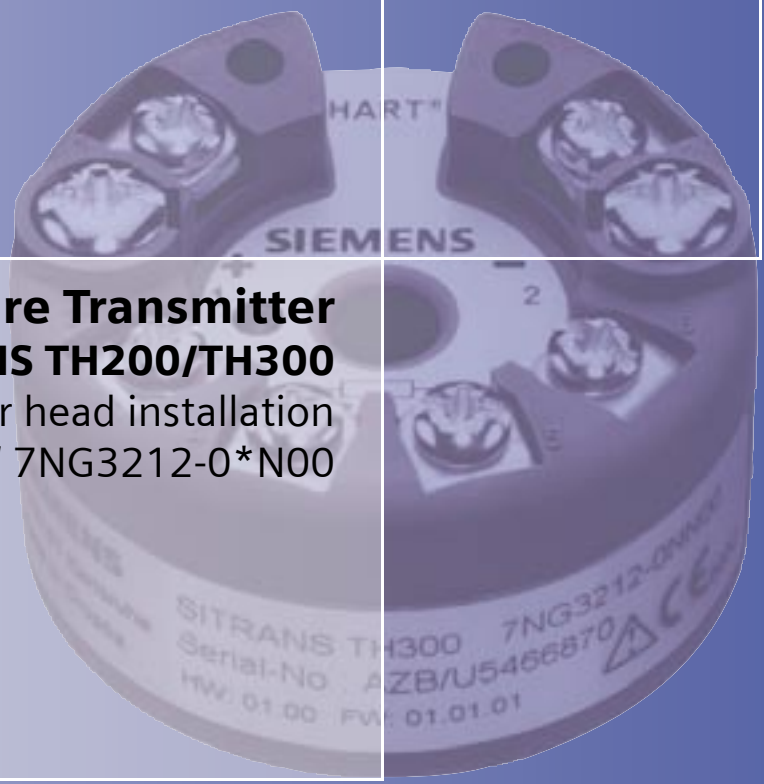
Operating Instructions Edition 06/2006



Temperature Transmitter
SITRANS TH200/TH300
for sensor head installation
7NG3211-1*N00 / 7NG3212-0*N00

sitrans

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SITRANS TH200/TH300
7NG3211–1*N00/7NG3212–0*N00

Edition 06/2006

Temperature transmitter for sensor head installation

Operating instructions

www.siemens.de/sitranst

Safety information

This manual contains instructions which must be complied with for the sake of your personal safety and also to prevent damage to property. The information concerning your personal safety is indicated with a warning triangle; information solely concerning damage to property is given without a warning triangle. Depending on the level of danger, the warning information is given in decreasing order, as follows:

Danger

means that death or severe injury **will** result if the corresponding precautions are not taken.

Warning

means that death or severe injury **may** result if the corresponding precautions are not taken.

Caution

with a warning triangle means that slight injury may result if the corresponding precautions are not taken.

Caution

without a warning triangle means that damage to property may result if the corresponding precautions are not taken.

Attention

means that an undesirable event or condition may result if the respective information is not observed.

If more than one level of danger applies, the warning information for the highest level will always be given. If information warning against personal injury is given with a warning triangle, it may contain an additional warning against damage. to property.

Qualified personnel

This device/system may only be installed and operated together with this document. Installation and operation of devices/systems are to be carried out only by **qualified personnel**. Qualified personnel is defined within the context of the safety information contained in this document as persons who have been authorized to operate, ground or label devices, systems and electrical circuits in accordance with accepted technical safety standards.

Correct usage

Observe the following:

Warning

The device may only be applied in the cases prescribed in the catalogue and in the technical description and only in conjunction with third–party devices and components recommended or approved by Siemens. Proper transportation, storage, installation, operation and maintenance of the product are vital for ensuring correct and safe operation.

Trademarks

All names labeled with the symbol ® are registered trademarks of Siemens AG. Other names in this document may be trademarks, whose use by a third party for their own purposes may impinge on the rights of the owner.

Exclusion of liability
We have checked to ensure that the information contained in this document corresponds to the characteristics of the actual hardware and software. Nevertheless, we cannot assume responsibility for any deviations that may arise. The information contained in this document is checked regularly for errors. Necessary corrections made to the text appear in later editions.

Siemens AG
Automation and Drives, Postfach 4848, D–90327 Nürnberg

Siemens AG
Technical changes may be made without prior notice.

Siemens Aktiengesellschaft

A5E00393069

Table of contents

1 Introduction

1.1 Purpose of this documentation

These instructions contain all the information you need for commissioning and using the transmitter.

It is aimed both at persons mechanically installing the device, connecting it electronically, configuring the parameters and putting it into operation, and at service and maintenance engineers.

1.2 Document history

This document history establishes the connection between the current documentation and the valid firmware of the device.

The documentation of this edition applies to the following firmware:

Edition	Firmware identifier on nameplate	System integration	Installation path for PDM
01 06/2006	FW: 01.01.02	TH200: SIPROM T V1.07 TH300: PDM V6.0 DD rev. 1.00	TH200: not relevant TH300: SITRANS TH300

The following table shows the most important changes in the documentation compared to each previous edition.

Edition	Comment
01 06/2006	First edition

1.3 Further information

Information

The contents of these instructions shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract which also contains the complete and solely applicable warranty conditions. Any statements contained herein do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

Offices

If you need more information or have particular problems which are not covered sufficiently by the operating instructions, contact your local Siemens office. You will find your local Siemens office on the Internet under:

www.siemens.de/prozessinstrumentierung

Click on “Contact” and select your closest town.

Product information on the Internet

The operating instructions are a constituent part of the enclosed CD “sitrans t – temperature transmitters” (order number A5E00364512) and are available on the Internet at:

www.siemens.de/sitranst

Click on “More Info” and then “–> Instructions and Manuals”.

On the CD, you will find an extract of the catalog FI 01 “Field Instruments for Process Automation” with the current order data. The entire FI 01 catalog is also available at the above web address.

2 General safety notes

2.1 General notes

This device left the factory free from safety problems. In order to maintain this status and to ensure safe operation of the device, please observe the safety information and warnings contained in these instructions.

2.2 Intended use

The device may only be used for the purposes specified in these instructions.

Insofar as they are not expressly stated in these instructions, all changes to the device are the sole responsibility of the user.

2.3 Laws and directives

The regulations of the test certification valid in your country are to be observed.

WARNING

This device may only be installed and operated once qualified personnel have ensured that appropriate power supplies are in use. These power supplies must guarantee that no hazardous voltage can reach the device, whether during normal operation or in the event of a malfunction of the system or one of its parts.

2.4 Qualified personnel

“Qualified personnel” means those who are familiar with the installation, mounting, commissioning and operation of the product. They must have the following, appropriate qualifications for their activities:

- Training or instruction/authorization in operating and maintaining devices/systems according to the safety regulations for electrical circuits, high pressures and aggressive media.
- Training and instruction in maintenance and use of adequate safety equipment according to safety regulations.
- For explosion-proof devices: Training or instruction/authorization in carrying out work on electrical circuits for systems subject to explosive hazards.
- First aid training

NOTE

The general regulations for operation of the system must be followed during operation and maintenance of the transmitter.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

3 Description

3.1 Scope of application

SITRANS TH200 and SITRANS TH300 transmitters can be used in all industries. Their compact size means that they can be installed in connection heads of type B (DIN 43729) or larger. Their universal input stage means that the following sensor and signal sources can be connected:

- Resistance thermometer
- Thermocouples
- Resistance-type transmitter/potentiometer
- DC voltage sources

The output signal is an output current of 4 to 20 mA that corresponds to the sensor characteristic curve.

