ABB MEASUREMENT & ANALYTICS | DATA SHEET

TSP341-N

Sensor for non-invasive temperature measurement

HERMES AWARD 2019



Measurement made easy

A simpler and safer approach to temperature measurement

Greater safety – no process penetration

- Global approvals for explosion protection up to Zone 0
- Consideration of the NAMUR recommendation NE 24
- Sensor monitoring and self monitoring (NE 89, NE 107)

Increased flexibility – faster and more cost-effective measurements

- Precise temperature measurement without intervention in the process
- Quick, easy and universal surface mounting
- Greater cost reduction thanks to the omission of the thermowell

Keep your measurement quality

- Accuracy and response time close to or better than an invasive measurement for common industrial process conditions
- Repeatability proven under long term industrial testing
- Transmitter based on the successful TTH300 (HART) with optional LCD indicator in robust connection head

Areas of use and application

- All sectors of industry and heavy industry, including chemical, power, oil & gas and petrochemical
- Any application in which intervention in the process, or a thermowell in the process / measuring medium is critical
- Well suited for low viscosity, liquid media, with medium to high flow rates (turbulent flow)

Introduction

Non-invasive temperature measurement

Classic temperature measurement in process technology is made by directly introducing the temperature sensor into the measuring medium.
The measuring medium (gaseous, liquid or paste-like) is usually in a vessel or piping.
The measuring medium can stand idle or flow at high speed. Then especially abrasive measuring media are critical.

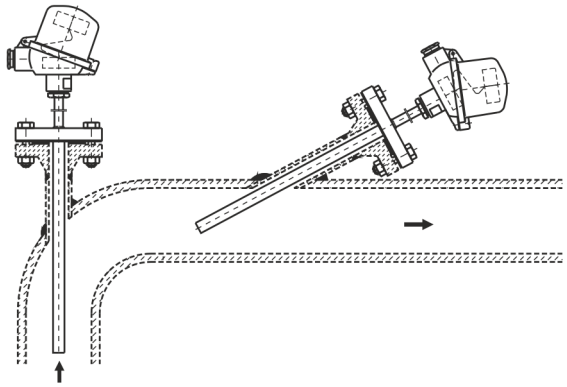


Figure 1: Classic installation of temperature sensors in piping

Depending on the material properties, the temperature sensor needs special protection to protect it from chemical and mechanical loads. For example, abrasive dust or sands, which move through the piping at high speeds, present a special challenge.

To protect the temperature sensor, the thermowells used must be inspected regularly and replaced as needed.
Chemically aggressive or abrasive media can lead to the erosion of thermowell material.
A thermowell placed in flowing media can also begin to vibrate due to vortex formation and in extreme cases it can break.
Therefore, guidelines and standards for the stability of thermowells have become more restrictive over time, and so the costs of maintenance and exchange have increased as well.

In addition to current costs, other costs are already incurred during planning and design of an installation for openings in vessels and piping, through which the temperature sensor is introduced into the measuring medium. Here, for example, flanges or structural reinforcements are required.

The costs mentioned above can be eliminated if the process temperature could be measured indirectly and outside of the process. Using non-invasive temperature measurement, it is often possible to record process temperatures with an accuracy which is sufficient for the application.

ABB's first new-generation sensor from the line of sensors for non-invasive temperature measurement in process technology is the TSP341-W ('W' stands for 'wireless') introduced in 2014.
Thanks to its WirelessHART® wireless communications protocol, the sensor is especially suited for later expansions in industrial installations.

The TSP341-N* surface temperature sensor now combines non-invasive temperature measurement with the established HART® communications protocol in two-wire technology. Therefore, the device can also be integrated into existing structures without any issues whatsoever.

The 'N' in TSP341-N stands for non-invasive temperature measurement here. The calculation algorithms developed by ABB for non-invasive temperature measurement take ambient conditions, among other factors, into account during the measurement and therefore increase the accuracy of the surface measurement significantly.

Surface temperature measurement is especially suited in low-viscosity measuring media, in measuring media with high thermal conductivity and in processes with high medium velocity or turbulent flow. Examples: water, watery solutions and water-based liquids as well as fast flowing oil or saturated steam.

