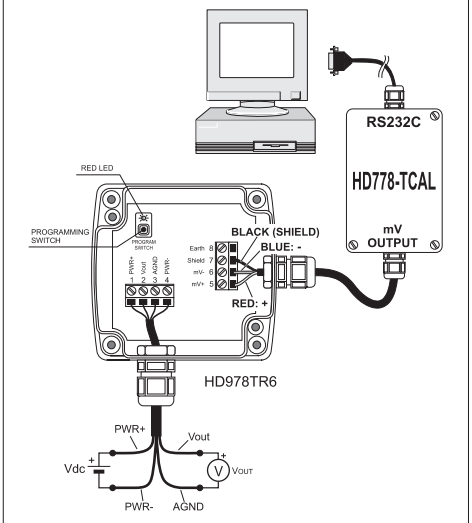


Fig. 13 Connection diagram for programming HD978TR6 with HD778-TCAL

Member of GHM GROUP

HD9022

HD9022
CONFIGURABLE MICROPROCESSOR INDICATOR, REGULATOR
Pt100 4 WIRES CURRENT OR VOLTAGE INPUT

The microprocessor-controlled panel instrument HD9022 is an indicator with alarm thresholds that may be programmed and configured by the user. At input it accepts signals arriving from 2 or 3 wire transmitters with 0÷1V, 0÷10V voltage or 0÷20 mA, 4÷20 mA current signals, or 4 wires Pt100 sensors. Configuration is always completely present in the instrument, no additional cards are required. The choice for the configuration of the input signals is made by means of the keyboard on the front of the instrument. The dimensions of the instrument are 96x48 mm with depth 145 mm in conformity with DIN 45700. The mode of operation of the HD9022 is chosen depending on the application, configuring the instrument with the keyboard. The instrument may also be reconfigured with absolute simplicity on the field in order to adapt it to changes in processing requirements.

The configuration involves the input, the scale range, the set point and the auxiliary outputs.

Applications

Typical applications are the display of signals sent by transmitters which may concern temperature, humidity, pressure, speed, capacity, level, force, etc., for the most varied industrial sectors, operating machines and automated systems.

Characteristics

- Set point configurable from -9999 to +19999.
- Indication provided by red leds with seven ½ inch segments.
- Separate terminals for voltage input 0÷1 / 0÷10V, current input 0÷20 / 4÷20 mA and Pt100 input (-200÷+800°C).
- The instrument has an auxiliary power supply output : -5 Vdc max 10 mA and +15 Vdc non stabilized max 40 mA for the possible supply of 2-wire transmitters.
- R_{IIN} = 25 Ω, R_{VIN} = 200 kΩ.
- Instrument accuracy: ±0.1% Rdg ± 1 Digit.
- A/D converter resolution: 0.05 mV/Digit, 1µA/Digit.
- Functions: One relay with independent exchange contact for output HI (SP1, SP2).
  One relay with independent exchange contact for output LO (SP3, SP4).
  One relay with maximum or minimum alarm closing contact (L max, L min.) ALARM.
  Resistive relay contacts 3A/220V 50Hz.
- Instrument working temperature: (electronic componentry) 5°C÷50°C.
- Power supply: 12÷24Vac/Vdc (110÷240Vac/Vdc on request).
- Instrument absorption: 5VA.
- Minimum power of the supply transformer: 20VA.

Function of the keys on the front panel, the display and the LEDs

1 Digital display. During programming the following wording appears: F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10.
2 State indicator of HI relay.
3 State indicator of LO relay.
4 State indicator of ALARM relay.
5 Decimal point.

Sequential programming of working parameters

6 PROG Every time this key is pressed the program moves one step forward (F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10).
7 ENTER When this key is pressed during programming, the value of the selected variable, which can be modified by the ▲▼ keys, is displayed; pressing once again **ENTER** confirms the stored value.
8 ▲ Pressing this key during programming increases the value indicated on the display; in F2, it moves the decimal point towards the right. In normal operation it flashes to indicate the value in Volts, mA or Pt100 corresponding to the input; with a second impulse it returns to normal operation.
9 ▼ Pressing this key during programming decreases the value indicated on the display; in F2, it moves the decimal point towards the left. In normal operation it flashes to indicate the value in Volts, mA or temperature corresponding to the input; with a second impulse it returns to normal operation.

Configuration of the HD9022 panel indicator

1) Supply power to the instrument.
2) The instrument performs an internal check, the wording C.E.I. appears for a few seconds followed by a number at random.
3) Press **PROG** and the message **F0** appears.
4) Press **PROG** and the message **F1** appears.
5) Press **ENTER** and the symbol U, A or **Pt** appears. Using the ▲▼buttons, choose the input for voltage: U, current: A or Pt100: **Pt** signals. Press **ENTER** to confirm.
6) Press **PROG** and the message **F2** appears; press **ENTER**; with the ▲▼keys, set the decimal point in the desired position.

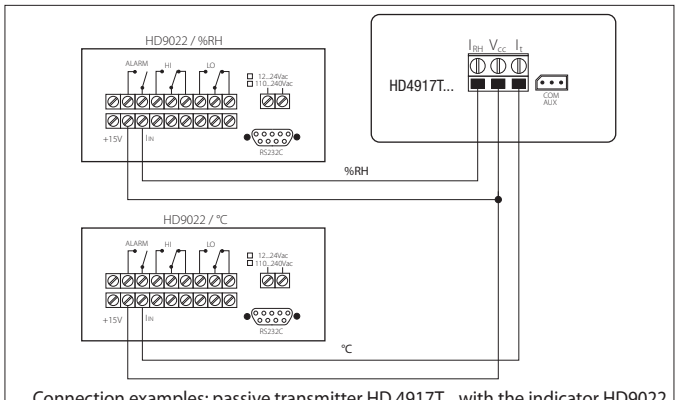
Press **ENTER** to confirm.
7) Press **PROG** and the message **F3** appears; press **ENTER**, with the ▲▼ keys, set the voltage, current or Pt100 value (as desired) corresponding to the beginning of the scale S1 for example 0V, 4 mA or 0°C. Press **ENTER** to confirm.
8) Press **PROG** and the message **F4** appears; press **ENTER**, with the ▲▼ keys, set the numerical value corresponding to the beginning of the

scale R1 for example 0°C. Press **ENTER** to confirm.

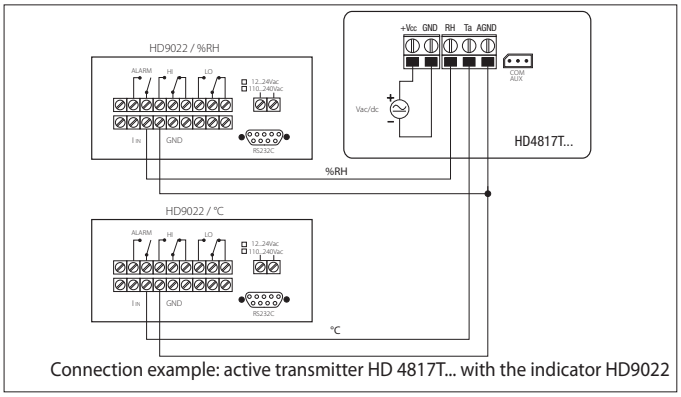
9) Press **PROG** and the message **F5** appears; press **ENTER**, with the ▲▼ keys, set the voltage or current value (as selected in point 5) corresponding to the end of the scale S2 for example 10V, 20 mA or 200.0°C. Press **ENTER** to confirm.
10) Press **PROG** and the message **F6** appears; press **ENTER**, with the ▲▼ keys, set the numerical value corresponding to the end of the scale R2 for example 100°C. Press **ENTER** to confirm.
11) Press **PROG** and the message **F7** appears; press **ENTER**, with the ▲▼ keys, set the maximum alarm threshold value L max for the Alarm relay for example 110°C. Press **ENTER**to confirm.
12) Press **PROG** and the message **F8** appears; press **ENTER**, with the ▲▼ keys, set the minimum alarm threshold value L min for the Alarm relay for example -10°C. Press **ENTER** to confirm.
13) Press **PROG** and the message **SP1** appears; press **ENTER**, with the ▲▼ keys, set the Set value for the first threshold "SET relay HI" for example 40°C. Press **ENTER** to confirm.
14) Press **PROG** and the message **SP2** appears; press **ENTER**, with the ▲▼ keys, set the Reset value for the first threshold "RESET relay HI" for example 45°C. Press **ENTER** to confirm.
15) Press **PROG** and the message **SP3** appears; press **ENTER**, with the ▲▼ keys, set the Set value for the second threshold "SET relay LO" for example 50°C. Press **ENTER** to confirm.
16) Press **PROG** and the message **SP4** appears; press **ENTER**, with the ▲▼ keys, set the reset value for the second relay "RESET relay LO" for example 48°C. Press **ENTER** to confirm.
17) Press **PROG** and the message S10 appears. Press **ENTER,** with the ▲▼ keys, set the desired speed of RS232 serial transmission among the following ones: 300, 600, 1200, 2400, 4800, 9600 baud. Press **ENTER** to confirm.
18) Press **PROG** and the message F0 appears. AT THIS POINT THE CONFIGURATION OF THE INSTRUMENT IS COMPLETE.
19) Connect the input of the instrument, press the **ENTER** key and the display will indicate the value corresponding to the input signal.

Varying the configuration

To vary a stored parameter at any stage of the program it is sufficient to the step of the program to be changed with the **PROG** key (F1, F2, F3, etc.). press **ENTER** and use the ▲▼ keys to modify the parameter previously set; press **ENTER** to confirm, return to F0 and press **ENTER**.
This simple procedure modifies the desired step of the program.



Connection examples: passive transmitter HD 4917T... with the indicator HD9022



Connection example: active transmitter HD 4817T... with the indicator HD9022

Note

If the **ENTER,** ▲ or ▼ key is pressed independently during operation, the instrument input value (V, mA or °C) flashes on the display. To return to normal operation, press the s tor **ENTER** key independently again.

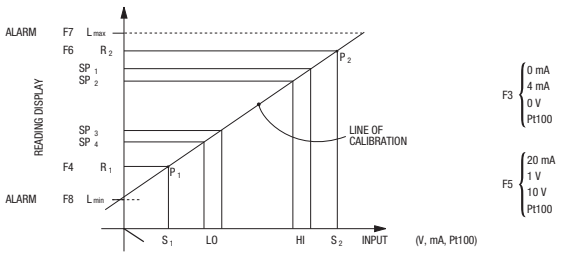
Error signal

The instrument indicates an error signal in the following cases:

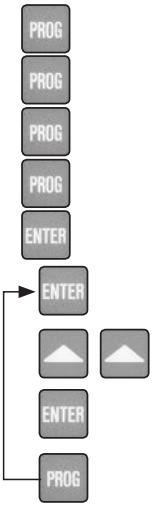
OFL: this appears when the set value of R max is exceeded.
-OFL: this appears when the set value of R min is exceeded.
E1: this appears when the set points P1 and P2 require a resolution of the A/D converter higher than the one available.
E2: this appears when the values of F7 and F8 are inverted.