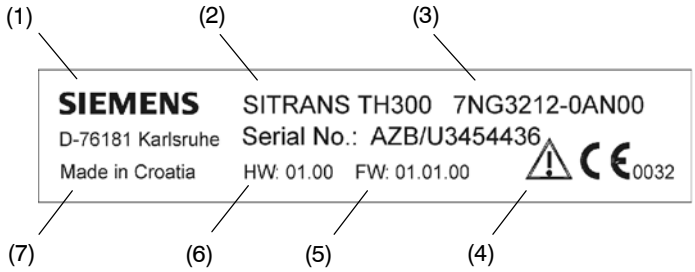
Explosion-proof transmitters can be installed and operated within potentially explosive atmospheres in accordance with the information on the EC type examination certificate (ATEX certificate) and these operating instructions.

3.2 Product features

- Transmitter with two-wire technology
- Installation in connection heads of type B (DIN 43729) or larger, or on a DIN rail
- With communications capability (HART protocol rev. 5.9 in SITRANS TH300, proprietary protocol in SITRANS TH200); this allows sensor activation, measuring range and many other variables to be programmed
- Electrical isolation
- Intrinsically safe version for use in hazardous areas
- Two additional test pins for connecting a multimeter make it possible to measure the current signal without interrupting the current loop
- Operating status message (LED green or red)
- Special characteristic curve
- Diagnostic functions in SITRANS TH300 (slave pointer, operating hours counter, simulation)

3.3 Structure of the nameplate

The nameplate is located on the housing and carries the order number and other important product information.



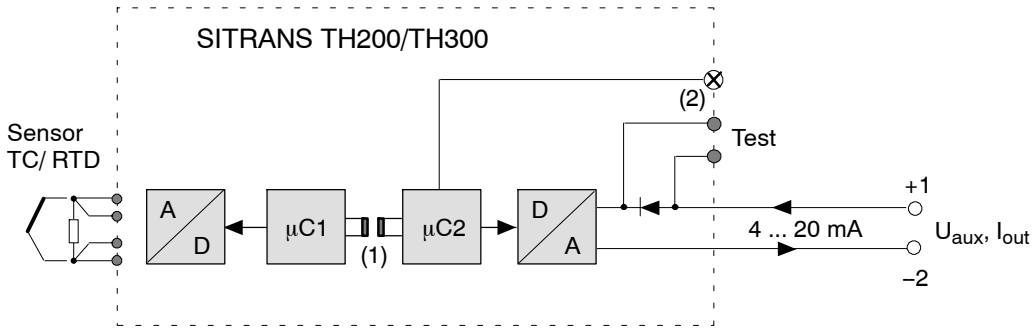
(1) Manufacturer
(2) Product name
(3) Order number
(4) Pay attention to the instruction manual
(5) Firmware revision
(6) Hardware revision
(7) Place of manufacture

Fig. 1 Structure of the nameplate

3.4 Mode of operation

The measurement signal sent by a resistance-type transmitter (two-wire, three-wire or four-wire connection) or thermocouple is converted into a digital signal in an analog-to-diigital converter. This signal is then evaluated in a microcontroller (µC1), corrected in accordance with the sensor characteristic and transmitted to the microcontroller (µC2) via the electrical isolation. There, the analog output value is calculated, the functional status is indicated by LED and the communications data is prepared. The measured value is converted into an output current of 4 to 20 mA by a digital-to-analog converter. The auxiliary power source is located in the output signal circuit.

The parameters of the SITRANS TH200 and the SITRANS TH300 are set and the devices are operated via a PC that is connected to the two-wire line via a suitable coupling module (SIPROM T modem or HART modem). Equally, the parameters of the SITRANS TH300 can be set with a HART communicator. The signals needed for communication using the HART protocol rev. 5.9 are superimposed on the output current in accordance with the frequency shift keying (FSK) process. The data specific to the transmitter and the data for parameter assignment is stored in two non-volatile memories (EEPROMs).



Input:

A/D	Analog-to-digital converter
Sensor	Resistance thermometer, thermocouple, resistance-type transmitter, millivolt transmitter
µC1	Microcontroller secondary side

Output:

µC2	Microcontroller primary side
D/A	Digital-to-analog converter
U_{aux}	Auxiliary power
I_{out}	Output current

(1)	Electrical isolation
(2)	LED

Fig. 2 SITRANS TH200 and SITRANS TH300 function diagram

4 Installation

4.1 Installation in the connection head

CAUTION

The following must be observed before the head transmitter is installed:

- The SITRANS TH200 and SITRANS TH300 transmitters need to be installed in a suitable housing.
- The protection type and housing material need to be adapted to meet the relevant requirements.
- The ambient conditions specified in the technical data (chapter 10, page 45) need to be adhered to.

Springs and screws for securing the transmitter are included with the device.

The SITRANS TH200 and the SITRANS TH300 can be secured either in the base of the connection head or in the raised cover of the connection head.

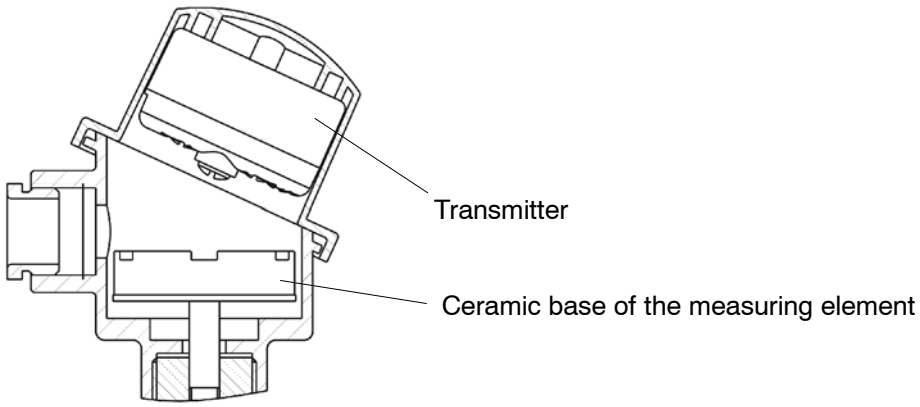


Fig. 3 Securing the transmitter in the connection head cover

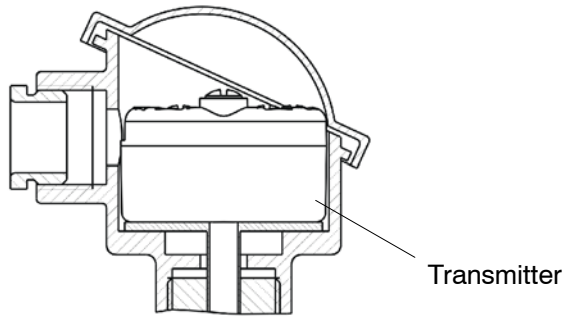


Fig. 4 Securing the transmitter in the connection head base

WARNING

When installing the device in hazardous areas, the housing must have at least IP54 type of protection according to the IEC 60529. Note the data of the EC type examination certificate.

4.2 Installation on DIN rail and G rail

The transmitters can be secured either on a 35 mm DIN rail (DIN EN50022) or a 32 mm G rail (DIN EN50035). The DIN rail adapter required for installation can be ordered as an accessory under the order number 7NG3092-8KA.

The ambient conditions specified in the technical data (chapter 10, page 45) need to be adhered to for rail installation.

