

HD2304.0



HD2304.0 MANOMETER - THERMOMETER HANDHELD - READ ONLY

HD2304.0 is a portable instrument with a LCD display. It performs measurements of absolute, relative and differential pressure, and temperature.

The PP471 electronic module is used to measure the pressure. The PP471 electronic module works as an interface between the instrument and the TP704 and TP705 series Delta OHM probes. The temperature is detected with immersion, penetration, contact or air Pt100 probes with SICRAM module or 4-wire direct Pt100 probes. The temperature probes are fitted with SICRAM module and the factory calibration settings are memorized inside.

Upon turning on, the instrument automatically detects them. The Max, Min and Avg function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded.

The instrument has IP67 protection degree.

Technical specifications	
For all pressure specifications, see table at page 13	
Measurement of temperature	
Pt100 measurement range	-200...+650 °C
Resolution	0.1° C
Accuracy	±0.1 °C
Drift after 1 year	0.1° C/year
Measuring unit	°C - °F - Pa - hPa - kPa - mbar - bar - atm mmHg - mmH ₂ O - kgf/cm ² - PSI - inchHg
Power supply	
Batteries	3 x 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	< 20 µA
Connections	
Input module for the probes	8-pole male DIN45326 connector
Operating conditions	
Operating temperature	-5 ... 50 °C
Storage temperature	-25 ... 65 °C
Working relative humidity	0...90% RH without condensation
Protection degree	IP67
General characteristics	
Dimensions (Length x Width x Height)	140x88x38 mm
Weight	160 g (complete with batteries)
Materials	ABS
Display	2 rows 4½ digits plus symbols Visible area: 52x42 mm

ORDERING CODES

HD2304.0: The kit consists of the instrument HD2304.0, 3 1.5V alkaline batteries, operating manual, case. **Probes and interface module PP471 have to be ordered separately.**

For all pressure probes, PP471 module and Pt100 temperature probes see from **pag.13** onwards.



HD2304.0



PP471

PRESSURE PROBE

Full scale pressure	Maximum overpressure	Resolution	ORDERING CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• TP705-10MBD			0.5 % f.s.	0..+60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• TP705-20MBD			0.5 % f.s.	0..+60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	TP705-50MBD			0.5 % f.s.	0..+60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	TP705-100MBD			0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % f.s.	-30..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	TP705-200MBD			0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % f.s.	-30..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		TP704-400MBGI		0.25 % f.s.	-40..+125 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	TP705-500MBD			0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		TP704-600MBGI		0.25 % f.s.	-40..+125 °C	¼ BSP
			TP705-1BD			0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
1.00 bar	2.00 bar	1 mbar		TP704-1BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
					TP704-1BAI	0.25 % f.s.	-40..+125 °C	¼ BSP
			TP705-2BD			0.25 % f.s.	0..+60 °C	Tube Ø 5 mm
2.00 bar	4.00 bar	1 mbar		TP704-2BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-5BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar			TP704-5BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-10BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar			TP704-10BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-20BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-50BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar			TP704-50BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-100BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
				TP704-200BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 bar				0.25 % f.s.	-40..+125 °C	¼ BSP
				TP704-500BGI		0.25 % f.s.	-40..+125 °C	¼ BSP
500 bar	1000 bar	0.1 bar				0.25 % f.s.	-40..+125 °C	¼ BSP
	700 bar	0.1 bar			TP704-500BAI *	0.25 % f.s.	-25..+85 °C	¼ BSP

* Ceramic diaphragm

• Only report of calibration, no Accredia certificate

All TP704 and TP705 series Delta OHM probes can be connected to the PP471 module.