* The temperature sensor TSP341-N belongs to ABB's product family SensyTemp TSP. It is listed in the related type examination certificates for explosion protection as SensyTemp TSP341-N.

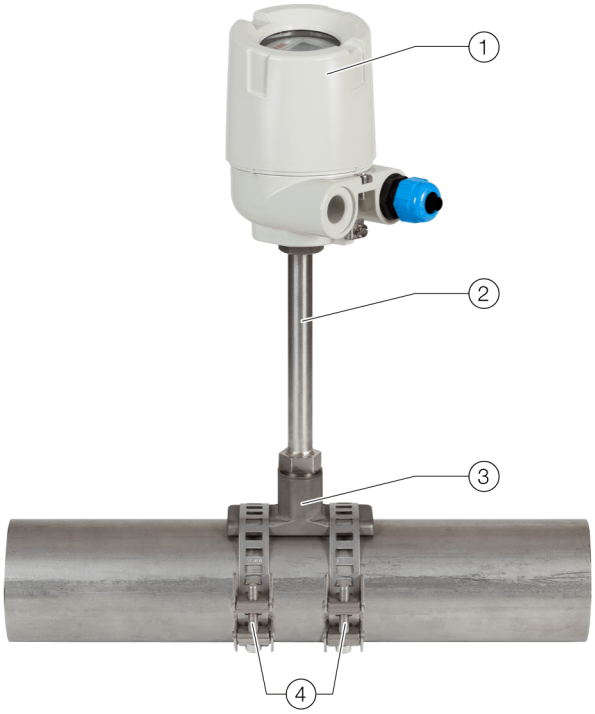
… Introduction

System structure

The TSP341-N temperature sensor contains a temperature transmitter based on the TTH300 by ABB with integrated calculation algorithms for non-invasive temperature measurement.
The transmitter has an analog 4 to 20 mA current output and supports communication through the HART 7® protocol.
As an option, the type AS LCD indicator can be integrated.

The transmitter supports two connected temperature sensors. One sensor measures the surface temperature at the measuring point, while a second sensor measures the temperature at the reference test point near the measuring point.

By using the algorithms for accurate non-invasive temperature calculation, a process temperature range of −40 to 400 °C (−40 to 752 °F) with an ambient temperature of −40 to 85 °C (−40 to 185 °F) is covered.
The transmitter can be configured using the software provided by ABB with TSP341-N-support (DTM and EDD) and tools such as Field Information Manager (FIM) in accordance with the current conditions of use.



1 Connection head with transmitter
2 Extension tube
3 Retaining plate
4 Clamp collars

Figure 2: TSP341-N

For non-invasive temperature measurement, the temperature sensor is fastened to a piping or vessel surface. Installation is made using two clamp collars, which fix the retaining plate to the foot of the sensor.
Clips with different expansion coefficients are available to adapt to the piping or vessel material. Metallic materials are required for surface measurement. The surface under the measurement sensor must be straight, without foreign matter and without any coating.
To shorten the response time of the sensor, there is a hole in the retaining plate, through which the sensor element is guided directly to the surface of the measuring point.
During installation, make sure that the measuring tip with the integrated sensor element has optimal contact with the measuring point.
In addition, insulation to protect against the influence of ambient temperature is recommended by applying suited insulation materials.

Pure surface measurement is often less accurate than temperature measurement directly in the process.
However, thanks to the ambient temperature effect taken into consideration by the TSP341-N, the accuracy has been improved to the point that along with the obtainable response time, it is comparable to the values of classic measurement using a thermowell.
Accuracy and response time can be increased even more with suited insulation at the measuring point.

Through the device configuration option (DTM, EDD, FIM) provided for the TSP341-N, the insulation of the measuring point is taken into consideration during temperature calculation (preset upon delivery of the device).
As a result, measuring accuracy and response time achieve values which make non-invasive temperature measurement a reasonable and cost-saving alternative to measurement in the process.