ATTENTION

Potentially explosive atmospheres

Installation on a DIN rail or G rail in potentially explosive atmospheres is only permitted when a suitable protective housing (at least IP54) is used.

ATTENTION

Electromagnetic compatibility

If the sensor is installed outside closed buildings, the function of the device must be checked following a lightning strike.

Fig. 5 Securing the transmitter on the DIN rail

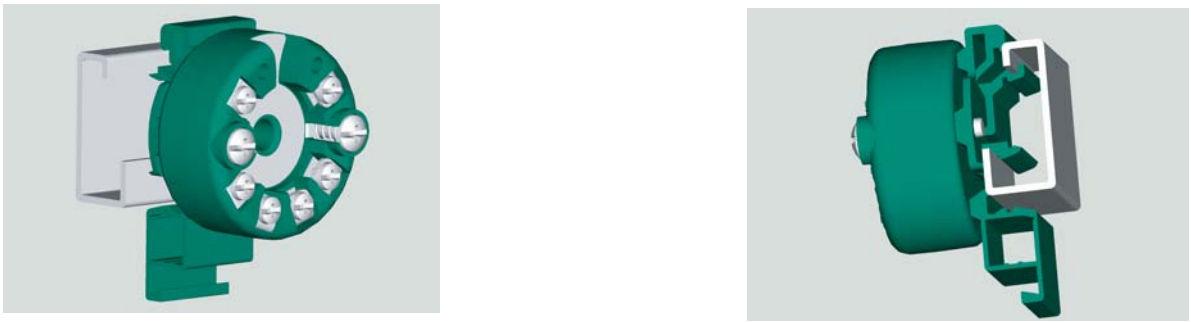


Fig. 6 Securing the transmitter on the G rail

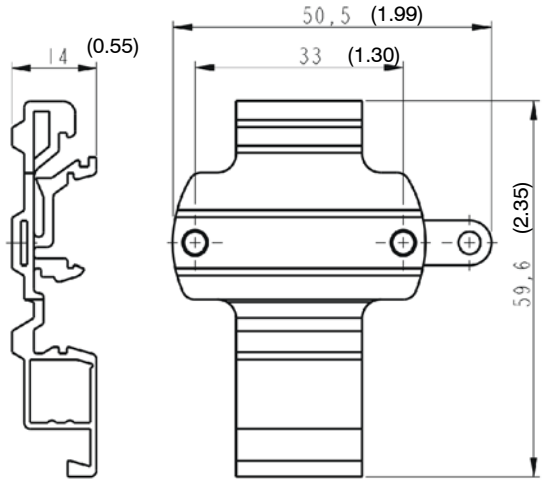


Fig. 7 Dimensions of the DIN rail

5 Electrical connection

5.1 General connection notes

WARNING

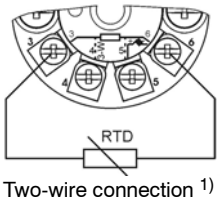
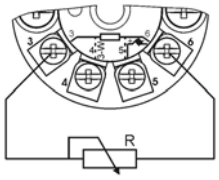
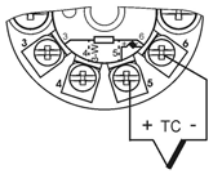
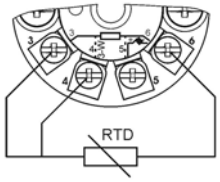
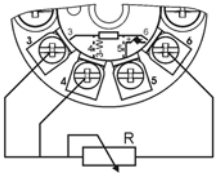
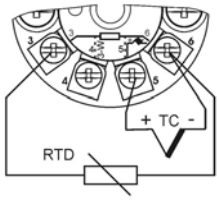
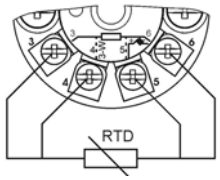
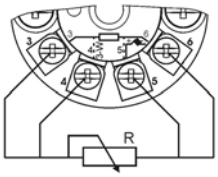
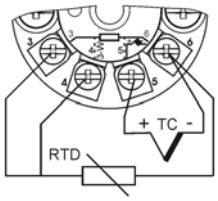
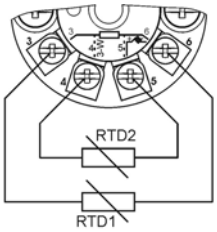
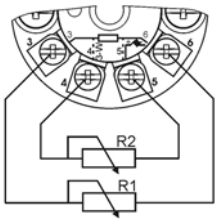
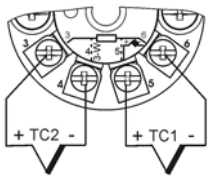
The regulations of the test certification valid in your country are to be observed.

Electrical connection in hazardous zones with explosive atmospheres

The national directives and laws for areas subject to explosion valid in your country must be observed for electrical connection. In Germany these are, for example:
- the “Ordinance on Industrial Safety and Health”
- the “Installation of electrical systems in hazardous areas” standard, DIN EN60079–14 (previously VDE 0165, T1)
- the EC-type examination certificate

Where auxiliary power is required, we recommend checking the auxiliary power to ensure that it corresponds with that on the nameplate and with the test certification valid for your country.

- Connection of the sensor, see Fig. 8, page 18
- Auxiliary power:
  Connect the wires for the auxiliary power supply to terminals “1(+)” and ”2(–)”, as shown in Fig. 8, ensuring polarity is correct (device is reverse polarity protected).
- Test terminals:
  Connect the ammeter to both test terminals “Test(+)” and “Test(–)” as shown in Fig. 8, the 4 to 20 mA current can now be checked.
- Connection cable:
  Max. cable cross section 2.5 $mm^{2.}$
  Lay signal cables separately from cables with voltages $>$ 60 V.
  Use cable with twisted strands.
  Avoid getting too close to large electrical equipment or use shielded cables.
  Full specification according to HART®, revision 5.9 in SITRANS TH300 only with shielded cables.

Resistance thermometer	Resistor	Thermocouple
 Two-wire connection [1]	 Two-wire connection [1]	 Cold junction compensation/fixed value
 Three-wire connection	 Three-wire connection	 Cold junction compensation with external Pt100 in two-wire connection[1]
 Four-wire connection	 Four-wire connection	 Cold junction compensation with external Pt100 in three-wire circuit
 Averaging/determination of difference [1]	 Averaging/determination of difference [1]	 Averaging/determination of difference with internal cold junction compensation

[1] Line resistance for correction is programmable

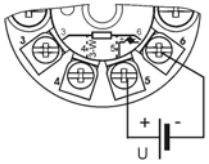
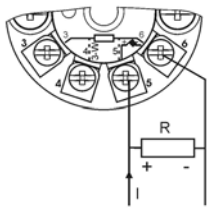
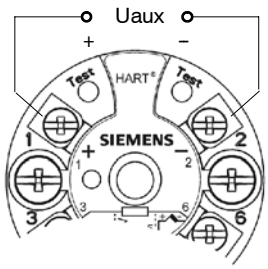
Voltage measurement	Current measurement	Connection of auxiliary power (U_{aux})
		

Fig. 8 Connection diagrams

5.2 Connection in hazardous zones with explosive atmospheres

Zones 0 and 1

The transmitter is only allowed to be connected to devices that are certified as intrinsically safe in accordance with the EC type examination certificate. It is essential for the parameters and limit values listed there to be complied with.

