

**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

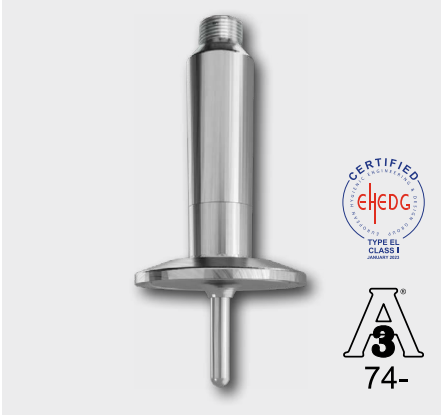
**Options/Accessories**

- 2x RTD
- Front-flush mounting
- Integrated transmitter
- Programmable transmitters TTM.I and TTM.H 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
- Programmable with any IO-Link master
- Add-On Instructions are available at [www.anderson-negele.com/aoi](http://www.anderson-negele.com/aoi)

**Communication**



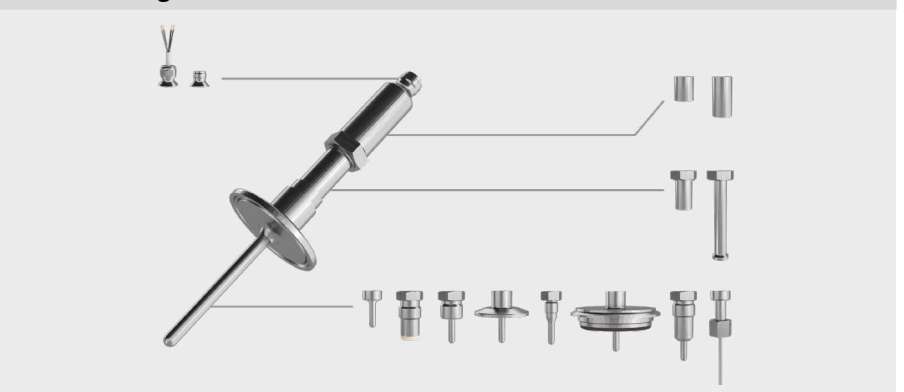
**Temperature sensor TSM with Tri-Clamp**



**Temperature sensor TSM for FLEXadapt ESF system**



**Modular design**



Temperature sensor		
<b>Process connection</b>	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 $\varnothing$ 3 mm Sensor with cap nut, sensor tip $\varnothing$ 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)
<b>Tightening torque</b>	CLEANadapt M12, G1/2"-P, -SP, -PFF, -SPFF CLEANadapt G1/2"	10 Nm 20 Nm
<b>Dimensions</b>	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
<b>Materials</b>	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
<b>Surface finish</b>		$R_a \leq 0.8 \mu\text{m} / 32 \mu\text{in}$
<b>Operating pressure</b>	CLEANadapt CLEANadapt G1/2"-P, -SP, -PFF, -SPFF	50 bar maximum 10 bar maximum
<b>Process temperature</b>	standard range extended range	-50...250 °C / -58...482 °F -200...400 °C / -328...752 °F
<b>Resistance Temperature Detector (RTD)</b>	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: $\pm(0.03 + 0.0005 \times  t )$ °C
<b>Electrical connection</b>	plug connection hardwired cable hardwired cable	M12 plug 1.4301 / AISI 304 PVC LIYY 4 x 0.25 mm <sup>2</sup> / AWG 23 (perm. process temp. $\leq$ 90 °C) PTFE 4 x 0.14 mm <sup>2</sup> / AWG 26 (perm. process temp. $\leq$ 250 °C)
<b>Protection class</b>		IP 69 K (with electrical connection M12 plug)

