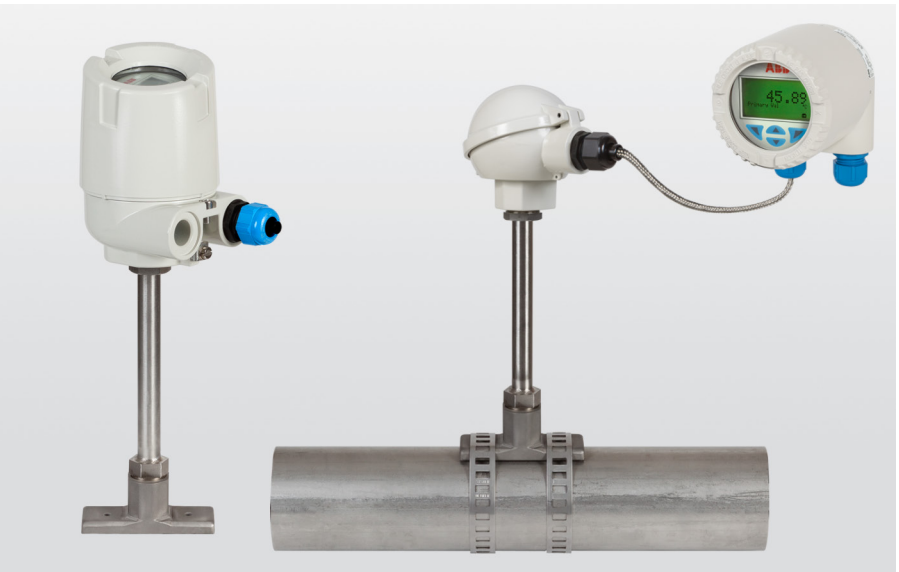
# NINVA™ TSP341-N

## Sensor for non-invasive temperature measurement



## Measurement made easy

TSP341-N

## Introduction

The temperature sensor TSP341-N allows for reliable temperature measurement without intervention in the process.
Plant safety is clearly increased as a result.
Thanks to the quick and easy surface mounting and by eliminating the thermowell and the need to open the process, substantial cost reductions are achieved.

* 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.

## Additional Information

Additional documentation on TSP341-N is available for download free of charge at www.abb.com/**temperature**.
Alternatively simply scan this code:

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# 1 Safety

## General information and instructions

These instructions are an important part of the product and must be retained for future reference.
Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.
For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.
The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times.
The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

## Warnings

The warnings in these instructions are structured as follows:

**⚠ DANGER**

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

**⚠ WARNING**

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

**⚠ CAUTION**

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

***NOTICE***

The signal word *'**NOTICE**'* indicates possible material damage.

**Note**

'**Note**' indicates useful or important information about the product.

# … 1 Safety

## Intended use

Temperature sensor to enable non-invasive measurement of temperature of a flowing fluid in a pipe by accurately measuring the surface temperature.
The device is designed for use exclusively within the values stated on the name plate and in the specifications (see **Specifications** in the operating instruction or data sheet).

- The permissible ambient temperature range may not be up-scaled or down-scaled.
- The IP rating must be observed during operation.
- For use in potentially explosive atmospheres, follow the respective guidelines.
- When using as a SIL-device in safety-relevant applications, the corresponding SIL-Safety Manual should be observed.

## Improper use

The following are considered to be instances of especially improper use of the device:

- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

## Use in Potentially Explosive Atmospheres

**Note**

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- The Ex safety instructions in this additional document are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values listed there are also observed.
  The icon on the name plate indicates the following:



## Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

## Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface.
It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).
Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.
ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

On www.abb.com/cybersecurity under 'Additional resources', 'Alerts and notifications' you will find notifications about newly discovered software vulnerabilities. It is recommended that you visit this website regularly and activate 'Subscribe to email alerts' to receive email notifications about 'ABB cyber security alerts and notifications'.

## Software downloads

By visiting the web page indicated below, you will find options to download the latest software. It is recommended that you visit this web page regularly:

ABB-Library – NINVA TSP341-N – Software Downloads

## Manufacturer's address

**ABB AG**
**Measurement & Analytics**
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

## Service address

**Customer service center**
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com

# 2 Design and function

## 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 and highly influences the selection of traditional invasive measurements.

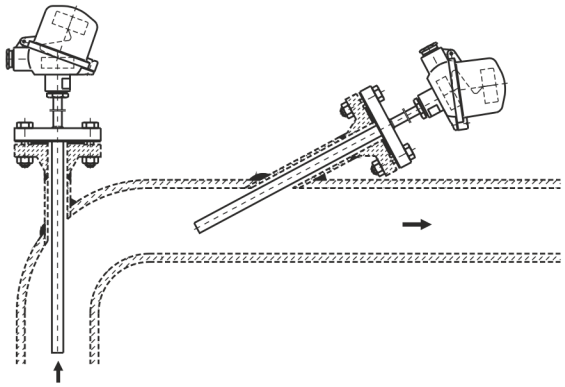


**Figure 1: Classic installation of temperature sensors in piping**

Depending on the process 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 prevent potential catastrophic failure, thermowells used must be inspected regularly and replaced as needed in known critical conditions.

These life cycle costs are in addition to capital expenditure costs incurred during planning and designing temperature measurement points. Engineering costs for stability calculations, structural flanges to support and seal the thermowells, and welding and fabrications costs all add up to the total capital expenditure.

The costs mentioned above can be eliminated if the process temperature could be measured non-invasively. Using ABB's non-invasive approach, it is possible to get an accurate measurement of the process temperature without the need for a thermowell.

The NINVA™ TSP341-N* temperature sensor now combines non-invasive temperature measurement with the established HART® communications protocol in two-wire technology. Therefore, the device can be integrated seamlessly in existing and future process facilities.

The 'N' in TSP341-N stands for non-invasive temperature measurement and can turn a metal pipe carrying a process media into a temperature sensor. Using model based algorithms in the transmitter electronics to compensate for ambient and surface contact conditions, a NINVA delivers an accurate measurement of the true surface temperature of the pipe. When coupled with process conditions, the sensor provides a non-invasive approach to measure the process temperature without the need for a thermowell for the process conditions.

A non-invasive approach to temperature measurement is well suited for turbulent, liquid like flows in metal pipes where the surface temperature is well correlated with the bulk temperature of the process media. However, the sensor can be effectively used in the vast majority of process and piping conditions without any need for the input of process or piping specification. Please see more details in the section **How to effectively use a non-invasive measurement** on page 8.

* 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.

# … 2 Design and function

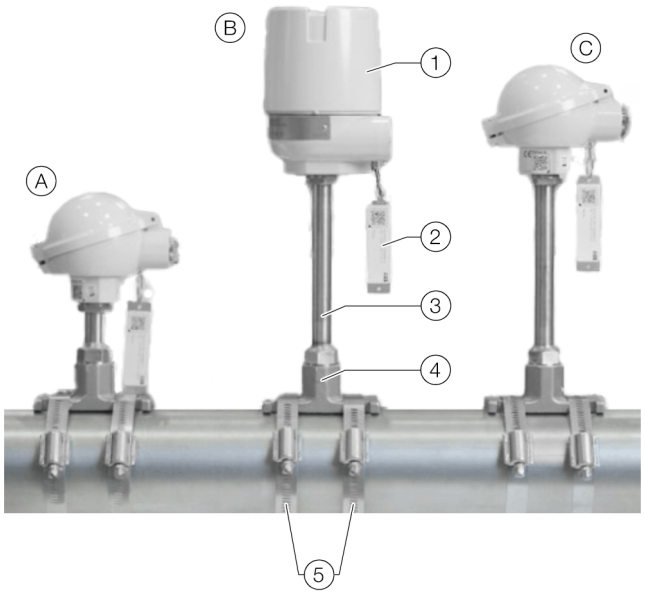
## System design

The TSP341-N temperature sensor contains a TTH300-N temperature transmitter 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 A and AS LCD indicator can be integrated.

The transmitter is connected to two temperature sensors. The first - sensor 1 - measures the contact temperature at the measuring point, while the second - sensor 2 - measures the ambient temperature at a 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 177 °F) is covered. In a remote configuration, process temperature options up to 550 °C (1022 °F) can be realized as special designs with the remote temperature sensor being able to withstand ambient temperatures up to 100 °C (212 °F).

The transmitter can be configured using the software provided by ABB with TSP341-N-support via the device drivers (FDIX/DTM/EDD) and tools such as Field Information Manager (FIM) in accordance with the current conditions of use.




(A) TSP341-N Compact
(B) TSP341-N Integrated
(C) TSP341-N Remote temperature sensor

(1) Connection head
(2) Tag plate
(3) Extension tube
(4) Retaining plate
(5) Clamp collars

**Figure 2: TSP341-N terminology**

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.

Clamps with different expansion coefficients are available to adapt to the piping or vessel material. For a good measurement, the surface under the retaining plate should be straight, and cleaned to remove any particles or dust. The presence of standard paint coatings (up to 300 µm) on a surface have a minimal effect on the absolute accuracy. For larger organic or non-thermally conductive coatings, please see more details in the section **How to effectively use a non-invasive measurement** on page 8.
During installation, make sure that the measuring tip with the integrated sensor element has optimal contact with the measuring point.

In addition, insulation to minimize the effect of humidity (rain and ice) and wind on the pipe surface temperature is recommended.