The maximum resolution of the converter is 0.05 mV/Digit, 1µA/Digit.

Summary of programming steps of HD9022



INPUT mA	INPUT V
0 ÷ 1 mA 0 ÷ 10 mA 0 ÷ 16 mA 0 ÷ 20 mA 0 ÷ 5 mA 0 ÷ 10 mA 0 ÷ 20 mA Input resistance 25 Ω± 0,1%	0 ÷ 100 mV 0 ÷ 1 V 0 ÷ 5 V 0 ÷ 10 V 1 ÷ 5 V -10V a +10V Input inpendance 200K Ω± 0,1%



Programming start. Selects the programming step, F0.

Selects the programming step, F1.

Selects the programming step, F2.

....

Exit program mode.

Allows modification of the variable.

Modifies the variable on display.

Confirms the modification.

Moves to next programming step.

STEP	COMMENT	LIMITS
F0	Press ENTER to exit program mode	
F1	Select type of input: Voltage, current, Pt100	U - A - Pt
F2	Position of the decimal separator	0 - 0.0 - 0.00 - 0.000
F3	Beginning scale value of the input (Voltage, Current, °C)	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F4	Beginning scale value of the display	-9999...19999
F5	Full scale value of the input (Voltage, Current, °C)	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F6	Full scale value of the display	-9999...19999
F7	Maximum alarm threshold	-9999...19999
F8	Minimum alarm threshold	-9999...19999
SP1	ON Threshold of Set-point HI	-9999...19999
SP2	OFF Threshold of Set-point HI	-9999...19999
SP3	ON Threshold of Set-point LO	-9999...19999
SP4	OFF Threshold of set-point LO	-9999...19999
S10	Baud rate	300, 600, 1200, 2400, 4800, 9600

Serial interface RS-232C

The HD9022 is equipped with standard serial interface RS-232C which is available on the SUB D male 9-pin connector. The arrangement of the signals on this connector is as follows:

Pin	Signal	Description
2	TD	Datum transmitted by the HD9022
3	RD	Datum received by the HD9022
5	GND	Reference logic ground

The transmission parameters with which the instrument is supplied are:
- baud rate 9600 baud
- parity None
- n. bits 8
- stop bit 1

The data transmission speed may be changed by altering the set-up parameter S10 with the keyboard; the possible baud rates are: 9600, 4800, 2400, 1200, 600, 300. The other transmission parameters are fixed.

All the messages reaching and leaving the HD9022 must be inserted in a "Communication frame" with the following structure:

<Stx><Record><Etx>

Where:
<Stx> Start of text (ASCII 02)
<Record> constitutes the message
<Etx> End of text (ASCII 03)

Host commands

The structure of the command records is as follows:
<Command character><Sub-command><Values>

Where:

<Command character>	is characterized by an alphabetic character indicating the set of commands.
<Sub-command>	is characterized by a character indicating the type of command.
<Values>	is characterized by ASCII characters that depend on the type of command.

The replies provided by the HD9022 are essentially of two types: "Information" and "Data"

The former allow information on the status and programming of the HD9022 to be obtained, as well as the diagnosis of the message received; the latter contain data on the channel at the moment the request is made. It is also possible to make use of the serial line for the complete programming of the HD9022, with the exception of the data transmission speed which may be set only with the keyboard.
The diagnostic replies of the HD9022 are composed of the following control characters, sent individually (not inserted in the communication frame):
-ack- Command executed (ASCII 06)
-nak- Incorrect command (ASCII 15H)

COMMAND A

Sub-command		Values	Replies
A	Type of terminal		HD9022
C	Company		DELTA OHM
D	Firmware Version		Vxx/Rxx
E	Firmware Date		dd/mm/yy
F	Serial Number (rd)		xxxxxx
	(wr)	stxAFxxxxxxetx	ack/nak

COMMAND M

Sub-command	Values	Replies
1	Measure Channel 1	ack/nak

RESET COMMAND

	Values	Replies
(wr)	stxRESETetx	ack/nak

CHANNEL 1

C1F01 x	Input in	V/A/Pt	ack/nak
C1F02 x	Point	0/1/2/3	ack/nak
C1F03 xxxx	Start of scale	-9999...19999	ack/nak
C1F04 xxxx	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C1F05 xxxx	End of scale	-9999...19999	ack/nak
C1F06 xxxx	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C1F07 xxxx	Energ. Relay HI	-9999...19999	ack/nak
C1F08 xxxx	De-energ. Relay HI	-9999...19999	ack/nak
C1F09 xxxx	Energ. Relay LO	-9999...19999	ack/nak
C1F10 xxxx	De-energ. Relay LO	-9999...19999	ack/nak
C1F11 xxxx	Min Relay Alarm	-9999...19999	ack/nak
C1F12 xxxx	Max Relay Alarm	-9999...19999	ack/nak

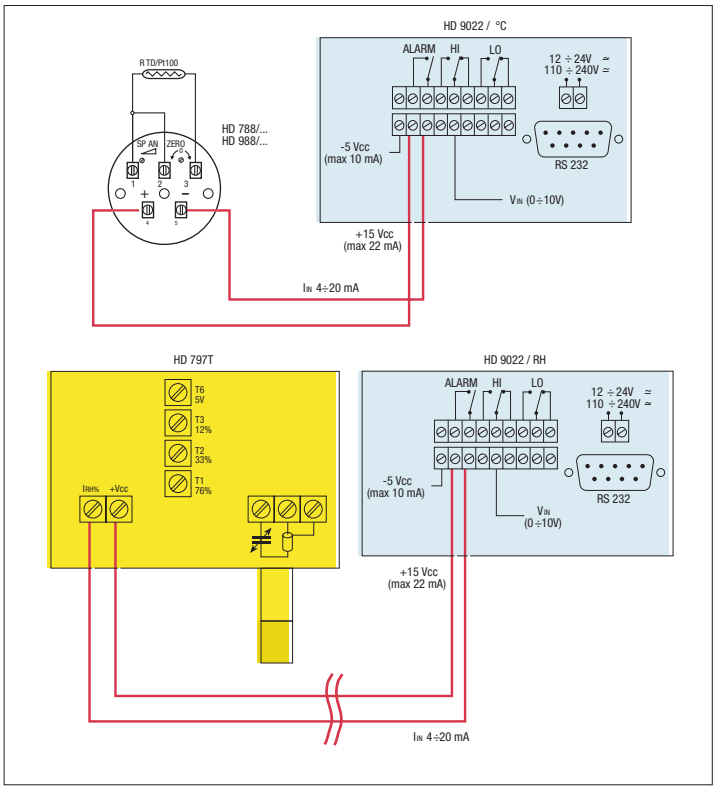
As regards the command just described, a few remarks must be made:
- There is no command character.
- For the other controls of the type C1F01 etc., the present programming status is supplied for the specific command if only the sequence of the sub-command characters is sent.

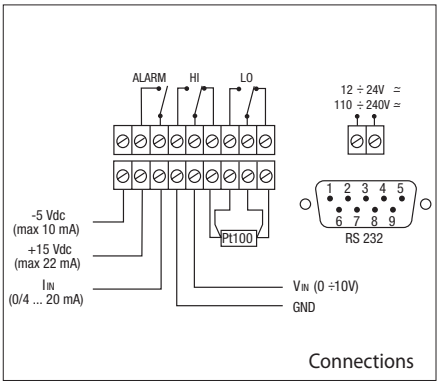
Ex: StxC1F01Etx Request from Host
StxC1F01:1Etx Reply

If the sequence of the sub-command characters is followed by a space and then the desired programming value, the programming of the parameter is produced.

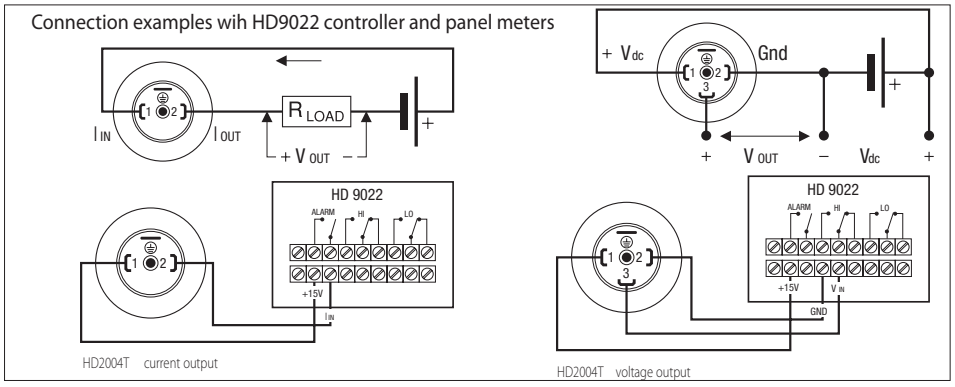
Ex: StxC1F01 1Etx Command from Host
ack / nak Reply
StxC1F03 1000Etx Command from Host
ack / nak Reply
StxC1F03-2000Etx Command from Host
ack / nak Reply
StxC1F0512000Etx Command from Host
ack / nak Reply

Note: for programming of the point F03...F12, the value field has fixed length of 5 characters. The first character in the value field may be a space, the minus sign, or the number 1.





Connections



Member of GHM GROUP

HD48... SERIES, HD 49... SERIES

HD48...SERIES, HD49...SERIES PASSIVE OR ACTIVE TEMPERATURE, RELATIVE HUMIDITY, RELATIVE HUMIDITY AND TEMPERATURE, TEMPERATURE AND DEW POINT TRANSMITTERS

HD48... and HD49... series of transmitters measure temperature, relative humidity and the dew point temperature.

Versions with only standard analog output or with only RS485 output with MODBUS- RTU protocol are available. The models with analog output provide a signal suitable for transmission to a remote display, recorder or PLC. The models with RS485 output are suitable for connection to a PC or PLC.

The models of the HD48.. series are active transmitters and accept both direct and 24Vac alternating power supply; they have standard current (4…20 mA) or voltage (0…10V) outputs, or a serial RS485 output, depending on the model. The models of the HD49.. series are passive transmitters and thus suitable to be inserted in a 4…20 mA current loop. The HD48.. and HD49.. series of transmitters are designed for temperature and humidity control in conditioning and ventilation applications (HVAC/BEMS) in the following sectors: pharmacy, museums, clean rooms, ventilation ducts, industrial and civil sectors, crowded places, canteens, auditoria, gyms, high-density farms, greenhouses, etc.

The HD48.. and HD49.. transmitters measure relative humidity with a well proven temperature compensated capacitive sensor that assures precise and reliable measurements in the course of time. The transmitters of the HD48.. and HD49.. series are available in two probe temperature ranges: standard -20…+80 °C and extended -40…+150 °C for the most critical applications. A stainless steel 10µm filter protects the sensors against dust and particles (other filters are available for different applications).

The transmitters are factory calibrated and no further adjustments are required.