Technical characteristics of PP471 module

Accuracy	±0.05% of full scale
Peak duration	≥ 5ms
Peak accuracy	±0.5% of full scale
Peak dead band	≤ 2% of full scale

PRESSURE UNITS OF MEASUREMENTS

CONVERSION FACTORS

kPa	Mpa	bar	mbar	mmH ₂ O	Torr mmHg	at Kg/cm ²	Atm	Inch H ₂ O	Inch Hg	Psi lbf/in ²
1	1•10 ⁻³	1•10 ⁻³	10	102.0	7.501	10.20•10 ⁻³	9.869•10 ⁻³	4.016	0.2953	0.14505
1•10 ³	1	10	1•10 ⁴	102.0•10 ³	7501	10.20	9.869	4016	295.3	145.05
100	0.1	1	1•10 ³	10.20•10 ³	750.1	1.020	0.9869	401.6	29.53	14.505
0.1	1•10 ⁻⁴	1•10 ⁻³	1	10.20	0.7501	1.020•10 ⁻³	0.9869•10 ⁻³	0.4016	29.53•10 ⁻³	14.505•10 ⁻³
9.807•10 ⁻³	9.807•10 ⁻⁶	98.07•10 ⁻⁶	98.07•10 ⁻³	1	73.56•10 ⁻³	1•10 ⁻⁴	96.78•10 ⁻⁶	0.03937	2.896•10 ⁻³	1.4224•10 ⁻³
0.13332	133.32•10 ⁻³	1.333•10 ⁻³	1.333	13.59	1	1.359•10 ⁻³	1.316•10 ⁻³	0.5351	3.937•10 ⁻²	0.01934
98.07	98.07•10 ⁻³	0.9807	980.7	1•10 ⁴	735.6	1	0.9678	393.7	28.96	14.224
101.3	0.1013	1.013	1013	10.33•10 ³	760	1.033	1	406.7	29.92	14.68
0.2491	0.2491•10 ⁻³	2.491•10 ⁻³	2.491	25.4	1.8684	2.54•10 ⁻³	2.458•10 ⁻³	1	7.355•10 ⁻²	36.126•10 ⁻³
3.386	3.386•10 ⁻³	3.386•10 ⁻²	33.86	345.3	25.4	3.453•10 ⁻²	3.342•10 ⁻²	13.60	1	0.4912
6.8948	6.8948•10 ⁻³	6.8948•10 ⁻²	68.948	703.1	51.715	70.31•10 ⁻³	68.948•10 ⁻³	27.68	2.036	1



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, R₀=100 Ω, α= 3.851·10⁻³ °C⁻¹.

For particular applications, probes with Pt1000 sensor or with a thermistor sensor are available. The response time τ_{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.