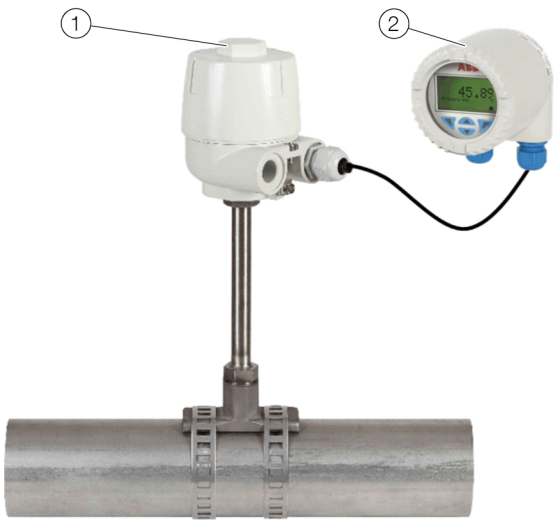
## Variants

There are four installation variants for non-invasive temperature measurement:

- **TSP341-N Integrated** – TSP341-N with integrated head-mount transmitter TTH300-N
- **TSP341-N Remote temperature sensor** – TSP341-N with connected field mount transmitter TTF300-N
- **TSP341-N Compact** – TSP341-N with integrated head-mount transmitter TTH300-N for high vibration
- **TSP341-N Compact remote temperature sensor** – TSP341-N for high vibration with connected field mount transmitter TTF300-N

The unique advantage of the ABB NINVA approach is that the sensor assembly can be mounted remotely to the transmitter without affecting the performance of the measurement. This approach has advantages in allowing the sensor to be used in situations where the process temperature is higher than 400 °C (which exceeds the capabilities of the transmitter electronics in the connection head), or where higher vibration resistance or small piping with weight restrictions exists.

Additionally, the remote temperature sensor is advantageous when the sensor is mounted in locations where the visibility of the display and access to the transmitter is difficult. When a remote installation is required, the TSP341-N Remote temperature sensor, is to be used in conjunction with a TTF300-N field-mount transmitter.




① Remote temperature sensor ② TTF300-N transmitter

**Figure 3: Installation of the TTF300-N with the TSP341-N Remote temperature sensor**

The TTF300-N differs from a TTF300 in the following manner:

1. The TTF300-N is capable of non-invasive temperature measurements, which is set up as the factory default.
2. When connected to a TSP341-N for non-invasive temperature measurement, care must be taken to wire the sensors to the transmitter according to this manual to ensure a correct measurement. See **Figure 2** on page 6.
3. The TTF300-N can be used in conventional mode wherein it functions as a TTx300 for use with both RTDs and thermocouples. Details can be found in the corresponding **Operating Instruction OI/TTF300**.

# … 2 Design and function

## How to effectively use a non-invasive measurement

A NINVA™ TSP341-N can be mounted on any process pipe or container to provide an accurate measurement of the surface temperature of the structure. Uniquely, by contacting the surface perpendicular to the primary axis of the pipe, a NINVA™ measurement can be handled and managed in a similar manner to any thermowell measurement.

However, the NINVA™ TSP341-N approach provides unprecedented abilities to estimate the complete performance of a temperature measurement point before installation. When considering a NINVA measurement, the following three steps should be followed:

**Step 1: Verify the expected measurement performance**
Input nominal process parameters and pipe dimensions into the **ABB performance predictor** to obtain an expected steady state result of a NINVA™ measurement. If the outcome is satisfactory for the application, proceed with the installation.

NINVA performance predictor

**Step 2: Mount in location**
Follow the mounting instructions carefully ensuring to loosen the nut on the head before mounting the device (see **Installation of the temperature sensor** on page 12).

***NOTICE***

**Impairment of the device function**
For trouble-free operation of the temperature sensor, the following points should be observed:

- If fluid accumulation in the extension tube can be expected at the installation location, install the temperature sensor with connection head above the horizontal line.
- The extension tube and retaining plate are tightened at the plant with a torque of 70 Nm, do not loosen this connection!
- Make sure that both sensor elements of the TSP341-N do not come into contact with each other at the ends.
- Make sure that no lateral forces (e.g. due to shifting of the retaining plate) are exerted on the protruding contact sensor during assembly.
- Make sure that both contact areas of the retaining plate are set level on the measuring point over their entire length.

Follow the detailed mounting instructions presented in this video:
Movie - ABB NINVA™ | Preparation and mounting

Or as a document in the Detailed Installation Instructions.

This ensures that the contact sensor tip will not get damaged or bent and that a good and repeatable contact of the sensor is made once the final tightening of the head is completed.

If the default or ordered preset measurement range does not match the requirement for the location, the lower (4 mA) and upper (20 mA) temperature range should be adjusted to the desired measurement range using a handheld terminal.

**Step 3: Insulate if used on an outdoor location**
NINVA™ turns the pipe into a sensor and measures the surface temperature of the pipe. If it rains or the wind is blowing strongly at the location, the true surface temperature of the pipe can be affected. The correlation with the process temperature will therefore deviate. Insulation will allow the pipe surface temperature to better correlate with the process temperature. However, in all cases, the NINVA™ will compensate the contact sensor measurement for ambient effects delivering the true surface temperature of the pipe under the sensor under all conditions.

Detailed background information on non-invasive temperature measurement can be found at:

# 3 Product identification

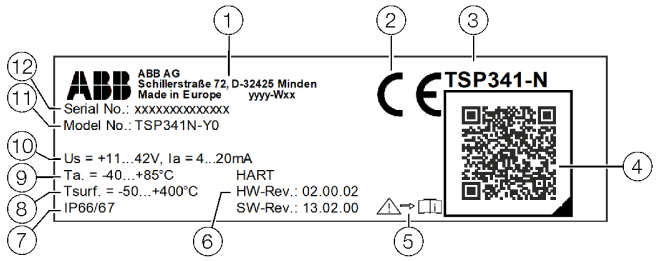
## Name plate

**Note**

The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

**Note**

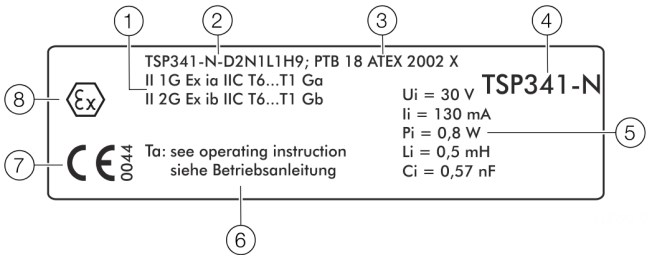
The values specified on the name plate are maximum values and do not take process-related stress into consideration. This should be taken into consideration when working with the instruments.




1. Manufacturer address, year / week of manufacture
2. CE mark (EU conformity), if not on additional plate
3. Type designation / model
4. AutoID according to IEC 61406
5. Note: Observe product documentation
6. With integrated transmitter: Hardware / software revision
7. IP rating of housing
8. Surface temperature range $T_{amb.}$, for Ex versions on additional plate
9. Ambient temperature range $T_{amb}$. (temperature on connection head), for Ex versions on additional plate
10. Transmitter specification
11. Model number
12. Serial number

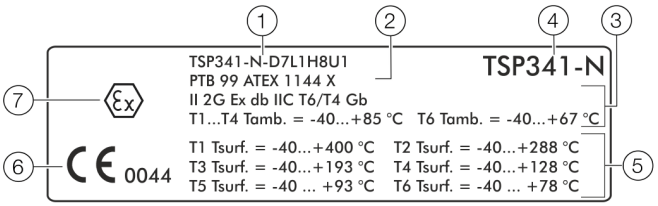
**Figure 4: TSP341-N name plate (example for 'Ex i – intrinsic safety' type of protection)**

**Additional certification plate for explosion-proof devices**




1. Ex marking
2. Type designation in accordance with approval
3. Approval number
4. Type designation
5. Device connection data
6. Note on instruction for ambient temperature
7. CE mark (EU conformity) and notified body for quality assurance
8. Ex Mark

**Figure 5: Additional certification plate for devices with type of protection "Ex i - intrinsic safety" (example)**




1. Type designation in accordance with approval
2. Approval number
3. Ex marking
4. Type designation
5. Temperature range
6. CE mark (EU conformity) and notified body for quality assurance
7. Ex Mark

**Figure 6: Additional certification plate for devices with type of protection "Ex d - flameproof enclosure" (example)**

# 4 Transport and storage

## Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.
All claims for damages must be submitted to the shipper without delay and before installation.

## Transporting the device

Observe the following instructions:

- Do not expose the device to humidity during transport. Pack the device accordingly.
- Pack the device so that it is protected against vibrations during transport, for example, by using air-cushioned packing.

## Storing the device

Bear the following points in mind when storing devices:

- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

**Ambient conditions**

The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device.
Adhere to the device data sheet!

## Returning devices

For the return of devices, follow the instructions in **Repair** on page 37.

# 5 Installation

## Safety instructions

**⚠ DANGER**

**Improper installation and commissioning of the device carries a risk of explosion.**
For use in potentially explosive atmospheres, observe the information in the corresponding safety instructions.

**⚠ CAUTION**

**Risk of burns due to hot measuring media**
The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

## General Notes

The sensor assembly is designed to ensure long term mechanical stability in mounting and performance. The sensor is mounted on to the pipe or vessel by means of at least 2 clamp collars. The collars are tensioned with a screw lock assembly where a torque of 10 Nm is specified in order to ensure that the mounting is stable in service.

When installing the temperature sensor using clamp collars, observe the following points:

- The temperature sensor must be firmly and securely installed in a way that conforms to the application.
- The temperature sensor must be installed at angle of 90° to the piping.
- The retaining plate of the temperature sensor must lie flat on the measuring point, with the sides of the plate parallel to the centerline of the pipe. Ensure that the contact surface is free of dirt or loose materials.
- The retaining plate of the temperature sensor must be installed on the piping using suited clamp collars. Select the length of the clamp collars and the material according to the installation position.
- The IP rating will no longer apply in the event of damage to the connection head or the threads, gaskets or cable glands on the connection head.
- The connection leads must be firmly connected to the terminals.
- After connecting the connection lines with a suited tool (screwdriver, wrench), securely close and seal the connection head. Be sure to observe here that the sealing rings of the connection heads are clean and undamaged.
- Insulation of the piping around the measuring point is recommended for any installation to ensure that the pipe surface temperature correlates to the process temperature without convective losses to the environment. Ambient conditions like rain will affect the pipe surface temperature and the corresponding relation to the true process temperature.

