

Patented quality product (patent no. DE 10 2012 017 500.0 and DE 10 2015 015 941 B4)

Calibratable temperature measuring transducer **THERMASGARD® TM 43 / TM 65**, with eight switchable measuring ranges (max. $-20...+150\text{ }^{\circ}\text{C}$ / $-4...+302\text{ }^{\circ}\text{F}$), active output, straight protective tube, housing made from impact-resistant plastic with snap-on lid (IP54) / with quick-locking screws (IP67), optionally with/without display. The standard display can be changed from SI [$^{\circ}\text{C}$] to imperial [$^{\circ}\text{F}$] units via DIP switch.

The measuring transducer converts the measured variables into a standard signal of 0-10 V or 4...20 mA.

The unit with **Automatic Output Switching** (AOS) detects the required output type and automatically switches to U or I output.

Alternatively, a **type version** (2-wire) with 2-wire connection and I output is available.

For the detection of temperatures in liquid or gaseous media. For aggressive media, stainless steel immersion sleeves must be used.

It is used e.g. in piping systems, in heating technology, in storage tanks, in district heating compact stations, in hot-water and cold-water systems, in oil and lubricant circulation systems, in mechanical, apparatus and plant engineering as well as in the entire industrial sector.

The sensor is factory-calibrated; an environmental precision adjustment by an expert is possible.

TECHNICAL DATA

TMxx - I	
Power supply:	15...36V DC, depending on working resistance, residual ripple stabilised $\pm 0.3\text{ V}$
Working resistance:	R_L (ohm) = $(U_L - 14\text{ V}) / 0.02\text{ A}$
Connection type:	2-wire connection
Output:	4...20 mA
TMxx - A (AOS)	
Power supply:	24 V AC / DC ($\pm 10\%$)
Load resistance:	$R_L = 25...450\text{ Ohm}$ with AOS I variant $R_L > 15\text{ kOhm}$ with AOS U variant
Connection type:	3-wire connection
Output:	automatic 0-10 V / 4...20 mA (via Automatic Output Switching – the unit detects the required output type and automatically switches to U or I output)

GENERAL	
Power consumption:	< 1.0 VA / 24 V DC; < 2.2 VA / 24 V AC
System of units:	SI (default) or Imperial (switchable via DIP switch)
Data points:	temperature [$^{\circ}\text{C}$] [$^{\circ}\text{F}$]
Measuring ranges:	multi-range switching with 8 switchable measuring ranges , see table (other ranges optional) with manual zero point correction ($\pm 10\text{ K}$)
Sensor:	Pt1000, DIN EN 60751, class B (Perfect Sensor Protection)
Deviation, temperature:	typically $\pm 0.2\text{ K}$ at $+25\text{ }^{\circ}\text{C}$ / $\pm 0.4\text{ }^{\circ}\text{F}$ at $+77\text{ }^{\circ}\text{F}$
Protective tube:	stainless steel, V4A (1.4571), $\varnothing = 6\text{ mm} / 0.24\text{ in}$, inserted length (EL) = 50-400 mm / 2-16 in (see table)
Housing:	plastic, UV-resistant, material polyamide, 30% glass-globe reinforced, colour traffic white (similar to RAL 9016), housing cover for display is transparent! TM 43 with snap-on lid TM 65 with quick-locking screws (slotted / Phillips head combination)
Housing dimension:	72 x 64 x 37.8 mm / 2.83 x 2.52 x 1.49 in (Tyr1 without display) 72 x 64 x 43.3 mm / 2.83 x 2.52 x 1.70 in (Tyr1 with display)
Cable connection:	cable gland , plastic (M 16 x 1.5; with strain relief, exchangeable, max. inner diameter 10.4 mm / 0.41 in) or M12 connector according to DIN EN 61076-2-101 (optional on request)
Electrical connection:	0.14 - 1.5 mm ² / 24-16 AWG, via terminal screws
Ambient temperature:	measuring transducer $-30...+70\text{ }^{\circ}\text{C}$ / $-22...+158\text{ }^{\circ}\text{F}$
Humidity:	< 95% RH, non-precipitating air
Protection class:	III (according to EN 60730)
Protection type:	TM 43 IP54 (according to EN 60529)* Housing tested, TÜV SÜD, Report No. 713160960A (Tyr01) TM 65 IP67 (according to EN 60529)* Housing tested, TÜV SÜD, Report No. 713139052 (Tyr1) *Housing in the built-in state
Standards:	CE conformity, electromagnetic compatibility according to EN 61326, according to EMC directive 2014 / 30 / EU
Optional:	two-line display with illumination , cutout approx. 36 x 15 mm / 1.4 x 0.6 in (W x H), for displaying the ACTUAL temperature and the internal diagnostics (sensor breakage, sensor short circuit)

