

Product Information TSM FOOD

Temperature Sensor Mini



Application/Specified usage

- Temperature sensor in mini housing for food applications
- Aseptic temperature process connections without product contact for inline, precise and fast measurement. Prefabricated thermowells and build-in systems avoid opening process.
- Demounting the sensor without opening the process and without electrical disconnection avoid downtime of the equipment at calibration and maintenance

Application examples

- Monitoring of CIP-/SIP-process
- Safe temperature measurement in hot steam and pressurized pipes
- Measurement in vessels with agitators with front flush version
- Temperature monitoring in vessels or pipes

Hygienic design/Process connection

- Hygienic process connection with CLEANadapt or FLEXadapt
- All wetted materials are FDA-conform
- Sensor completely made of stainless steel or stainless steel and PEEK
- Complete overview of process connections: see order code
- The Anderson-Negele CLEANadapt and FLEXadapt system offers a flow-optimized, hygienic and easily sterilizable installation solution for sensors.

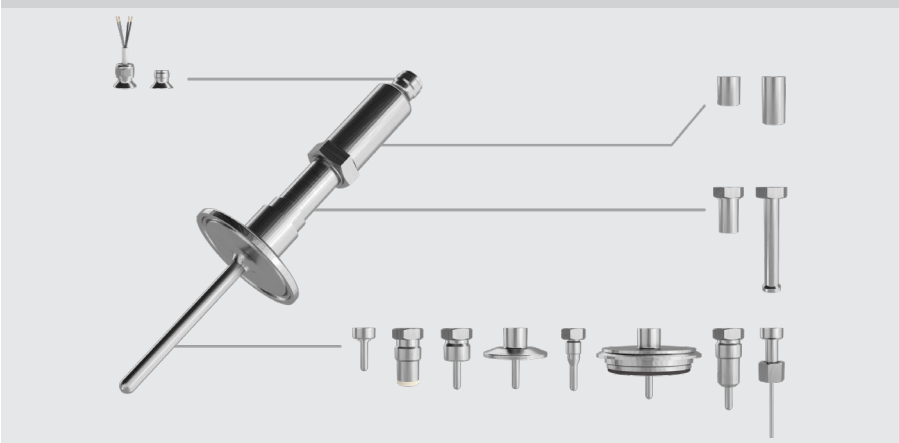
Features/Advantages

- High accuracy and high ambient temperature resistance
- Customer offset and slope adjustment
- Flex hybrid mode with digital IO-Link and analog 4...20 mA
- Process temperature range -50...+250 °C / -58...+482 °F

Options/Accessories

- 2x RTD
- Front flush mounting
- Integrated transmitter
- Programmable transmitters TTM.H and TTM.I using IO-Link
- Different RTDs (Pt100, Pt1000) and classes of accuracy (A, AA, AAA)
- Fast response sensor tip \varnothing 3 mm / 0.12 in
- Spacers for high process temperature up to 250 °C / 482 °F
- Extended temperature range (-200...400 °C / -328...752 °F)
- Pre-assembled connecting cable for M12 plug
- Hardwired cable in customer length and other material available