Transmitter TTM.I, TTM.H		
<b>Temperature ranges</b>	ambient storage	-40...95 °C / -40...203 °F -55...90 °C / -67...194 °F
<b>Measuring ranges</b>		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
<b>Accuracy</b>	input repeatability	$\leq 0.1$ K (at ambient $\leq 85$ °C / 185 °F) $\leq 0.05$ K
<b>Temperature drift</b>	typical maximum	5 mK/K (at 25 °C / 77 °F) 10 mK/K (at 25 °C / 77 °F)
<b>Adjustments</b>	damping offset slope	0...120 s $\leq \pm 10$ K $\leq \pm 25$ %
<b>Digital output</b>	digital resolution master cycle time power supply	IO-Link 0.01 K $\geq 51.2$ ms 18...30 V DC according to IO-Link
<b>Analog output (TTM.H only)</b>	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) $R \leq (V \text{ DC} - 12 \text{ V}) : 0.024 \text{ A}$ (at 25 °C / 77 °F), see diagram 12...30 V DC

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

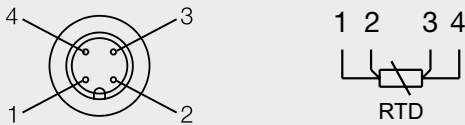
Pt100	Class A	Class AA / 1/3 DIN B	Class AAA / 1/10 DIN B
0 °C / 100 Ω	±0.15 K / ±0.06 Ω	±0.10 K / ±0.04 Ω	±0.03 K / ±0.01 Ω
100 °C / 138.5 Ω	±0.35 K / ±0.13 Ω	±0.27 K / ±0.10 Ω	±0.08 K / ±0.03 Ω

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

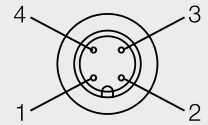
1x RTD with M12 plug



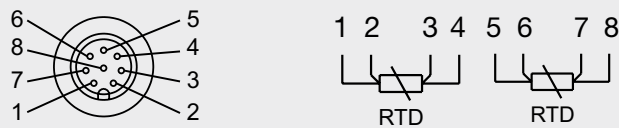
Electrical connection with transmitter

1x RTD with M12 plug for analog operation

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

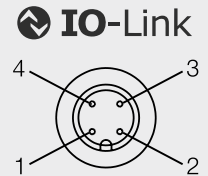


2x RTD with M12 plug



1x RTD with M12 plug for IO-Link operation

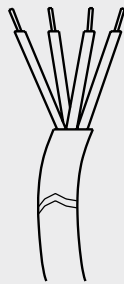
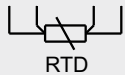
- 1: + power supply 24 V DC
- 2: not connected
- 3: - power supply
- 4: IO-Link



Hardwired cable | PVC (LIYY)

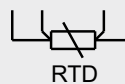
1x RTD

WH YE BN GN

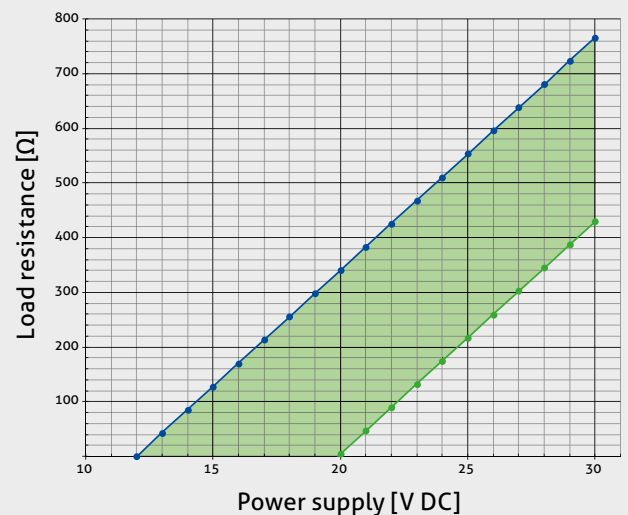


2x RTD

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



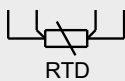
Load resistance diagram at ambient temperature 85 °C / 185 °F



Hardwired cable | PTFE

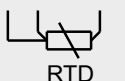
1x RTD

RD RD WH WH



2x RTD

RD RD WH 1st RTD  
VT VT YE 2nd RTD



● R<sub>max</sub>

● R<sub>min</sub> (85 °C / 185 °F ambient temperature)