ACCESSORIES	
MF-15-K	Mounting flange , plastic, 56.8 x 84.3 mm, $\varnothing = 15.2\text{ mm}$ tube gland, $T_{\text{max}} = +100\text{ }^{\circ}\text{C}$
TH08-ms/xx	Immersion sleeve, brass, nickel-plated / galvanised , $\varnothing = 8\text{ mm}$, $T_{\text{max}} = +150\text{ }^{\circ}\text{C}$, $p_{\text{max}} = 10\text{ bar}$
TH08-VA/xx	Immersion sleeve, stainless steel, V4A (1.4571), $\varnothing = 8\text{ mm}$, $T_{\text{max}} = +600\text{ }^{\circ}\text{C}$, $p_{\text{max}} = 40\text{ bar}$
TH08-VA/xx/90	Immersion sleeve, stainless steel, V4A (1.4571), with neck tube (90 mm), $\varnothing = 8\text{ mm}$, $T_{\text{max}} = +600\text{ }^{\circ}\text{C}$, $p_{\text{max}} = 40\text{ bar}$

Measuring ranges [°C] (adjustable)	DIP 1	DIP 2	DIP 3	Measuring ranges [°F] (adjustable)
-20...+150 °C	ON	ON	ON	-4...+302 °F
-50... +50 °C	OFF	ON	ON	-58...+122 °F
-20... +80 °C	ON	OFF	ON	-4...+176 °F
-30... +60 °C	OFF	OFF	ON	-22...+140 °F
0... +40 °C	ON	ON	OFF	32...+104 °F
0... +50 °C (default)	OFF	ON	OFF	32...+122 °F (default)
0...+100 °C	ON	OFF	OFF	32...+212 °F
0...+150 °C	OFF	OFF	OFF	32...+302 °F

Readout in the display (switchable)	DIP 4
Imperial	[°F] ON
SI (default)	[°C] OFF

Readout in the display
Temperature [°C] → [°F]

The display value depends
on the set unit system (DIP4).



TEMPERATURE RANGES:

When selecting measuring transducer ranges,
it is necessary to ensure that the maximum temperatures
permissible for sensor/housing are not exceeded!