Each series is available in different versions: with horizontal probe for duct mounting (HD48...TO..., HD49…TO…), with vertical probe for wall mounting (HD48...TV..., HD49… TV…) or with remote probe connected to the transmitter by means of a cable (HD48...TC..., HD49…TC…), cable lengths available are 2, 5 and 10m, for the measure of compressed air in pipelines (HD48…T480, HD49…T480) or for in-line installation (HD48…T481, HD49…T481) The probes can be supplied in two different lengths (135mm or 335mm).

Various accessories are available for the installation: for example to fix the probe to the duct, it can be used the HD9008.31 flange, a 3/8" universal biconical connection or a PG16 metal cable gland (Ø10…14mm). A 4-digit optional display ("L" model) allows to display the measured parameters in a continuous or sequential mode.

Technical specifications			
	STANDARD RANGE		EXTENDED RANGE
Relative Humidity			
Sensor	Capacitive		
Measuring range	0…100%RH		
Accuracy @T=15…35°C	±1.5% RH (0..90%RH), ±2.0% RH (90…100%RH)		
Accuracy @ rest of T range	±(1.5+1.5% of the measure) %RH		
Repeatability	0.4%RH		
Sensor working temperature	-20…+80 °C		-40…+150 °C
Temperature			
Measuring range	-20…+80 °C -40…+60 °C (for T480/T481)		-40…+150 °C
Sensor	NTC 10kΩ		Pt100 class A
Accuracy	±0.3 °C (0..+70 °C) ±0.4°C (-20..0 °C, +70..+80 °C)		±0.3°C
Repeatability	0.05°C		0.05°C
Dew Point			
Sensor	Parameter calculated from relative humidity and temperature		
Measuring range	-20…+80 °C DP		
Accuracy	See table 1		
Repeatability	0.5°C DP		
Type of output (according to the model)			
Models HD4807T..	Temperature	4...20 mA (-20...+80 °C), R_L < 500Ω 22 mA outside the measuring range	
Models HD4807ET..	Temperature	4...20 mA (-40...+150 °C), R_L < 500Ω 22 mA outside the measuring range	
Models HD48V07T..	Temperature	0…10 Vdc (-20...+80 °C), R_L > 10kΩ 11 Vdc outside the measuring range	
Models HD48V07ET..	Temperature	0…10 Vdc (-40...+150 °C), R_L > 10kΩ 11 Vdc outside the measuring range	
Models HD48S07T.. HD48S07ET..	Temperature	Only RS485 with MODBUS-RTU protocol	
Models HD4907T..	Temperature	4…20 mA (-20..+80 °C), $R_{L\,max}$ = (Vdc-12)/0.022 22 mA outside the measuring range	
Models HD4907ET..	Temperature	4…20 mA (-40..+150 °C), $R_{L\,max}$ = (Vdc-12)/0.022 22 mA outside the measuring range	
Models HD4801T.. HD4801ET	Relative Humidity	4…20 mA (0...100%RH), R_L< 500Ω 22 mA outside the measuring range	
Models HD48V01T.. HD48V01ET..	Relative Humidity	0…10 Vdc (0...100%RH), R_L > 10kΩ 11 Vdc outside the measuring range	
Models HD48S01T.. HD48S01ET..	Relative Humidity	Only RS485 with MODBUS-RTU protocol	
Models HD4901T.. HD4901ET..	Relative Humidity	4…20 mA (0...100%RH), $R_{L\,max}$ = (Vdc-12)/0.022 22 mA outside the measuring range	
Models HD4817T..	Relative Humidity	4…20 mA (0...100%RH), R_L < 500Ω 22 mA outside the measuring range	
	Temperature	4...20 mA (-20...+80 °C), R_L < 500Ω 22 mA outside the measuring range	
Models HD4817ET..	Relative Humidity	4…20 mA (0...100%RH), R_L < 500Ω 22 mA outside the measuring range	
	Temperature	4...20 mA (-40...+150 °C), R_L < 500Ω 22 mA outside the measuring range	

Models HD48V17T..	Relative Humidity	0…10 Vdc (0...100%RH), R_L > 10kΩ 11 Vdc outside the measuring range
	Temperature	0…10 Vdc (-20...+80 °C), R_L > 10kΩ 11 Vdc outside the measuring range
Models HD48V17ET..	Relative Humidity	0…10 Vdc (0...100%RH), R_L > 10kΩ 11 Vdc outside the measuring range
	Temperature	0…10 Vdc (-40...+150 °C), R_L > 10kΩ 11 Vdc outside the measuring range
Models HD48S17T.. HD48S17ET	Relative Humidity	Only RS485 with MODBUS-RTU protocol
	Temperature	
Models HD4917T..	Relative Humidity	4…20 mA (0...100%RH), R_{Lmax} = (Vdc-12)/0.022 22 mA outside the measuring range
	Temperature	4...20 mA (-20...+80 °C), R_{Lmax} = (Vdc-12)/0.022 22 mA outside the measuring range
Models HD4917ET..	Relative Humidity	4…20 mA (0...100%RH), R_{Lmax} = (Vdc-12)/0.022 22 mA outside the measuring range
	Temperature	4...20 mA (-40...+150 °C), R_{Lmax} = (Vdc-12)/0.022 22 mA outside the measuring range
Models HD4877T..	Dew Point	4...20 mA (-20...+80 °C DP), R_L < 500Ω 22 mA outside the measuring range
	Temperature	4...20 mA (-20...+80 °C), R_L < 500Ω 22 mA outside the measuring range
Models HD48V77T..	Dew Point	0…10 Vdc (-20...+80 °C TD), R_L > 10kΩ 11 Vdc outside the measuring range
	Temperature	0…10 Vdc (-20...+80 °C), R_L > 10kΩ 11V dc outside the measuring range
Models HD48S77T..	Dew Point	Only RS485 with MODBUS-RTU protocol
	Temperature	
Models HD4977T..	Dew Point	4…20 mA (-20...+80 °C DP), R_{L_max} = (Vdc-12)/0.022 22 mA outside the measuring range
	Temperature	4...20 mA (-20...+80 °C), R_{Lmax} = (Vdc-12)/0.022 22mA outside the measuring range
Models HD4877T480 HD4877T481	Dew Point	4...20 mA (-40...+60 °C DP), R_L < 500Ω 22 mA outside the measuring range
	Temperature	4...20 mA (-40...+60 °C), R_L < 500Ω 22 mA outside the measuring range
Models HD48V77T480 HD48V77T481	Dew Point	0…10 Vdc (-40...+60 °C DP), R_L > 10kΩ 11 Vdc outside the measuring range
	Temperature	0…10 Vdc (-40...+60 °C DP), R_L > 10kΩ 11 Vdc outside the measuring range
Models HD48S77T480 HD48S77T481	Dew Point	Only RS485 with MODBUS-RTU protocol
	Temperature	
Models HD4977T480 HD4977T481	Dew Point	4…20 mA (-40...+60 °C DP), R_{L_max} = (Vdc-12)/0.022 22 mA outside the measuring range
	Temperature	4…20 mA (-40...+60 °C), R_{L_max} = (Vdc-12)/0.022 22 mA outside the measuring range

Power supply and electrical connections		
	HD48...	HD49...
Power supply	18...40 Vdc or 24 Vac ±10%	12...40 Vdc
Consuption	- 4 mA@24V(models with voltage output) - 4 mA@24V with open output, 20 mA@24V with 12 mA output (models with current output) - 2 mA@24V models with serial RS485 output	
Electrical connections	Screw type terminal block, max 1,5mm², M16 cable gland for input cable	

General characteristics		
TV probe working temperature	-20...+80 °C	
…TO,…TC Probes working temperature	STANDARD RANGE	EXTENDED RANGE
	-20…+80 °C	-40…+150 °C
T480/T481 probes working temperature	-40…+80 °C	
Electonics working temperature	-20…+60 °C	
Storage temperature	-20…+80 °C	
Electronics protection class	IP66	
Case dimensions (lenght x width x height)	80x84x44	

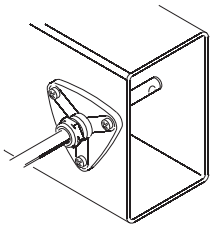
Table 1 -Accuracy of dew point measurement:

Temperature °C \ TD °C	-20	-10	0	10	20	30	40	60	80
-20	≤±1								
-10	≤±1	≤±1							
0	≤±1	≤±1	≤±1						
10	≤±3	≤±1	≤±1	≤±1					
20	≤±4	≤±2	≤±1	≤±1	≤±1				
30		≤±3	≤±1,5	≤±1	≤±1	≤±1			
40				≤±2	≤±1	≤±1	≤±1		
60		NOT SPECIFIED		≤±5	≤±2,5	≤±2	≤±1	≤±1	
80						≤±4	≤±2	≤±1	≤±1

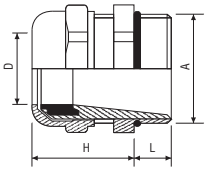
DP LIMIT

Installation notes

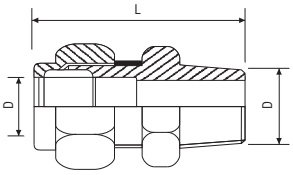
To fix the probe inside a ventilation duct, a pipe, etc., use for example the HD9008.31 flange, a PG16 metal cable gland (Ø10…14mm) or a ⅜" universal biconical connection.



HD9008.31 Flange



PG16 metal cable gland
D = 10…14mm
L = 6.5mm
H = 23mm
A = PG16



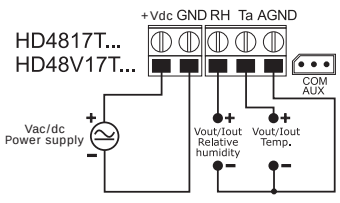
Universal biconical connector
L = 35mm
D = 14mm
A = 3/8"

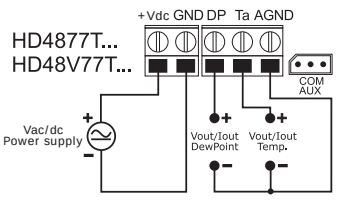
Electrical connections

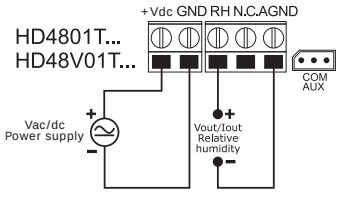
HD48.. series with analog output

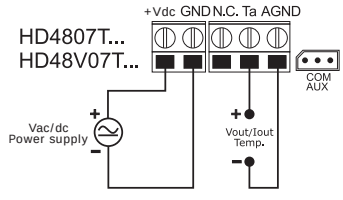
Power the instrument as shown in the below connection schemes, the power supply terminals are marked as +Vcc and GND.
Depending on the model, the output signal is available between:

- Ta and AGND terminals for the transmitters of the HD4807T..and HD48V07T… series.
- RH% and AGND terminals for the transmitters of the HD4801T.. and HD48V01T.. series.
- RH% and AGND, Ta and AGND terminals for the transmitters of the HD4817T.. and HD48V17T.. series.
- DP and AGND, Ta and AGND terminals for the transmitters of the HD4877T.. and HD48V77T.. series.



