Head Sensors with ceramic tube

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In this Operation Manual, there are represented the following series of temperature sensors with ceramic tube: TT..CU-22, TT...C-22, TT...CC-22, TT...C-42, TT…ACT, TT...CS-22, TT...GWC-1..., TT...CT-22. The sensors as above are equipped with either a terminal block or with a 4-20 mA transmitter (designated as APTT) instead of the terminal block.

The sensors as described above comply with the Polish Standard PN-EN 60584.

1. Construction and principle of operation.

Measuring thermoelectric insert in outer ceramic tube is a principal element of the sensors represented in this Manual. The clamps of this insert are protected by a connection head made of aluminium alloy. Inside the sheath, there is a thermocouple connected with the clamps of terminal block or of 4-20 mA transmitter. The sensors of these series are fixed on external gauges by the use of either slidable or threaded clamping holders.

The measuring element of insert responds to a change in temperature of a medium by changing its electromotive force EMF /thermocouple/. The changes correspond to their thermometric characteristics as defined in the Polish standard PN-EN 60 584.

Specification:

Thermocouple.....1 or 2x Fe-CuNi /J/; NiCr-Ni /K/; PtRh10-Pt /S/; PtRh13-Pt /R/ Class 1, 2; PtRh30-PtRh6 /B/ Class 2, 3 according to PN-EN 60584

Maximum Measurement Range..... from -40÷1200ºC as for thermocouple K
from 0÷1200ºC as for thermocouples S, R
from 600÷1600ºC as for thermocouple B

Measuring junction .....isolated hot junction

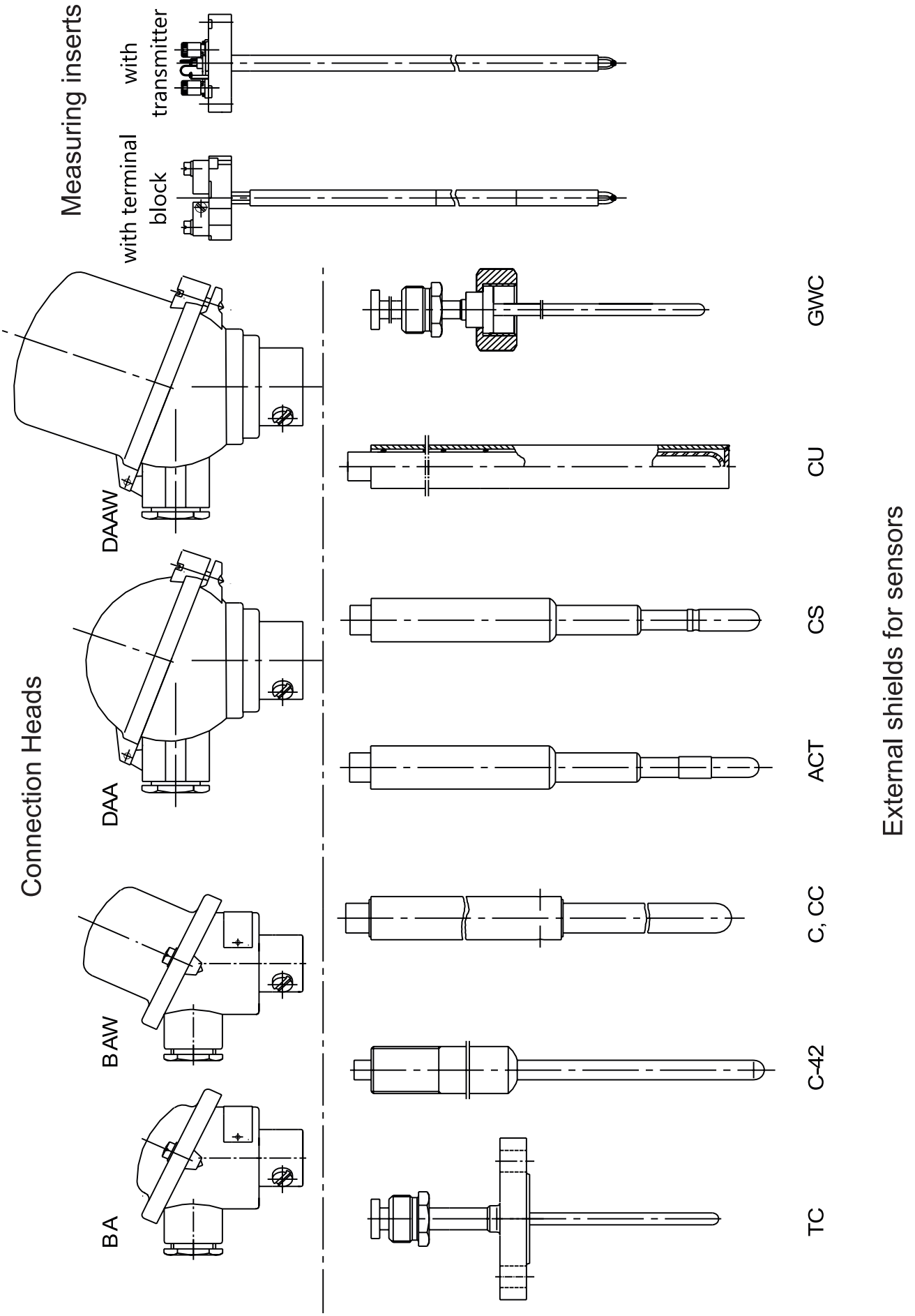
Allowable working temperature of head with a rubber seal.....100ºC
and with a silicone seal.....150ºC