Modular design



Communication



Temperature sensor TSM with Tri-Clamp



Temperature sensor TSM for FLEXadapt ESF System



Temperature sensor		
Process connection	CLEANadapt FLEXadapt ESF G3/8" Sensor G3/8" Tri-Clamp Varivent Thread Plain rod	M12, G1/2", G1/2"-P, G1/2"-SP Sensor with cap nut, sensor tip \varnothing 3mm Sensor with cap nut, sensor tip \varnothing 4mm 1/2", 3/4", DN10, 1", 1½", 2", 2½", 3" (DIN 32676) DN10/15 (type B), DN25 (type F), DN40/50 (type N) G1/4", G1/2" (DIN ISO 228)
Tightening torque	CLEANadapt M12, G1/2"-P, G1/2"-SP CLEANadapt G1/2"	10 Nm 20 Nm
Dimensions	insertion length probe diameter sensor tip diameter	0...2000 mm / 0...78.74 in 3, 4, 6, 8, 10, 12 mm / 0.12, 0.16, 0.24, 0.31, 0.39, 0.47 in 3, 4, 6 mm / 0.12, 0.16, 0.24 in, see dimensional drawings
Materials	connecting head, spacer wetted parts CLEANadapt G1/2"-P, G1/2"-SP	stainless steel 1.4301 (AISI 304) stainless steel 1.4404 (AISI 316L) PEEK, FDA 21 CFR 177.2415
Operating pressure	CLEANadapt CLEANadapt G1/2"-P, G1/2"-SP	50 bar maximum 10 bar maximum
Process temperature	standard range extended range	-50...+250 °C / -58...482 °F -200...+400 °C / -328...752 °F
Resistance Temperature Detector (RTD)	accuracy classes	Class A: $\pm(0.15 + 0.002 \times t)$ °C Class AA / 1/3 DIN B: $\pm(0.1 + 0.0017 \times t)$ °C Class AAA / 1/10 DIN B: $\pm(0.03 + 0.005 \times t)$ °C
Electrical connection	plug connection hardwired cable hardwired cable	M12 plug 1.4301 (AISI 304) PVC LIYY 4 x 0.25 mm ² / AWG 23 (perm. process temp. \leq 90 °C) PTFE 4 x 0.14 mm ² / AWG 26 (perm. process temp. \leq 250 °C)
Protection class		IP 69 K (with electrical connection M12 plug)

Transmitter TTM.I, TTM.H		
Temperature ranges	ambient storage	-40...+85 °C / -40...185 °F -55...+90 °C / -67...194 °F
Measuring ranges		standard °C: -10...40, 0...50 / 100 / 150 / 200 °C standard °F: 0...100, 0...150, 0...200, 30...230, 0...250 °F custom ranges programable
Accuracy	input repeatability	\leq 0.1 K (at ambient \leq 85 °C / 185 °F) \leq 0.05 K
Temperature drift	typical maximum	5 mK/K (at 25 °C / 77 °F) 10 mK/K (at 25 °C / 77 °F)
Adjustments	damping offset slope	0...120 s \leq \pm 10 K \leq \pm 25 %
Digital output	IO-Link digital resolution master cycle time power supply	v1.1 0.01 K \leq 51.2 ms 18...30 V DC according to IO-Link
Analog output (TTM.H only)	signal accuracy temperature drift typical temperature drift max effect of supply voltage variations maximum load resistance power supply	4...20 mA, 2 wire \leq 0.05 % of upper range limit 0.0005 %/K (at 25 °C / 77 °F) 0.003 %/K (at 25 °C / 77 °F) < 0.001 %/V (at 24 V DC) $R \leq (V_{DC} - 12 V) : 0.024 A$ (at 25 °C / 77 °F), see diagram 12...30 V DC

Accuracy classes of temperature sensors | Tolerances for Pt100 acc. to DIN EN 60751

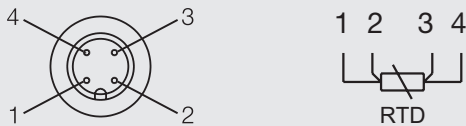
Pt100	Class A	Class AA / 1/3 DIN B	Class AAA / 1/10 DIN B
0 °C / 100 Ω	±0.15 K / ±0.06 Ω	±0.10 K / ±0.04 Ω	±0.03 K / ±0.01 Ω
100 °C / 138.5 Ω	±0.35 K / ±0.13 Ω	±0.27 K / ±0.10 Ω	±0.08 K / ±0.03 Ω

Accuracy classes of temperature sensors | Tolerances for Pt1000 acc. to DIN EN 60751

Pt1000	Class A	Class AA / 1/3 DIN B	Class AAA / 1/10 DIN B
0 °C / 1000 Ω	±0.15 K / ±0.6 Ω	±0.10 K / ±0.4 Ω	±0.03 K / ±0.1 Ω
100 °C / 1385.1 Ω	±0.35 K / ±1.3 Ω	±0.27 K / ±1.0 Ω	±0.08 K / ±0.3 Ω