## Ambient conditions

### 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  as well in declarations of conformity and type examination certificates!

| Permissible ambient temperature range $T_{amb.}$ on the connection head | |
|---|---|
| Connection head without transmitter and without cable gland | −40 to 100 °C (−40 to 212 °F) |
| Connection head with transmitter | −40 to 85 °C (−4 to 185 °F) |

**Table 1: Ambient temperature on the connection head**

When using a contact 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 2: 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.

For detailed information on insulating the measuring point, see .

### Conductor material

If the temperature on the cable entries of the device is over 70° C (158 °F), connection leads with sufficient temperature resistance must be used.

# … 5 Installation

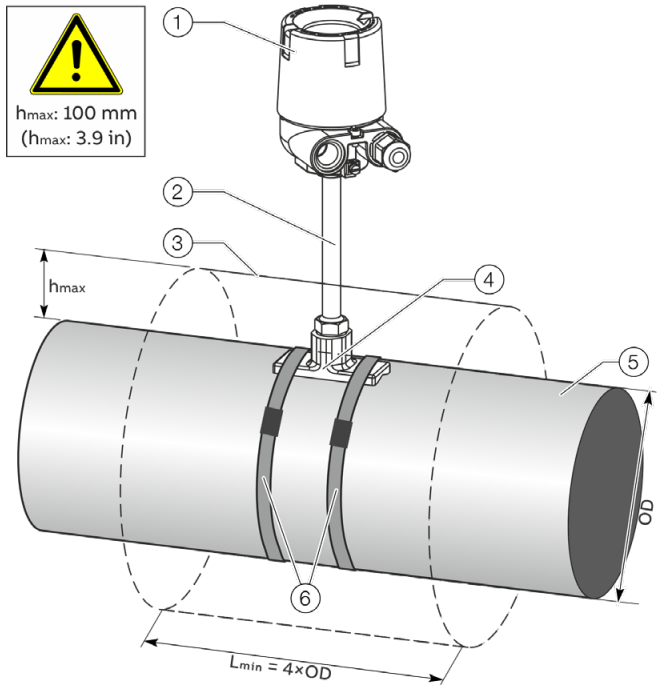
## Mounting

### Installation of the temperature sensor

Follow the detailed mounting instructions presented in this video:
Movie - ABB NINVA™ | Preparation and mounting

Or as a document in the Detailed Installation Instructions.

### Assembly of the TSP341-N Integrated




| | | | |
|---|---|---|---|
| 1 | Connection head | 5 | Piping |
| 2 | Extension tube | 6 | Clamp Collars |
| 3 | Insulation of the measuring point | $L_{min}$ | minimum insulation length |
| 4 | Retaining plate | OD | Pipe outer diameter |

**Figure 7: Assembly on piping TSP341-N Integrated**

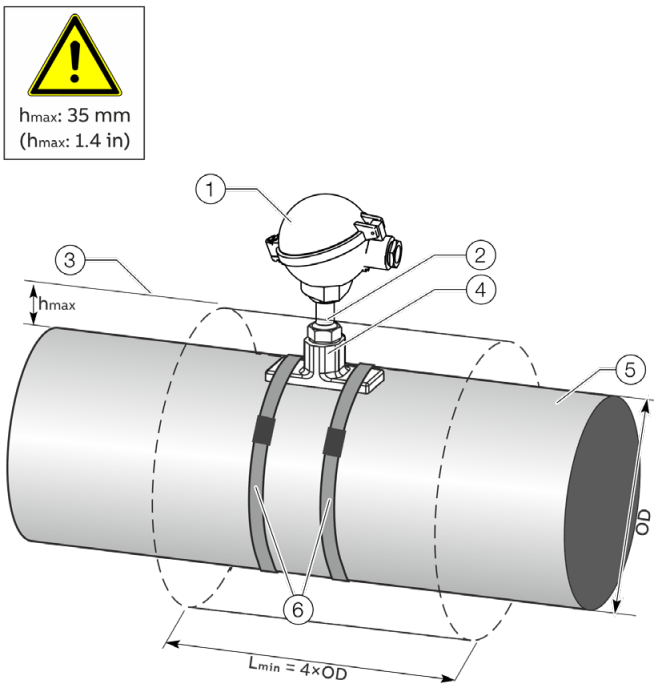
## *NOTICE*

**Impairment of the device function**

For trouble-free operation of the temperature sensor, the following points should be observed:

- If fluid accumulation in the extension tube can be expected at the installation location, install the temperature sensor with connection head above the horizontal line.
- The extension tube and retaining plate are tightened at the plant with a torque of 70 Nm, do not loosen this connection!
- Make sure that both sensor elements of the TSP341-N do not come into contact with each other at the ends.
- Make sure that no lateral forces (e.g. due to shifting of the retaining plate) are exerted on the protruding contact sensor during assembly.
- Make sure that both contact areas of the retaining plate are set level on the measuring point over their entire length.

## Assembly of the TSP341-N Compact

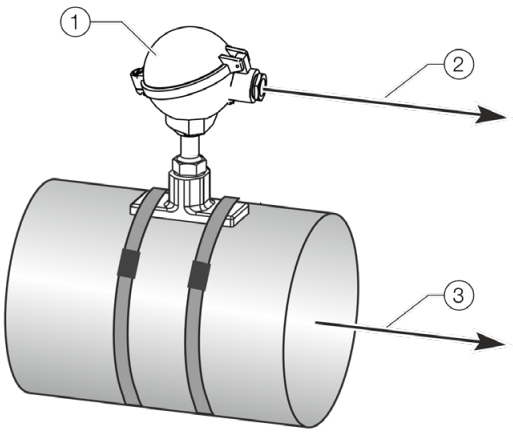



| | | | |
|---|---|---|---|
| 1 | Connection head | 5 | Piping |
| 2 | Extension tube | 6 | Clamp Collars |
| 3 | Insulation of the measuring point | $L_{min}$ | minimum insulation length |
| 4 | Retaining plate | OD | Pipe outer diameter |

**Figure 8: Assembly on piping TSP341-N Compact**

### Direction of cable entry for the TSP341-N Compact

To ensure good measurement results, careful and exact installation is required. Ensure that the cable entry of the connection head is aligned with the axis of the piping (see figure 9).




| | | | |
|---|---|---|---|
| 1 | Connection head | 3 | Axis of piping |
| 2 | Direction of cable entry | | |

**Figure 9: Mounting details for the TSP341-N Compact**

### Clamp collars

The clamp collars should be selected according to the pipe diameter where the sensor will be located. They are available as accessories.

The clamps sets are designed with a low thermal mass and with as much continuous contact to the pipe as possible. This ensures a fast thermal response of that keeps the sensor in strong mechanical mounting contact with the pipe even through dramatic temperature changes.

**Note**

Please ensure the clamp collars that are selected have a thermal expansion coefficient that is closest to that of the pipe.

# … 5 Installation

## … Mounting

**Insulation of the measuring point**

Insulation of the piping around the measuring point is recommended for any installation to ensure that the pipe surface temperature correlates to the process temperature without convective losses to the environment. Ambient conditions like rain will affect the pipe surface temperature and the corresponding relation to the true process temperature. Typical insulation should be at least 2 × outer diameter (OD) of the piping on either side of the sensor mounting position with a thickness of at least 3 cm (see **Figure 7**). Mineral wool or particle foam (PET) based insulations are typical forms of insulating material that can be used.

For high temperature applications, the insulation also protects the connection head from excessive temperatures due to heat radiation from the piping.

In all cases, the insulating material used must be suited for the process and ambient conditions that apply to the process and are the responsibility of the user.

***NOTICE***

**Impact on measuring accuracy**

Impairment of measuring accuracy due to improper insulation of the measuring point.

- Insulate measuring point to the height '$h_{max}$' as presented in **Figure 7** only.
- The extension tube should not be insulated above the measuring point.

## Electrical connections

**Safety instructions**

**⚠ WARNING**

**Risk of injury due to live parts.**

Improper work on the electrical connections can result in electric shock.

- Connect the device only with the power supply switched off.
- Observe the applicable standards and regulations for the electrical connection.

The electrical connection may only be established by authorized specialist personnel.

Notices on electrical connection in this instruction must be observed; otherwise, electric safety and the IP-rating may be adversely affected.

Safe isolation of electric circuits which are dangerous if touched is only guaranteed when the connected devices fulfill the requirements of EN 61140 (basic requirements for secure separation).

To ensure safe isolation, install supply lines so that they are separate from electrical circuits which are dangerous if touched, or implement additional isolation measures for them.

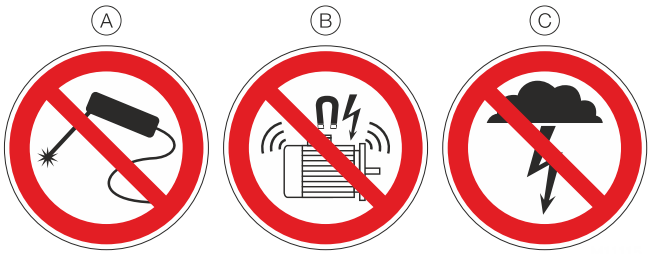
### Protection of the transmitter from damage caused by highly energetic electrical interferences

The transmitter has no switch-off elements. Therefore, overcurrent protective devices, lightning protection, or voltage disconnection options must be provided at the plant.

**NOTICE**

**Temperature transmitter damage!**

Overvoltage, overcurrent and high-frequency interference signals on the supply connection as well as sensor connection side of the device can damage the temperature transmitter.




(A) Do not weld

(B) No high-frequency interference signals / switching operations of large consumers

(C) No overvoltage due to lightning

**Figure 10: Warning signs**

Overcurrent and overvoltage can occur through for example welding operations, switching operations of large electric consumers, or lightning in the vicinity of the transmitter, sensor, as well as connector cables.

Temperature transmitters are sensitive devices on the sensor side as well. Long connector cables to the sensor can encourage damaging interference. This can already happen if temperature sensors are connected to the transmitter during installation, but are not yet integrated into the system (no connection to the supply isolator / DCS)!