Protection Degree provided by the housing .....IP-55 as for head B
IP-65 as for head DA

Cable Gland .....PG16 or M20x 1.5

Transmitters…….....TxBlock, APAQHCF, LTT-01, FLEX TOP 2211, 248H

2. Assembly diagram of sensor's units exchangeable measuring inserts; connection heads MA/DAN/; with a terminal block; with a transmitter; outer sheaths of the sensors



3. List of sensor types.

Type of sensor	*Material of tube*	*Diameter thermoelectrode*	*Measurement range*	*Method of mounting/fixing*	*Diameter of ceramic tube*	*Protection degree provided by the housing*
TTKCU-22	H24Js+799	ø2	0÷1200°C	UZ-11 UZ-21	ø15 + steel ø22	IP53
TTSCU-22	H24Js+799	ø0,35	0÷1200°C			
		ø0,5	0÷1200°C			
TTRCU-22	H24Js+799	ø0,35	0÷1200°C			
		ø0,5	0÷1200°C			
TTKC-22	610 (mullite)	ø2	-40÷1200°C		ø15	
TTKC-22	799 (corundum)	ø2	-40÷1200°C			
TTBC-22		ø0,5	600÷1600°C			
TTSC-22	610 (mullite)	ø0,35	0÷1200°C			
		ø0,5	0÷1400°C			
TTSC-22	799 (corundum)	ø0,35	0÷1200°C			
		ø0,5	0÷1500°C			
TTRC-22	610 (mullite)	ø0,35	0÷1200°C			
		ø0,5	0÷1400°C			
TTRC-22	799 (corundum)	ø0,35	0÷1200°C			
		ø0,5	0÷1500°C			
TTBCC-22	799 (corundum)	ø0,5	600÷1600°C		ø15 or ø24	
TTSCC-22	610 (mullite)	ø0,5	0÷1400°C			
TTSCC-22	799 (corundum)	ø0,5	0÷1500°C			
TTRCC-22	610 (mullite)	ø0,5	0÷1400°C			
TTRCC-22	799 (corundum)	ø0,5	0÷1500°C			
TTBC-42	799 (corundum)	ø0,35 or ø0,5	600÷1600°C	UG1	ø5 ø6 ø7 ø10	IP55
TTSC-42			0÷1300°C			
TTRC-42			0÷1300°C			
TTBC-42	SAP (Saphiro)	ø0,35 or ø0,5	600÷1600°C			
TTSC-42			0÷1300°C			
TTRC-42			0÷1300°C			
TTBCS-22	799 (corundum) + thimble Pt	ø0,35 or ø0,5	600÷1700°C	UG1	ø10 ø12 ø15	
TTSCS-22			0÷1600°C			
TTRCS-22			0÷1600°C			
TTSCACT	799 (corundum) + sputtered Pt	ø0,35 or ø0,5	0÷1600°C	UZ-11 UZ-21	ø10 ø12 ø15	
TTBCACT			600÷1700°C			
TTRCACT			0÷1600°C			
TTKCT-22	799 (corundum)	ø2	-40÷1200°C	Flange PN-EN 1092	ø15 ø24	
TTSCT-22		ø0,35 or ø0,5	0÷1500°C			
TTBCT-22			600÷1600°C			
TTRCT-22			0÷1500°C			
TTKGWC-42	799 (corundum)	ø1	-40÷1200°C	Nut G½	ø6 ø8 ø10	
TTSGWC-42		ø0,35 or ø0,5	0÷1600°C			
TTBGWC-42			600÷1700°C			
TTRGWC-42			0÷1600°C			

Minimum immersion depth of the sensor /thermometer/ - l_{min}.

Temperature sensing part of the thermometer C>30 mm
Outer diameter of the sheath: D
→ in flowing air: l_{min} = C + 5 D

4. Thermocouple sensors - designation of connection clamps.

Terminal block

When connecting thermocouple sensors, polarity must be carefully observed; thus, on a terminal block, the positive pole of thermocouple is marked as + in order to allow the end user to properly connect the thermocouple sensor.