Electrical connection without transmitter

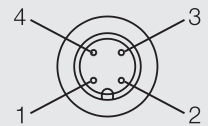
1x RTD with M12 plug



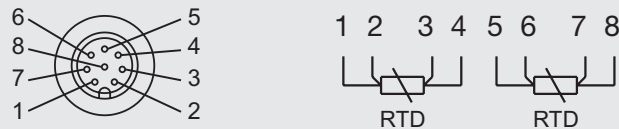
Electrical connection with transmitter

1x RTD with M12 plug for analog operation

- 1: + power supply
- 2: - power supply 4...20 mA
- 3: not connected
- 4: not connected

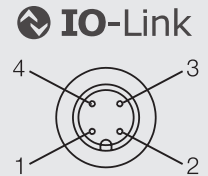


2x RTD with M12 plug



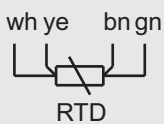
1x RTD with M12 plug for IO-Link operation

- 1: + power supply 24 V DC
- 2: not connected
- 3: - power supply
- 4: IO-Link

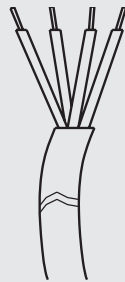
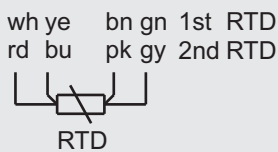


Hardwired cable | PVC (LIYY)

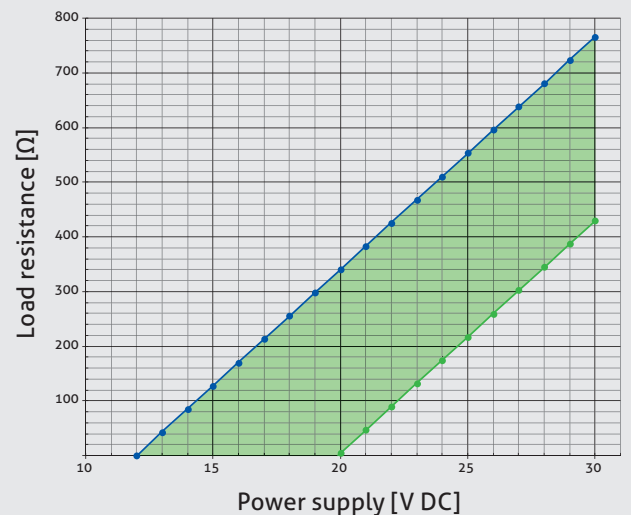
1x RTD



2x RTD



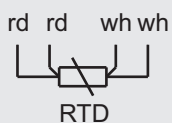
Load resistance diagram at ambient temperature 85 °C



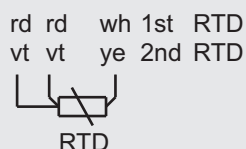
- R_{max}
- R_{min} (85 °C / 185 °F ambient temperature)