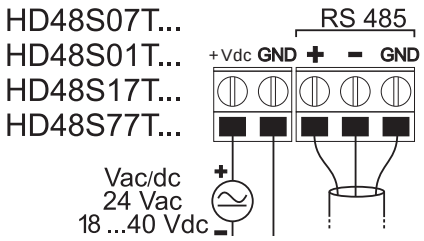




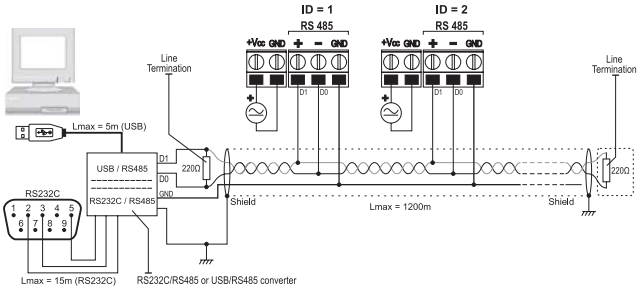


HD48…series with RS485 output

Connect the instrument as shown in the below connection schemes, the power supply terminals are marked as +Vcc and GND.



Thanks to RS485 output, several instruments can be connected to form a network. The instruments are connected in a sequence through a shielded cable with twisted pair for signals and a third wire for the ground.



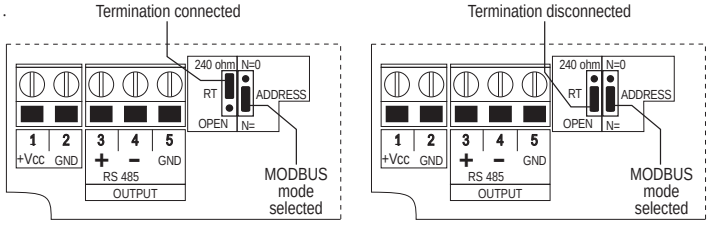
Line termination must be set at the two network ends. To polarize the line during nontransmission periods, resistor are connected between signal and power supply lines. The maximum number of devices that can be connected to the (Bus) line RS485 depends on the load characteristics of the devices to be connected.

The standard RS485 requires that the total load does not exceed 32 Unit Loads. The load of a HD48S.. transmitter is equal to ¼ of the unit load.

If the total load is more than 32 unit loads, divide the net in segments and insert a signal repeater between one segment and the next one. At the beginning and at the end of each segment a line termination must be connected.

The instrument has a built in line termination that can be connected or removed through a short jumper placed next to the terminal block. If the instrument is the last or the first device of a network group, connect the termination placing the short jumper between the "RT" and "240 ohm" indications. If the instrument is not at the end of a network group, remove the termination placing the short jumper between the "RT" and "OPEN" indications

.

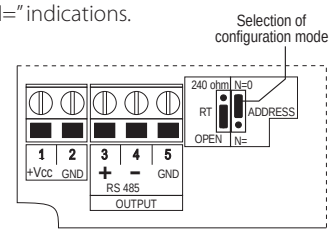


The cable shield must be connected to both line ends. The cable should have the following features:

- Characteristic impedance: 120 ohm
- Capacity: less than 50pF/m
- Resistance: less than 100 ohm/km
- gauge: 0,22 mm^2 (AWG24) at least.

The cable maximum length depends on baud rate and cable characteristics. Typically, the maximum length is 1200m. The data line must be kept separated from any power lines in order to prevent interferences on the transmitted signal. For connection to a PC, a RS232/RS485 or a USB/RS485 converter must be used. To operate with the MODBUS-RTU protocol be sure that the ADDRESS short jumper is between "ADDRESS" and "N=" indications.

Each transmitter of the network is univocally identified by an address. The address must be between 1 and 247. There must not be any other transmitters connected with the same address. The address must be configured before connecting the instrument to the network. To set the instrument address use the HD48STCAL kit. The kit includes the RS48 cable with built in USB/RS485 adapter. To configure the instrument it is necessary to move the ADDRESS short jumper between the "ADDRESS" and "N=0" indications to select the setup mode. After the configuration, move the short jumper back between the "ADDRESS" and "N=" indications.



In MODBUS mode it is possible to read the measured values by the instrument through the 04h functioning code (Read Input Registers). Table 2 represents the available quantities with its relative register address.

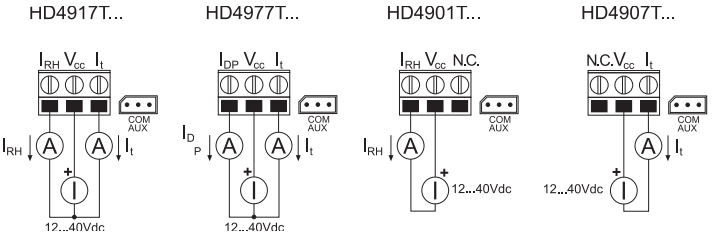
Table 2 – MODBUS Registers

Address	Quantities	Format
0	Temperature in °C (x10)	16-bit integer
1	Temperature in °F (x10)	16-bit integer
2	Relative Humidity in % (x10)	16-bit integer
3	Dew Point in °C (x10)	16-bit integer
4	Dew Point in °F (x10)	16-bit integer
5	State register Bit 0 = 1 => temperature measure in error Bit 1 = 1 => relative humidity measure in error Bit 2 = 1 =>dew point temperature calculation in error Bit 3 = 1=>error in data configuration	16-bit integer

HD49.. series

Follow the connection schemes shown below, the maximum load resistance that can be connected to each 4…20 mA output depends on the power supply Vcc applied, according to the relation:

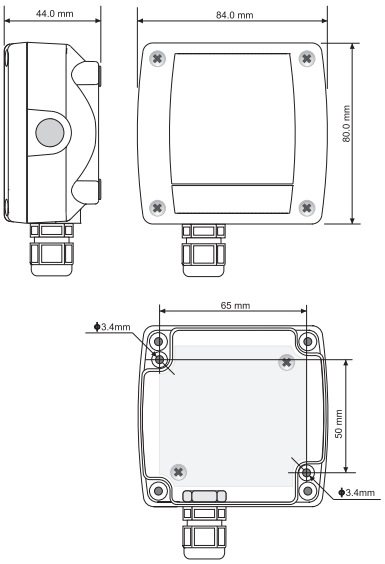
R_{Lmax} = (Vdc-12)/0.022, e.g. if Vdc=24Vdc the max load is R_{Lmax} =545 ohm.



Relative humidity probe calibration

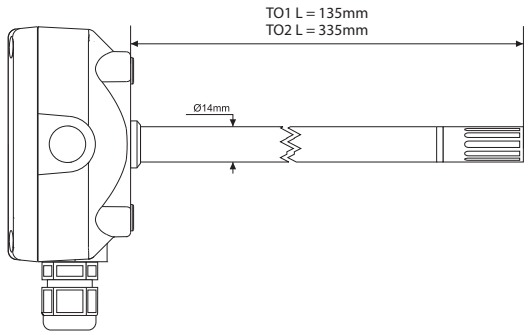
The HD48.. and HD49.. transmitters are supplied factory calibrated and ready to use. If necessary, it is possible to calibrate the relative humidity sensor using the saturated salt solutions HD75 (75%RH saturated salt solution) and HD33 (33%RH saturated salt solution) by connecting the instrument to the PC and using the HD48TCAL software.

Case dimension

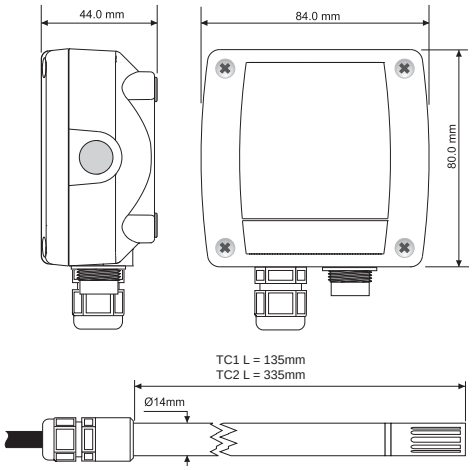


Probe dimensions

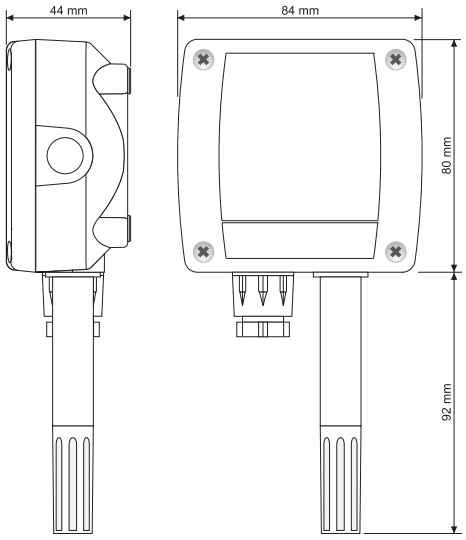
TO series



TC series



TV series



ORDERING CODES:

HD48 HD49 ☐☐☐☐.☐ **L L**

L = with LCD display

Cable length
2 = 2m
5 = 5m
10 = 10m
Note: T480 version is available only with a cable 2m long.

Probe type
TO1 = 135mm
TO2 = 335mm
TC1 = 135mm
TC2 = 335mm
TV = wall mounting Probe L=92mm
T480 = for compressed air
T481 = for pipe

Blank= standard range –20…+80 °C
(-40…+60 °C for the T480 and T481 version)
E = extended range –40…+150 °C (models TV excluded)

07 = temperature output
01 = %RH output
17 = Temperature and %RH outputs
77 = Temperature and dew point outputs

Blank = 4…20 mA analog output
V = 0…10 Vdc analog output (only HD48.. models)
S = only RS485 output with MODBUS-RTU protocol (only HD48.. models)
Note: Versions with analog output have one analog output for each measured quantity.

EXEMPLES OF ORDERING CODES

HD4801TV: Wall mounting digital active relative humidity transmitter.
Relative humidity range 0...100%RH.
Analog output: 4…20 mA (0...100%RH).
Probe working range -20...+80 °C. Power supply 18...40 Vdc or 24Vac.

HD4917TO1: Digital passive (current loop) temperature and relative humidity transmitter for duct mounting. AISI304 steel probe, diameter 14mm and stem length 135mm,
Relative humidity range 0...100%RH, temperature range -20...+80 °C.
Analog outputs: 4…20 mA (0...100%RH) for RH and 4...20 mA (-20...+80 °C) for temperature. Probe working range -20...+80 °C. Power supply 12...40 Vdc.

HD4817TC25L: Digital active temperature and relative humidity transmitter with LCD display. AISI304 steel probe, diameter 14mm and stem length 335mm, with 5m cable.
Relative humidity range 0...100%RH, temperature range -20...+80 °C.
Analog outputs: 4…20 mA (0...100%RH) for RH and 4...20 mA (-20...+80 °C) for temperature. Probe working range -20...+80 °C. Power supply 18...40 Vdc or 24Vac.

