

Product Information TSMF**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


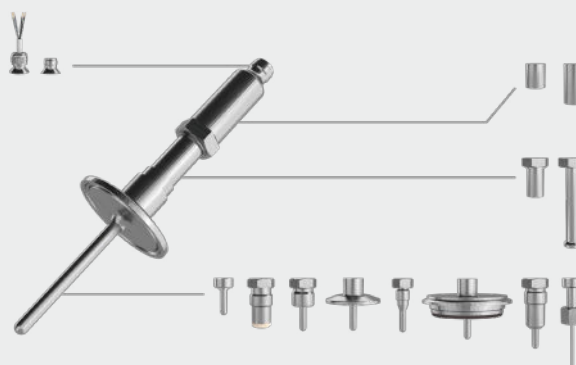
- Hygienic process connection with CLEANadapt or FLEXadapt
- Versions available with EHEDG approval
- Versions available to conform to 3-A Standard 74-
- All wetted materials are FDA-conform
- Sensor completely made of stainless steel or stainless steel and PEEK
- Complete overview of process connections: 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 or 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
- IO-Link Master (IOM-1)
- Add-On Instructions are available at www.anderson-negele.com/aoi

Communication
 **IO-Link**  **4...20 mA**
Temperature sensor TSM with Tri-Clamp**Temperature sensor TSM for FLEXadapt ESF system****Modular design**

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, G1/2"-PFF, G1/2"-SPFF Sensor with cap nut, sensor tip ø 3 mm Sensor with cap nut, sensor tip ø 4 mm 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, -SP, -PFF, -SPFF	10 Nm
	CLEANadapt G1/2"	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, -SP, -PFF, -SPFF	stainless steel 1.4301 / AISI 304 stainless steel 1.4404 / AISI 316L PEEK, FDA 21 CFR 177.2415
Surface finish		$R_a \leq 0.8 \mu\text{m} / 32 \mu\text{in}$
Operating pressure	CLEANadapt	50 bar maximum
	CLEANadapt G1/2"-P, -SP, -PFF, -SPFF	10 bar maximum
Process temperature	standard range	-50...250 °C / -58...482 °F
	extended range	-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. ≤ 90 °C) PTFE 4 x 0.14 mm ² / AWG 26 (perm. process temp. ≤ 250 °C)
Protection class		IP 69 K (with electrical connection M12 plug)

Transmitter TTM.I, TTM.H		
Temperature ranges	ambient storage	-40...95 °C / -40...203 °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	≤ 0.1 K (at ambient ≤ 85 °C / 185 °F) ≤ 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 ≤ ±10 K ≤ ±25 %
Digital output	digital resolution master cycle time power supply	IO-Link 0.01 K ≥ 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 ≤ 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

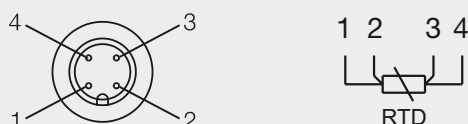
Pt100	Class A	Class AA / 1/3 DIN B	Class AAA / 1/10 DIN B
0 °C / 100 Ω	±0.15 K / ±0.06 Ω	±0.10 K / ±0.04 Ω	±0.03 K / ±0.01 Ω
100 °C / 138.5 Ω	±0.35 K / ±0.13 Ω	±0.27 K / ±0.10 Ω	±0.08 K / ±0.03 Ω

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

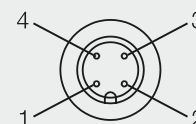
1x RTD with M12 plug



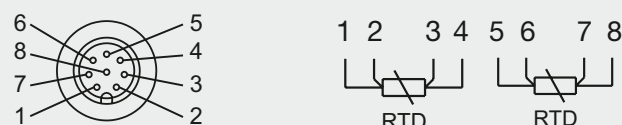
Electrical connection with transmitter

1x RTD with M12 plug for analog operation

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

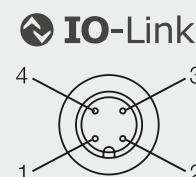


2x RTD with M12 plug



1x RTD with M12 plug for IO-Link operation

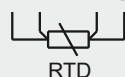
- 1: + power supply 24 V DC
- 2: not connected
- 3: - power supply
- 4: IO-Link