#### Suited protective measures

The following items should be observed to protect the transmitter from sensor-side damage:

- In the vicinity of the transmitter, sensor and sensor connector cable in case of a connected sensor, high-energy overvoltage, overcurrent and high-frequency interference signals due to welding operations, lightning, circuit breakers or large consumers of electricity among others should be absolutely avoided.
- The connection cable of the sensor on the transmitter should be disconnected when performing welding work in the vicinity of the installed transmitter, sensor, as well as supply lines from the sensor to the transmitter.
- This correspondingly also applies to the supply side, if there is a connection there.

### Cable glands

The cable diameter must be appropriate for the cable gland used so that IP rating IP 66 /IP 67 or NEMA 4X can be maintained. This must be checked during installation.

For delivery without cable gland (thread M20 × 1.5 or NPT ½ in), the following points must be observed:

- Use cable glands in accordance with version M20 × 1.5 or NPT ½ in.
- Observe information in the data sheet for the cable gland used.
- Check the working temperature for the cable gland used.
- Check the IP rating IP 66 / IP 67 or NEMA 4X of the cable gland used.
- Check the Ex relevant specifications for the cable gland used in accordance with the manufacturer data sheet or the Ex declaration.
- The cable gland used must be approved for the cable diameter (IP rating).
- Observe tightening torque in accordance with information in data sheet / operating instructions for the cable gland used.

### Conductor material

**NOTICE**

**Danger of wire breakage**

The use of conductive material with solid wires can lead to wire breakage.

- For the electrical connection of the temperature sensor, only use cable material with flexible conductors.

#### Power supply

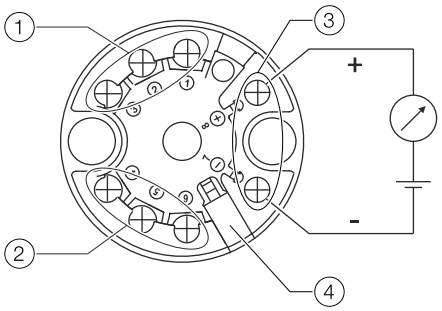
- Cable type: flexible standard cable material
- Maximum wire cross-section: 1.5 $mm^2$ (AWG 16)

# … 5 Installation

## … Electrical connections

### Terminal layout

The transmitter used in the TSP341-N temperature sensor is based on the TTH300-N.




(1) terminals 1 to 3 for sensor 1 (Contact Sensor)

(1) terminals 4 to 6 for sensor 2 (Reference Sensor)

(3) terminals 8/+ and 7/− for current output of 4 to 20 mA and HART communication

(4) LCD indicator interface

**Figure 11: Pin assignment of the integrated transmitter**

Terminals 1 to 6 are internally connected to the TSP341-N sensors.
The power supply and signal are routed in the same line and must be implemented as a SELV or PELV circuit in accordance with the relevant standard (standard version).

- For the explosion-proof design, the guidelines in accordance with the Ex standard must be adhered to.
- The cable wires must be provided with end sleeves.
- The user is responsible for ensuring EMC-compliant cabling.

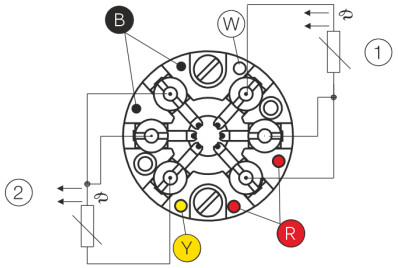
The power supply and signal are routed in the same line and must be implemented as a SELV or PELV circuit in accordance with the relevant standard (standard version).
For the explosion-proof design, the guidelines in accordance with the Ex standard must be adhered to.

- The cable wires must be provided with end sleeves.
- The user is responsible for ensuring EMC-compliant cabling.

## Connections for the TSP341-N Remote temperature sensor

In the TSP341-N Remote temperature sensor, the two sensors (sensor 1 and 2) are connected to a ceramic terminal board and marked with a color coding as shown in Figure 12.

The non-invasive device has two resistance sensors, each in three-wire circuit internally. Sensor 1 (contact sensor) is assigned to colors RED and WHITE, sensor 2 (reference sensor) to colors BLACK and YELLOW.




(R) Red (Y) Yellow (B) Black (W) White

(1) Sensor 1 (contact sensor)

(2) Sensor 2 (reference sensor)

**Figure 12: Pin assignment for ceramic terminal block in the remote transmitter (view from above)**

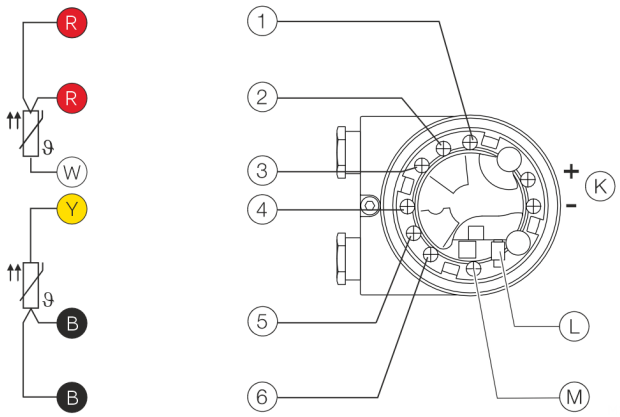
**Note**

For the correct connection to the ceramic terminal block, the color markings described are decisive, rather than any numbers that may be on the base.

The TSP341-N Remote temperature sensor can then be connected to a TTF300-N with six wire cables to obtain a NINVA™ measurement. The wiring in the TTF300-N transmitter follows the pin assignments shown in brief in Figure 13. More details on the pin assignment can be found in the **Operating Instructions 'OI/TTF300'** or the **Commissioning Instructions 'CI/TTF300'** for the TTF300-N.

### *NOTICE*

If the sensor is connected to any 2-channel temperature transmitter other than the TTF300-N with non-invasive model, the temperature measurements from the sensors will still function as two independent, 3-wire, Pt100s. However, the design of the TSP341-N Remote temperature sensor is not suitable for any other measurement application other than to measure the surface temperature of piping and vessels. In such a case, the red and white contacts would provide the surface sensor temperature and the yellow and black would provide reference sensor temperature in the vicinity of the surface sensor.




From sensor:

(R) Red
(W) White
(Y) Yellow
(B) Black

To transmitter:

(1) to (3) Connection sensor 1 (contact sensor)
(4) to (6) Connection sensor 2 (reference sensor)

(K) 4 to 20 mA HART®
(L) Interface for LCD indicator
(M) Ground terminals for shield support for sensors and supply / signal lines

When connected to the TSP341-N Remote temperature sensor, sensor 1 is the contact sensor and sensor 2 is the reference sensor.

**Figure 13: Pin assignment for processing and displaying component.**

### *NOTICE*

For an accurate non-invasive temperature measurement using a TSP341-N Remote temperature sensor, the appropriate sensor pair value indicated on the device has to be input into the TTF300-N (**SPV**). This can be done when following the steps for the 'Easy Set-up' configuration of the TTF300-N transmitter. The following section details the operation of the display interface to the device. The relation to the process temperature can be found in the section **How to effectively use a non-invasive measurement** on page 8.

# 6 Commissioning and operation

## Safety instructions

**⚠ CAUTION**

**Risk of burns due to hot measuring media**

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

## General

When so ordered, the temperature sensor is ready for operation after assembly and installation of the connections.

The parameters of the integrated transmitter are preset at the factory based on factory defaults and the customer specific order. The settings can be changed at any time through HART communication via the device drivers (FDIX/DTM/EDD) or through an LCD indicator.

The operation of the display is valid for TTx300-N transmitters and applies to both the integral version of the TSP341-N with a built-in transmitter as well as for the TTF300-N. The menu, display and parameters outlined here are specific to the non-invasive measurement functionality.

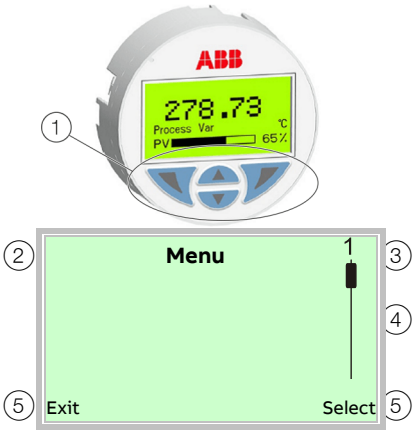
## Checks prior to commissioning

The following points must be checked before commissioning the device:

- Check the installation of the sensor for optimal contact with the measuring point and correct insulation.
- Correct wiring in accordance with **Electrical connections** on page 14.
- Potential equalization must be connected.
- The connected lines must be checked for firm seating. Only firmly seated lines ensure full functionality.
- The ambient conditions must correspond to the information given on the name plate and in the data sheet.
- If devices are to be used in potentially explosive atmospheres, the temperature and electric data in accordance with the separate safety instructions document must be maintained.