Ambient temperature for measuring transducers:
-30...+70 °C / -22...+158 °F

Apparent ohmic resistance = see load resistance diagram

THERMASGARD® TM 43		Basic device with snap-on lid (IP 54), Standard			
THERMASGARD® TM 65		Basic device with quick-locking screws (IP 67), Premium			
Output I variante	Inserted Length (EL) mm = xx	Item No. TM43-I xx	Item No. TM43-I xx LCD	Item No. TM65-I xx	Item No. TM65-I xx LCD
2-wire		IP 54	IP 54 ■	IP 67	IP 67 ■
4...20mA	50 mm / 2 in	1101-7112-0019-900	1101-7112-2019-900	1101-7122-0019-900	1101-7122-2019-900
4...20mA	100 mm / 4 in	1101-7112-0029-900	1101-7112-2029-900	1101-7122-0029-900	1101-7122-2029-900
4...20mA	150 mm / 6 in	1101-7112-0039-900	1101-7112-2039-900	1101-7122-0039-900	1101-7122-2039-900
4...20mA	200 mm / 8 in	1101-7112-0049-900	1101-7112-2049-900	1101-7122-0049-900	1101-7122-2049-900
4...20mA	250 mm / 10 in	1101-7112-0059-900	1101-7112-2059-900	1101-7122-0059-900	1101-7122-2059-900
4...20mA	300 mm / 12 in	1101-7112-0069-900	1101-7112-2069-900	1101-7122-0069-900	1101-7122-2069-900
4...20mA	400 mm / 16 in	-	-	1101-7122-0089-900	1101-7122-2089-900
Output AOS variante	Inserted Length (EL) mm = xx	Item No. TM43-A xx	Item No. TM43-A xx LCD	Item No. TM65-A xx	Item No. TM65-A xx LCD
3-wire		IP 54	IP 54 ■	IP 67	IP 67 ■
0-10V / 4...20mA	50 mm / 2 in	1101-711E-0019-900	1101-711E-2019-900	1101-712E-0019-900	1101-712E-2019-900
0-10V / 4...20mA	100 mm / 4 in	1101-711E-0029-900	1101-711E-2029-900	1101-712E-0029-900	1101-712E-2029-900
0-10V / 4...20mA	150 mm / 6 in	1101-711E-0039-900	1101-711E-2039-900	1101-712E-0039-900	1101-712E-2039-900
0-10V / 4...20mA	200 mm / 8 in	1101-711E-0049-900	1101-711E-2049-900	1101-712E-0049-900	1101-712E-2049-900
0-10V / 4...20mA	250 mm / 10 in	1101-711E-0059-900	1101-711E-2059-900	1101-712E-0059-900	1101-712E-2059-900
0-10V / 4...20mA	300 mm / 12 in	1101-711E-0069-900	1101-711E-2069-900	1101-712E-0069-900	1101-712E-2069-900
0-10V / 4...20mA	400 mm / 16 in	-	-	1101-712E-0089-900	1101-712E-2089-900
Automatic Output Switching:	Patented analogue interface (patent no. DE 10 2015 015 941 B4) Device automatically detects the required output type 0-10V or 4...20mA.				
Extra charge:	Other ranges optional Cable connection with M12 connector according to DIN EN 61076-2-101 on request				

MR: 0...+100°C
MR: +32...+212°F

°C	U _A [V]	I _A [mA]	°F
0	0.0	4.0	32
5	0.5	4.8	41
10	1.0	5.6	50
15	1.5	6.4	59
20	2.0	7.2	68
25	2.5	8.0	77
30	3.0	8.8	86
35	3.5	9.6	95
40	4.0	10.4	104
45	4.5	11.2	113
50	5.0	12.0	122
55	5.5	12.8	131
60	6.0	13.6	140
65	6.5	14.4	149
70	7.0	15.2	158
75	7.5	16.0	167
80	8.0	16.8	176
85	8.5	17.6	185
90	9.0	18.4	194
95	9.5	19.2	203
100	10.0	20.0	212

MR: -20...+80°C
MR: -4...+176°F

°C	U _A [V]	I _A [mA]	°F
-20	0.0	4.0	-4
-15	0.5	4.8	5
-10	1.0	5.6	14
-5	1.5	6.4	23
0	2.0	7.2	32
5	2.5	8.0	41
10	3.0	8.8	50
15	3.5	9.6	59
20	4.0	10.4	68
25	4.5	11.2	77
30	5.0	12.0	86
35	5.5	12.8	95
40	6.0	13.6	104
45	6.5	14.4	113
50	7.0	15.2	122
55	7.5	16.0	131
60	8.0	16.8	140
65	8.5	17.6	149
70	9.0	18.4	158
75	9.5	19.2	167
80	10.0	20.0	176

MR: 0...+50°C
MR: +32...+122°F

°C	U _A [V]	I _A [mA]	°F
0	0.0	4.0	32
5	1.0	5.6	41
10	2.0	7.2	50
15	3.0	8.8	59
20	4.0	10.4	68
25	5.0	12.0	77
30	6.0	13.6	86
35	7.0	15.2	95
40	8.0	16.8	104
45	9.0	18.4	113
50	10.0	20.0	122