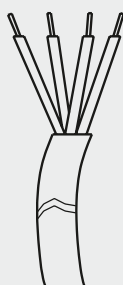
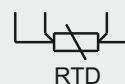
Hardwired cable | PVC (LIYY)

1x RTD

WH YE BN GN



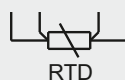
2x RTD

WH YE BN GN 1st RTD
RD BU PK GY 2nd RTD

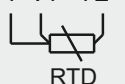
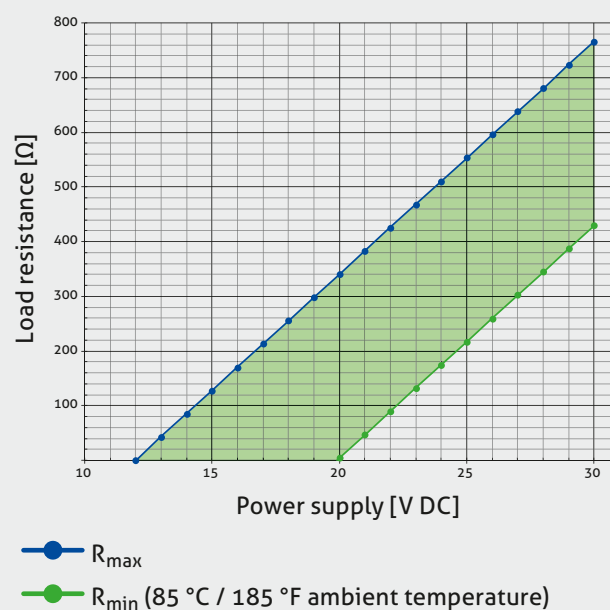
Hardwired cable | PTFE

1x RTD

RD RD WH WH



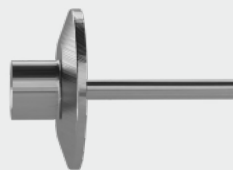
2x RTD

RD RD WH 1st RTD
VT VT YE 2nd RTDLoad resistance diagram at ambient temperature
85 °C / 185 °F

Modular design

Electrical
connection

Head

Spacer
extensionProcess
connection

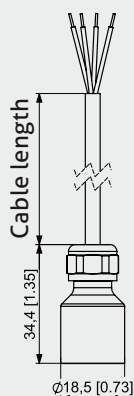
Electrical connection | Head



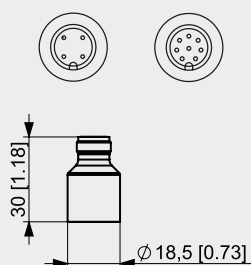
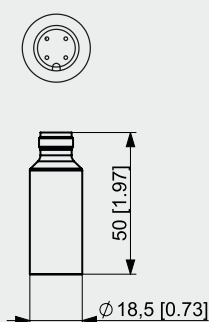
Spacer extension