## Operation / control

### Menu navigation




1. Operating buttons for menu navigation
2. Indication of menu designation
3. Indication of menu number
4. Marking to indicate relative position within the menu
5. Indication of the current function assigned to the operating buttons and

**Figure 14: LCD indicator (example)**

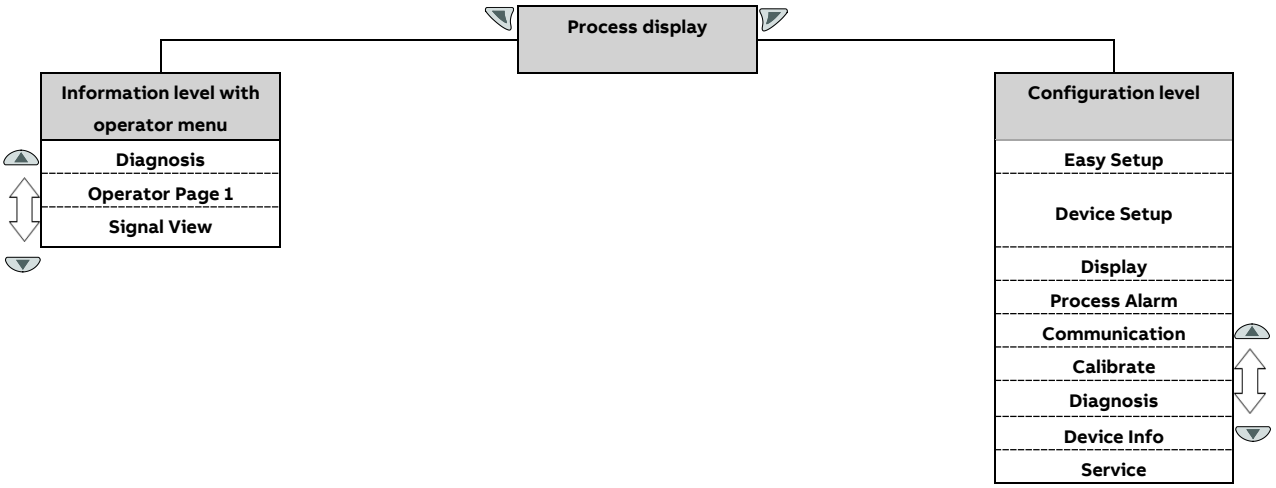
You can use the or operating buttons to browse through the menu or select a number or character within a parameter value.
Different functions can be assigned to the and operating buttons. The function (5) that is currently assigned to them is shown on the LCD indicator.

### Control button functions

| | Meaning |
|---|---|
| Exit | Exit menu |
| Back | Go back one submenu |
| Cancel | Cancel a parameter entry |
| Next | Select the next position for entering numerical and alphanumeric values |

| | Meaning |
|---|---|
| Select | Select submenu / parameter |
| Edit | Edit parameter |
| OK | Save parameter entered |

## HART® menu levels




**Process display**
The process display shows the current process values.

**Operator menu**
On the information level, the operator menu can be used to display diagnostic information and choose which operator pages to display.

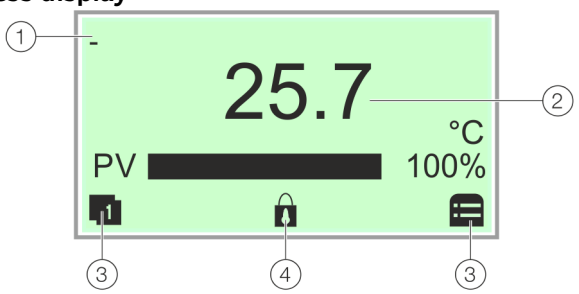
**Configuration level**
The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level.

**Commissioning**
The menu item “Easy Setup” enables a simplified configuration of the device.

# … 6 Commissioning and operation

## … HART® menu levels

### Process display




1. Measuring point tagging (Device TAG)
2. Current process values
3. 'Button function' symbol
4. 'Parameterization protected' symbol

**Figure 15: Process display (example)**

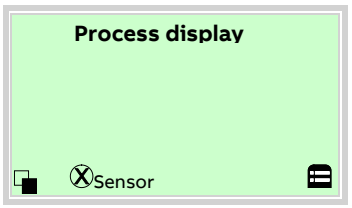
The process display appears on the LCD indicator when the device is powered on.It shows information about the device and current process values.
The way in which the current process values are shown can be adjusted on the configuration level.
The symbols at the bottom of the process display are used to indicate the functions of the operating buttons and , in addition to other information.

Two process variables can also be optionally displayed: one is displayed above the other.

| Symbol | Description |
|---|---|
| | Call up information level. |
| | Call up configuration level. |
| | The device is protected against changes in the parametrization. |

### Error messages in the HART® LCD indicator

In the event of an error, the relevant device status symbol and the associated diagnosis group will appear:




The diagnostic messages are divided into the following groups in accordance with the NAMUR classification scheme:

| Status symbols according to NAMUR NE 107** | Description | |
|---|---|---|
| not applicable | OK or Information | Device is functioning or information is available |
| | Check Function | Device is undergoing maintenance (for example simulation) |
| | Off Specification | Device or measuring point is being operated outside of the specifications |
| | Maintenance Required | Request service to prevent the measuring point from failing |
| | Failure | Error; measuring point has failed |

The error can then be read in plain text via the "Diagnosis" information level.

Additionally, the diagnostic messages are divided into the following areas:

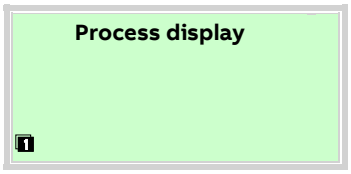
| Range | Description |
|---|---|
| Electronics | Diagnosis for device hardware. |
| Sensor | Diagnosis for sensor elements and connection lines. |
| Configuration | Diagnosis of the communication interface and parameterization / configuration. |
| Operating conditions | Diagnosis for ambient and process conditions. |
| Process | Notes and warnings when leaving the sensor or process temperature range. |

**Note**
For a detailed description of the errors and notices on troubleshooting, see **Diagnosis / error messages** on page 36.

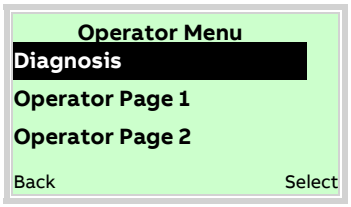
**Diagnosis / error messages** on page 36

### Switching to the information level (operator menu)

On the information level, the operator menu can be used to display diagnostic information and choose which operator pages to display.




1. Open the using Operator Menu.




2. Select the desired submenu using / .
3. Confirm the selection with .

| Menu | Description |
|---|---|
| **... / Operator Menu** | |
| Diagnosis | Selection of the 'Diagnosis' ' submenu, see also **Error messages in the HART® LCD indicator** on page 20 |
| Operator Page 1 | Selection of operator page to be displayed. |
| Autoscroll | When 'Multiplex mode' is activated, automatic switching of the operator pages is initiated on the process screen. |
| Signal View | Selects the 'Signal View' submenu, in which all dynamic measured values are displayed. |

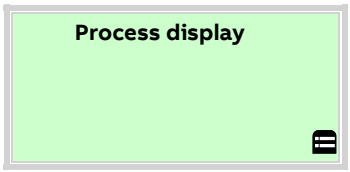
**Error messages in the HART® LCD indicator** on page 20

# … 6 Commissioning and operation

## … HART® menu levels

### Switching to the configuration level (parameterization)

The device parameters can be displayed and changed on the configuration level.




1. Switch to the configuration level using .

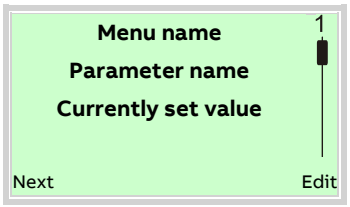
The LCD indicator now indicates the first menu item on the configuration level.

2. Select a menu using / .
3. Confirm the selection with .

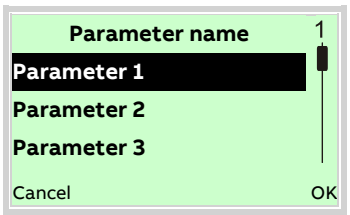
### Selecting and changing parameters

#### Entry from table

When an entry is made from a table, a value is selected from a list of parameter values.




1. Select the parameters you want to set in the menu.
2. Use to call up the list of available parameter values. The parameter value that is currently set is highlighted.

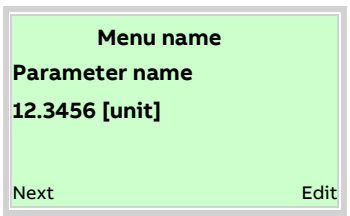



3. Select the desired value using / .
4. Confirm the selection with .

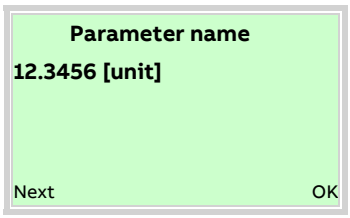
This concludes the procedure for selecting a parameter value.

#### Numerical entry

When a numerical entry is made, a value is set by entering the individual decimal positions.




1. Select the parameters you want to set in the menu.
2. Use to call up the parameter for editing. The decimal place that is currently selected is highlighted.

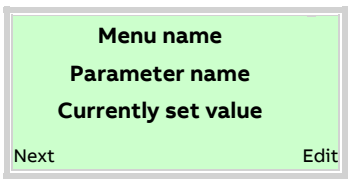



3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

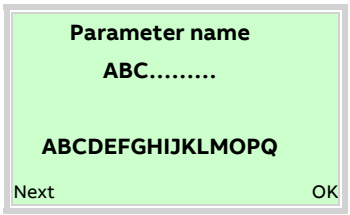
This concludes the procedure for changing a parameter value.

**Alphanumeric entry**

When an alphanumeric entry is made, a value is set by entering the individual decimal positions.




1. Select the parameters you want to set in the menu.
2. Use to call up the parameter for editing. The decimal place that is currently selected is highlighted.




3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

This concludes the procedure for changing a parameter value.