Hardwired cable | PTFE

1x RTD



2x RTD





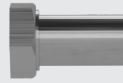
Modular design



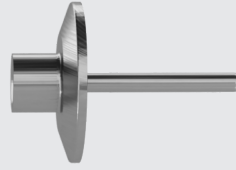
Electrical connection



Head



Spacer extension



Process connection

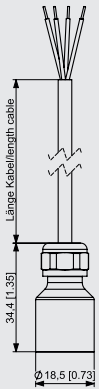
Electrical connection | Head



Spacer extension

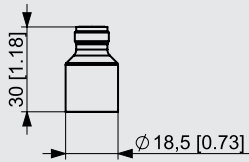


Hardwired cable

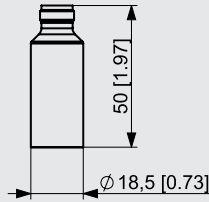


M12 plug 4 pins / 8 pins without transmitter

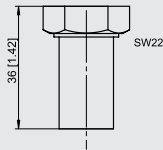
1x RTD: 4 pins
2x RTD: 8 pins



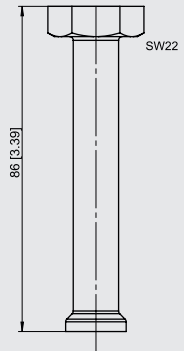
M12 plug 4 pins with transmitter



Short



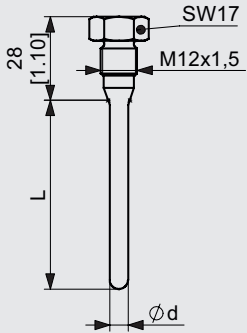
Long



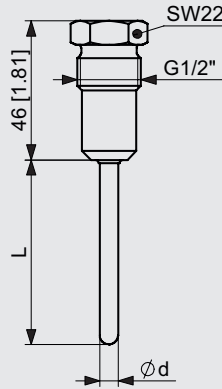
Process connection



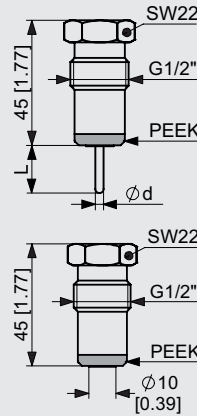
C01 | CLEANadapt M12



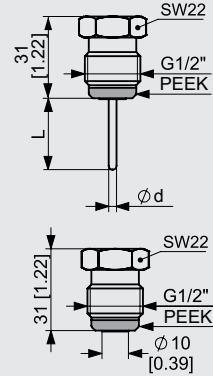
C02 | CLEANadapt G1/2"