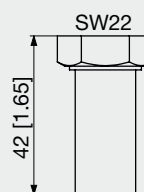
Hardwired cable

M12 plug 4 pins / 8 pins
without transmitter

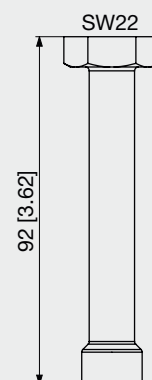
1x RTD: 4 pins
2x RTD: 8 pins

M12 plug 4 pins
with transmitter

Short



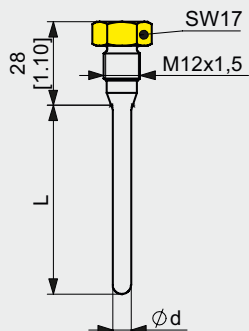
Long



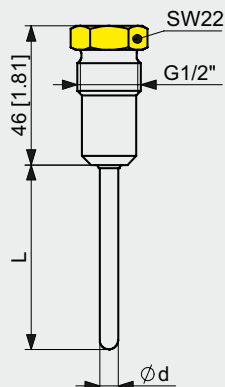
Process connection



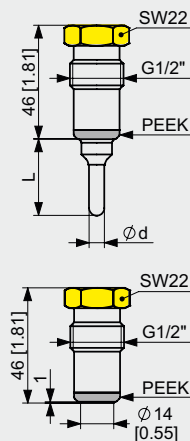
C01 | CLEANadapt M12



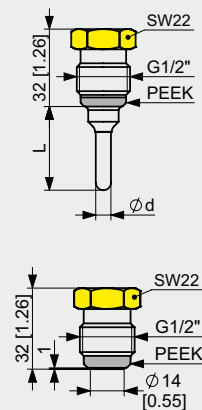
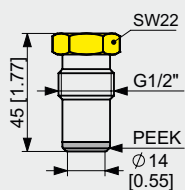
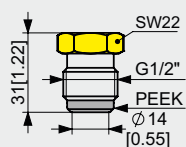
C02 | CLEANadapt G1/2"



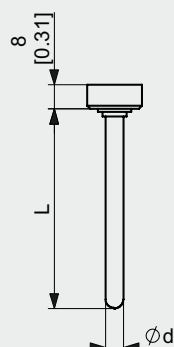
C03 | CLEANadapt G1/2"-P



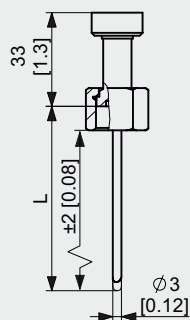
C04 | CLEANadapt G1/2"-SP

C05 | CLEANadapt
G1/2"-PFFC06 | CLEANadapt
G1/2"-SPFF

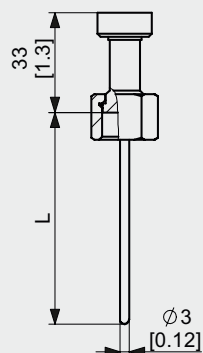
N01 | Plain rod



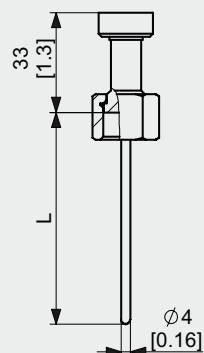
M01 | FLEXadapt ESF G3/8"
cap nut, \varnothing 3 mm,
spring loaded



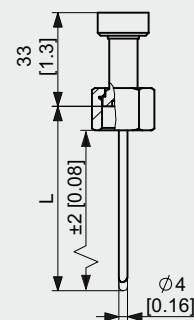
M02 | FLEXadapt ESF G3/8"
cap nut, \varnothing 3 mm



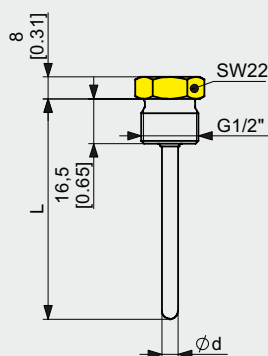
M03 | Sensor G3/8"
cap nut, \varnothing 4 mm



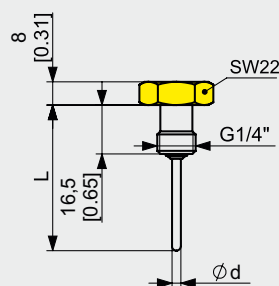
M04 | Sensor G3/8"
cap nut, \varnothing 4 mm
spring loaded



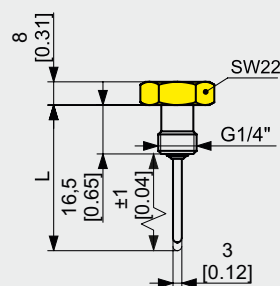
G01 | Thread G1/2"



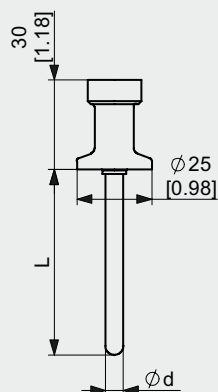
G02 | Thread G1/4"



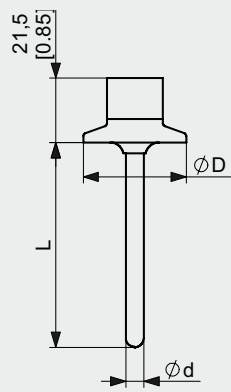
G03 | Thread G1/4"
 \varnothing 3 mm, spring loaded



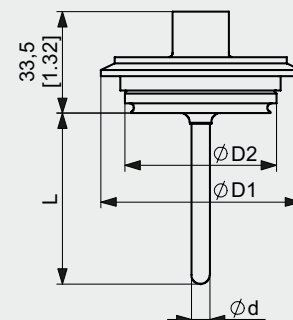
T05 | Tri-Clamp 1/2", 1/4"



Txx | Tri-Clamp



Vxx | Varivent



Advice



Tighten the sensor only
at the lower, marked in
yellow spanner flat!