Zone 2 in protection type "nL" – Limited energy

The transmitter is only allowed to be connected to the following devices:

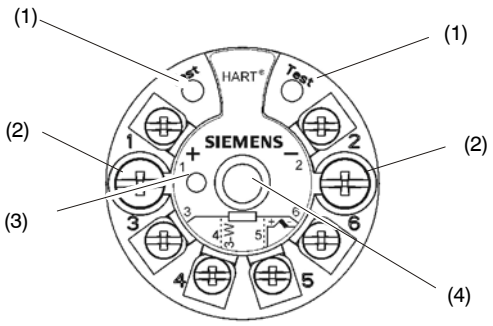
- Devices that are certified as intrinsically safe in category 1 or 2.
- "nL"-certified devices (limited energy) in category 3.

The maximum permitted input voltage is U_i = DC 30 V. The relevant permitted values for external capacitance and inductance must be adhered to.

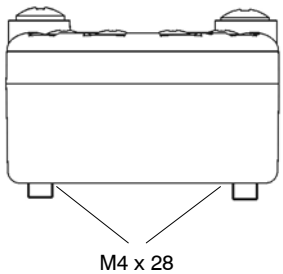
Zone 2 in protection type "nA" – Non-sparking

The conditions for installers applicable to this type of protection must be adhered to. The maximum permitted input voltage is U = DC 35 V.

5.3 Connection assignment



1(+) and 2 (–)	Auxiliary power U_{aux}, output current I_{out}
3, 4, 5 and 6	Sensor (interface see Fig. 8, page 18)
Test (+), Test (–)	Measurement of the output current with a multimeter



(1)	Test terminal
(2)	Fastening screw M4x28
(3)	LED
(4)	Internal diameter of center hole 6.3 (0.25)

Fig. 9 Connection assignment

5.4 Notes on measuring current

Connect an external measuring resistor R to the transmitter connection terminals 5 and 6 if the transmitter is used for measuring current. The transmitter uses this resistor to perform the required current measurement as a voltage measurement. Therefore, the following instructions must be complied with in the parameter assignment software (SIPROM T with SITRANS TH200 and SIMATIC PDM or HART communicator with SITRANS TH300):

- Sensor class selection = Millivolt transmitter

- Measured value scaling: The start and finish of the measurement of the required current measuring range must be multiplied with the resistance value R connected externally to terminals 5 and 6 of the transmitter.

- **Example:** (Measurement of a 0 to 20 mA current via an external resistance R of 10 Ohm)
  Sensor class = Millivolt transmitter
  Measured value scaling:
  Start of measurement = 0 mA · 10 Ω = 0 mV
  Start of measurement = 20 mA · 10 Ω = 200 mV
  The 4 to 20 mA output current now follows the profile of the sensor input (0 to 20 mA current signal).

If the measured values are called up via the digital interface (e.g. HART with SITRANS TH300) for a current measurement, the operating software displays the measurement data as a voltage signal in the unit mV (scaled by the factor of the externally connected resistance value R).

5.5 LED operating indicator

- Operating indicator does not light: No supply voltage

- Constant green light: Everything OK, normal error-free operating status

- Constant/flashing red light: Disrupted operation

  Constantly lit up: Indication of errors in the device (e.g. RAM, ROM, EEPROM, CHECKSUM, WATCHDOG, STACK error or violation of the permitted ambient temperature limits)

  Flashing (approx. 2 Hz): Indication of faults independent of the device (e.g. wire break, sensor short circuit, violation of sensor limits)

5.6 Test terminals for output signal

The “Test +” and “Test –” test terminals are used for checking the 4 to 20 mA current with an ammeter. The voltage drop across the ammeter is not allowed to exceed 0.4 V at a 23 mA output current.

6 Communication

- SITRANS TH200

  This device variant does not have an interface to HART.
  Setting the parameters of the SITRANS TH200 is only possible in “Offline” status using the modem for SITRANS TH100/TH200. Please refer to chapter 9, page 41 in these instructions for information on setting the SITRANS TH200 parameters.

- SITRANS TH300

  The device has a parameter assignment interface according to the HART specification. This permits access to all the functions of the device via a HART modem or a HART communicator. The HART modem or HART communicator must be connected according to Fig. 10, page 21.

WARNING

Only intrinsically safe HART modems or HART communicators are allowed to be operated in the intrinsically safe area or on intrinsically safe circuits.

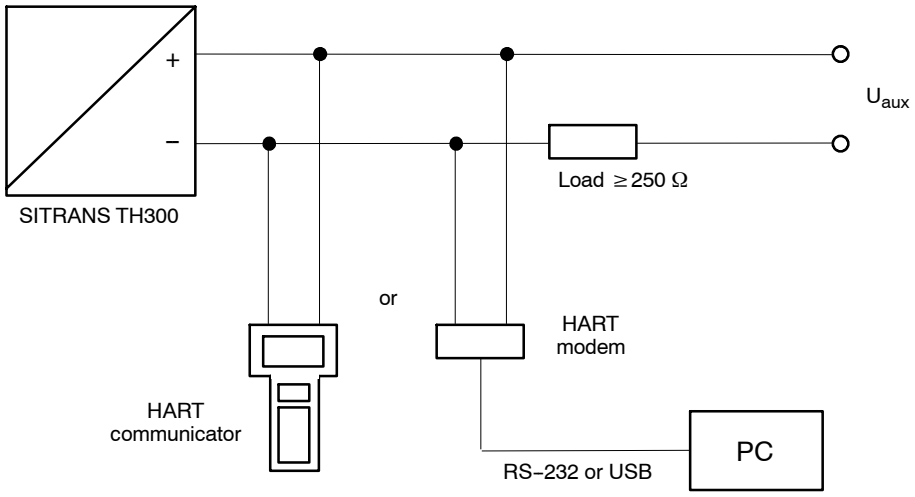
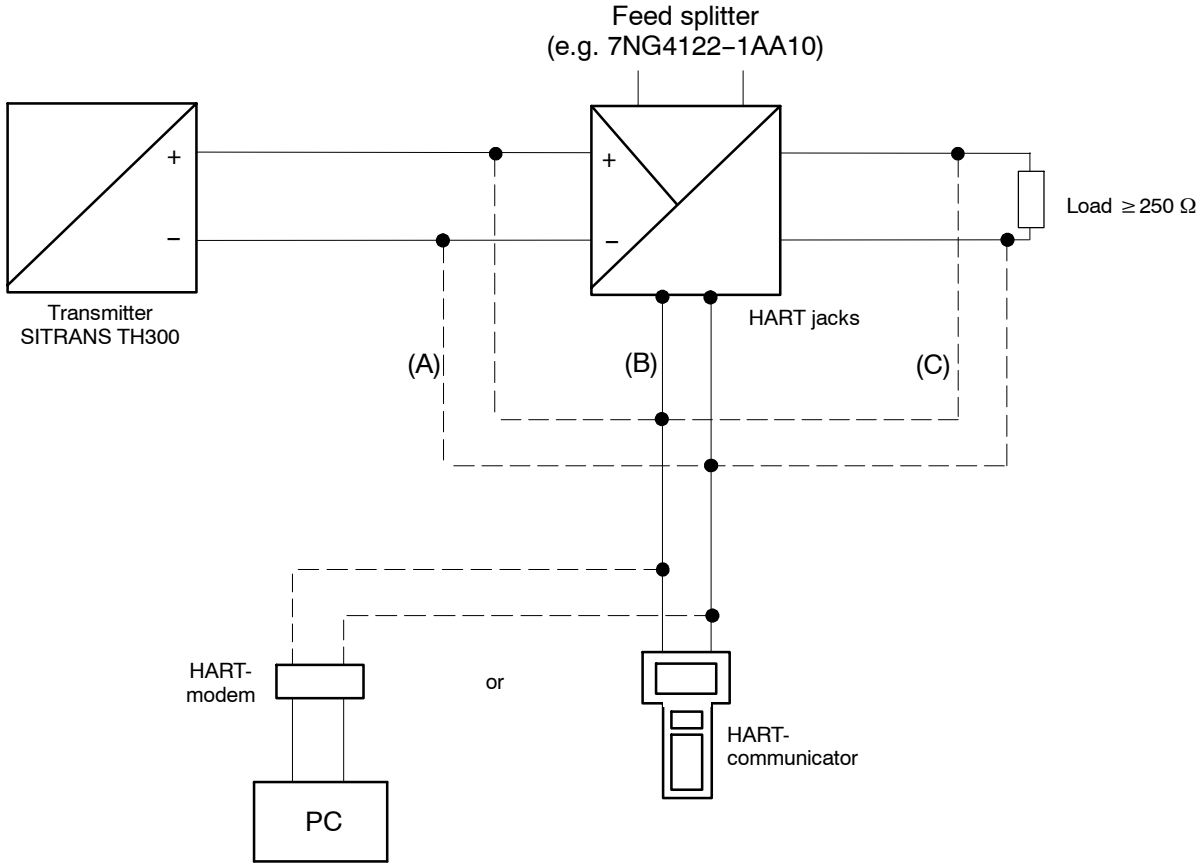