When the thermoelectric sensor is connected with external devices, then, the corresponding pole on the terminal block must be connected with the corresponding pole of the wire (which has a polarity-specific colour). In the Table below, there are shown: thermoelectric sensor types, the respective rule to connect a specific sensor type, and corresponding colour codes.

Type of thermo-electric. sebnsor	*Type of wire*		*Metal Composition*		*Colour Code„+”*		*Tolerances*		*Temperatu-re range.*
	Compensa-tion	*Termo-electric*	*Wire +*	*Wire -*	*IEC 584 „-”white*	*ANSI „-”red.*	*Class 1*	*Class 2*	
K	-	KX	NiCr	NiAl	green	yellow	±1.5	±2.5	-25÷200°C
K	KCA	-	Fe	410 Alloy	green	-	-	±2.5	0÷150°C
K	KCB	-	Cu	CuNi	green	-	-	±2.5	0÷100°C
S, R	RCA/SCA	-	Cu	11 Al-loy	orange	white	-	±2.5	0÷100°C
S, R	RCB/SCB	EX	NiCr	CuNi	orange	white	-	±5	0÷200°C
B	BC	-	Cu	Cu	grey	purple	-	±4	-25÷200°C

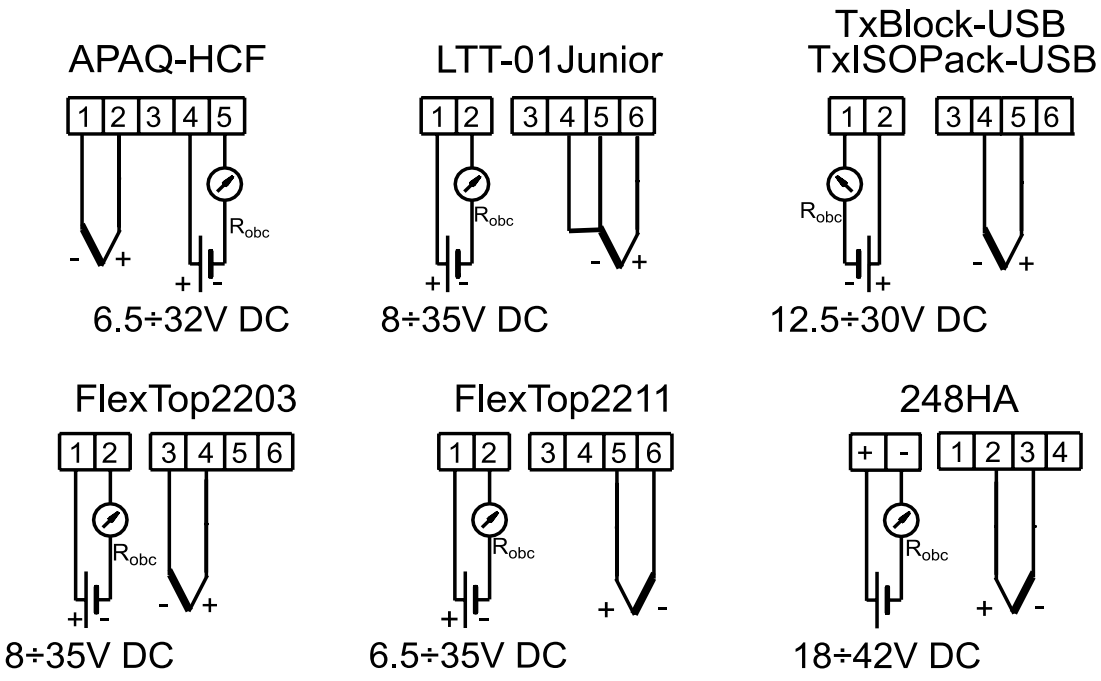
• cross-section areas of compensation and extension wires:
0.22 mm^2; 0.5 mm^2; 0.75 mm^2; 1.0 mm^2; 1.5 mm^2. The recommended cross-section areas of compensation and extension wires used to connect sensors with external instruments are 1.0 mm or 1.5 mm according to PN-89/M-53859

General rules on applying respective colours to compensation wires (colour coding of compensation wires):

• according to the German Standard DIN IEC 584, **the colour** of an outer insulating sheath, an outer insulation, and a positive wire assigned to positive thermoelectrode in the sensor is **the same**, and the colour of negative wire is **white**;

• according to the Polish Standard PN-89/M-53859, the colours of an outer insulating sheath, and an outer insulation are different, the colour of insulation of the wire assigned to the positive thermoelectrode is red, whereas the insulation of the wire assigned to the negative thermoelectrode may be of any other colour except for red, purple, and pink.