Tri-Clamp size

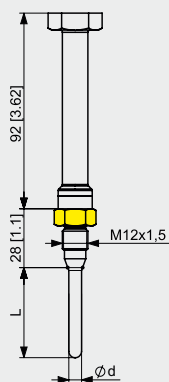
Type	\varnothing D [mm / inch]
T10	34.0 / 1.34
TC1	50.5 / 1.99
TC2	64.0 / 2.52
T25	77.5 / 3.05
TC3	91.0 / 3.58

Dimensions table Varivent

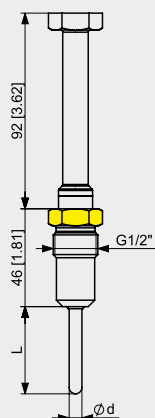
Type	Varivent type	\varnothing D1 [mm / inch]	\varnothing D2 [mm / inch]
V10	B	52.7 / 2.09	31.0 / 1.22
V25	F	66.0 / 2.60	50.0 / 1.97
V40	N	84.0 / 3.31	68.0 / 2.68

Process connections with extended temperature range

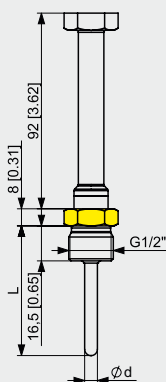
CH1 | CLEANadapt M12



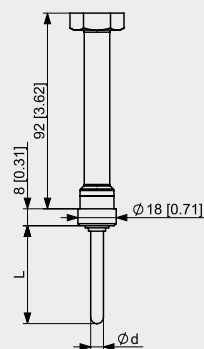
CH2 | CLEANadapt G1/2"



GH1 | Thread G1/2"



NH1 | Plain rod

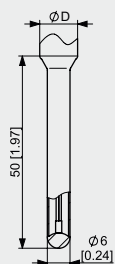


Sensor tip diameter and response time

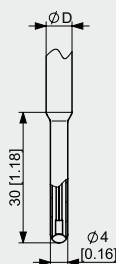
All temperature sensors are available with smaller sensor tips, to ensure a shorter response time. The mentioned times were measured by emersing a temperature sensor from room temperature into boiling water. The response times given are typical measured values and may vary due to factors such as process connection, immersion length and medium.

 ϕ 6 mm

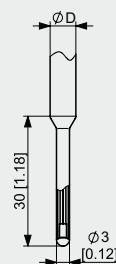
$t_{50} \leq 1.8$ s
 $t_{90} \leq 5.2$ s
 D: 8, 10, 12 mm

 **ϕ 4 mm**

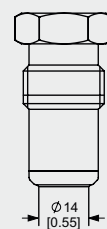
$t_{50} \leq 1.2$ s
 $t_{90} \leq 3.5$ s
 D: 6, 8, 10 mm

 **ϕ 3 mm**

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

**Front-flush**

$t_{50} \leq 2.5$ s
 $t_{90} \leq 15$ 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!

Note on 3-A Sanitary Standard 74-

Information on installation according to 3-A standard is available on our website:
www.anderson-negele.com/3A74.pdf

Click on the PDF icon to download the document.



Click or Scan

Note on IO-Link

Information on parameters and events are available on our website:

www.anderson-negele.com/iodd

Click on the IO-Link icon to open the website.



Click or Scan

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.

Note on EHEDG Hygienic Standard Type EL Class I

Information on installation according to EHEDG standard is available on our website:
www.anderson-negele.com/EHEDG.pdf

Click on the PDF icon to download the document.