MR: 0...+40°C
MR: +32...+104°F

°C	U _A [V]	I _A [mA]	°F
0	0.0	4.0	32
5	1.3	6.0	41
10	2.0	8.0	50
15	3.8	10.0	59
20	5.0	12.0	68
25	6.3	14.0	77
30	7.5	16.0	86
35	8.8	18.0	95
40	10.0	20.0	104

MR: -20...+150°C
MR: -4...+302°F

°C	U _A [V]	I _A [mA]	°F
-20	0.0	4.0	-4
-15	0.3	4.5	5
-10	0.6	4.9	14
-5	0.9	5.4	23
0	1.2	5.9	32
5	1.5	6.4	41
10	1.8	6.8	50
15	2.1	7.3	59
20	2.4	7.8	68
25	2.6	8.2	77
30	2.9	8.7	86
35	3.2	9.2	95
40	3.5	9.6	104
45	3.8	10.1	113
50	4.1	10.6	122
55	4.4	11.1	131
60	4.7	11.5	140
65	5.0	12.0	149
70	5.3	12.5	158
75	5.6	12.9	167
80	5.9	13.4	176
85	6.2	13.9	185
90	6.5	14.4	194
95	6.8	14.8	203
100	7.1	15.3	212
105	7.4	15.8	221
110	7.6	16.2	230
115	7.9	16.7	239
120	8.2	17.2	248
125	8.5	17.6	257
130	8.8	18.1	266
135	9.1	18.6	275
140	9.4	19.1	284
145	9.7	19.5	293
150	10.0	20.0	302

MR: -50...+50°C
MR: -58...+122°F

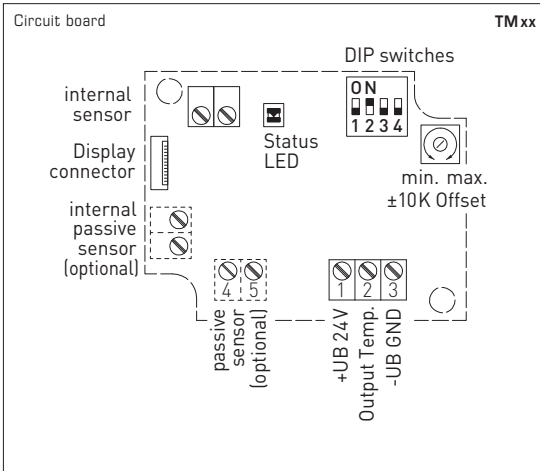
°C	U _A [V]	I _A [mA]	°F
-50	0.0	4.0	-58
-45	0.5	4.8	-49
-40	1.0	5.6	-40
-35	1.5	6.4	-31
-30	2.0	7.2	-22
-25	2.5	8.0	-13
-20	3.0	8.8	-4
-15	3.5	9.6	5
-10	4.0	10.4	14
-5	4.5	11.2	23
0	5.0	12.0	32
5	5.5	12.8	41
10	6.0	13.6	50
15	6.5	14.4	59
20	7.0	15.2	68
25	7.5	16.0	77
30	8.0	16.8	86
35	8.5	17.6	95
40	9.0	18.4	104
45	9.5	19.2	113
50	10.0	20.0	122

MR: -30...+60°C
MR: -22...+140°F

°C	U _A [V]	I _A [mA]	°F
-30	0.0	4.0	-22
-25	0.6	4.9	-13
-20	1.1	5.8	-4
-15	1.7	6.7	5
-10	2.2	7.6	14
-5	2.8	8.4	23
0	3.3	9.3	32
5	3.9	10.2	41
10	4.4	11.1	50
15	5.0	12.0	59
20	5.6	12.9	68
25	6.1	13.8	77
30	6.7	14.7	86
35	7.2	15.6	95
40	7.8	16.4	104
45	8.3	17.3	113
50	8.9	18.2	122
55	9.4	19.1	131
60	10.0	20.0	140