• transmitter TC/4÷20 mA



5. Recommended outer diameters of cables for cable glands in the temperature sensors' connection heads manufactured by the company "Limatherm Sensor" in Limanowa, Poland.

<u>For Seals without Cuts</u>
• Cable gland: Pg16 cable diameter /ø5.5 - 7.5 mm/
• Cable gland: M20x1.5 cable diameter /ø5.5 - 7.5 mm/

<u>For Seals with Cuts</u>
• Cable gland: Pg16 cable diameter /ø4 - 12.5 mm/
• Cable gland: M20x1.5 cable diameter /ø4 - 12.5 mm/

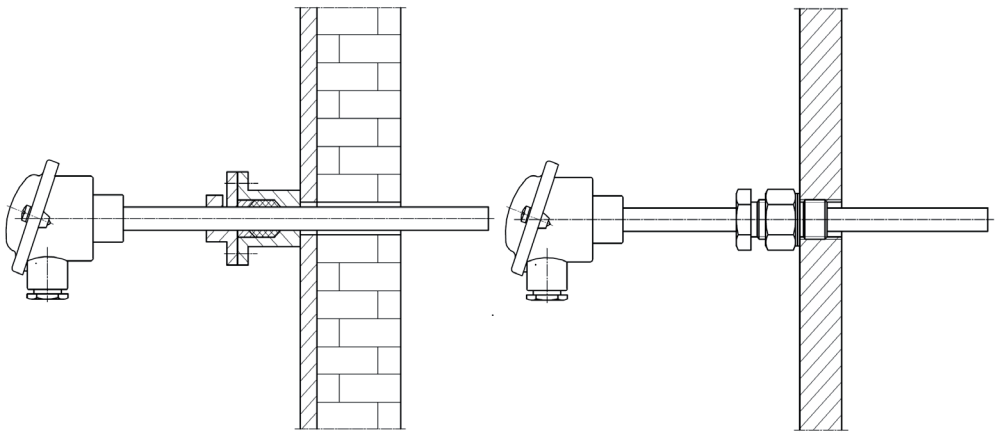
6. Packing and storing instructions, transportation.

The sensors to be transported must always be properly packed in order to avoid any damage during the transportation. It is recommended to place the sensors to be transported either in one general, shared package or in individual unit packages. The sensors should be stored in their packages in indoor storage spaces: the indoor air must contain **no traces of vapours and/or aggressive substances**, the indoor air temperatures must range from +5 °C to 50°C, and the relative humidity **must not exceed 85%.** Whilst being transported, the sensors must be protected against shifting inside the packagings. The sensors manufactured by 'Limatherm Sensor' can be transported using maritime, rail, road, or air modes of transport, in all cased provided that the direct impact of atmospheric factors on the sensors during the transportation it totally eliminated. The detailed transportation conditions are specified in the Polish Standard PN-81/M-42009.

7. Warranty.

- The Manufacturer provides the original purchaser of the sensor (sensors) with a twelve (12) month warranty and necessary service; for this period, the Manufacturer guarantees the uninterrupted and error free functioning of sensors;
- The twelve (12) month warranty begins on the day of purchase;
- Also, the Manufacturer provides the original purchaser of the sensors with a post-warranty service;
- The warranty voids in the case of any changes in and repairs of the instrument performed by the user;
- This warranty does not cover damages resulting from improper transportation, nor defects and errors caused by bad handling or misuse which does not comply with the provisions as set forth in this Operation Manual.

8. Recommended examples of assembling the sensors.



Whilst assembling/mounting and, next, operating the sensors as represented in this Operation Manual, the following rules should always be applied:

- The sensors should be mounted in locations to which access is easy and quick in order to facilitate the service and maintenance of the sensors;
- When measuring high temperatures, the sensors, especially the long ones, should be mounted in a vertical positions. If the configuration of site makes it impossible to vertically position a sensor, it is advisable to use adequate supporting elements for sheaths to protect them against their being bent under their own weight/mass;
- Should a sensor with ceramic sheath be mounted on an object in operation, such a sensor must be slowly/gradually inserted into a measuring socket in order to avoid that the sensor's sheath becomes rapidly heated and, in consequence thereof, gets broken;
- For the purpose of eliminating a measurement error resulting from a temperature distribution, it is recommended to apply longer sensors since the ratio between the length of sheath immersed in a medium and the total length of the sensor is more favourable for longer sensors; it is also useful to thermally insulate those sections of sheaths, which protrude beyond the place being measured;
- When using the sensors as described in this Operation Manual, it is recommended:
    - to check resistance of the connection line **(it should not be lower than 3M W)**;
    - check whether or not the clamps in the terminal block are properly tightened;
    - if a sensor works within its upper temperature measurement range, the compliance of the sensor's characteristics must be checked and verified **at least once a year** , but it is better to check this compliance more frequently.