# … 6 Commissioning and operation

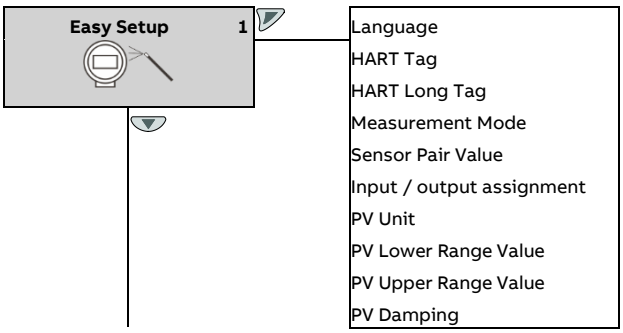
## Parameter overview HART® (for TTx300-N and TSP341-N)

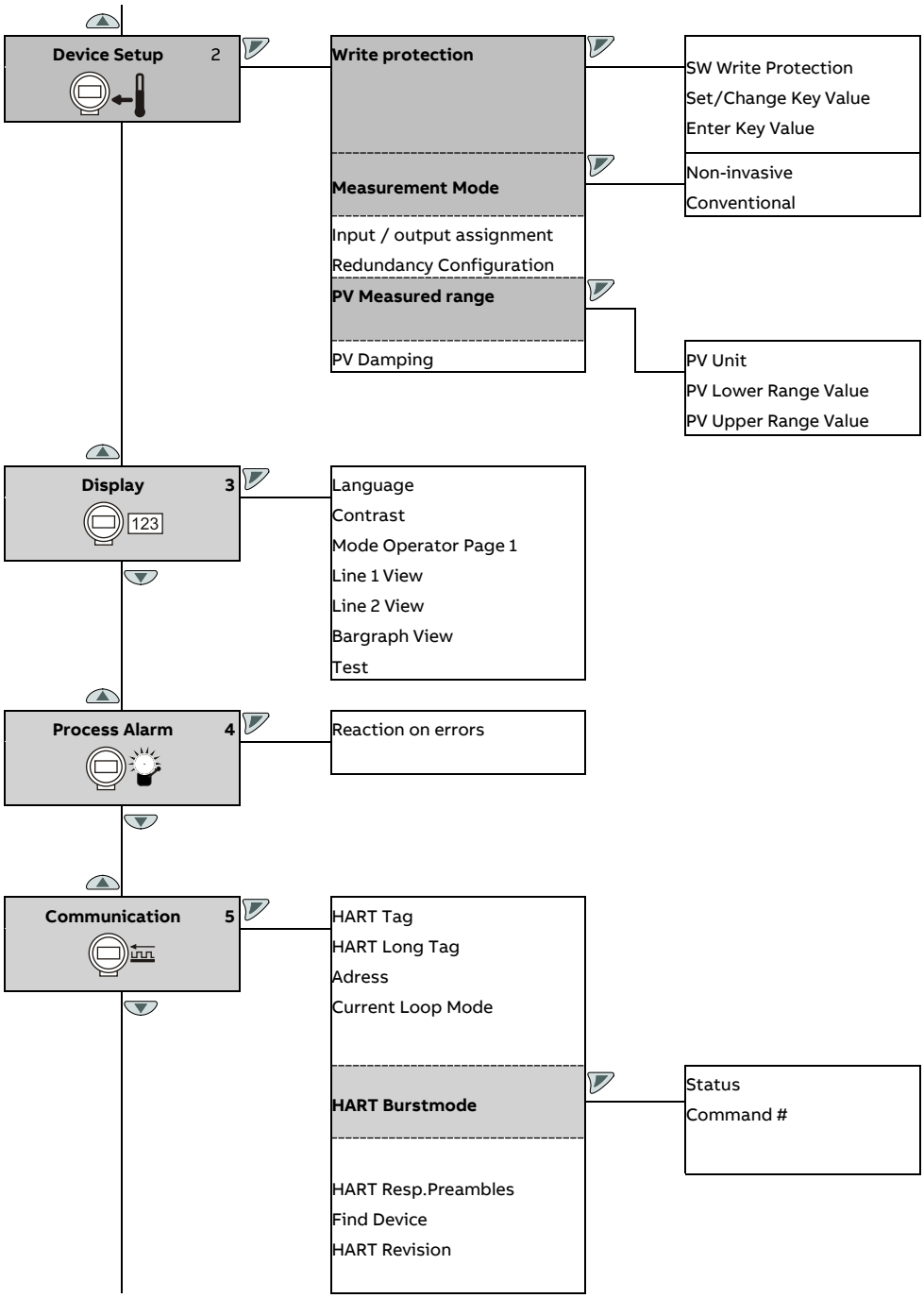
**Note**

This overview of parameters shows the menus and parameters available on the device by default. The TTx300-N differs from the standard TTx300 in that a measurement mode is selectable through the easy setup. There are two measurement modes: non-invasive and conventional. Every TSP341-N with a transmitter and TTF300-N uses a TTx300-N transmitter unit. The factory default setting is non-invasive mode. The non-invasive mode has a set configuration of the type of sensors (2 × 3 -wire PT100), and the associated outputs for current as well as the mapping of the HART variables (non-invasive temperature being the default 4 to 20 mA current output and the Primary Output variable for HART). This configuration cannot be changed in the non-invasive mode.

However, the transmitter can be switched to conventional measuring mode, at which point the full range of capabilities of the TTx300 is available. This flexibility has been implemented for advanced users to use the same transmitter for standard measurement tasks and to allow for the use of the transmitter in non-standard or novel non-invasive applications. When conventional mode is selected, the device will show an application warning and is diagnosed per default as 'Check function notification'.

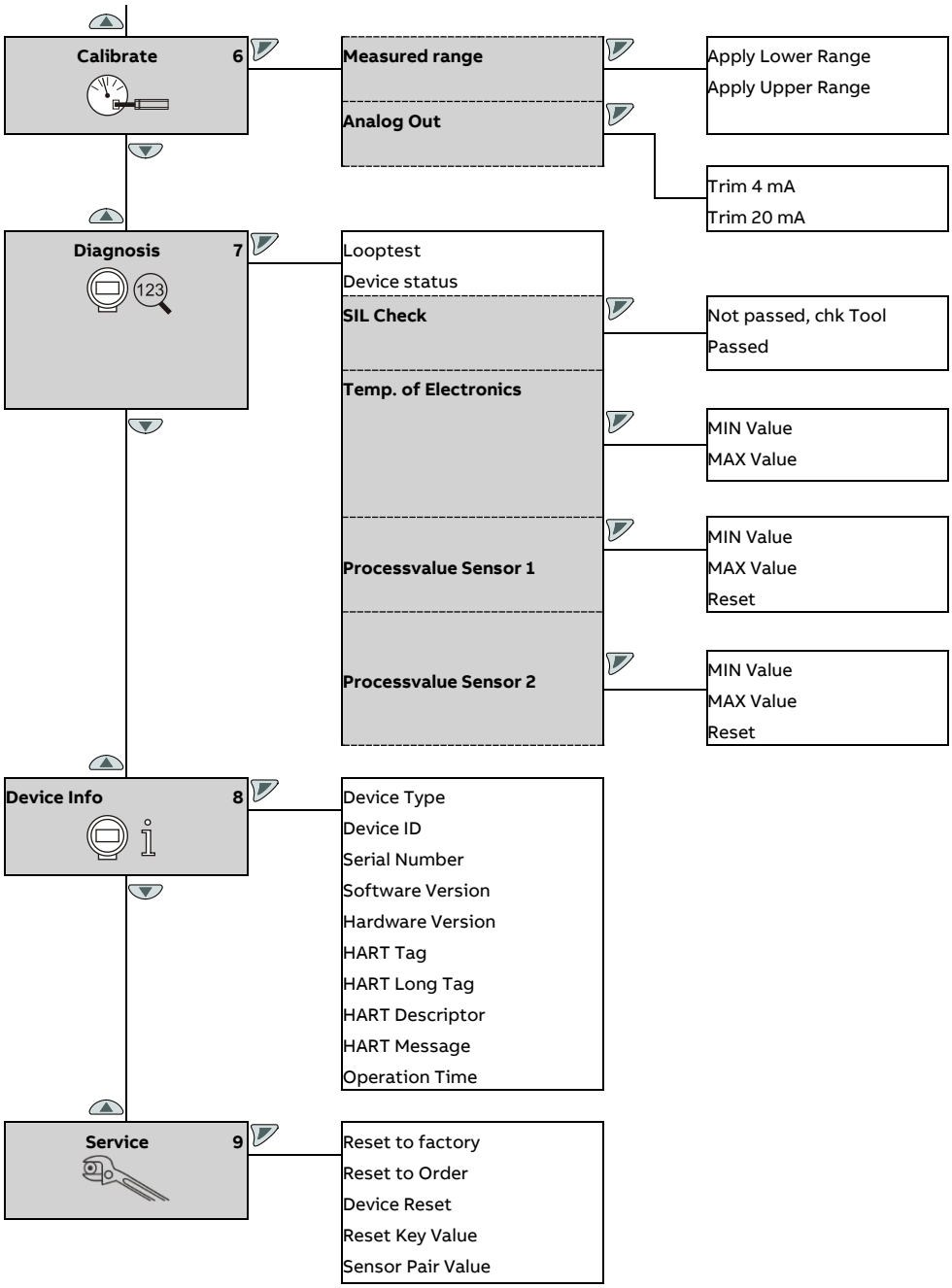
For additional information (event and configuration monitor, see HART interface description, COM/TTX300/HART) and detailed diagnostics can be displayed and configured via the device drivers (FDIX/DTM/EDD).




Device Setup 2
Write protection
SW Write Protection
Set/Change Key Value
Enter Key Value
Measurement Mode
Non-invasive
Conventional
Input / output assignment
Redundancy Configuration
PV Measured range
PV Damping
PV Unit
PV Lower Range Value
PV Upper Range Value
Display 3
123
Language
Contrast
Mode Operator Page 1
Line 1 View
Line 2 View
Bargraph View
Test
Process Alarm 4
Reaction on errors
Communication 5
HART Tag
HART Long Tag
Adress
Current Loop Mode
HART Burstmode
Status
Command #
HART Resp.Preambles
Find Device
HART Revision

# … 6 Commissioning and operation

## … Parameter overview HART® (for TTx300-N and TSP341-N)



## Parameter description HART® (for TTx300-N and TSP341-N)

This section only describes the additional parameters unique to the TTx300-N in non-invasive measuring mode. The standard list of parameters available on the TTH300 can be obtained when selecting the conventional mode. For a detailed description of the parameters in the TTH300 please refer to the manual associated with the SW-Rev.:03.00 and higher.