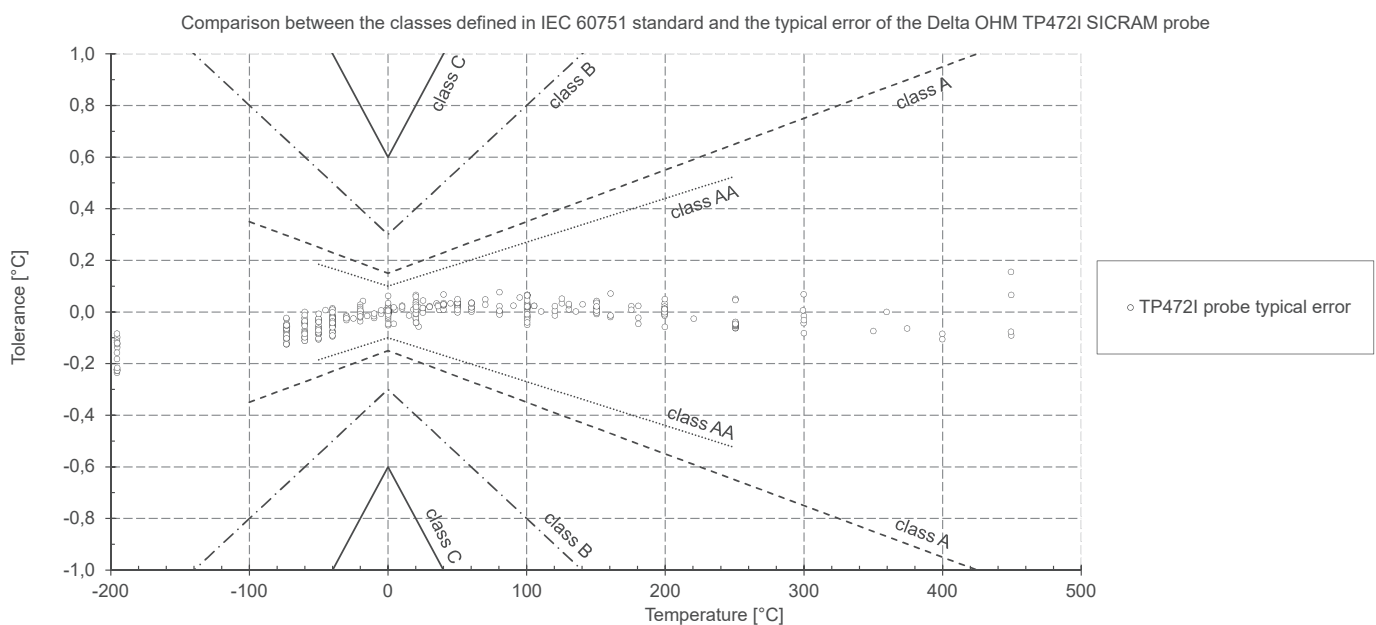
The IEC 60751:2008 standard defines the tolerance classes of the resistance thermometers as summarized in the following table:

Tolerance class	Temperature Range		Tolerance [°C]
	WIRE WOUND sensor	THIN FILM sensor	
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.

Tolerance [°C]	Temperature [°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.


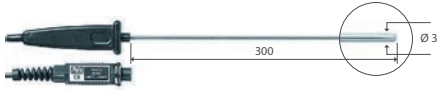

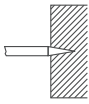

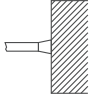



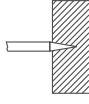




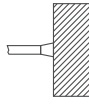
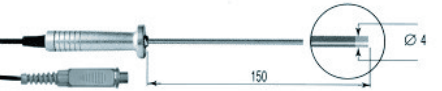
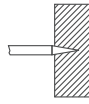


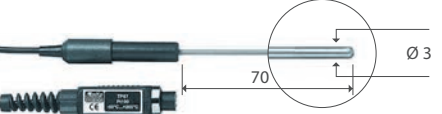


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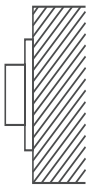
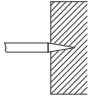
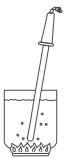


Temperature - Humidity - Pressure - Air speed
Photometry/Radiometry - Acoustics



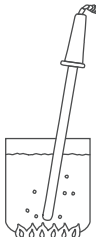

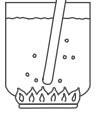
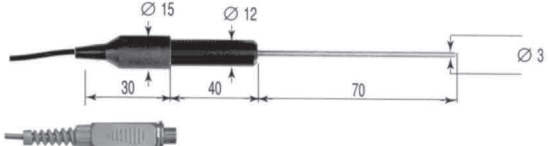
Pt100 PROBES WITH TP471 SICRAM MODULE

CODE	T (°C)	ACCURACY	USE	$\tau_{0.63}$	DIMENSIONS
TP472I	-196 +500	± 0.1 °C (@ 0 °C) ± 0.2 °C (-50 °C \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 250 °C)		12s	
TP472I.5	-50 +400	± 0.1 °C (@ 0 °C) ± 0.2 °C (-50 °C \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 250 °C)		4s	
TP87.O	-50 +200	± 0.1 °C (@ 0 °C) ± 0.2 °C (-50 °C \leq t \leq 250 °C)		3s	