Overview of temperature sensors

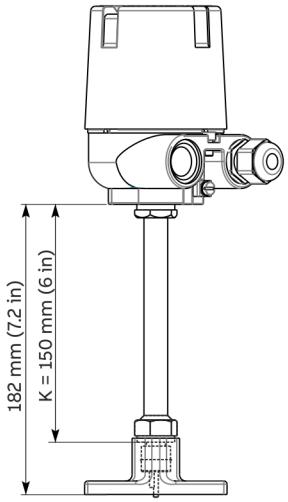
Type	**TSP341-N**
	
Design	Temperature sensor with integrated transmitter for surface mounting
components	Retaining plate, measuring inset with measuring tip, extension tube, connection head, transmitter, optional LCD indicator
Materials	Retaining plate: stainless steel 1.4408 (J92900) Measuring inset: stainless steel 1.4571 (ASTM 316Ti) Measuring tip: pure nickel 2.4068 (LC-Ni99) Extension tube: stainless steel 1.4571 (ASTM 316Ti) Gasket for connection head: EPDM (ethylene propylene diene-monomer rubber)
Encapsulation resin for the device	Polyurethane (PUR), WEVO PU-417
Process connection	Surface mounting to vessels and piping
Transport temperature / Storage temperature	−20 to 70 °C (−4 to 158 °F)
Ambient temperature range at connection head	Without LCD indicator: −40 to 85 °C (−40 to 185 °F) With LCD indicator: −20 to 70 °C (−4 to 158 °F)
Measuring range (Surface temperature)	−40 to 400 °C (−40 to 752 °F)
Sensor	Thin film resistor Pt100 in three-wire circuit, accuracy class A in accordance with IEC 60751, measuring range −40 to 400 °C (−40 to 752 °F)
Extension tube	Extension tube diameter: 15 mm (0.59 in) Extension tube length: K = 150 mm (6 in) **Note** For the distance from connection head to vessel or piping include additional ≈32 mm (≈1.3 in) for the retaining plate
Clamp collars	Clamp collars for a variety of thermal expansion coefficients are available. Clamp collars are available for pipe diameters of 40 to 2500 mm (DN 40 to 2500). **Recommendation for pipes and vessels made of chrome steel or carbon steel** Clamp collar material: chrome steel 1.4016 (ASTM 430), α = 10 to 10.5*10^{-6}/K **Recommendation for pipes and vessels made of chrome-nickel steel** Clamp collar material: stainless steel 1.4301 (ASTM 304), α = 16 to 17.5*10^{-6}/K

Table 1: Overview

Connection heads

Dimensions in mm (in)

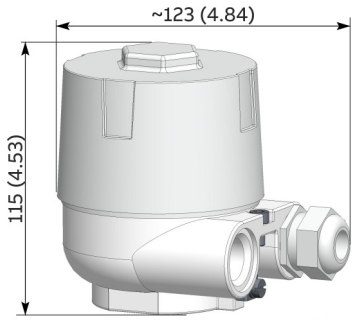
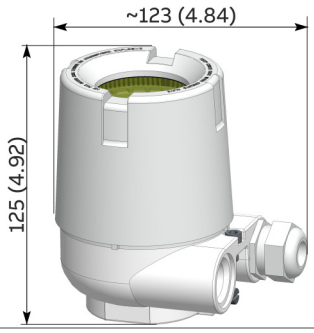
Head form	**AGL / AGS**	**AGLD / AGSD**
		
Material	AGL: Aluminum, epoxy-coated AGS: Stainless steel	AGLD: Aluminum, epoxy-coated AGSD: Stainless steel
Cover locking system	Screw-on cap	
Cable gland	M20 × 1.5, optional cable entry ½ in NPT, without screwed connection	
IP rating	IP 66 / IP 67	
Transmitter mounting	On the measuring inset	

Table 2: Overview of connection heads

Functions of the connection head

- Housing of a transmitter and the optional LCD indicator
- Protection of the connection area against adverse environmental influences

When the connection cable is fed into the connection head, a special cable guide cable automatically positions it inside the connection area. The flat base of the housing ensures optimum access to the connection area.

Specification

Measuring accuracy

The temperature sensors used correspond to accuracy class A in accordance with the IEC 60751 standard, measuring range −40 to 400 °C (−40 to 752 °F).

Both temperature sensors of the TSP341-N temperature sensor are connected in a three-wire circuit.
This increases measuring accuracy when compared to the less accurate two-wire circuit, in which line and contact resistances flow into the measurement.