Modular design



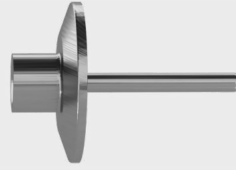
Electrical connection



Head



Spacer extension



Process connection

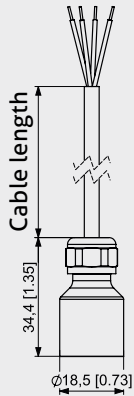
Electrical connection | Head



Spacer extension

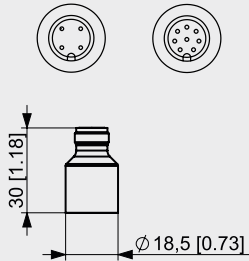


Hardwired cable

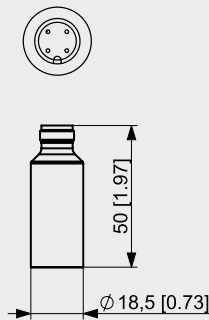


M12 plug 4 pins / 8 pins without transmitter

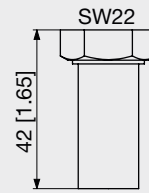
1x RTD: 4 pins  
2x RTD: 8 pins



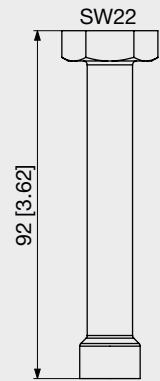
M12 plug 4 pins with transmitter



Short



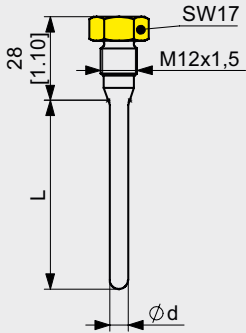
Long



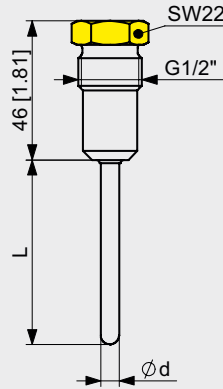
Process connection



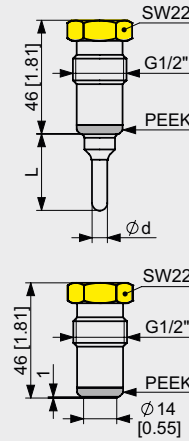
C01 | CLEANadapt M12



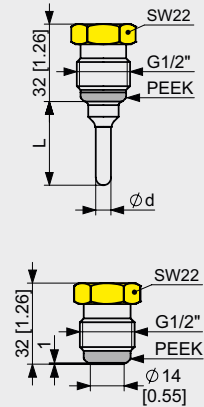
C02 | CLEANadapt G1/2"



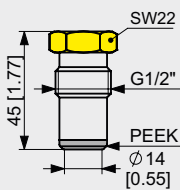
C03 | CLEANadapt G1/2"-P



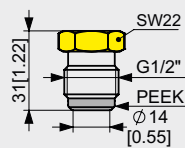
C04 | CLEANadapt G1/2"-SP



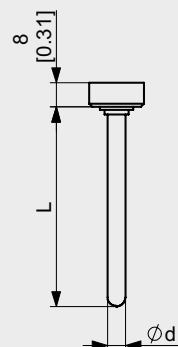
C05 | CLEANadapt G1/2"-PFF



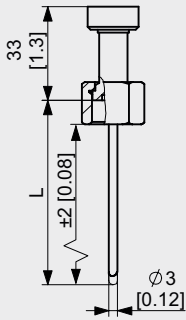
C06 | CLEANadapt G1/2"-SPFF



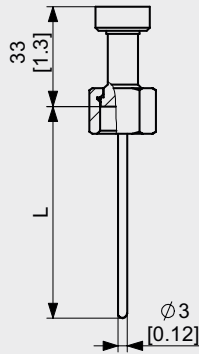
N01 | Plain rod



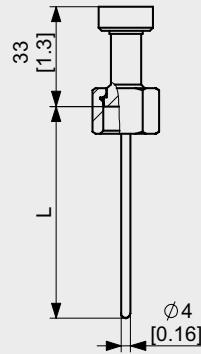
**M01 | FLEXadapt ESF G3/8"**  
cap nut,  $\varnothing$  3 mm,  
spring loaded