HD48V17ETC25: Digital active temperature and relative humidity transmitter, extended range. AISI304 steel probe, diameter 14mm and stem length 335mm, with 5m cable.
Relative humidity range 0...100%RH, temperature range -40...+150 °C.
Analog outputs: 0…10V (0...100%RH) for RH and 0...10V (-40...+150 °C) for temperature. Probe working range -40...+150 °C. Power supply 18...40 Vdc or 24Vac.

HD48S17TC25L: Digital active temperature and relative humidity transmitter with LCD display. AISI304 steel probe, diameter 14mm and stem length 335mm, with 5m cable.
Relative humidity range 0...100%RH, temperature range -20...+80 °C.
Only RS485 output with MODBUS-RTU protocol. Probe temperature working range -20…+80 °C. Power supply 18...40 Vdc or 24Vac.

Accessories

RS48: Cable for RS485 serial connection with buit-in USB/RS485 converter.
CP27: Connection/converter cable from COM AUX serial port to USB.
HD75: 75%RH saturated solution for the verification of the relative humidity sensor, complete of screw adaptors for probes with Ø 14mm and Ø 26mm.
HD33: 33%RH saturated solution for the verification of the relative humidity sensor, complete of screw adaptors with Ø 14mm and Ø 26mm.
HD9008.31: Wall flange with cable gland to fix Ø 14mm probes.

Protection for humidity probes Ø 14, thread M12x1
P6: 10µm sintered stainless steel protection. Operating temperature: -40…180 °C.
P7: 20µm PTFE protection. Operating temperature: -40…150 °C.
P8: PBT and 10µm stainless steel grid protection. Operating temperature: -40…120 °C.

TEMPERATURE PROBES – RESISTANCE THERMOMETERS

Delta OHM offers a wide choice of Platinum resistance thermometers with resistance equal to 100 Ω at 0 °C and temperature coefficient α as defined by the IEC 60751 standard: Pt100, R_0=100 Ω, α= $3.851 \cdot 10^{-3}$ $°C^{-1}$.

For particular applications, probes with Pt1000 sensor or with a thermistor sensor are available. The response time $\tau_{0.63}$ indicated for each probe is the response time of the sensor to a temperature variation, with a variation of the measured signal corresponding to the 63% of the total variation. The response times are referred:

• in water at 100 °C for immersion probes;

• to the contact with a metal surface at 200 °C for surface probes;

• to an air temperature of 100 °C for air probes.

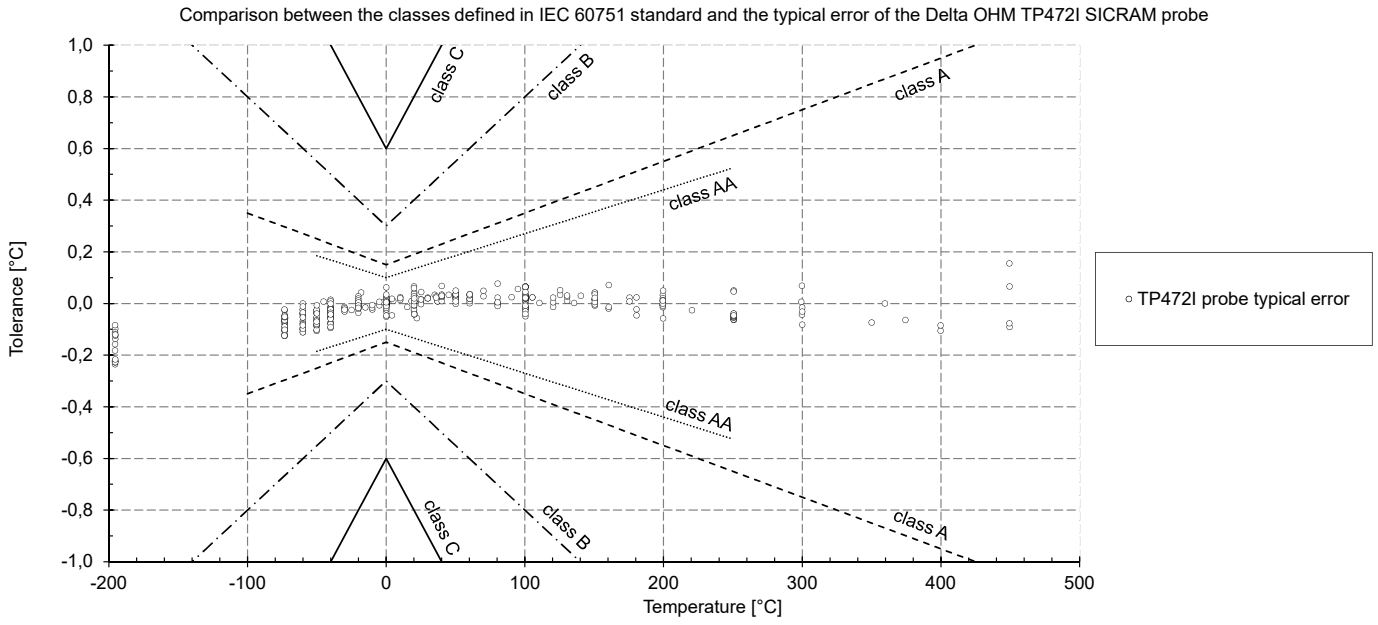
The IEC 60751:2008 standard defines the tolerance classes of the resistance thermometers as summarized in the following table:

	Temperature Range		
Tolerance class	WIRE WOUND sensor	THIN FILM sensor	Tolerance [°C]
classe AA (1/3 DIN)	from -50 °C to 250 °C	from 0 °C to 150 °C	±(0.1+0.0017·|t|)
classe A	from -100 °C to 450 °C	from -30 °C to 300 °C	±(0.15+0.002·|t|)
classe B	from -196 °C to 600 °C	from -50 °C to 500 °C	±(0.3+0.005·|t|)
classe C	from -196 °C to 600 °C	from -50 °C to 600 °C	±(0.6+0.01·|t|)

On request, the probes can be assembled with a compatible connector chosen from TP471 and TP47.

The TP471 connector developed by Delta OHM contains an electronic module **(SICRAM)** that allows the probe error to be adjusted. During the Quality Control, the probes provided with this module are individually checked in our laboratories, linearizing the characteristic and allowing more stringent accuracy over the entire working range.

The following graph shows the Delta OHM SICRAM module probe TP472I typical error values obtained from the calibrations performed in our ISO17025 calibration laboratory. The graph highlights the effectiveness of the linearization performed on the probes.



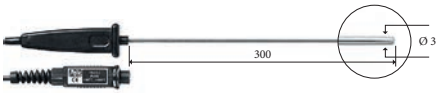
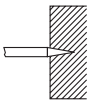
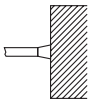
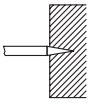
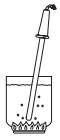
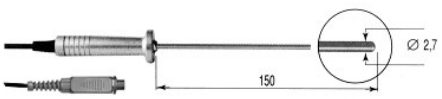
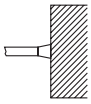
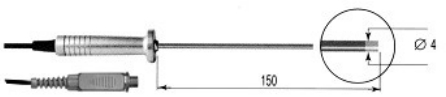
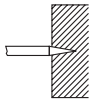
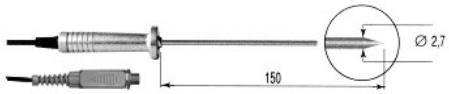
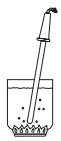
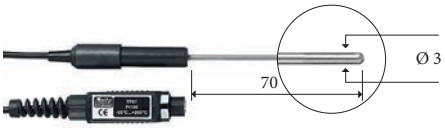
Tolerance as a function of temperature. The temperature range refers to the platinum wire wound probes.

	Temperature [°C]										
Tolerance [°C]	-196	-100	-50	0	100	250	300	350	450	500	600
class AA	---	± 0.27	± 0.19	± 0.10	± 0.27	± 0.53	± 0.61	± 0.70	---	---	---
class A	---	± 0.35	± 0.25	± 0.15	± 0.35	± 0.65	± 0.75	± 0.85	± 1.05	---	---
class B	± 1.28	± 0.80	± 0.55	± 0.30	± 0.80	± 1.55	± 1.80	± 2.05	± 2.55	± 2.80	± 3.30
class C	± 2.56	± 1.60	± 1.10	± 0.60	± 1.60	± 3.10	± 3.60	± 4.10	± 5.10	± 5.60	± 6.60
accuracy TP472I	± 0.30	± 0.30	± 0.20	± 0.10	± 0.20	± 0.20	± 0.30	± 0.30	± 0.30	± 0.30	---

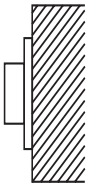
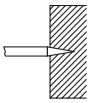
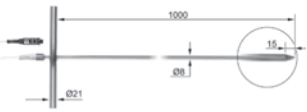
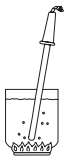
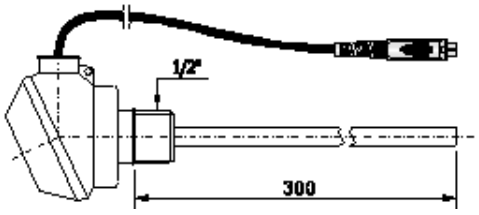
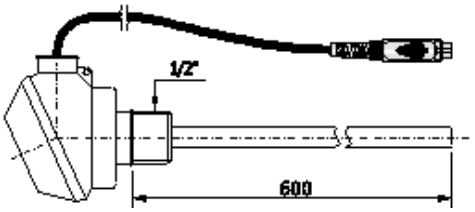
By means of the calibration, the purchased instrument can be metrologically characterized, determining the systematic error of the thermometer and ensuring at the same time the traceability to international standards. Delta OHM Laboratories are able to provide this service by issuing calibration reports according to **ISO 9001** or **ACCREDIA LAT** certificates in compliance with **ISO/IEC 17025** standard, recognized internationally through **ILAC MRA** agreements.