Vibration resistance

Temperature sensor with AGL or AGLD connection head in accordance with IEC 60068-2-6:

10 to 58 Hz: 0.075 mm (0.003 in)
> 58 to 2000 Hz: 10 m/s^2 (1 g)

Insulation resistance of measuring inset

The insulation resistance is measured between the outer sheath and both measuring loops. In addition, the insulation resistance between both measuring loops is also measured. Thanks to a special process used during manufacturing, ABB measuring insets can boast outstanding insulation values even at high temperatures.

Insulation resistance R_{iso}

≥ 500 MΩ with a ambient temperature range from 15 to 35 °C (59 to 95 °F)

Air humidity

< 80 %

Extension tube

The extension tube as a module between the retaining plate and connection head allows for the use of insulation material at the measuring point.
Without insulation, the extension tube serves as a cooling line between the temperature-sensitive electronics of the transmitter in the connection head and the hot vessel / piping surface. The protection of the electronics from excessive temperatures should be ensured through suited measures.

Extension tube length TSP341-N

K = 150 mm (6 in), plus the height of the retaining plate of approximately 32 mm (approximately 1.3 in)

Extension tube outer diameter

15 mm (0.59 in)

Extension tube material

Stainless steel 1.4571 (ASTM 316Ti)

… Specification

Ambient temperature at connection head

Note
During use in potentially explosive atmospheres, restrictions in permissible ambient temperature are possible which comply with additional data included in **Use in potentially explosive atmospheres in accordance with ATEX and IECEx** on page 10 as well in declarations of conformity and type examination certificates!

Permissible ambient temperature range $T_{amb.}$ on the connection head	
Connection head without LCD indicator	−40 to 85 °C (−40 to 185 °F)
Connection head with LCD indicator	−20 to 70 °C (−4 to 158 °F)

Table 3: Ambient temperature on the connection head

When using a surface sensor, temperature measurement is performed in direct contact with the hot surface.
Without suited insulation of the measuring point, the permissible ambient temperature must be reduced to prevent an up-scale of limit values.
The following table shows as an example the maximum ambient temperature $T_{amb.}$ for the TSP341-N at different surface temperatures $T_{surf.}$ for the TSP341-N with integrated LCD indicator.

Surface temperature $T_{surf.}$	Maximum permissible ambient temperature $T_{amb.}$:
100 °C (212 °F)	66 °C (150.8 °F)
200 °C (392 °F)	61 °C (141.8 °F)
300 °C (572 °F)	58 °C (136.4 °F)
400 °C (752 °F)	55 °C (131.0 °F)

Table 4: Ambient temperature as a function of surface temperature

Note
The operator must make sure, with the help of measurements if needed, that the maximum permissible temperature **in the connection head** is not up-scaled in intrinsically safe devices.

Cable gland

The plastic cable gland for cable outer diameters of 4 to 13 mm (0.16 to 0.51 in.) used as a standard is suited for a temperature range of −40 to 70 °C (−40 to 158 °F). For temperatures outside this range, an appropriate cable gland can be installed.

The metal cable gland for Ex d (flameproof enclosure) used as a standard for cable outer diameters of 3.2 to 8.7 mm (0.13 to 0.34 inch) covers a permissible temperature range of −40 to 85 °C (−40 to 185 °F).

Transmitter

The TSP341-N temperature sensor is equipped with a temperature transmitter with a current output of 4 to 20 mA and communication through the HART 7 protocol, based on the TTH300 HART.

Installing a transmitter has the following advantages:

- Cost savings due to reduced wiring costs
- Amplification of the sensor signal at the measuring point and conversion to a standard signal (thereby increasing the signal's interference immunity).
- Option to install an LCD display in the connection head

The transmitter built into the TSP341-N has algorithms enabling accurate temperature calculation for the defined process temperature range.
For this purpose, the current ambient temperature is considered in addition to the measured surface temperature. Self-heating of the transmitter should be neglected.

The transmitter has continuous sensor and self monitoring (supply voltage monitoring, wire break / corrosion monitoring in accordance with NE 89) and supplies diagnostic information in accordance with NE 107.

HART Device Type ID

TSP341-N: 0x1A0E

Write protection

- Software write protection through the HART protocol
- Hardware write protection through DIP switch on the transmitter

Note

You can find additional information on the transmitter in the data sheet DS/TTH300.