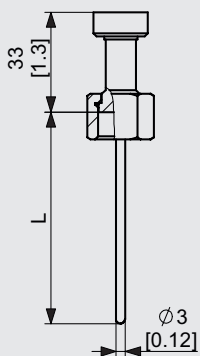
C03 | CLEANadapt G1/2"-P



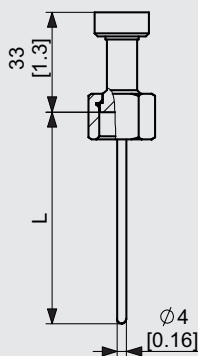
C04 | CLEANadapt G1/2"-SP



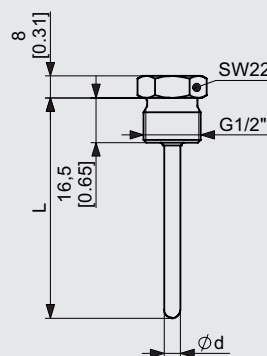
M02 | FLEXadapt G3/8" cap nut, Ø 3 mm



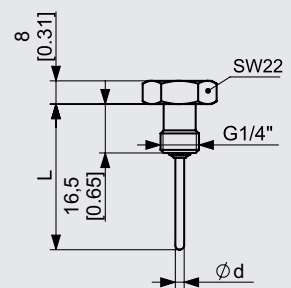
M03 | Sensor G3/8" cap nut, Ø 4 mm

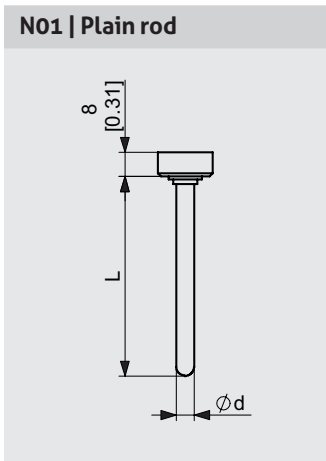
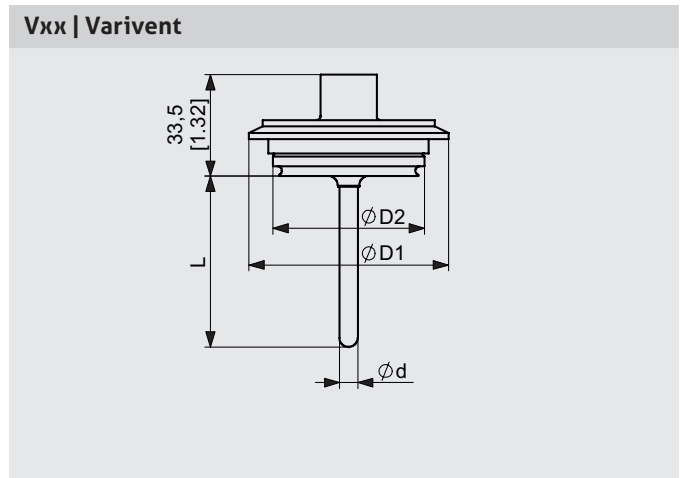
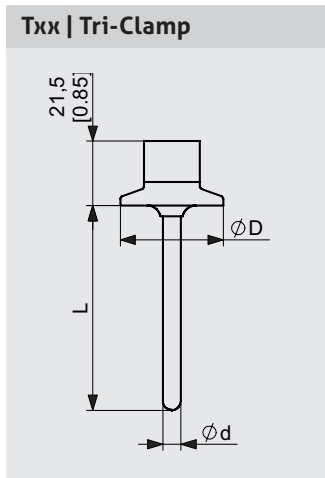
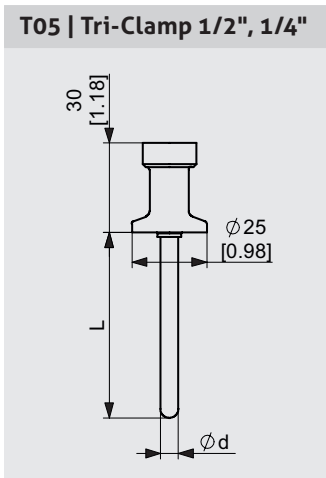
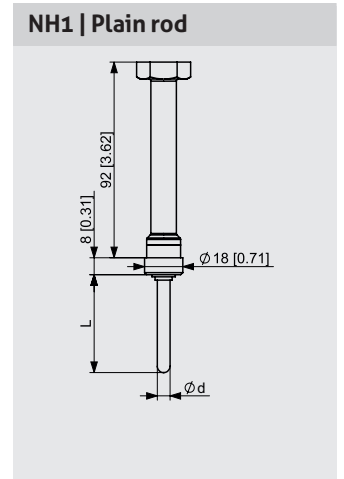
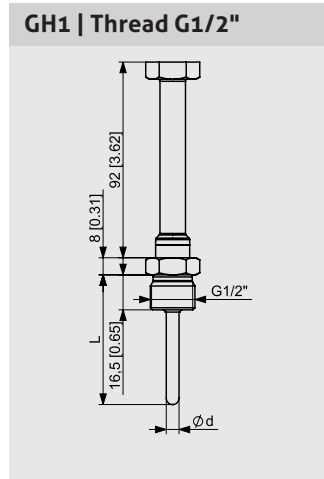
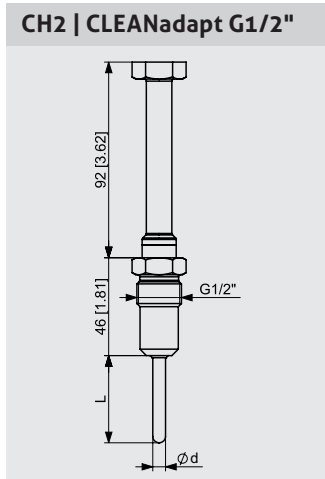
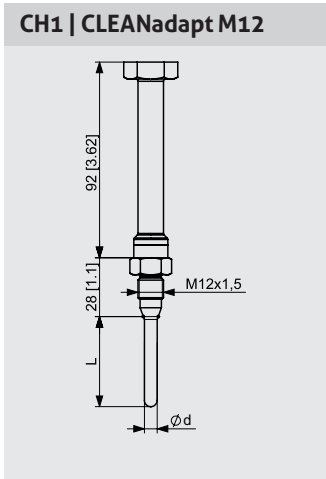


G01 | Thread G1/2"



G02 | Thread G1/4"





Tri-Clamp size

Type	Ø D [mm / inch]
T10	34.0 / 1.34
TC1	50.5 / 1.99
TC2	64.0 / 2.52
T25	77.5 / 3.05
TC3	91.0 / 3.58

Dimensions table Varivent

Type	Varivent Type	D1 [mm / inch]	D2 [mm / inch]
V10	B	52.7 / 2.09	31.0 / 1.22
V25	F	66.0 / 2.60	50.0 / 1.97
V40	N	84.0 / 3.31	68.0 / 2.68

Sensor tip diameter and response time

All temperature sensors are available with smaller sensor tips, to ensure a shorter response time. The mentioned times were measured by emerging a temperature sensor from room temperature into boiling water.