### Menu: Easy Setup

| Menu / parameter | Description |
|---|---|
| **... /Easy Setup** | |
| Language | Language selects the menu language.<br>• German<br>• English |
| HART Tag | Measuring point tagging<br>• 8 characters |
| HART Long Tag | Long tag:Unique device label in the plant (from HART 7)<br>• 32 characters |
| Measurement Mode | Selects the measurement mode of the transmitter<br>• Non-invasive (default)<br>• Conventional |
| Sensor Pair Value | Input only when used with TTF300-N<br>• Input value from TSP341-N Remote temperature sensor |
| In-output Assignment | Input / output assignment selects the inputs that are mapped to the current output<br>• Sensor 1 (contact temperature)<br>• Electr. Meas. S1<br>• Temp. of Electronics<br>• Difference (S2-S1)<br>• Meanvalue<br>• Sensor 2<br>• Electr. Meas. S2<br>• Redundancy (S1, S2)<br>• Difference (S1-S2)<br>• Non-invasive temp. (default)<br>• Surface temp. |
| PV Unit | Selects the physical unit for the sensor measuring signal<br>Units: °C, °F, °R, K, mV, Ω, V, kΩ |
| PV Lower Range Value | Defines the value for 4 mA (adjustable) |
| PV Upper Range Value | Defines the value for 20 mA (adjustable) |
| PV Damping | Configurable τ 63% output signal damping value<br>Value range:0 to 100 s |

# … 6 Commissioning and operation

## … Parameter description HART® (for TTx300-N and TSP341-N)

### Menu: Device Setup

| Menu / parameter | Description |
|---|---|
| **… / Device Setup** | |
| **Write protection** | Select the '**Write protection**' submenu. |
| **Measurement Mode** | Select 'Non-invasive' or 'Conventional' |
| Input / output assignment | Input / output assignment Selects the inputs that are mapped to the current.<br>see table of input / output assignment … / Easy Setup / In-output assignment |
| **PV Measured range** | Select the '**PV Measured range**' submenu. |
| PV Damping | Configurable τ 63% output signal damping value<br>Value range:0 to 100 s |

| **… / Device Setup / Measurement Mode** | |
|---|---|
| Non-invasive | Default – 2 × 3 -wire PT100; with following variable mapping<br>• 4-20 mA Signal – Non-invasive temp. (default)<br>• PV – Non-invasive temp. (default)<br>• SV – Surface temp.<br>• TV – Sensor 1 (contact temperature)<br>• SV – Sensor 2 (reference temperature) |
| Conventional | Standard TTx300 settings |

| **… / Device Setup / PV Measured range** | |
|---|---|
| PV Unit | Selects the physical unit for the sensor measuring signal<br>Units: °C, °F, °R, K, mV, Ω, V, kΩ |
| PV Lower Range Value | Defines the value for 4 mA (adjustable) |
| PV Upper Range Value | Defines the value for 20 mA (can be configured) |

## Menu: Display

| Menu / parameter | Description |
|---|---|
| **... /Display** | |
| Language | Language selects the menu language.<br>• German<br>• English |
| Contrast | Sets the display contrast<br>Value range: 0 to 100% |
| Mode Operator Page 1 | Selects the mode for the operator page (main view) of the display<br>• One Line: Show one measured value (default PV = process variable)<br>• One Line + Bargraph: In addition to line 1, display bar graph (default:output current %)<br>• Two Lines: Second line for an additional measured value (such as Sensor 2)<br>• Two Lines + Bargraph: Display 2 lines and a bar graph |
| Line 1 View | Selects the process value shown in Bargraph view of process display<br>• Process Variable: Calculated process variable (PV) - default is non-invasive temperature<br>• Sensor 1: Reading from sensor 1 (contact temperature)<br>• Sensor 2: Reading from sensor 2 (reference temperature)<br>• Difference (S1-S2): Calculate difference Sensor 1 – Sensor 2<br>• Electr. Meas. S1: Reading from sensor 1 (in Ω or mV)<br>• Electr. Meas. S2: Reading from sensor 2 (in Ω or mV)<br>• Difference (S2-S1): Calculate difference Sensor 2 – Sensor 1<br>• Average S1 S2: Calculate average Sensor 1 / Sensor 2<br>• Redundancy S1 S2: Redundancy Sensor 1 and Sensor 2<br>• Electr. Meas. S1: Reading from sensor 1 (in Ω or mV)<br>• Electr. Meas. S2: Reading from sensor 2 (in Ω or mV)<br>• Temp. Electronics: Temperature of transmitter<br>• Output Current: Output current of 4 to 20 mA signal<br>• Output %: Output value as % of measurement range<br>• Non-invasive temp. (default): Non-invasive temperature<br>• Surface temp. :Surface temperature |
| Line 2 View | Selects the process value shown in line 2 of process display (only 2 lines)<br>Table of selectable measured values: see "… / Display /Line 1 View" |
| Bargraph View | Selects the process value shown in bar graph view of process display<br>Table of selectable measured values: see "… / Display /Line 1 View" |
| Test | Display test - different patterns and letter sets are shown |

## Menu: Process Alarm

| Menu / parameter | Description |
|---|---|
| **... /Process Alarm** | |
| Reaction on errors | • Low Alarm:In the event of an error, the current (e.g. 3.5 mA) is output.<br>• High Alarm:In the event of an error, the current (e.g. 22 mA) is output. |

# … 6 Commissioning and operation

## … Parameter description HART® (for TTx300-N and TSP341-N)

### Menu: Communication

| Menu / parameter | Description |
|---|---|
| **… /Communication** | |
| HART Tag | Measuring point tagging<br>• 8 characters |
| HART Long Tag | Long tag:Unique device label in the plant (from HART 7)<br>• 32 characters |
| Address | Address range<br>Value range:0 to 63 (independent of Current Loop Mode) |
| Current Loop Mode | • Independent of the address<br>• Enabled = normal operation (output current depends on process variable (PV))<br>• Disabled = Constant output current (like Multidrop HART 5 address 0>) |
| **HART Burstmode** | Select the '**HART Burstmode**' submenu. |
| HART Resp.Preambles | Number of preambles to be used for sending<br>Value range:5 to 20 |
| Find Device | This option helps with finding a device<br>The HART master sends HART command #73 to search for the device.<br>Device answeres with HART initialize Command #0 (long address) - if found<br>Options:<br>• Disabled: no reaction HART command #0<br>• Once:One-time reaction to HART command #0<br>• Continuous:Always switch to HART command #0 |

| **… / Communication / HART Burstmode** | | |
|---|---|---|
| Status | • Off:HART burst operating mode inactive<br>• On:HART burst operating mode active | |
| Command # | Sets the HART command to be sent cyclically | |
| | • 1 Process value: | Process value PV |
| | • 2 current+%: | Output current and percentage range |
| | • 3 Current+Dyn.Vars: | Current output and dynamic variables PV, SV, QV, TV |
| | • 9 Dev.Variables : | Device variables |
| | • 48 Add.Dev.Status: | Additional device status |

**Note**
This menu / parameter structure is the same as for TTx300.

### Menu: Calibrate

| Menu / parameter | Description |
|---|---|
| **... /Calibrate** | |
| **Measured range** | Select the '**Measured range**' submenu. |
| **Analog Out** | Select the '**Analog Out**' submenu. |

| **... / Calibrate / Measured range** | |
|---|---|
| Apply Lower Range | The current reading (PV) is used as the lower range limit (4 mA). |
| Apply Upper Range | The current reading (PV) is used as the upper range limit (20 mA). |

| **... / Calibrate / Analog Out** | |
|---|---|
| Trim 4 mA | Adjusts the current output with a 4 mA setpoint<br>Value range:3.500 to 4.500 mA |
| Trim 20 mA | Adjusts the current output with a 20 mA setpoint<br>Value range:19.500 to 20.500 mA |

**Note**
This menu / parameter structure is the same as for TTx300.

### Menu: Diagnosis

| Menu / parameter | Description |
|---|---|
| **... /Diagnosis** | |
| Looptest | Simulates the current output signal<br>Value range:3.500 to 23.600 mA<br>0.000 mA:Ends loop test |
| Device status | Diagnostic notice (maintenance required, failure, etc.) |
| **SIL Check** | Select the '**SIL Check**' submenu.<br>• Not passed, chk Tool:Use tool for a detailed check of the current device configuration.<br>• Passed:SIL Configuration Check successful.The device configuration is valid for SIL Safety applications. |
| **Temp. of Electronics** | Select the '**Temp. of Electronics**' submenu.<br>Drag indicator: maximum or minimum device temperature |
| **Processvalue Sensor 1** | Select the '**Sensor 1 process data**' submenu.<br>Drag indicator: maximum or minimum sensor temperature for sensor 1<br>• Reset: Resets the values |
| **Processvalue Sensor 2** | Select the '**Sensor 2 process data**' submenu.<br>Drag indicator: maximum or minimum sensor temperature for sensor 2<br>• Reset: Resets the values |

**Note**
This menu / parameter structure is the same as for TTx300.

# … 6 Commissioning and operation

## … Parameter description HART® (for TTx300-N and TSP341-N)

### Menu: Device Info

| Menu / parameter | Description |
|---|---|
| **… /Device Info** | |
| Device Type | Displays device type. |
| Device ID | 7 or 8-digit serial number of the device electronic unit. |
| Serial Number | Serial number of the device (serial number in accordance with order) |
| Software Version | Displays device software version. |
| Hardware Version | Displays device hardware version. |
| HART Tag | Displays the HART Tag. |
| HART Long Tag | Display the HART long tag. |
| HART Descriptor | Displays the HART Descriptor. |
| HART Message | Display the HART message. |
| Operation Time | Displays device operating hours. |

**Note**

This menu / parameter structure is the same as for TTx300.