Type AS LC display

The AGLD and AGSD connection heads are equipped with the type AS digital LCD indicator, which is connected to the transmitter with a built-on interface cable.



Figure 3: Type AS LCD indicator

Note

The AS-type LCD indicator does not have operating elements for parameterization on site. Parameterization of the device takes place via the HART interface.

Use in potentially explosive atmospheres in accordance with ATEX and IECEx

The temperature sensor TSP341-N belongs to ABB's product family SensyTemp TSP. It is listed in the related type examination certificates for explosion protection as SensyTemp TSP341-N.

Ex marking

‘Ex i – Intrinsic safety’ type of protection

Model TSP341-N-D2 in zone 0, 1, 2	
ATEX	
Type examination certificate:	PTB 18 ATEX 2002 X
Ex marking	ATEX II 1 G Ex ia IIC T6...T1 Ga
	ATEX II 2 G Ex ib IIC T6...T1 Gb

Table 5: ATEX Ex marking, ‘Ex i – intrinsic safety’ type of protection

Model TSP341-N-J2 in zone 0, 1, 2	
IECEx	
Type examination certificate:	IECEx PTB 18.0041 X
Ex marking	Ex ia IIC T6...T1 Ga
	Ex ib IIC T6...T1 Gb

Table 6: IECEx Ex marking, ‘Ex i – intrinsic safety’ type of protection

‘Ex i – intrinsic safety’ type of protection in accordance with the NAMUR recommendation

Model TSP341-N-N3 in zone 0, 1, 2	
ATEX	
Type examination certificate:	PTB 18 ATEX 2002 X
Ex marking	NE24 and ATEX II 1 G Ex ia IIC T6...T1 Ga
	NE24 and ATEX II 2 G Ex ib IIC T6...T1 Gb

Table 7: NE24 and ATEX Ex marking, ‘Ex i – intrinsic safety’ type of protection

‘Ex d - flameproof (enclosure)’ type of protection

Model TSP341-N-D7 in zone 1, 2	
ATEX	
Type examination certificate:	PTB 99 ATEX 1144 X
Ex marking	ATEX II 2 G Ex db IIC T6/T4 Gb

Table 8: ATEX Ex marking, ‘Ex d – flameproof (enclosure)’ type of protection

Model TSP341-N-J7 in zone 1, 2	
IECEx	
Type examination certificate:	IECEx PTB 12.0039 X
Ex marking	Ex db IIC T6/T4 Gb

Table 9: IECEx Ex marking, ‘Ex d – flameproof (enclosure)’ type of protection

General information

Thermal resistance

In addition to measurement of the surface temperature, a temperature measurement at a reference test point at small physical distance is made to improve measuring accuracy. For this, the measuring inset has two temperature sensors in two separate mineral insulated cables.

The following data applies for both temperature sensors, see also **Temperature rise in the event of a fault** on page 11.

Heat resistance R_{th} for mineral insulated cable Ø 3 mm (0.12 in)	
$\Delta t = 200\ K/W \times 0.038\ W = 7.6\ K$	
Resistance thermometer without thermowell	200 K/W

K/W = kelvin per watt

Note

The specified thermal resistance R_{th} should be indicated under the conditions ‘stationary gas (environment)’ and ‘mineral insulated cable without thermowell’.

Temperature rise in the event of a fault
In the event of a fault, the temperature sensors will exhibit a temperature rise Δt as appropriate for the applied power. This temperature rise Δt must be considered when determining permissible temperature classes, see **Permissible ambient temperature** on page 11.

Note
A dynamic short-circuit current that occurs in the measurement circuit for a matter of milliseconds in the event of a fault is irrelevant with regard to heating.
The temperature rise Δt can be calculated using the following formula:

$$\Delta t = R_{th} \times P_o \quad \left[K/W \times W\right]$$

Δt Temperature rise

R_{th} Thermal resistance

P_o Output power of the integrated transmitter

Example:
Resistance thermometer diameter approximately 3 mm (0.12 in) without thermowell:
R_{th} = 200 K/W,
P_o= 38 mW
Δt = 200 K/W × 0.038 W = 7.6 K

For a transmitter output power P_o = 38 mW, a temperature rise of approx. 8 K results in the event of a fault.
In consideration of this temperature rise, the maximum possible surface temperatures $T_{surf.}$ arise for temperature classes T1 to T6, as presented in **Table 10** on page 11 .