Fig. 10 HART communication with supply from voltage source



(A) Only intrinsically safe HART communicators or HART modems are allowed to be used with an intrinsically safe supply.

(B) HART communication via HART jacks of the feed splitter

(C) Load ≥ 250 Ω only relevant if HART communication takes place via this branch. Otherwise, load 0 to 650 Ω for variant (A) or (B)

Fig. 11 HART communication with supply via feed splitter

7 Commissioning

The operating data of the transmitter have to be set in accordance with the requirements of the measurement task at hand. Ensure that the operating data corresponds to the data on the nameplate.

When the transmitter is installed in the connection head, the connection head cover needs to be closed after the sensor and the auxiliary power supply are connected. When you switch the auxiliary power on, the transmitter begins operation after a response time of about 10 seconds.

☞ **NOTE**

To obtain stable measured values, the transmitter needs to be allowed to warm up for five minutes or so after the power supply is switched on.

8 Functions

8.1 General information

The following functions can be performed using the SIPROM T parameter assignment software for the SITRANS TH200 and with the SIMATIC PDM parameter assignment software or the HART communicator for the SITRANS TH300:

- Identification

  Information on operational safety: TAG, description, message, assembly number

- Device data (this information is read-only)

  Manufacturer and product name
  Order number, device serial number
  Revision numbers (firmware and hardware revision)

- Information about the measuring procedure

  Sensor class and sensor type (e.g. Pt100 resistance thermometer or thermocouple type B)
  Sensor factor
  Sensor characteristic curve (e.g. linear temperature)
  Measuring range and measuring unit

- Information on measurement interface

  Interface type (standard, differential or averaging circuit)
  Connection type / sensor connection (two-wire, three-wire or four-wire connection with resistance-type transmitters)
  Resistors for line compensation
  Offset in measuring signal
  Additional information for the cold junction in thermocouples (internal, external or fixed)
  Enable/disable of wire break or short circuit test

- Information about the output signal

  Filter time constant for noise suppression attenuation
  Output limit values (alarm and saturation limits)

- Certificates and approvals

  Information whether the transmitter is allowed to be operated in intrinsically safe mode or not (this information is read-only). This function can only be performed using the SIMATIC PDM parameterization software or with the HART communicator.

- Free material parameters (boxes for describing the connected sensor in more detail)

  Type of the sensor
  Composition of protective tube
  Length of protective tube
  Screw thread / installation flange
  Supplier / manufacturer
  F no. of sensor
  Order code

- Other functions that can be set in the parameters include:
  - Slave pointer functions
  - Sensor calibration function with selectable trimming range within the limits of the measuring range
  - Trimming the analog output (from 4 to 16 mA with SITRANS TH200, from 4 to 20 mA with SITRANS TH300)
  - Factory reset: Resetting the operating data to the factory settings
  - Simulation of measurement input, electronics temperature and analog output (only with SITRANS TH300)

The operating data is stored in a non-volatile memory (EEPROM).

8.2 Wire break monitoring

Wire break monitoring on a specific measurement channel can be performed for thermocouples and millivolt transmitters. Break monitoring is permanently active in resistance thermometers and resistance-type transmitters. No reference temperature of the internal sensor (electronics temperature) can be obtained if there is a wire break.

All sensor cables are permanently monitored for wire break when line break monitoring is switched on. The programmed fault current (3.6 mA to 23 mA) is output in the event of a fault.

NOTE

If a wire break occurs when break monitoring is switched off, invalid values may ensue for the measured value and the internal electronics temperature in the slave pointer pairs and their operating hours counters.

8.3 Short circuit monitoring

Short circuit monitoring on a specific measurement channel is only possible with resistance thermometers and resistance-type transmitters. The threshold value for the short circuit check can be set in the parameters.

The programmed fault current (3.6 mA to 23 mA) is output in the event of a sensor short circuit.

8.4 Line compensation

Compensation for line resistance values is possible in the following measurements:

- Resistance thermometer or resistance-type transmitter in two-wire connection
- Resistance thermometer or resistance-type transmitter for differentiation or averaging
- Thermocouple with external cold junction with Pt100 in two-wire connection

The compensation is performed by numerical preset of the measured line resistance (combined total of sending and return conductors).

8.5 Type of characteristic curve (rising or falling)

The type of the characteristic curve at the 4 to 20 mA analog output can be selected (rising or falling). The characteristic curve type is defined as follows by setting the parameters for the start and finish of measurement:

- Rising characteristic: End of measurement is greater than start of measurement
- Falling characteristic: End of measurement is smaller than start of measurement

8.6 Measured value offset

An offset response on a specific measurement channel can be set in the parameters for applications in which the process variable to be measured cannot be measured directly at the measuring point.

8.7 Sensor factor

The sensor factor is used for adapting the characteristic curve when resistance thermometers and thermocouples are connected in series or in parallel. It must be multiplied by their basic series. Values from 0.25 to 10.0 can be set as the scaling factor in resistance thermometers, while values from 1 to 10 can be set for thermocouples.

Example: 3 x Pt500 parallel: Sensor factor = 5/3 = 1.67 (basis is Pt100)

8.8 Cold junction compensation with thermocouples

It is possible to select the connection type of the resistance thermometer for cold junction measurement with thermocouples: Use of the built-in Pt100 or an external Pt100 that is required if the measuring point is distant from SITRANS TH200 or SITRANS TH300.

The following cold junction compensation variants can be selected:

- Internal: In this case, the thermocouple (TC) or the compensating line is directly connected to the transmitter. The cold junction temperature is obtained by an internal Pt100.
- External with fixed value: The external cold junction temperature (e.g. of a thermostat) must be specified as the fixed value in this case. The transmitter then compensates according to this constant cold junction temperature.
- External with Pt100: An external Pt100 measures the cold junction temperature in this case. The Pt100 can be connected to the transmitter with a two-wire or three-wire connection. Cold junction compensation takes place using the current temperature of the external Pt100.

8.9 Differentiation/averaging

The differential and averaging connection interfaces have the following peculiarities compared to the standard connection:

Setting start and finish of measurement:

- The start and finish of measurement must be entered for both individual sensors first. The start and finish of measurement are the same for both sensors. It is not possible to set difference measuring ranges for the individual sensors in the parameters (hint: use the largest measuring range).
- Following this, set the parameters for the start and finish of the differentiation and average value measurements.