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
LAT N° 124

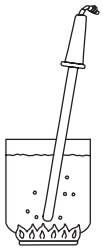
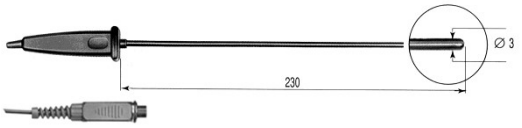
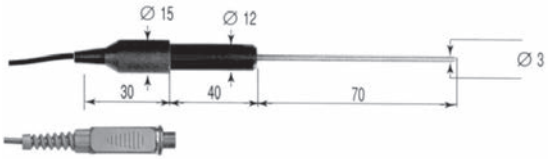
Temperature - Humidity - Pressure - Air speed
Photometry/Radiometry - Acoustics

Pt100 PROBES WITH TP471 SICRAM MODULE					
CODE	T (°C)	ACCURACY	USE	$\tau_{0.63}$	DIMENSIONS
TP472I	-196 +500	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3s	
TP472I.O	-50 +300	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3s	
TP473P.I	-50 +400	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		5s	
TP473P.O	-50 +300	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)			
TP474C.O	-50 +300	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		5s	
TP475A.O	-50 +250	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		12s	
TP472I.5	-50 +400	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3s	
TP472I.10	-50 +400	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3s	
TP49A.I	-70 +250	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3,5s	
TP49AC.I	-70 +250	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C		5,5s	
TP49AP.I	-70 +250	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		4s	
TP87.O	-50 +200	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		3s	

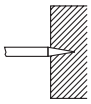
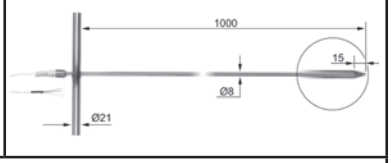
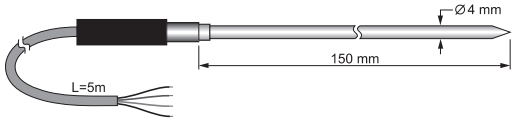
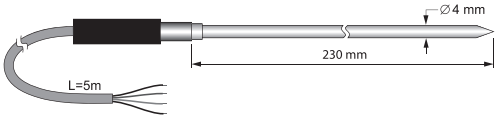
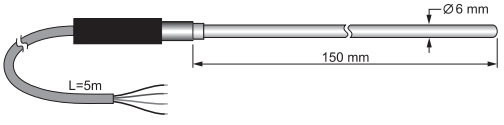
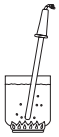
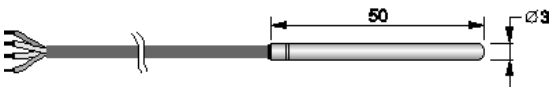
Pt100 PROBES WITH TP471 SICRAM MODULE

CODE	T (°C)	ACCURACY	USE	$\tau_{0.63}$	DIMENSIONS	
TP878.O	-40 +85	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		60s	Contact probe for solar panels, with SICRAM module. Cable L = 2 m	
TP878.1.O	-40 +85	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)			Contact probe for solar panels, with SICRAM module. Cable L = 5 m	
TP879.O	-20 +120	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		60s	Penetration probe for compost, with SICRAM module. Cable L = 5 m	
TP880/300.I	-50 +450	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		60s	Mignon head, cable length = 2m	
TP880/600.I	-50 +450	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)			Mignon head, cable length = 2m	
TP35.5AF.5S	-110 +180	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C) ±0.3 °C (t < -50 °C; t > 250 °C)		3s	 Cable L = 5 m. Shield in Inox + PTFE	
TP875.I	-30 +120	±0.1 °C (@ 0 °C) ±0.2 °C (-50 °C ≤ t ≤ 250°C)		15'	Globe-thermometer probe for measurement of radiant heat with Ø150mm. Accuracy according to ISO 7243 ISO 7726. Pt100 sensor, 4-wire cable L=2 m. Supplied with SICRAM module.	
TP876.I					Globe-thermometer probe for measurement of radiant heat with Ø 50mm. Accuracy according to ISO 7243 ISO 7726. Pt100 sensor, 4-wire cable L=2 m. Supplied with SICRAM module.	

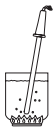
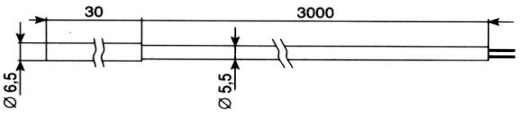
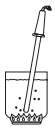
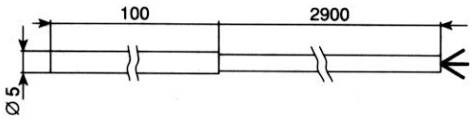
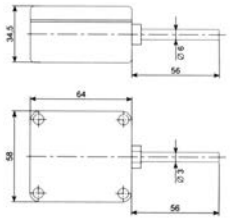
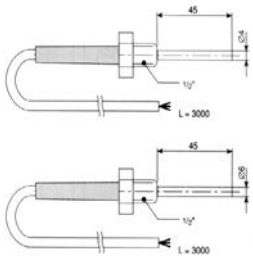
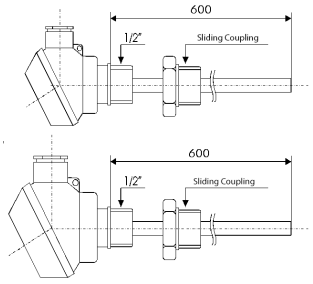
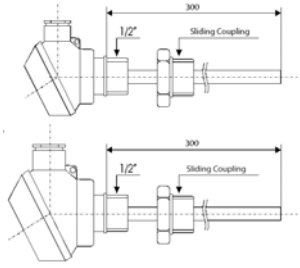
Pt100/Pt1000 PROBES WITH TP47 CONNECTOR WITHOUT SICRAM MODULE

CODE	T (°C)	CLASS	USE	$\tau_{0.63}$	DIMENSIONS
TP47.100.O (Pt100)	-50 +250	Class A		3s	
TP47.1000.O (Pt1000)					
TP87.100.O (Pt100)	-50 +200				
TP87.1000.O (Pt1000)					

Pt100 PROBES ENDING WITH FREE WIRES

TP875.1.I	-30 +120	Class A		15s	Globe-thermometer probe for measurement of radiant heat with Ø150mm. Accuracy according to ISO 7243 ISO 7726. Pt100 sensor, 4-wire cable L=2 m .
TP876.1.I					Globe-thermometer probe for measurement of radiant heat with Ø50mm. Accuracy according to ISO 7243 - ISO 7726. Pt100 sensor, 4-wire cable L=2 m.
TP878.1SS.O	-40 +85	Class A		60s	Contact probe for solar panels 4-wire cable L = 5 m 
TP879.1.O	-20 +120	Class A		60s	Penetration probe for compost 4-wire cable L = 5 m 
TP32MT.1P.I	-40 +100	Class A		40s	
TP32MT.1P.2	-50 +250	Class A		40s	
TP32MT.2.I	-40 +100	Class A		60s	
TP35.5AF.5	-110 +180	Class A		3s	 Cable L = 5 m. Shield in Inox + PTFE

TEMPERATURE PROBES FOR INDUSTRIAL USE

CODE	T (°C)	CLASS	USE	$\tau_{0.63}$	DIMENSIONS
HD882/EK (KTY81)	-40 +150	Not applicable		5s	
HD882/ E/100 (Pt100)	-50 +300	Class A		5s	
HD882/GK (KTY81)	-50 +100	Not applicable	Environmental	5s	
HD882/G100 (Pt100)	-50 +100	Class A	Environmental	5s	
HD882/L104 (Pt100)	0 +250	Class A	Process Thread	7s	
HD882/L106 (Pt100)	0 +250	Class A	Process Thread	15s	
HD882M100/600 (Pt100)	-50 +450	Class A	Process Thread - Miniature Head	15s	
HD882DM100/600 (Pt100)	-50 +450	Class A	Process Thread - DIN B Head	15s	
HD882M100/300 (Pt100)	-40 +100	Class A	Process Thread - Miniature Head	15s	
HD882DM100/300 (Pt100)	-50 +250	Class A	Process Thread - DIN B Head	15s	

CONNECTORS

TP47	Connector without SICRAM module. It can be connected to 4-wire Pt100 probes (and 3-wire with some instruments) or 2-wire Pt1000 probes.	
TP471	Connector with SICRAM electronic module for the connection of resistance thermometers and the correction of the characteristic of the sensor. It can be connected to 3-wire or 4-wire Pt100Ω platinum temperature probes. assembling and calibration only in Delta OHM	

TEMPERATURE PROBES – THERMOCOUPLES

Delta OHM offers a wide choice of K-type thermocouples, meeting the characteristics defined by the IEC 60584 standard..

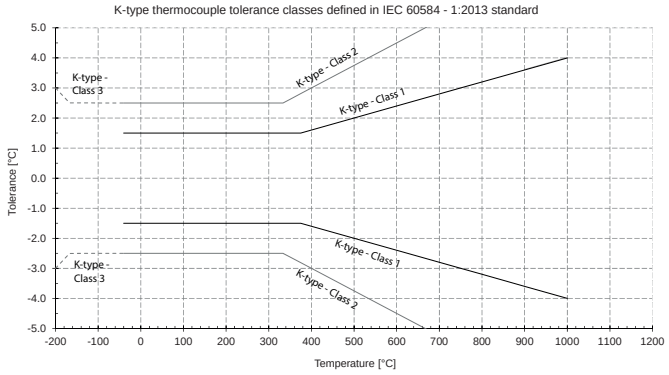
The response time $\tau_{0.63}$ indicated for each probe is the reaction time of the sensor to a temperature variation, with a variation of the measured signal corresponding to the 63% of the total variation. The response times are referred:

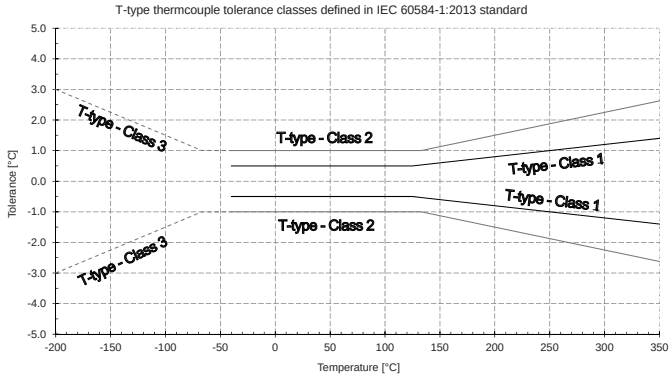
- in water at 100 °C for immersion probes;
- to the contact with a metal surface at 200 °C for surface probes;
- to an air temperature of 100 °C for air probes.

The IEC 60584-1:2013 standard defines the tolerance classes of the thermocouples as summarized in the following table:

	Class 1		Class 2		Class 3	
Thermocouple Type	Tolerance[1]	Temp. range	Tolerance[1]	Temp. range	Tolerance[1]	Temp. range
T	0.5 °C or 0.004·|t|	-40 °C...+350 °C	1 °C or 0.0075·|t|	-40 °C...+350 °C	1 °C or 0.015·|t|	-200 °C...+40 °C
E	1.5 °C or 0.004·|t|	-40 °C...+800 °C	2.5 °C or 0.0075·|t|	-40 °C...+900 °C	2.5 °C or 0.015·|t|	-200 °C...+40 °C
J		-40 °C...+750 °C		-40 °C...+750 °C	---	---
K		-40 °C...+1000 °C		-40 °C...+1200 °C	2.5 °C or 0.015·|t|	-200 °C...+40 °C
N		-40 °C...+1000 °C		-40 °C...+1200 °C		-200 °C...+40 °C
R	1 °C [1+0.003·(t-1100)]	0 °C...+1100 °C	1.5 °C or 0.0025·|t|	0 °C...+1600 °C	---	---
S		+1100 °C...+1600 °C		0 °C...+1700 °C	---	---
B	---	---		+600 °C...+1700 °C	4 °C or 0.005·|t|	600 °C...+1700 °C
C	---	---	0.01·|t|	+426 °C...+2315 °C	---	---
A	---	---		+1000 °C...+2500 °C	---	---

[1] Tolerance is expressed as a numerical value or as a function of temperature. The greater of the two values is valid





The elements that make up the thermocouple wires, with their respective polarity, are shown below.