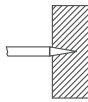
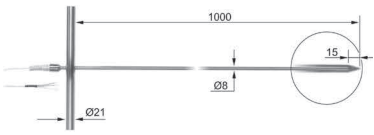
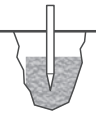
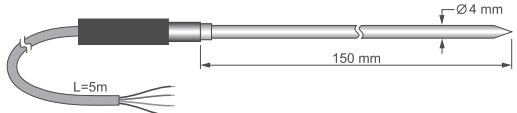
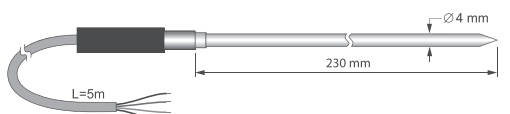
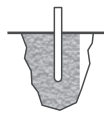
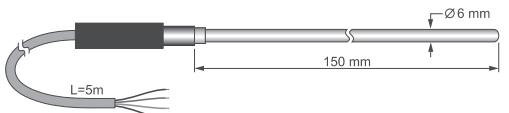

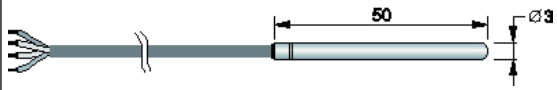
Pt100 PROBES WITH TP471 SICRAM MODULE

CODE	T (°C)	ACCURACY	USE	$\tau_{0.63}$	DIMENSIONS
TP878.O	-40 +85	± 0.1 °C (@ 0 °C) ± 0.2 °C (-50 °C \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 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 \leq t \leq 250°C) ± 0.3 °C (t < -50 °C; t > 250 °C)		3s	 Cable L = 5 m. Shield in Inox + PTFE
TP875.I				15'	Globe-thermometer probe for measurement of radiant heat with $\varnothing 150$ mm. Accuracy according to ISO 7243 ISO 7726. Pt100 sensor, 4-wire cable L=2 m. Supplied with SICRAM module.
TP876.I	-30 +120	± 0.1 °C (@ 0 °C) ± 0.2 °C (-50 °C \leq t \leq 250°C)			Globe-thermometer probe for measurement of radiant heat with $\varnothing 50$ mm. Accuracy according to ISO 7243 ISO 7726. Pt100 sensor, 4-wire cable L=2 m. Supplied with SICRAM module.


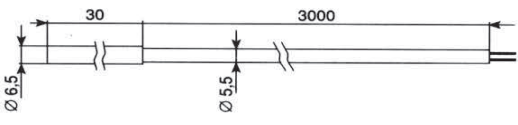

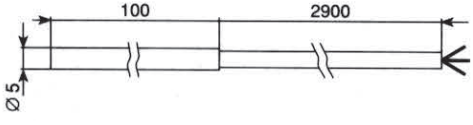
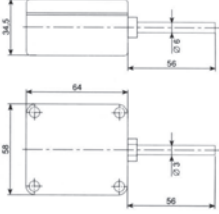
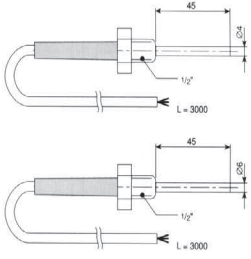
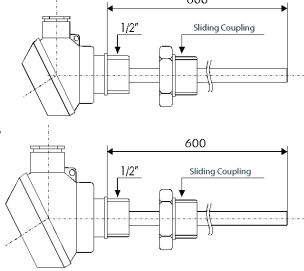
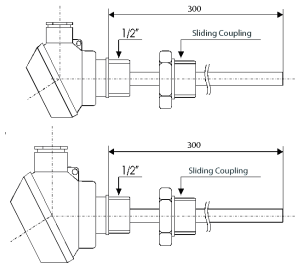
Pt100/Pt1000 PROBES WITH TP47 CONNECTOR WITHOUT SICRAM MODULE

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	Class A		3s	
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 $\varnothing 150$ mm. 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 $\varnothing 50$ mm. 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	