Sensor calibration:

- Sensor calibration is performed at the individual measuring range limits of the two individual sensors. The differentiation or average set in the parameters cannot be trimmed.

8.10 Electrical attenuation

The filter time constant of the electrical attenuation can be set within the range from 0 to 30 s.

8.11 Current sensor function (only in SITRANS TH300)

The transmitter can be switched to constant current mode for test purposes. In that case, the output current no longer corresponds to the process variable.

8.12 Alarm current

The magnitude of the alarm current can be set using this function. The alarm current signals a sensor fault or a hardware/firmware fault. The magnitude of the alarm current as well as the upper and lower limits of the linear control range can be set as required within the limits specified for the current control range (3.6 mA to 23 mA). Fig. 12 shows an example of this. The specified accuracy values of the output signal only apply to the corresponding nominal ranges.

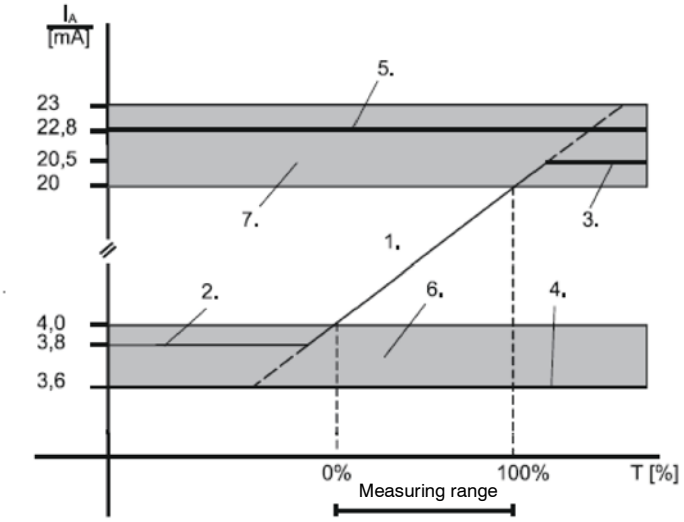


Fig. 12 Current limits with output signal 4 to 20 mA

1. Linear control range
2. Lower limit of the control range (default value = 3.84 mA)
3. Upper limit of the control range (default value = 20.5 mA)
4. Lower fault current value (3.6 mA)
5. Upper fault current value (default value = 22.8 mA)
6. Recommended setting range for lower fault current range and lower control range limit
7. Recommended setting range for upper fault current range and upper control range limit

8.13 Sensor calibration

8.13.1 Sensor calibration (single point)

The sensor calibration (single point) enables the characteristic curve of the connected sensor to be moved in relation to the zero point. This means it is possible to calibrate the initial value of the input sensor. This does not affect the measuring span.

The single point calibration corresponds to entering a sensor offset. The result of the single point calibration is stored in the “offset sensor” variable.

8.13.2 Sensor calibration (double point)

The sensor calibration (double point) can be used to set the characteristic curve of the connected sensor at two sensor trim points. The results are then correct measured values at the sensor trim points. A double point sensor calibration makes it possible to reduce the proportion of errors due to the characteristic curve.

8.13.3 Trimming of the lower sensor trim point

The process variable (e.g. temperature or resistance) on which the lower sensor calibration should be performed is applied to the transmitter input. The operating software (SIPROM T with SITRANS TH200 and SIMATIC PDM or HART communicator with SITRANS TH300) must be used for instructing the transmitter to accept this process value. This represents an offset shift of the characteristic curve (B, Fig. 13, page 29).

8.13.4 Trimming of the upper sensor trim point

The process variable (e.g. temperature or resistance) on which the upper sensor calibration should be performed is applied to the transmitter input. The operating software must be used for instructing the transmitter to accept this process value. A gradient correction is thereby applied to the characteristic curve (C, Fig. 13). The lower sensor trim point is not affected by this.

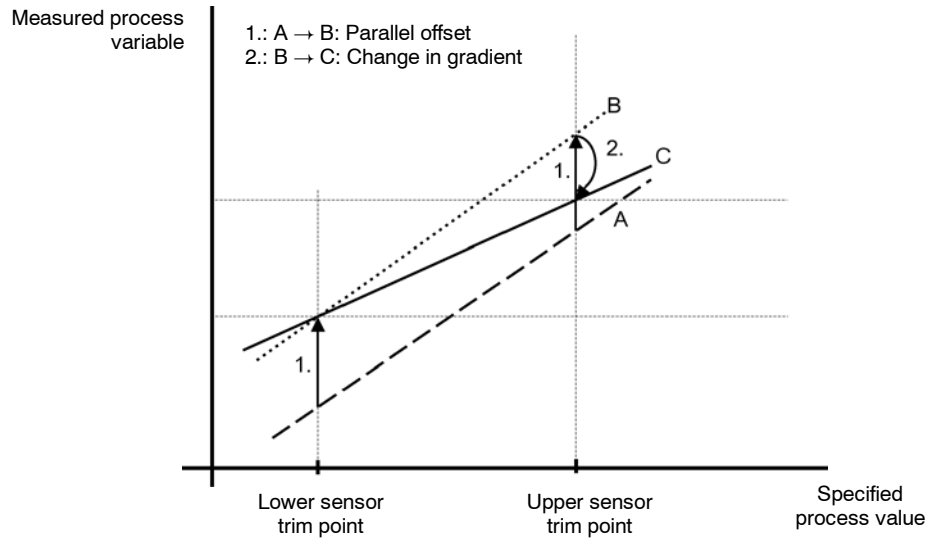


Fig. 13 Sensor trim

A: Output curve
B: Characteristic curve after lower sensor calibration
C: Characteristic curve after upper sensor calibration

☞ **NOTE**

If any of the following device parameters is changed by re-parameterization, a double point sensor calibration of SITRANS TH200/TH300 performed specifically for a customer is automatically reset:

- Sensor class
- Sensor type
- Interface
- Sensor connection
- Sensor factor

A double point sensor calibration performed by the user is also reset if the device is restored to its factory settings.

The sensor calibration can be performed both for measurement channel 1 and for measurement channel 2 in the differentiation or averaging interface type.

8.14 Current sensor calibration (DAC trim)

The current that is output by the transmitter can be trimmed independently of the process circuit. This function is designed for compensating inaccuracies in the processing chain following the transmitter. The trim can only be performed as follows:

- SITRANS TH200: at 4 mA and at 16 mA
- SITRANS TH300: at 4 mA and at 20 mA

Fig. 14, page 31 shows the trimming principle taking the example of the 4 to 20 mA current output.

Example of an application: Current output trim with 4 mA and 20 mA

The current is to be measured as a voltage drop from 1 V to 5 V at a resistance of 250 Ω ±5 %. To trim the tolerance of the resistance, set the current sensor so that the voltage drop at 4 mA is exactly 1 V and at 20 mA is exactly 5 V.

ATTENTION

The multimeter used must have a higher accuracy class than the transmitter.

Trim at 4 mA:

Use the menu DAC trim to instruct the transmitter to output 4 mA. On the voltmeter, read off the measured value and calculate the current value. Enter this using the operating software. The transmitter uses this value for offset correction of the current.

Trim at 20 mA:

Use the menu DAC trim to instruct the transmitter to output 20 mA. On the voltmeter, read off the measured value and calculate the current value. Enter this using the operating software. The transmitter uses this value for gradient correction of the current. The value for 4 mA is not affected by this.