Type of protection Ex i, intrinsic safety

Permissible ambient temperature
The following table shows the permissible ambient temperature $T_{amb.}$ for the corresponding equipment protection levels Ga (zone 0) and Gb (zone 1) as a function of the material of the connection head (aluminum or stainless steel), the thermal insulation at the measuring point and the surface temperature $T_{surf.}$ at the measuring point.

The surface temperatures ($T_{surf.}$) are determined as follows:
$T_{surf.}$ = T6 to T3 − 5°C − 8°C (Δt in the event of an error)
$T_{surf.}$ = T2 to T1 − 10°C − 8°C (Δt in the event of an error)

For Δt = 8 °C, see **Temperature rise in the event of a fault** on page 11.

Note
The ambient temperatures specified in the following table must be processed in accordance with EN 60079-14 for device protection level Ga (zone 0).

$T_{surf.}$	Maximum permissible ambient temperature $T_{amb.}$ for equipment protection levels Ga (zone 0) and Gb (zone 1)			
	Aluminum connection head		CrNi steel connection head	
	Without insulation	With insulation	Without insulation	With insulation
400 °C (T1)*	48 °C	67 °C	26 °C	50 °C
282 °C (T2)	62 °C	74 °C	49 °C	65 °C
187 °C (T3)	71 °C	78 °C	64 °C	74 °C
122 °C (T4)	77 °C	81 °C	75 °C	81 °C
72 °C (T6)	52 °C	55 °C	54 °C	57 °C

Table 10: Ambient temperature for equipment protection levels Ga (zone 0) and Gb (zone 1)

* Maximum measuring range of the device: 400 °C

Note
The standard supplied M20 × 1.5 plastic cable gland has a limited temperature range of −40 to 70 °C (−40 to 158 °F). When using the supplied cable gland, make sure that the ambient temperature is within this range.

… Use in potentially explosive atmospheres in accordance with ATEX and IECEx

TSP341-N connection data

The integrated transmitter is based on the TTH300 HART from ABB.

The intrinsic safety type examination certificates PTB 18 ATEX 2002 X and IECEx PTB 18.0041 X apply to the complete temperature sensor TSP341-N with integrated transmitter, so the type examination certificates for the TTH300 are **not** applicable.

When connecting the TSP341-N to certified intrinsically safe circuits, the following maximum input values must be observed.

Max. voltage U_i	30 V
Short-circuit current I_i	130 mA
Max. power P_i	0.8 W
Internal inductance L_i	0.5 mH
Internal capacitance C_i	0.57 nF

Table 11: Electrical data

Type of protection Ex d - flameproof (enclosure)

With connection head, the TSP341-N can be used in 'Ex d – flameproof (enclosure)' type of protection in zone 1.

- The connection conditions listed in the type examination certificate PTB 99 ATEX 1144 X or IECEx PTB 12.0039 X must be observed.
- For the TSP341-N with 'Ex d – flameproof (enclosure)' type of protection, the self-heating of the sensor in the event of a fault should be considered, see **Thermal resistance** on page 10.
- The temperature class and maximum permissible surface temperature or the temperature at the reference test point should be determined accordingly.

Temperature Data

Maximum permissible ambient temperature $T_{amb.}$ on the connection head		
Temperature class	**$T_{amb.}$ with LCD indicator**	**$T_{amb.}$ without LCD indicator**
T1 to T4	−20 to 70 °C (−4 to 158 °F)	−40 to 85 °C (−40 to 185°F)
T6	−20 to 67 °C (−4 to 152 °F)	−40 to 67 °C (−40 to 152 °F)

Table 12: Ambient temperature on the connection head

Temperature class	Maximum surface temperature $T_{surf.}$ in Zone 1*
T1	400 °C** (752 °F)**
T2	288 °C (550 °F)
T3	193 °C (379 °F)
T4	128 °C (262 °F)
T5	93 °C (199 °F)
T6	78 °C (172 °F)

Table 13: Permissible surface temperature

* Also applies for the temperature at the reference test point

** Maximum measuring range of the device: 400 °C (752 °F)

Tests and certificates

In order to increase the safety and accuracy of the process, ABB offers various mechanical and electrical tests. The results are confirmed with certificates in accordance with EN 10204.