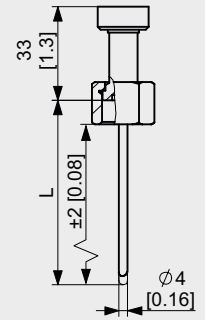
**M02 | FLEXadapt ESF G3/8"**  
cap nut,  $\varnothing$  3 mm



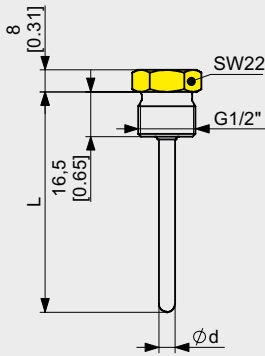
**M03 | Sensor G3/8"**  
cap nut,  $\varnothing$  4 mm



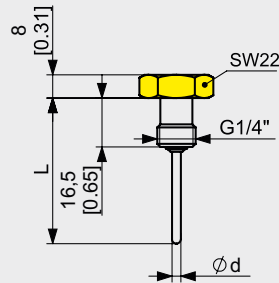
**M04 | Sensor G3/8"**  
cap nut,  $\varnothing$  4 mm  
spring loaded



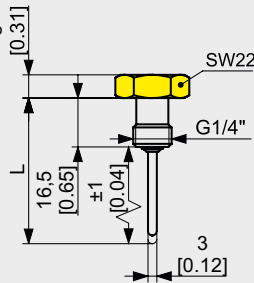
**G01 | Thread G1/2"**



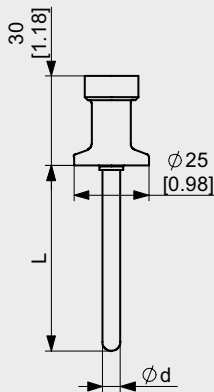
**G02 | Thread G1/4"**



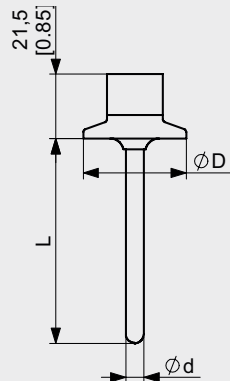
**G03 | Thread G1/4"**  
 $\varnothing$  3 mm, spring loaded



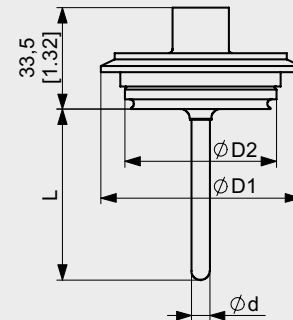
**T05 | Tri-Clamp 1/2", 3/4"**



**Txx | Tri-Clamp**



**Vxx | Varivent**



**Advice**



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

**Tri-Clamp size**

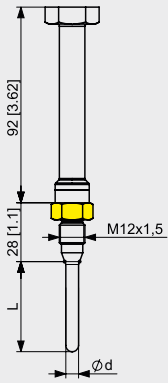
Type	$\varnothing$ D [mm / inch]
T10	34.0 / 1.34
TC1	50.5 / 1.99
TC2	64.0 / 2.52
T25	77.5 / 3.05
TC3	91.0 / 3.58

**Dimensions table Varivent**

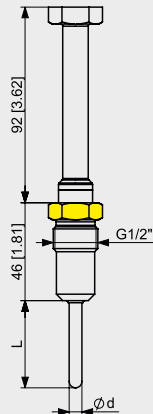
Type	Varivent type	$\varnothing$ D1 [mm / inch]	$\varnothing$ D2 [mm / inch]
V10	B	52.7 / 2.09	31.0 / 1.22
V25	F	66.0 / 2.60	50.0 / 1.97
V40	N	84.0 / 3.31	68.0 / 2.68