Scaled trim of the digital–to–analog converter (only with SITRANS TH300 and SIMATIC PDM):

This transmitter offers the additional possibility of scaled trimming of the analog output.

Use the menu digital-to-analog scaled trim (only with SITRANS TH300 and SIMATIC PDM) to enter the customer-specific scaling (the following applies in the example above: lower scaled sensor trim point = 1 V, upper scaled sensor trim point = 5 V) and then enter the values read off the measuring instrument directly into SIMATIC PDM.

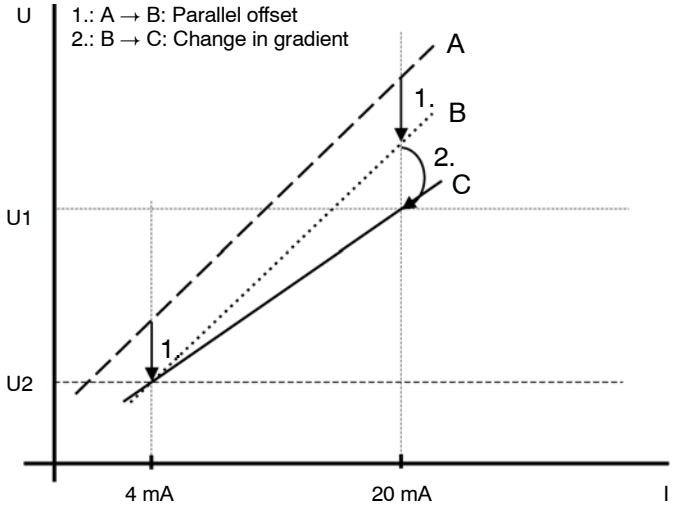


Fig. 14 Current sensor calibration: Example 4 to 20 mA output

A: Output curve
B: Characteristic curve after lower sensor calibration
C: Characteristic curve after upper sensor calibration

8.15 Special characteristic curve

The SITRANS TH200/TH300 makes it possible to connect sensors to the unit. Sensor characteristic curves valid for a large number of sensors are already programmed in the device.

Nevertheless, there are sensors (e.g. Cu100) for which this device does not offer sensor linearization as standard. In this case, however, it is possible to store a customer-specific special characteristic curve in the device. The sensor characteristic curve is then corrected by scaling the measured value output.

The SITRANS TH200/TH300 requires pairs of values (X-values, Y-values) for customer-specific characteristic curve correction. These pairs of values form sampling points and the output characteristic curve is generated in between these points by linear interpolation from the input characteristic curve. The maximum number of sampling points is restricted to 30 pairs of values. The individual pairs of values are entered as a percentage of the set measuring span.

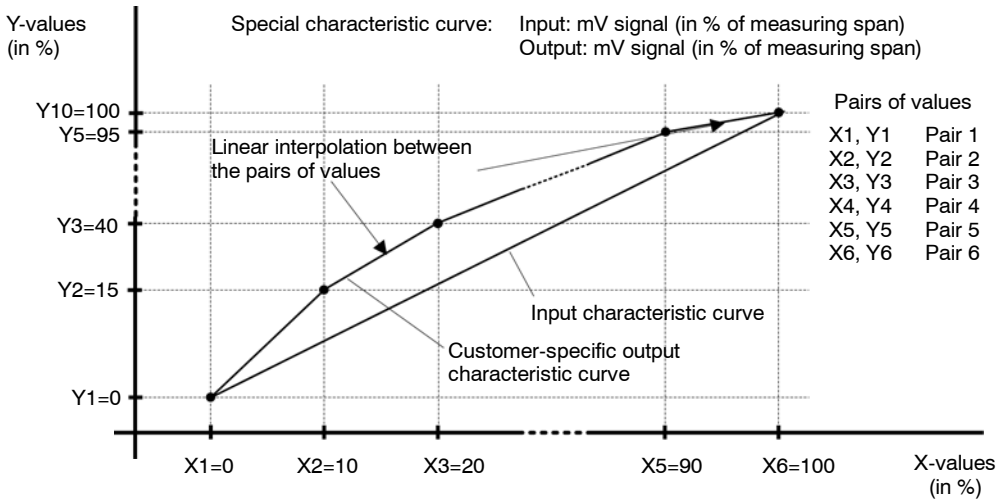


Fig. 15 Principle of customer-specific characteristic curve correction

Comply with the following points when setting the parameters of the customer-specific special characteristic curve. These are irrespective of the parameter assignment software and apply both to the SITRANS TH200 and the SITRANS TH300:

- The starting point of the characteristic curve correction is any sensor with its defined characteristic curve properties. Its sensor characteristic curve forms the basis (0-100%) for the following characteristic curve correction.

- The individual pairs of values must always be entered in the unit % of the set measuring span.

- The first pair of values is always (X=0%; Y=0%). The last pair of values is always (X=100%; Y=100%). The first and last pairs of values are specified by the parameter assignment software and cannot be changed. If a correction of the first and last pair of values is required, this is only possible by means of a two point trim of the sensor.

- The X-values must rise monotonously when the characteristic curve is input, the Y-values must rise or fall monotonously.

- The X-values do not have to be input in equidistant intervals.

Example

The SITRANS TH200/TH300 is to be used for measuring a customer-specific thermocouple. The thermocouple supplies the following mV signals in this case:

– At start of measurement: –10 mV
– At end of measurement: 40 mV

Characteristic curve correction of the thermocouple should be performed across 6 pairs of values. The type of cold junction compensation is fixed value = 0 °C.

☞ **NOTE**

It may be necessary to perform a sensor calibration at the start of measurement (–10 mV) and end of measurement (40 mV) before the sensor characteristic is recorded and the correction values have been entered.

Sensor signal at transmitter input	Characteristic curve pair			Measured value [i] after characteristic curve correction
	Pair of values	X[i]	Y[i]	
–10 mV	i = 1	0%	0%	–10 mV
–5 mV	i = 2	10%	15%	–2.5 mV
0 mV	i = 3	20%	40%	10 mV
15 mV	i = 4	50%	70%	25 mV
35 mV	i = 5	90%	95%	37.5 mV
40 mV	i = 6	100%	100%	40 mV

Determining the pairs of values X[i] and Y[i] taking the example of correcting the sensor signal from 0 mV to +10 mV (corresponds to pair of values i = 3):

Calculation X[i=3]

The characteristic curve parameter X[3] corresponds to 0 mV as a percentage in relation to the start of measurement = 10 mV and end of measurement = 40 mV.

$$\underline{\underline{X[3]}} = \frac{\text{Sensor signal} - \text{start of measurement}}{\text{End of measurement} - \text{start of measurement}} \cdot 100\% = \frac{0\ mV - (-10\ mV)}{40\ mV - (-10\ mV)} \cdot 100\% = \underline{\underline{20\%}}$$

Calculation Y[i=3]

The characteristic curve parameter Y[3] is the necessary correction value for correcting the sensor signal at X[3] = 10% from 0 mV to +10 mV

$$\underline{\underline{Y[3]}} = \frac{\text{Measured value [i = 3]} - \text{start of measurement}}{\text{End of measurement} - \text{start of measurement}} \cdot 100\% = \frac{10\ mV - (-10\ mV)}{40\ mV - (-10\ mV)} \cdot 100\% = \underline{\underline{40\%}}$$

The following pair of values must be transferred to the parameter assignment software for the characteristic curve correction of the pair of values i = 3: X[3] = 20% and Y[3] = 40%.