MR: 0...+150°C
MR: +32...+302°F

°C	U _A [V]	I _A [mA]	°F
0	0.0	4.0	32
5	0.3	4.5	41
10	0.7	5.1	50
15	1.0	5.6	59
20	1.3	6.1	68
25	1.7	6.7	77
30	2.0	7.2	86
35	2.3	7.7	95
40	2.7	8.3	104
45	3.0	8.8	113
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55	3.7	9.9	131
60	4.0	10.4	140
65	4.3	10.9	149
70	4.7	11.5	158
75	5.0	12.0	167
80	5.3	12.5	176
85	5.7	13.1	185
90	6.0	13.6	194
95	6.3	14.1	203
100	6.7	14.7	212
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110	7.3	15.7	230
115	7.7	16.3	239
120	8.0	16.8	248
125	8.3	17.3	257
130	8.7	17.9	266
135	9.0	18.4	275
140	9.3	18.9	284
145	9.7	19.5	293
150	10.0	20.0	302



Display and internal diagnostics

THERMAGGARD®
Measuring transducer with display

The display shows four different states:

- 22.0 °C: Temperature (°C)
- 76.6 °F: Temperature (°F)
- 9999 °C Err 1: Sensor breakage
- 999 °C Err 2: Sensor short circuit

Automatic Output Switching

Patented analogue interface for automated output switching (Patent no. DE 10 2015 015 941 B4)

Switching on the AOS unit will automatically analyse the network connected to the outputs and set the relevant output type U or I. Outputs that are not connected are detected as voltage outputs.

Network resistance > 15 kOhm => U output 0-10 V
 Network resistance < 450 Ohm => I output 4...20 mA

The following applies to units with AOS multiple output:
 if one of the outputs is detected as a current output,
 all outputs are configured together as output type I.
 Combined operation as current and voltage output is not possible.

The status LED indicates the detected output type.

Readout in the display

Standard display

As standard, the first line indicates the actual temperature at the unit. The value indicated depends on the system of units set (DIP 4).

°CSI (default)
 °FImperial

Internal diagnostics

Sensor breakage or sensor short circuit are detected by the unit and indicated in the display.

Err 1.....Sensor breakage
Err 2.....Sensor short circuit

Status LED

The status LED on the PCB shows the current operating mode of the unit:

TMxx - A (AOS)

redblinking.....unit switching on
green.....steady light ...U output 0-10 V
orange.....steady light ...I output 4...20 mA

TMxx - I (2-wire I)

yellowblinking.....unit switching on
yellowsteady light ...I output 4...20 mA

Offset potentiometer

A potentiometer on the PCB is used to adjust the offset manually. When the system is delivered, the potentiometer is in centre position and lacquer-sealed.

Range of adjustment: approx. $\pm 10 K$

2-wire connection* **TMxx - I**

1	+UB 24V DC
2	Output Temp. 4...20mA
3	-UB GND (optional for backlighting)

* 2-wire connection for devices with / without display (not illuminated)

3-wire connection for devices with illuminated display

3-wire connection (AOS)* **TMxx - A**

1	+UB 24V AC/DC
2	Output Temp. 0-10V / 4...20mA
3	-UB GND

* 3-wire connection for devices with Automatic Output Switching

Pin assignment (M12) **TMxx - I**

- 1 +UB 24V DC
- 2 Output Temperature 4...20mA
- 3 free
- 4 -UB GND (optional for LCD backlighting)
- 5 Shield

Pin assignment (M12) **TMxx - A**

- 1 +UB 24V AC/DC
- 2 Output Temperature 0-10V / 4...20mA
- 3 free
- 4 -UB GND
- 5 Shield

Schematic diagram **TMxx - I**

+UB 24V DC

Output 4...20 mA

(optional for LCD backlighting)