The following certificates are issued:

- Declaration of compliance 2.1 for order conformity
- Inspection certificate 3.1 for visual, dimensional and function checks of the temperature sensor

Ordering Information

TSP341-N

Basic model												
Sensor for non-invasive temperature measurement	**TSP341-N**	**XX**	**XXX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Explosion Protection / Approvals												
Without explosion protection		Y0										
Intrinsic Safety ATEX, Zone 0: II 1 G Ex ia IIC T6 Ga, Zone 1: II 2 G Ex ib IIC T6 Gb		D2										
Intrinsic Safety acc. NAMUR NE 24 and ATEX II 1 G Ex ia IIC T6 Ga		N3										
Flameproof enclosure ATEX II 2 G Ex db IIC T6/T4 Gb		D7										
Intrinsic Safety Zone 0: Ex ia IIC T6 Ga, Zone 1: Ex ib IIC T6 Gb		J2										
Flameproof enclosure IECEx db IIC T6/T4 Gb		J7										
Sensor Mounting												
Clamp-on, sensor in 90° angle to pipe, pipe clamp material chromium steel 1.4016 (ASTM 430)			Y14									
Clamp-on, sensor in 90° angle to pipe, pipe clamp material stainless steel 1.4301 (ASTM 304)			Y15									
Pipe Clamp for Pipe Diameter												
DN 40 to 80				C8								
DN150				C1								
DN200				C2								
DN300				C3								
DN400				C4								
DN500				C5								
Others				Z9								
Extension Tube Length												
K = 150 mm (6 in), additionally ~32 mm (~1.3 in) for retaining plate					N1							
Measuring inset type												
RTD, TF, measuring range -40 to 400 °C (-40 to 752 °F)						S5						
Measuring Inset Diameter												
2 × 3 mm							N3					
Sensor Type and Wiring												
1 × Pt100, 3-wire								P2				
Sensor Accuracy												
Thin Film, Accuracy Class A, IEC 60751, Range -40 to 400 °C (-40 to 752 °F)									N2			
Connection Head Type / Material												
AGL / Aluminium, screwed cover										L1		
AGLD / Aluminium, screwed cover with display										L4		
AGS / Stainless steel, screwed cover										S1		
AGSD / Stainless steel, screwed cover with display										S4		
Transmitter												
Transmitter for non-invasive temperature measurement, HART®, output 4 to 20 mA											H8*	
Transmitter for non-invasive temperature measurement, HART®, output 4 to 20 mA Ex i											H9**	
Transmitter Measuring Range												
Customer-specific measuring range												AZ

* Only available with **'Explosion Protection / Approval'** codes Y0, D7 and J7

** Only available with **'Explosion Protection / Approval'** codes D2, N3 and J2

… Ordering Information

Additional ordering information

TSP341-N	**XX**	**XXX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Sensor for non-invasive temperature measurement								
Certificates								
Declaration of compliance according EN 10204-2.1, with the order	C4							
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test	C6							
Others	CZ							
Handling of Certificates*								
Send via e-mail		GHE						
Send via mail		GHP						
Send via mail express		GHD						
Send with instrument		GHA						
Only archived		GHS						
Cable Entry Options								
1 × M20 × 1.5, without cable gland			U1					
1 × ½ in NPT, without cable gland			U2					
Display Type**								
LCD indicator type AS				L1				
Other Options								
Name plate stanless steel					PV			
Others					PZ			
Documentation Language								
German						M1		
English						M5		
Language package Western Europe / Scandinavia (Languages: DA, ES, FR, IT, NL, PT, FI, SV)						MW		
Language package Eastern Europe (Languages: EL, CS, ET, LV, LT, HU, HR, PL, SK, SL, RO, BG)						ME		
TAG Plate								
Stainless steel plate with TAG no.							T1	
Additional Identification Plate								
Stainless steel plate with customer specific text								T2
Adhesive label								T3

* Select for '**Certificates**' code C4, C6

** Select for '**Connection head**' code L4, S4

Trademarks

HART is a registered trademark of FieldComm Group, Austin, Texas, USA

Sales **Service**



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