Without reduction
D: all diameters

Ø 6 mm
 $t_{50} \leq 1.8 \text{ s}$
 $t_{90} \leq 5.2 \text{ s}$
D: 8, 10, 12 mm

Ø 4 mm
 $t_{50} \leq 1.2 \text{ s}$
 $t_{90} \leq 3.5 \text{ s}$
D: 6, 8, 10 mm

Ø 3 mm
 $t_{50} \leq 0.8 \text{ s}$
 $t_{90} \leq 2.2 \text{ s}$
D: 6 mm

frontflush
 $t_{50} \leq 4 \text{ s}$
 $t_{90} \leq 30 \text{ s}$

Mechanical connection/Installation

- Use Negele CLEANadapt or FLEXadapt system for safe operation of measuring point!

Transport/Storage

- Do not store outside
- Store in an area that is dry and dust-free
- Do not expose to corrosive media
- Protect against solar radiation
- Avoid mechanical shock and vibration
- Storage temperature -55...+90 °C / -67...194 °F
- Relative humidity max. 98 %

Cleaning/Maintenance

- When using a pressure washer, do not point the nozzle directly at the electrical connections.

Reshipment

- Sensors shall be clean and free of media or heat-conductive paste and must not be contaminated with dangerous media!
- Use suitable transport packaging only to avoid damage of the equipment!

Conventional usage

- Not suitable for applications in explosive areas.
- Not suitable for applications in safety-relevant system parts (SIL).

Standards and guidelines

- Compliance with the applicable regulations and directives is mandatory.

Note on CE

- Applicable directives:
Electromagnetic Compatibility Directive 2014/30/EU
- Compliance with the applicable EU directives is identified by the CE label on the product.
- The operating company is responsible for complying with the guidelines applicable to the entire installation.

Disposal

- Electrical devices should not be disposed of with household trash. They must be recycled in accordance with national laws and regulations.
- Take the device directly to a specialized recycling company and do not use municipal collection points.

Order code

TSMF Temperatur Sensor Mini for Food Applications, material wetted parts 1.4404 (AISI 316L)

Standard temperature range (-50...250 °C / -58...482 °F)

Process connection

T05	Tri-Clamp 1/2" and 3/4"
T10	Tri-Clamp DN10
TC1	Tri-Clamp 1" and 1½"
TC2	Tri-Clamp 2"
T25	Tri-Clamp 2½"
TC3	Tri-Clamp 3"
V10	Varivent type B DN10/15
V25	Varivent type F DN25
V40	Varivent type N DN40/50
C01	CLEANadapt M12
C02	CLEANadapt G1/2"
C03	CLEANadapt G1/2"-P (PEEK)
C04	CLEANadapt G1/2"-SP (short version, PEEK)
N01	Plain rod
G01	Thread G1/2"
G02	Thread G1/4"

Ext. temperature range (-200...400 °C / -328...752 °F)

Process connection

CH1	CLEANadapt M12 (incl. spacer)
CH2	CLEANadapt G1/2" (incl. spacer)
GH1	Thread G1/2" (incl. spacer)
NH1	Plain rod (incl. spacer)

Process connection without media contact

M02	FLEXadapt ESF G3/8" with cap nut, sensor tip ø 3 mm
M03	Sensor G3/8" with cap nut, sensor tip ø 4 mm

Spacer extension

X	Without spacer (perm. process temp. ≤ 100 °C / 212 °F, standard for extended temperatur range)
S	Short spacer (permanent process temperature ≤ 150 °C / 305 °F)
H	Long spacer (permanent process temperature ≤ 250 °C / 482 °F)