## Process connections with extended temperature range

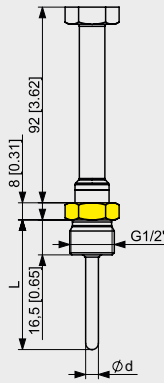
## CH1 | CLEANadapt M12



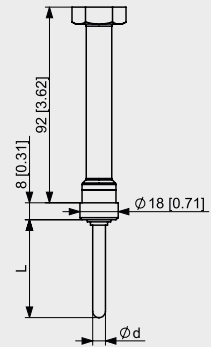
## CH2 | CLEANadapt G1/2"



## GH1 | Thread G1/2"



## NH1 | Plain rod

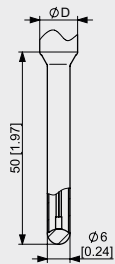


## Sensor tip diameter and response time

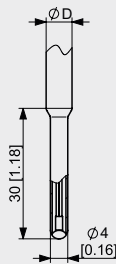
All temperature sensors are available with smaller sensor tips, to ensure a shorter response time. The mentioned times were measured by immersing a temperature sensor from room temperature into boiling water. The response times given are typical measured values and may vary due to factors such as process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

 **$\phi$  6 mm**

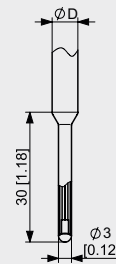
$t_{50} \leq 1.8$  s  
 $t_{90} \leq 5.2$  s  
 D: 8, 10, 12 mm

 **$\phi$  4 mm**

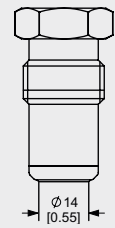
$t_{50} \leq 1.2$  s  
 $t_{90} \leq 3.5$  s  
 D: 6, 8, 10 mm

 **$\phi$  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](http://www.anderson-negele.com/3A74.pdf)

Click on the PDF icon to download the document.

**Note on IO-Link**

Information on parameters and events are available on our website:

[www.anderson-negele.com/iodd](http://www.anderson-negele.com/iodd)

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

**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](http://www.anderson-negele.com/EHEDG.pdf)

Click on the PDF icon to download the document.

## 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**

<b>0</b>	Only for front-flush process connections C03, C04, C05, C06
<b>10...150</b>	In steps of 5 mm, process connections N01, G01, G02, GH1, NH1: min. length 30 mm
<b>160...500</b>	In steps of 10 mm
<b>550...2000</b>	In steps of 50 mm, 550 mm up to 1000 mm 100 mm, 1100 mm up to 2000 mm

**Intermediate lengths** Not for M0x, C03, C04, C05, C06, G03  
(Minimum order quantity: 3 pieces)

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

<b>0</b>	Front-flush version
<b>10</b>	With probe $\varnothing$ 8 mm
<b>30...500</b>	With probe $\varnothing$ 6 mm In steps of 5 mm, 30 mm up to 150 mm In steps of 10 mm, 160 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**

<b>00</b>	0 mm (standard for front-flush version: C03, C04, C05, C06)
<b>03</b>	3 mm (standard for M01, M02, G03, not for xHx)
<b>04</b>	4 mm (standard for M03, M04)
<b>06</b>	6 mm (standard for C03, C04 with probe length 30 mm up to 500 mm)
<b>08</b>	8 mm (standard for C03, C04 with probe length 10 mm, not for T05, V10, C01, CH1)
<b>10</b>	10 mm (not for Txx, Vxx, C01, G02, CH1)
<b>12</b>	12 mm (not for Txx, Vxx, C01, G02, CH1)

**Sensor tip diameter, only for probe length  $\geq$  50 mm**

<b>X</b>	Without reduction (standard for M0x, G03)
<b>3</b>	For probe $\varnothing$ 6 mm
<b>4</b>	For probe $\varnothing$ 6, 8, 10 mm
<b>6</b>	For probe $\varnothing$ 8, 10, 12 mm

**Material**

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

## Order code

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

## 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

## 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