-UB AC/DC GND

PLC Working resistance

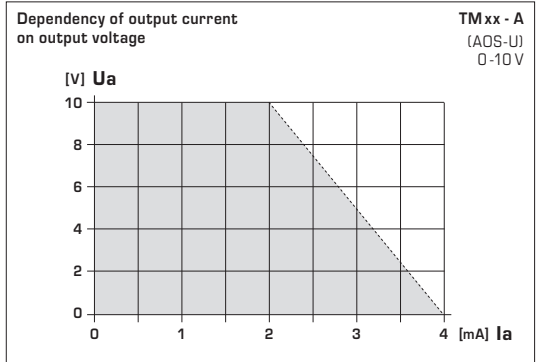
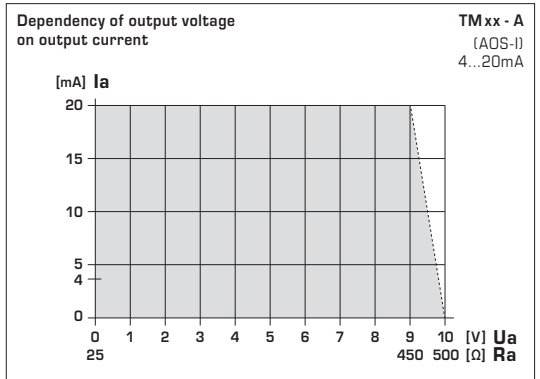
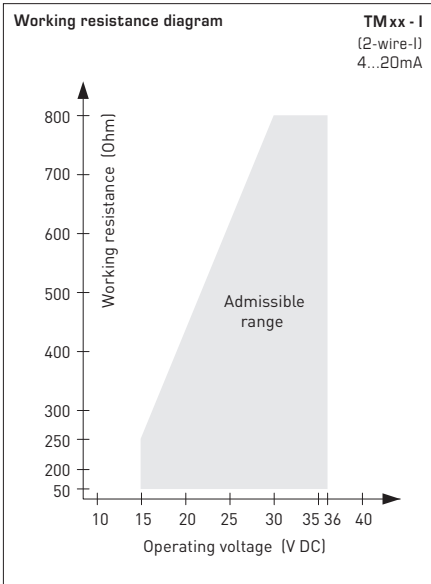
Schematic diagram **TMxx - A**

+UB 24V AC/DC

Output 4...20 mA / 0-10V

-UB AC/DC GND

PLC PC



SUPPLY VOLTAGE

For operating voltage reverse polarity protection, a one-way rectifier or reverse polarity protection diode is integrated in this device variant. This internal one-way rectifier also allows operating 0-10V devices on AC supply voltage.

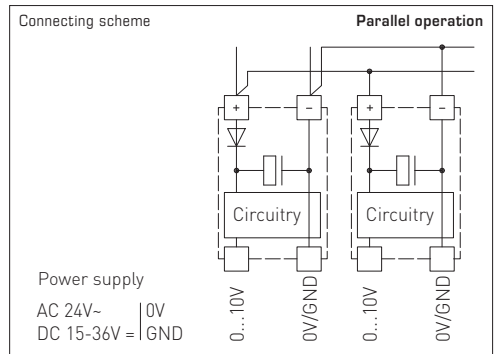
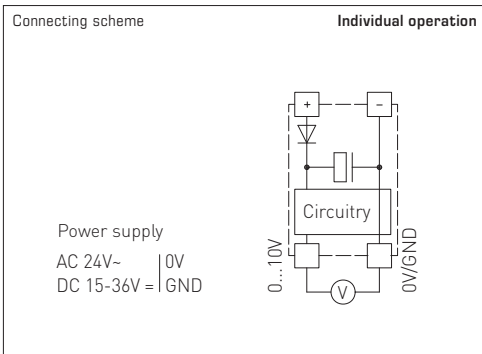
The output signal is to be tapped by a measuring instrument. Output voltage is measured here against zero potential (0V) of the input voltage!

When this device is operated on **DC supply voltage**, the operating voltage input UB+ is to be used for 15...36V DC supply and UB- or GND for ground wire!

When several devices are supplied by one 24V **AC voltage supply**, it is to be ensured that all "positive" operating voltage input terminals (+) of the field devices are connected with each other and all "negative" operating voltage input terminals (-) (= reference potential) are connected together (in-phase connection of field devices). All outputs of field devices must be referenced to the same potential!

In case of reversed polarity at one field device, a supply voltage short-circuit would be caused by that device. The consequential short-circuit current flowing through this field device may cause damage to it.

Therefore, pay attention to correct wiring!