### Menu: Service

| Menu / parameter | Description |
|---|---|
| **… /Service** | |
| Reset to factory | Device restarts with factory settings applied. |
| Reset to Order | Device restarts with settings according to the customer order. |
| Device Reset | Device restarts without configuration changes. |
| Reset Key Value | Key value of the advanced write protection is reset to factory setting. |
| Sensor Pair Value | Input Sensor Pair Value. For use only in TTF300-N when used with TSP341-N Remote temperature sensor |

**Software write protection**

In addition to regular software write protection, the device features advanced software write protection. It can be configured on the device both via the LCD indicator and via the device drivers (FDIX/DTM/EDD).

If write protection has been activated, a padlock symbol will appear in the LCD indicator or the device drivers.

If the configured key value for the advanced software write protection is entered incorrectly more than five times, the device will be permanently locked.This locking function can only be deactivated on the device via the "„Reset Key Value" function.

**Enable or disable regular write protection**

1. "Device Setup" can be confirmed via , then select the "Write protection" submenu.
   - The "Write protection" submenu will be displayed.
2. Select the "SW Write Protection" entry and confirm with .
   - The current write protection configuration will be displayed.
3. Use "Edit" to edit the current write protection configuration (enabled/disabled), and confirm with .
   - If the "Edit" menu item is not available, the advanced write protection has been activated.
4. The current write protection setting is displayed.

**Enable advanced software write protection**

1. "Device Setup" can be confirmed via , then select the "Write protection" submenu.
   - The "Write protection" submenu will be displayed.
2. Select the "Set/Change Key Value" entry and confirm with .
3. Use "Edit" to edit the current key value configuration.
4. Using / , select four alphanumeric characters, and confirm with .The key value must differ from "0000".
5. The advanced write protection has been activated, the device is write-protected.

**Temporarily disable software write protection**

1. "Device Setup" can be confirmed via , then select the "Write protection" submenu.
   - The "Write protection" submenu will be displayed.
2. Select the "Enter Key Value" entry and confirm with .
3. Use "Edit" to edit the current key value configuration. If the "Edit" menu item is not available, the device will be locked permanently.
4. Using / , select four alphanumeric characters, and confirm with .
5. When the correct key value has been entered, write protection will be temporarily disabled, the "Write protection" subitem shows "Disabled".
6. By activating the write protection or entering a new key value, the advanced write protection will be reactivated and the device will be write-protected.

**Disable advanced software write protection**

1. "Device Setup" can be confirmed via , then select the "Write protection" submenu.
   - The "Write protection" submenu will be displayed.
2. Select the "Enter Key Value" entry and confirm with .
3. Use "Edit" to edit the current key value configuration.If the "Edit" menu item is not available, the device will be locked permanently.
4. Using / , select four alphanumeric characters, and confirm with .
5. Using / , select the "Set/Change Key Value" menu item, and confirm with .
6. Using / , select the "0000" input combination, and confirm with .
7. The advanced write protection has been disabled, the device is no longer write-protected.

**Reset key value**

1. Confirm "Service" with and select the "Reset Key Value" item. The submenu will be displayed.
2. Confirm reset of the key value using "OK".
3. The advanced write protection has been disabled, the device is no longer write-protected.

# … 6 Commissioning and operation

## Factory settings

### Firmware settings

The transmitter is configured ex works.

These devices can be reset to the factory setting as well as to the setting according to the customer order.

- With the menu item “Reset to factory” in the service menu, the settings are reset to the factory settings in accordance with the following table (corresponds to default configuration BS).
- The menu item “Reset to Order” in the service menu is used to reset the settings to the configuration ordered by the customer (default configuration BS, customer-specific configuration without special user characteristic BF.

### Devices with HART® (all SW revisions)

The following table with the corresponding parameter values applies:

| Menu | Designation | Parameter | Factory setting |
|---|---|---|---|
| Device Setup | Write protection | – | No |
| | Input Sensor 1 | Sensor Type | Pt100 (IEC60751) |
| | Sensor Pair Value = 306 | R-Connection | Three-wire |
| | | Measured Range Begin | 0 |
| | | Measured Range End[1)] | 100 |
| | | Engeneering Unit | Degrees °C |
| | | Damping | Off |
| Process Alarm | | Fault signaling | Underrange / low alarm 3.5 mA |
| | Input Sensor 2 | Sensor Type | Pt100 (IEC60751) |
| | | R-Connection | Three-wire |
| | Input / output assignment | Measurement type | Non-invasive |
| | TAG | – | – |
| | HART Descriptor | – | – |
| Display | Display Value | – | Process Variable |
| | Bargraph | – | Yes, output % |
| | Language | – | English |
| | Contrast | – | 50 % |
| Communication | HART Burstmode | Status | Off |
| | Simulation mode | – | Off |

## Commissioning the TSP341-N Remote temperature sensor with TTF300-N

After connecting and powering up a TTF300-N transmitter, the non-invasive model parameters of the TSP341-N Remote temperature sensor must be entered to ensure an accurate measurement. This model parameter is termed as a sensor pair value and needs to be entered during commissioning.

For an integral TSP341-N Sensor with an inbuilt transmitter, the sensor pair value is derived and entered at the factory and does not need to be changed. However, for a TTF300-N, the factory default is the same for every transmitter (Default = 306) and the sensor pair value from the remote temperature sensor must be entered. The sensor pair value (SPV) can be found on the ceramic mount and is indicated as 'SPV' (see figure 22).

**Note**
Failure to enter the SPV will result in a non-invasive temperature measurement error of up to + 10% of the difference in temperature between the process and the surrounding ambient temperature. In addition, the speed of response will also be affected.




(1) Exemplary location of SPV: 332

**Figure 16: Positioning of sensor pair value (SPV) on the remote temperature sensor (example)**

# 7 Diagnosis / error messages

## Error messages

**Note**
For a detailed description of the diagnostics settings, errors and notices on troubleshooting, see the TTH300 transmitter operating instructions.

## Malfunctions

The entire temperature measurement circuit should be tested routinely. The table below contains the most important errors together with their possible causes and suggestions for how to remedy them.

| Failure | Cause | Repair |
|---|---|---|
| Measuring signal fault | • Electrical/magnetic interspersion | • Electrostatic shielding via on one point grounded foil/netting.<br>• Twist wires (pairs) against magnetic interspersion. |
| | • Earth Fault | • Create only one grounding point in measuring loop or 'floating' measuring system (not grounded). |
| | • Decrease of insulation resistance | • Humidity has possibly penetrated into the temperature sensor or the measuring inset; dry if necessary and seal again.<br>• Replace measuring inset.<br>• Check whether the temperature sensor is thermally overloaded. |
| Response times too long, incorrect measuring signals | Incorrect position of the measuring point.<br>• In the area of influence of a heat source | • Select the position of the measuring point in such a way to make sure that the measurement of the surface temperature is not distorted by external influence.<br>• Minimize environmental influence on the measuring point by using suited insulating materials |
| | Incorrect installation method:<br>• Error due to poor contact | • Guarantee thermal contact, by following the installation procedure. Ensure that the contact surface is clean and free of dirt or objects that would prevent the contact sensor from making good contact –**Mounting** on page 12.<br>• Ensure that the sensor is mounted firmly – Follow a sensor mount check as shown in the Mount check video<br>• When using a TSP341-N Remote temperature sensor, ensure that the sensor pair value has been correctly entered – **Commissioning the TSP341-N Remote temperature sensor with TTF300-N** on page 35 |
| Interruptions in temperature sensor output | Loose wiring or loosely mounted sensor | • Check all connections (sensor and power)<br>• Ensure that the device is mounted firmly by trying to move the neck. Any large movements indicate a poor installation.<br>• Relocation of the measuring point (if possible). |

# 8 Maintenance

## Safety instructions

**⚠ CAUTION**

**Risk of burns due to hot measuring media**

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

The temperature sensor does not require any maintenance if it is used as intended under normal operating conditions. If wetted parts of the temperature sensor are exposed to the influence of abrasive or corrosive measuring media, periodic inspection by the operator must be performed.
No on-site repair or replacement of electronic parts by the user is required.

## Cleaning

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the seals.
To avoid static charge, a damp cloth must be used for cleaning.

# 9 Repair

## Safety instructions

**⚠ DANGER**

**Explosion hazard**

Explosion hazard due to improper repair of the device. Faulty devices must not be repaired by the operator.

- The device may only be repaired by the ABB Service Department.

## Exchange of measurement insets

Please see latest service manual for exchange aspects that are permitted on the device.

## Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.
Fill out the return form (see **Return form** on page 39) and include this with the device.
In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:
All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Please contact Customer Center Service acc. to page 4 for nearest service location.

# 10 Dismounting and disposal

## Dismounting

**⚠ CAUTION**

**Risk of burns due to hot measuring media**

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

Bear the following points in mind when dismantling the device:

- Switch off the power supply.
- Disconnect electrical connections.
- Allow device / piping to cool.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notes in **Returning devices** on page 37.

## Disposal

**Note**



Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following points in mind when disposing of them:

- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, our Service can take care of its pick-up and disposal for a fee.

# 11 Specification

**Note**

The device data sheet is available in the ABB download area at www.abb.com/temperature.

# 12 Additional documents

**Note**

Declarations of conformity of the device are available in the download area of ABB at www.abb.com/temperature. In addition, these are also included with the device in case of ATEX-certified devices.

# 13 Appendix

## Return form

**Statement on the contamination of devices and components**

Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.
Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

**Customer details:**

Company:

Address:

Contact person: Telephone:

Fax: Email:

**Device details:**

Type: Serial no.:

Reason for the return/description of the defect:

**Was this device used in conjunction with substances which pose a threat or risk to health?**

☐ Yes ☐ No

If yes, which type of contamination (please place an X next to the applicable items):

☐ biological ☐ corrosive / irritating ☐ combustible (highly / extremely combustible)

☐ toxic ☐ explosive ☐ other toxic substances

☐ radioactive

Which substances have come into contact with the device?

1.

2.

3.

We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date Signature and company stamp

# Trademarks

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

**ABB Measurement & Analytics**

For your local ABB contact, visit:
**www.abb.com/contacts**

For more product information, visit:
**www.abb.com/temperature**

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