Click or Scan

Order code

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

Process connection (A): 3-A conform, (E): EHEDG approval)

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

T05 Tri-Clamp 1/2" and 3/4" (A and E only for 3/4")

T10 Tri-Clamp DN10

TC1 Tri-Clamp 1" and 1½" (A) (E)

TC2 Tri-Clamp 2" (A) (E)

T25 Tri-Clamp 2½" (A) (E)

TC3 Tri-Clamp 3" (A) (E)

V10 Varivent type B DN10/15

V25 Varivent type F DN25 (A) (E)

V40 Varivent type N DN40/50 (A) (E)

C01 CLEANadapt M12

C02 CLEANadapt G1/2"

C03 CLEANadapt G1/2"-P (PEEK) (A) (E)

C04 CLEANadapt G1/2"-SP (short version, PEEK) (A) (E)

C05 CLEANadapt G1/2"-PFF (PEEK front-flush)

C06 CLEANadapt G1/2"-SPFF (short version, PEEK front-flush)

N01 Plain rod

G01 Thread G1/2"

G02 Thread G1/4"

Without media contact

G03 Thread 1/4", sensor tip Ø 3 mm, spring loaded

M01 FLEXadapt ESF G3/8" with cap nut, sensor tip Ø 3 mm, spring loaded

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

M04 Sensor G3/8" with cap nut, sensor tip Ø 4 mm, spring loaded

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

CH1 CLEANadapt M12 (incl. spacer)

CH2 CLEANadapt G1/2" (incl. spacer)

GH1 Thread G1/2" (incl. spacer)

NH1 Plain rod (incl. spacer)

Spacer extension

X Without spacer (permanent process temperature ≤ 100 °C / 212 °F, standard for extended temperature 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 ≤ 150 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 (probe length ≥ 50 mm)

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 (probe length ≥ 50 mm)

A 1x Pt1000 A, 2-wire

B 1x Pt1000 AA, 2-wire

C 2x Pt1000 A, 2-wire

D 2x Pt1000 AA, 2-wire

Order code

Variable probe length [mm] - for process connections not listed separately

0	Only for front-flush version C03, C04, C05, C06
10...50	In steps of 5 mm
51...150	In steps of 5 mm
151...250	In steps of 10 mm
251...2000	In steps of 10 mm, 251 mm up to 500 mm 50 mm, 501 mm up to 1000 mm 100 mm, 1001 mm up to 2000 mm
Intermediate lengths	Minimum order quantity: 3 pieces, not for M0x, C03, C04, C05, C06, G03

Probe lengths [mm] for different process connections**For process connection C03, C04**

0	Front-flush version
10	With probe ø 8 mm
20...500	With probe ø 6 mm In steps of 5 mm, 20 mm up to 150 mm In steps of 10 mm, 151 mm up to 500 mm

For front-flush process connection C05, C06**0****For process connection without media contact M01, M02**

37
59
83
97
160

For process connection without media contact M03, M04

68
148
198
234
238
249

For process connection without media contact G03

36
61
75
93
100
105
115
120
130
140
160

Probe diameter

00	0 mm (standard for front-flush version: C03, C04, C05, C06)
03	3 mm (standard for M01, M02, G03, not for xHx)
04	4 mm (standard for M03, M04)
06	6 mm (standard for C03, C04 with probe length 20 mm up to 500 mm)
08	8 mm (standard for C03, C04 with probe length 10 mm, not for T05, V10, C01, CH1)
10	10 mm (not for Txx, Vxx, C01, G02, CH1)
12	12 mm (not for Txx, Vxx, C01, G02, CH1)

Sensor tip diameter, only for probe length ≥ 50 mm

X	Without reduction (standard for M0x, G03)
3	For probe ø 6 mm
4	For probe ø 6, 8, 10 mm
6	For probe ø 8, 10, 12 mm

Material

0	1.4404 / AISI 316L without certificate (standard for C03, C04, G0x, M02, M03)
1	1.4404 / AISI 316L incl. material certificate

Order code

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, brass nickel-plated, IP69K, shielded

M12-PVC/5G-8m 5 pin, length 8 m
 M12-PVC/5G-15m 5 pin, length 15 m
 M12-PVC/5G-30m 5 pin, length 30 m

IOM-1

Anderson-Negele USB IO-Link Master for IO-Link Sensors
 incl. power supply, USB cable,
 M12 connection cable (1.5 m / 59.1 in)

IOM-1