Devices are to be connected under dead-voltage condition. Devices must only be connected to safety extra-low voltage. Consequential damages caused by a fault in this device are excluded from warranty or liability. These devices must be installed and commissioned by authorised specialists. The technical data and connecting conditions shown on the device labels and in the mounting and operating instructions delivered together with the device are exclusively valid. Deviations from the catalogue representation are not explicitly mentioned and are possible in terms of technical progress and continuous improvement of our products. In case of any modifications made by the user, all warranty claims are forfeited. Operating this device close to other devices that do not comply with EMC directives may influence functionality. This device must not be used for monitoring applications, which serve the purpose of protecting persons against hazards or injury, or as an EMERGENCY STOP switch for systems or machinery, or for any other similar safety-relevant purposes. Dimensions of housing or housing accessories may show slight tolerances on the specifications provided in these instructions. Modifications of these records are not permitted. In case of a complaint, only complete devices returned in original packing will be accepted.

These instructions must be read before installation and commissioning and all notes provided therein are to be regarded!

Our "General Terms and Conditions for Business" together with the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry" (ZVEI conditions) including supplementary clause "Extended Retention of Title" apply as the exclusive terms and conditions.

Notes regarding mechanical mounting and attachment:

Mounting shall take place while observing all relevant regulations and standards applicable for the place of measurement (e.g. such as welding instructions, etc.). Particularly the following shall be regarded:

- VDE /VDI directive technical temperature measurements, measurement set-up for temperature measurements.
- The EMC directives must be adhered to.
- It is imperative to avoid parallel laying of current-carrying lines.
- We recommend to use shielded cables with the shielding being attached at one side to the DDC /PLC.
- If the sensor is used in refrigeration circuits, it must be insulated together with the housing to reduce the temperature potential between the device and the medium to a minimum and thus prevent condensation damage.

Permissible approach velocities [flow rates] for crosswise approached protective tubes in water.

The approaching flow causes protective tube to vibrate. If specified approach velocity is exceeded even by a marginal amount, a negative impact on the protective tube's service life may result (material fatigue). Discharge of gases and pressure surges must be avoided as they have a negative influence on the service life and may damage the protective tubes irreparably.

Please observe maximum permissible approach velocities

for stainless steel protective tubes 8x0.75 mm (1.4571) (see graph TH08-VA/xx, TH08-VA/xx/90) as well as for brass protective tubes 8x0.75 mm (see graph TH08-ms/xx):

Before mounting, make sure that the existing thermometer's technical parameters comply with the actual conditions at the place of utilization, in particular in respect of:

- Measuring range
- Permissible maximum pressure, flow velocity
- Installation length, tube dimensions
- Oscillations, vibrations, shocks are to be avoided (< 0.5 g)

Attention! In any case, please observe the mechanical and thermal load limits of protective tubes according to DIN 43763 respectively according to specific S+S standards!

Notes regarding process connection of built-in sensors:

If possible, select material of protective tube to match the material of piping or tank wall, in which the thermometer will be installed!

Maximum temperatures T_{max} and maximum pressures p_{max} are as follows: for TH-MS brass sleeves $T_{max} = +150\text{ }^{\circ}\text{C}$, $p_{max} = 10\text{ bar}$ and for TH-VA stainless steel sleeves (standard) $T_{max} = +400\text{ }^{\circ}\text{C}$, $p_{max} = 40\text{ bar}$.

Screw-in threads:

Ensure appropriate support of the gasket or sealing material when mounting! Permissible tightening torque standard values for screw-in threads, are as follows:

- M 18 x 1.5; M 20 x 1.5; pipe thread G 1/2" : 50 Nm
- M 27 x 2.0; pipe thread G 3/4" : 100 Nm

Flange mounting:

In case of flange mounting, screws in the flange part must be equally tightened. The lateral pressure screw must clamp securely, otherwise the feeler shaft might slip through.