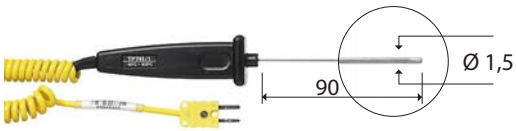
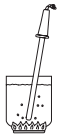
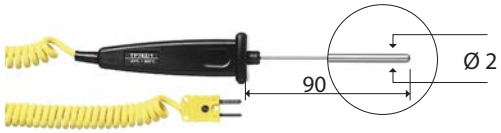
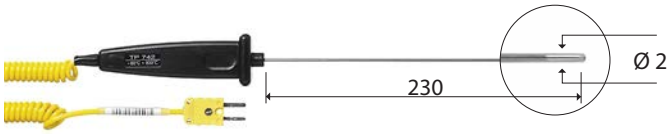
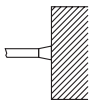
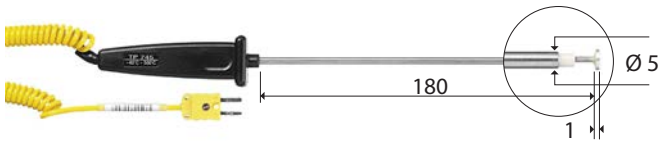
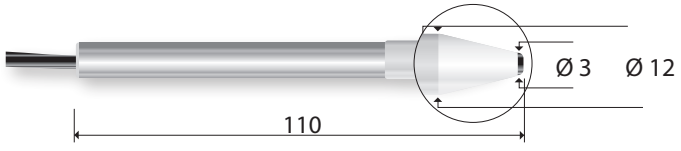
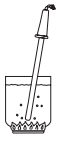
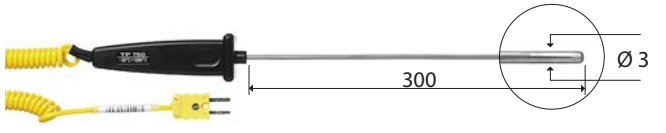
	Alloy standard elements and composition	
Thermocouple type	Positive conductor	Negative conductor
R	Platinum – 13 % Rhodium	Platinum
S	Platinum – 10 % Rhodium	Platinum
B	Platinum – 30 % Rhodium	Platinum
J	Iron	Copper - Nickel
T	Copper	Copper - Nickel
E	Nickel - Chrome	Copper - Nickel
K	Nickel - Chrome	Nickel - Aluminium
N	Nickel - Chrome - Silicon	Nickel - Silicon
C	Tungsten - 5 % Rhenium	Tungsten - 26 % Rhenium
A	Tungsten - 5 % Rhenium	Tungsten - 20 % Rhenium

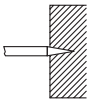
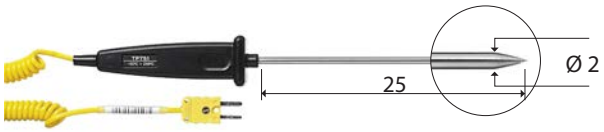
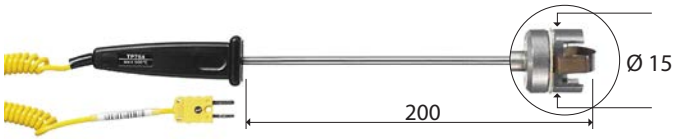
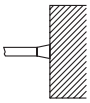
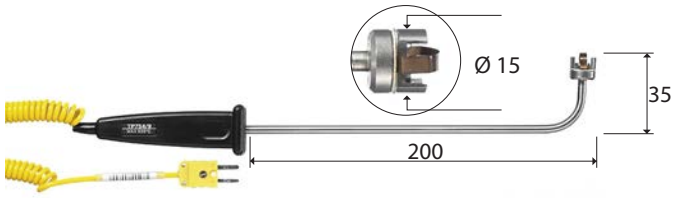
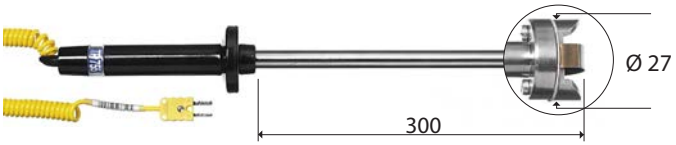
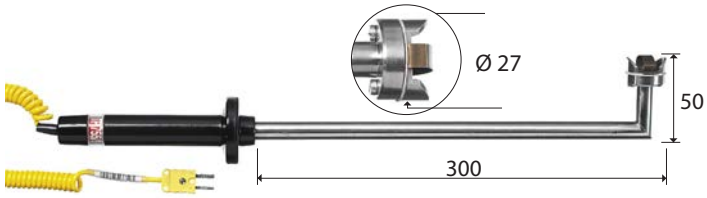
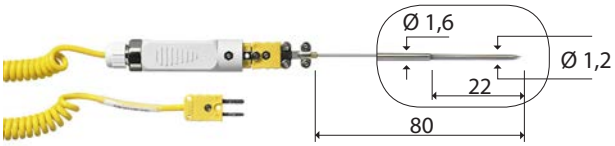
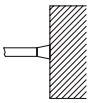
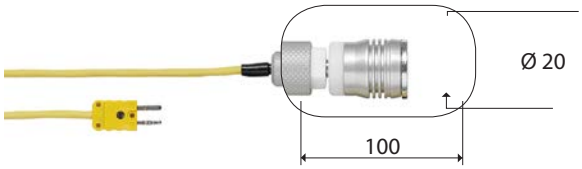
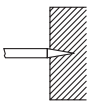
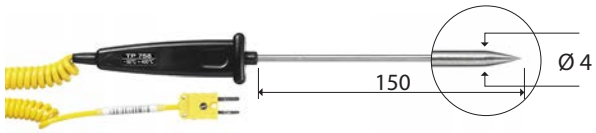
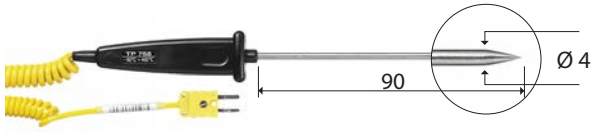
By means of the calibration, the purchased instrument can be metrologically characterized, determining the systematic error of the thermometer and ensuring at the same time the traceability to international standards. Delta OHM Laboratories are able to provide this service by issuing calibration reports according to ISO 9001 or ACCREDIA LAT certificates in compliance with ISO/IEC 17025 standard, recognized internationally through ILAC MRA agreements.

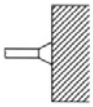
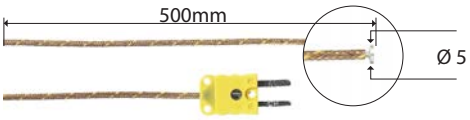
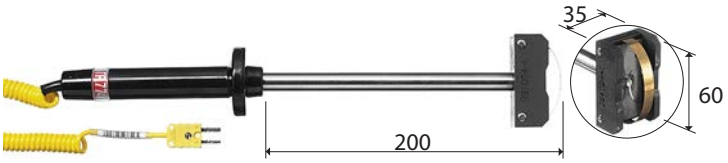
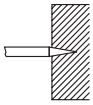
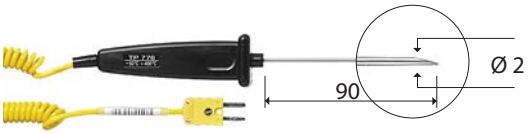
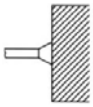
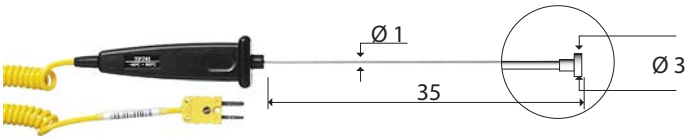
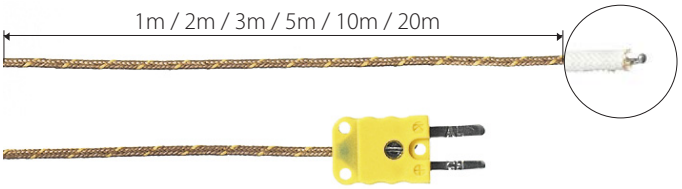
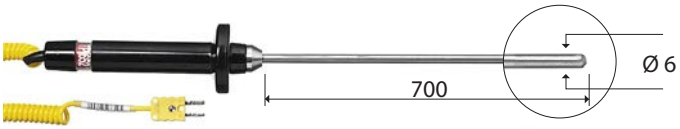
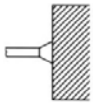
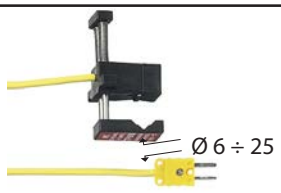
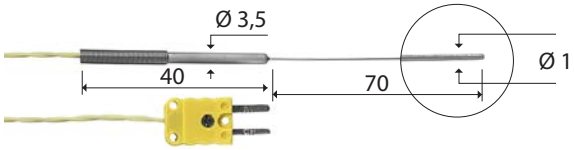
ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
LAT N° 124

Temperature - Humidity - Pressure - Air speed
Photometry/Radiometry - Acoustics

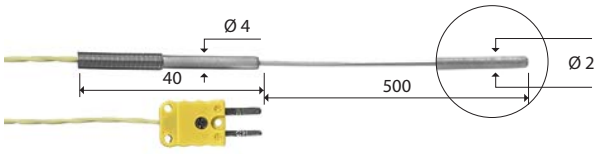
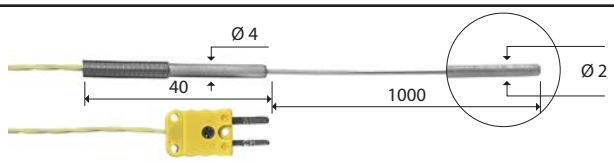
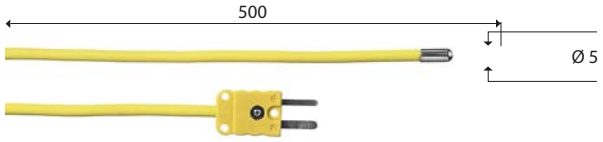
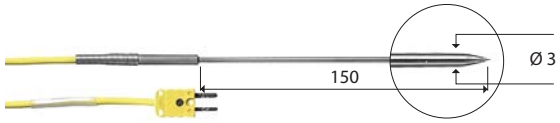
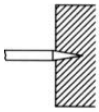
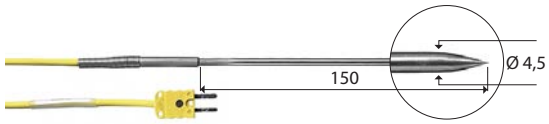
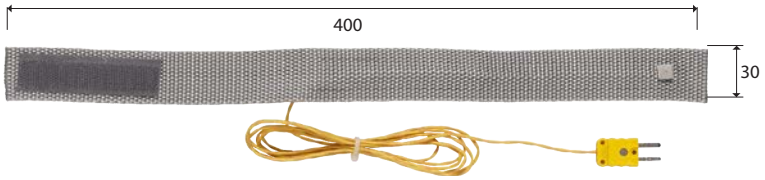
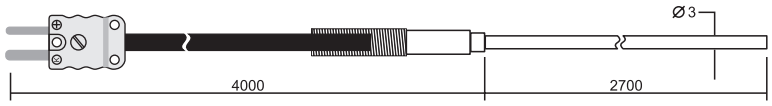
"K" type THERMOCOUPLES - Chromel (Ni-Cr) / Alumel (Ni-Al) - Class 1