RTD type

0	1x Pt100 A, 2-wire (probe length ≤ 250 mm)
1	1x Pt100 AA, 2-wire (probe length ≤ 250 mm)
2	2x Pt100 A, 2-wire (probe length ≤ 250 mm)
3	2x Pt100 AA, 2-wire (probe length ≤ 150 mm)
4	1x Pt100 A, 4-wire (probe length ≥ 50 mm)
5	1x Pt100 AA, 4-wire (probe length ≥ 50 mm)
6	1x Pt100 AAA, 4-wire
7	2x Pt100 A, (3) 4-wire (probe length ≥ 50 mm, 3-wire with sensor tip ø 3 mm)
8	2x Pt100 AA, (3) 4-wire (probe length ≥ 50 mm, 3-wire with sensor tip ø 3 mm)
9	2x Pt100 AAA, 4-wire
A	1x Pt1000 A, 2-wire

Variable probe length [mm]

0...50	In steps of 5 mm
51...250	In steps of 5 mm
251...500	In steps of 10 mm
501...1000	In steps of 50 mm
1001...2000	In steps of 100 mm
intermediate lengths	Not for M02, M03, C03, C04

Probe length for process connection [mm]

M02	M03	C03, C04
37	68	0
59	148	10
83	198	
97	234	
160	238	
	249	

Probe diameter

03	3 mm (standard for M02, not for xHx)
04	4 mm (standard for M03)
06	6 mm
08	8 mm (standard for C03, C04 with sensor tip)
10	10 mm (standard for C03, C04 frontflush, not for Txx, Vxx)
12	12 mm (not for Txx, Vxx)

Sensor tip diameter, only for probe length ≥ 50 mm

X	Without reduction (standard for M02, M03)
3	For probe diameter 6 mm
4	For probe diameter 6, 8, 10 mm
6	For probe diameter 8, 10, 12 mm

Order code

Material

- 0** 1.4404 (AISI 316L) without certificate
(standard for C03, C04, G01, G02, M02, M03)
- 1** 1.4404 (AISI 316L) incl. material certificate

Surface finish

- 0** $R_a \leq 0.8 \mu\text{m} / 32 \mu\text{in}$

Transmitter

- 0** Without transmitter
- I** TTM.I (IO-Link only)
- H** TTM.H (hybrid: analog and IO-Link)

Measurement range

- 000** Without transmitter
- 00C** Unit °C (only for TTM.I)
- 00F** Unit °F (only for TTM.I)
- 00K** Unit K (only for TTM.I)
- 04C** -10...40 °C
- 05C** 0...50 °C
- 10C** 0...100 °C
- 15C** 0...150 °C
- 20C** 0...200 °C
- 25C** 0...250 °C
- 10F** 0...100 °F
- 15F** 0...150 °F
- 20F** 0...200 °F
- 23F** 30...230 °F
- 25F** 0...250 °F
- M00** TTM custom configuration

Electrical connection with transmitter

- 4** M12 plug (4 pin)

Electrical connection without transmitter

- 4** M12 plug (4 pin) 1x RTD
- 8** M12 plug (8 pin) 2x RTD
- P** PVC-cable ($\leq 90 \text{ °C} / 194 \text{ °F}$)
- T** PTFE-cable ($\leq 250 \text{ °C} / 482 \text{ °F}$)

Cable length [m]
(with hardwired cable only)

1...50

TSMF / C01 / X / 0 / 100 / 06 / 4 / 0 / 0 / 0 / 000 / P / 12

Accessories

PVC-cable with M12 connection made of 1.4305 (AISI 303), IP 69 K, unshielded

- M12-PVC / 4-5 m** PVC-cable 4 pin, length 5 m
- M12-PVC / 4-10 m** PVC-cable 4 pin, length 10 m
- M12-PVC / 4-25 m** PVC-cable 4 pin, length 25 m

TPE-cable with M12 connection made of 1.4571 (AISI 316Ti), IP 69, shielded

- M12-TPE / 8-5 m** TPE-cable 8 pin, length 5 m
- M12-TPE / 8-10 m** TPE-cable 8 pin, length 10 m

PVC-cable with M12-connection