Welding sleeves:

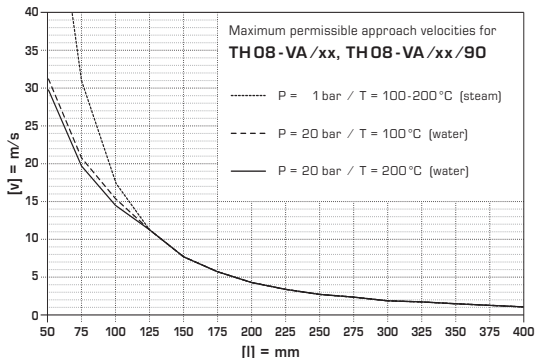
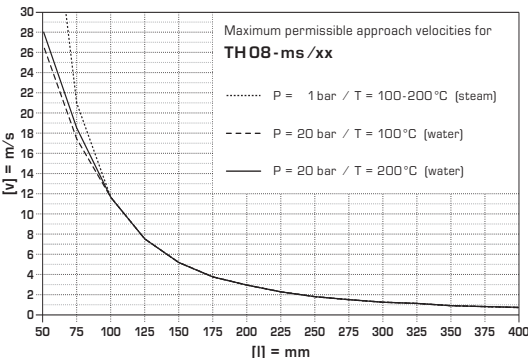
Specific welding instructions shall be observed. On principle, unevenness or the like that might influence the system's "CIP ability" must not develop at welds.

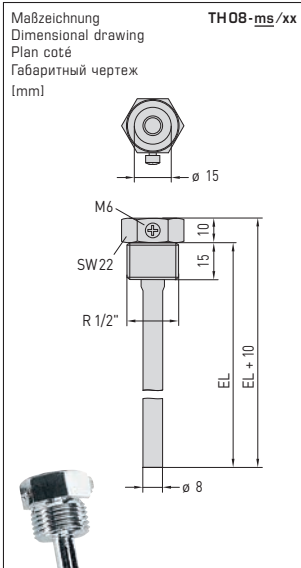
For high-pressure lines, pressure test certifications and inspections are required.

Notes on commissioning:

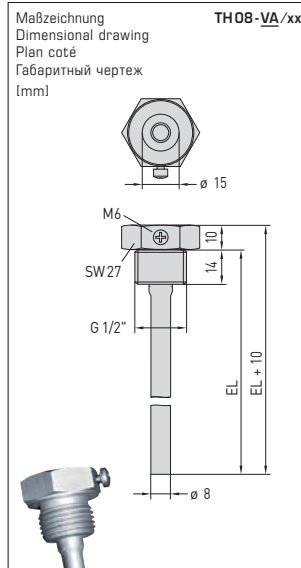
This device was calibrated, adjusted and tested under standardised conditions. When operating under deviating conditions, we recommend performing an initial manual adjustment on-site during commissioning and subsequently at regular intervals.

Commissioning is mandatory and may only be performed by qualified personnel!

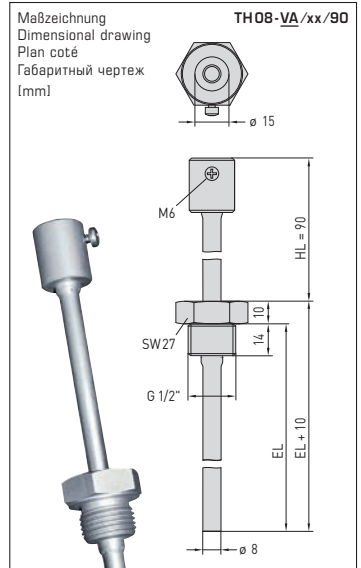




TH08-ms/xx
Tauchhülse aus Messing
vernickelt / verzinkt
Immersion sleeve, brass,
nickel-plated / galvanised
doigt de gant en
laiton nickelé / galvanisé
Гильза погружная
из латуни / оцинкованная



TH08-VA/xx
Edelstahltauchhülse
Stainless steel
immersion sleeve
doigt de gant
en acier inox
Гильза погружная
из высококачественной
стали



TH08/xx/90
Edelstahltauchhülse
mit Halsrohr
Stainless steel
immersion sleeve
with neck tube
doigt de gant
en acier inox avec
tube prolongateur
Гильза погружная
из высококачественной
стали с горловиной