CODE	T_{max}(°C)	USE	$\tau_{0.63}$	DIMENSIONS
TP741	+800		2s	
TP741/1	+400		2s	
TP741/2	+800		2s	
TP742	+800		2s	
TP742/1	+400		2s	
TP742/2	+800		2s	
TP743	+800		3s	
TP744	+400		4s	
TP745	+500		5s	
TP746	+250		2s	
TP750	+1000		3s	
TP750.0	+800		3s	

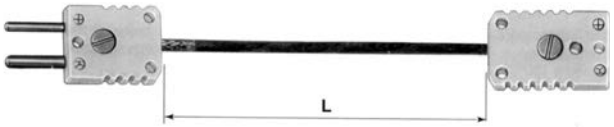
"K" type THERMOCOUPLES - Chromel (Ni-Cr) / Alumel (Ni-AI) - Class 1				
CODE	T_{max}(°C)	USE	$\tau_{0.63}$	DIMENSIONS
TP751	+200		2s	
TP754	+500		2s	
TP754/9	+500		2s	
TP755	+800		2s	
TP755/9	+800		2s	
TP756	+200		2s	
TP757	+180		30s	Magnetic probe for contact measurements on magnetic metal surfaces 
TP758	+400		4s	
TP758.1	+400		4s	

"K" type THERMOCOUPLES - Chromel (Ni-Cr) / Alumel (Ni-Al) - Class 1				
TP772	+400		3s	
TP774	+250		2s	
TP776	+200		2s	
TP777	+200		3s	
TP647 TP647/2 TP647/3 TP647/5 TP647/10 TP647/20	+300		2s	Fiberglass cable 
TP651	+1200		6s	
TP652	+1200		6s	
TP655	+180		2s	
TP656	+200		1s	

"K" type THERMOCOUPLES - Chromel (Ni-Cr) / Alumel (Ni-Al) - Class 1

CODE	T_{max}(°C)	USE	$\tau_{0.63}$	DIMENSIONS
TP656/1	+1000		1s	
TP656/2	+1000		1s	
TP657/1	+100		5s	
TP659	+400		3s	
TP660	+400		4s	
TP661	+50		30s	
TP662	+180		120s	 Strap probe with velcro for measurements on pipes with Ø max 110 mm
TP663	+1050		3s	

THERMOCOUPLE CONNECTORS AND CABLES

CM CS	"K"	 CS  CM
PW	"K"	 Cable Lenght: 2m/5m/10m/15m/20m

Temperature Probes and Suitable Instruments

	Tempera-ture Handhelds	Pressure Handhelds	Relative Humidity Handhelds	Air Speed Han-dhelds	Water Analysis Handhelds	Water Analysis Bench Top	Mul-tifun-ction	Micro-climate	Air Quality - CO-CO_2
ALL Pt100 PROBES* WITH SICRAM MODULE CAN BE CON-NECTED TO	HD2107.1 HD2107.2 HD2127.1 HD2127.2 HD2307.0 HD2178.1 HD2178.2 HD32.7	HD2114.0 HD2114.2 HD2134.0 HD2134.2 HD2164.0 HD2164.2 HD2114B.0 HD2114B.2 HD2124.1 HD2124.2 HD2304.0	HD2101.1 HD2101.2 HD2301.0	HD2103.1 HD2103.2 HD2303.0	HD2105.1 HD2105.2 HD2106.1 HD2106.2 HD2156.1 HD2156.2 HD2109.1 HD2109.2 HD2305.0 HD2306.0 HD98569	HD2205.2 HD2206.2 HD2256.2 HD2259.2 HD22569.2 HD3405.2 HD3406.2 HD3456.2 HD3409.2	DO9847 HD31	HD32.1	HD37AB1347
	*Please note: -TP875.I and TP876.I can't be connected to pressure, water analysis and microclimate handhelds and water analysis bench top mentioned above -TP47.100.0/TP47.1000.0/TP87.100.0/TP87.1000.0 can't be connected to DO9847, microclimate and air quality instruments mentioned above								

Temperature Probes and Suitable Instruments

	Temperature Handhelds	Pressure Handhelds	Multifunction
ALL THERMOCOUPLE PROBES CAN BE CONNECTED TO	HD2328.0 HD2108.1 HD2108.2 HD2128.1 HD2128.2 HD2178.1 HD2178.2 HD32.8.8 HD32.8.16	HD2114P.0 HD2114P.2 HD2134P.0 HD2134P.2	DO9847 HD31 only through optional module TP471DX

Thermoresistance and Thermocouple: how to choose?

Thermoresistance

Pt100 or Pt1000 (thermo-resistance) probes have a wide operating range and are very stable and reliable. The platinum temperature element has a fixed resistance at 0°C. For the Pt100 this means 100 ohms at 0°C, for the Pt1000 element this is 1000 ohm at 0°C. The resistance varies when the temperature of the element gets higher or lower. The measuring instrument converts this variation into an accurate measurement of the temperature.

When to use a Pt100 or Pt1000:

- √ **Passive element with high accuracy**
- √ **Accurate over total measurement range**
- √ **High resolution Pt100/Pt1000 0,01 °C**
- √ **Very standardized measuring method between all suppliers.**

Delta OHM has the unique SICRAM module to connect Pt100 probes to the measuring instrument. What does this SICRAM module do for you:

- √ **It contains the exact calibration curve of that particular sensor**
- √ **This makes sure to always have the highest possible accuracy**
- √ **When switching several sensors on 1 instrument it will read and use the calibration curve of that particular sensor**
- √ **The best and most accurate way of measuring!**

Thermocouple

Thermocouple probes are composed by joining together 2 different metals connected at one end (junction). These two metals will generate a voltage (Seebeck effect).
Depending on which types of metal are used this Voltage will vary, but it is always in the µV/°C range. Most widely used is thermocouple type K which consists of chromel–alumel wires, the generated voltage with this type is 41µV/°C. When the 'junction' is heated the voltage goes up. Knowing the exact curve for the material as used, the measuring device will convert the voltage in a temperature reading. The thermocouple probes use standard thermocouple connectors which are standardized throughout the industry.

When to use a thermocouple:

- √ **For fast response measurements**
- √ **Very light construction possible**
- √ **Very suitable for high temperatures measurements: temperature range for type K sensors goes up to 1370 °C**
- √ **For measuring on difficult to reach places: a small wire is all it takes.**

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

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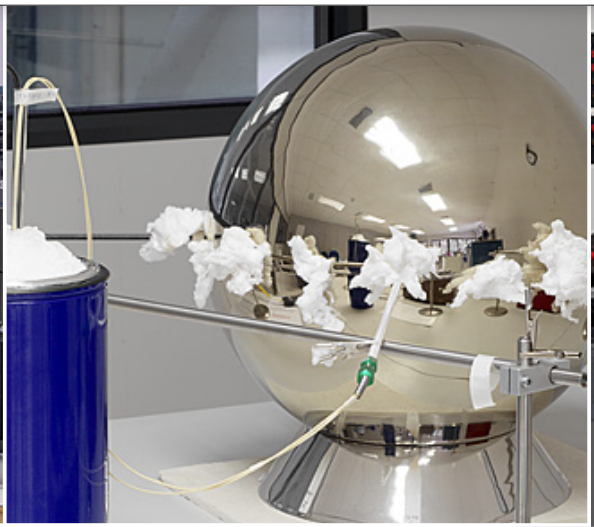
ACCREDITATION TABLE

Quantity	Instruments to be calibrated	Measuring range	Uncertainty (*)	Note
Temperature	Noble metal thermocouples	-50 °C...250 °C 250 °C…540 °C 540 °C...1100 °C 1100 °C...1250 °C	0,3 °C 0,4 °C 1,1 °C 2,0 °C	
	Common metal thermocouples	-196 °C -75 °C...250 °C 250 °C...540 °C 540 °C...1100 °C 1100 °C...1250 °C	0,40 °C 0,40 °C 0,53 °C 1,5 °C 2,2 °C	
	Resistance thermometers	-196 °C -75 °C...0 °C 0 °C...100 °C 100 °C...250 °C 250 °C...600 °C	0,20 °C 0,15 °C 0,05 °C 0,10 °C 0,20 °C	
	Thermometric chains Temperature indicators and transmitters - Noble metal thermocouples	-50 °C...250 °C 250 °C…540 °C 540 °C...1100 °C 1100 °C...1250 °C	$2\sqrt{0,15^2+u_{ris}^2}$ °C $2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,55^2+u_{ris}^2}$ °C $2\sqrt{1,0^2+u_{ris}^2}$ °C	①
	Thermometric chains Temperature indicators and transmitters - Common metal thermocouples	-196 °C -75 °C...250 °C 250 °C...540 °C 540 °C...1100 °C 1100 °C...1250 °C	$2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,26^2+u_{ris}^2}$ °C $2\sqrt{0,75^2+u_{ris}^2}$ °C $2\sqrt{1,1^2+u_{ris}^2}$ °C	①
	Thermometric chains Temperature indicators and transmitters - Resistance thermometers	-196 °C -75 °C...0 °C 0 °C...100 °C 100 °C...250 °C 250 °C...600 °C	$2\sqrt{0,10^2+u_{ris}^2}$ °C $2\sqrt{0,075^2+u_{ris}^2}$ °C $2\sqrt{0,025^2+u_{ris}^2}$ °C $2\sqrt{0,050^2+u_{ris}^2}$ °C $2\sqrt{0,10^2+u_{ris}^2}$ °C	①
	Calibrators - Simulators - for resistance thermometers	National and international standards for temperature sensors	$2\sqrt{0,025^2+u_{ris}^2}$ °C	①
	Calibrators - Simulators - for thermocouples	National and international standards for temperature sensors	$2\sqrt{0,10^2+u_{ris}^2}$ °C	①
	Air temperature	0 °C...60 °C	0,1 °C	

(*) The uncertainties are expressed on a confidence level of about 95%.
① u_{ris} is the uncertainty value expressed in °C depending on the resolution of the instrument.



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