The transmitter then delivers 10 mV at its output when a 0 mV signal is applied.

The correction pairs are calculated in the same way as for customer-specific thermocouples when the SITRANS TH200/TH300 should be used for measuring customer-specific resistance thermometers. However, the characteristic curve correction is then based on resistance values rather than mV signals.

8.16 Factory parameters

It is possible to use the Factory parameters menu item to reset the transmitter's configuration to its factory settings. Once a factory reset has been performed, the SITRANS TH200 or SITRANS TH300 has the following configuration:

Parameter	Reset to value
TAG	Is not reset
Description	Is not reset
Message	Is not reset
Serial number	Is not reset
Installation date (electronics)	Is not reset
Sensor class	Resistance thermometer
Sensor type	Pt100 DIN IEC 751
Interface	Standard connection
Sensor connection	Three-wire connection
Sensor factor	1.00
Sensor offset 1	0.00°C
Start of measurement	0°C
End of measurement	100°C
Unit	°C
Break monitoring	ON
Short circuit monitoring	OFF
Short circuit limit	1.00 Ω
Lower end point analog output	Is not reset
Upper end point analog output	Is not reset
Alarm value	Is not reset
Linearization type	Linear to temperature
Attenuation	0.00 s
Operating hours counters PV	are all reset to 0 h
Operating hours counters, field device	are not reset
Slave pointers PV	are all reset to 0
Slave pointers electronics temperature	are not reset
Manufacturer data sensor	are not reset

Furthermore, resetting the device to its factory settings also resets a customer-specific digital-to-analog converter trim and sensor calibration (one point trim or two point trim).

8.17 Diagnostic functions

The diagnostic concept of the SITRANS TH200 and the SITRANS TH300 envisages that a diagnostic warning can be set in the parameters for diagnostic functions that are used for monitoring limit values and that a diagnostic interrupt can be set in the parameters for diagnostic functions that are used for monitoring error conditions.

Diagnostic interrupts can be output via:

- Analog output
- Operating indicator (LED)
- HART communication (only in SITRANS TH300)

Diagnostic warnings can be output via:

- HART communication (only in SITRANS TH300)

Diagnostic interrupt: The device goes into the alarm current state. In addition, the diagnostic event is made available via the operating software. The table below summarizes all the diagnostic functions that can be set in the parameters. The specified priorities apply when several faults occur at the same time (priority 1 = highest priority)

Diagnostic warning: The device transmits the diagnostic event that has occurred via the operating software. The analog output value is unchanged.

Diagnostics function	Priority	HART (only with TH300)	Analog output	LED
Diagnostic interrupt				
Hardware/firmware defect				
RAM/ROM error	1	Status	On alarm value	Red
Flash/EEPROM error	1	Status	On alarm value	Red
Watchdog error	1	Status	On alarm value	Red
Electronics defect (hardware/firmware)	1	Status	On alarm value	Red
Electronics temperature outside the limit [1]	1	Status	On alarm value	Red
Sensor error				
Sensor break	2	Status	On alarm value	Red 2 Hz
Sensor short circuit	2	Status	On alarm value	Red 2 Hz
Measured value (PV) outside the sensor limit [2]	2	Status	On alarm value	Red 2 Hz
Diagnostic warning				
Measured value out of the measurement area		Status	Unchanged	Green
Output saturation warning		Status	Unchanged	Green
Measured value (PV) outside the sensor limit		Status	Unchanged	Green
Electronics temperature outside the limit		Status	Unchanged	Green

[1] A diagnostic interrupt is not triggered unless the measured value is higher or lower than the limit value by 3 °C (5.40 °F).

[2] A diagnostic warning is triggered immediately when the measured value exceeds the limit value. However, the diagnostic interrupt is triggered if the limit value is exceeded by more than 2%.

Table 1 Diagnostic functions

☞ **NOTE**

- The configuration will not be completely stored in the device if the supply voltage fails during a write operation to the device. In this case, a new configuration must be written to the device. The device will then revert to working in accordance with the specifications.

- The transmitter can detect if the device configuration is incorrect and signals this by the red diagnostic LED being continuously lit. In addition, the “HW/FW defect” diagnostic but is set via HART in this case.

⚠ **CAUTION**

- The specification of the transmitter is no longer guaranteed if the device detects that it has been used outside its ambient temperature limits (–40°C to +85°C). In this case, the transmitter outputs the fault current set in its parameters as the output signal. The “Ambient temperature error/electronics temperature error” label remains stored in the device even after the voltage supply has been switched off and on again.

- The parameter assignment software makes it possible to reset the “Ambient temperature error/electronics temperature error” label in the device. However, this is only permitted if a sensor calibration and D/A trim have been carried out and confirm that the transmitter functions with the degree of accuracy acceptable to the user.

- Even after recalibration, devices approved for explosion protection may no longer be used in explosion-protected environments.

8.17.1 Operating hours counters in temperature classes

The SITRANS TH200 and SITRANS TH300 offer various operating hours counters for monitoring the connected process sequence.

1. Operating hours counter for transmitter electronics

- Monitors the number of operating hours during which the transmitter remained in continuous operation, depending on the ambient temperature.
- The operating hours sequence of the transmitter is recorded in 9 ambient temperature ranges.
- Starts with the first commissioning at the factory.
- Operating hours counter and temperature ranges cannot be reset or set by the user.
- The operating hours counter is only updated if the device is in measuring mode. The operating hours counter is not updated in simulation mode.

2. Operating hours counter for process variable

- Monitors the sequence of the sensor connected to the transmitter in various process areas.
- The operating hours sequence of the process variable is recorded in 9 ranges. It is subdivided according to the connected sensor and its sensor limits. The user cannot set the ranges.

- The operating hours counter is automatically reset if one of the following parameters is changed in the device:
  - Sensor class
  - Sensor type
  - Interface
  - Sensor connection
  - Sensor factor

The operating hours counters can be read out using the parameter assignment software (SIMATIC PDM or HART communicator with SITRANS TH300 and SIPROM T with SITRANS TH200). The operating hours counters are automatically stored in the non-volatile memory once every second. All operating hours counters are available once again after the next restart if the device is disconnected from its supply voltage.

8.17.2 Slave pointers

This device offers a total of two slave pointer pairs by means of which the following measured variables can be monitored for negative and positive peak values:

- Slave pointer pair for measured value (e.g. temperature differential T1–T2 with two resistance thermometers in a differential circuit)
- Slave pointer pair for electronics temperature (cannot be reset)

Resetting the slave pointer is only possible for the measured value. A reset is performed:

- At the user's request
- Automatically when any of the following parameters is changed in the device:
  - Sensor class
  - Sensor type
  - Interface
  - Sensor connection
  - Sensor factor

8.17.3 Simulation (only in SITRANS TH300)

The "Simulation" diagnostic function makes it possible to receive and process (quasi) measured data without a process value at the device. In this way, individual process sequences can be run through in "cold" status to enable process statuses to be simulated. Furthermore, applying simulation values makes it possible to check the cable routing for the analog output.

The value to be simulated can be provided as a fixed value or in the form of a ramp function. The following simulations are possible for the measurement input and analog output:

Measurement input:

- Fixed value simulation or ramp simulation for primary process variable
- Fixed value simulation or ramp simulation for electronics temperature

Measurement output:

- Fixed value simulation of the analog output

Simulation of the primary process variable, electronics temperature and analog output is handled in the same way in terms of parameter assignment and function, so the following will only deal with the general simulation procedures "Fixed value" and "Ramp function", taking the example of the measurement input.

For reasons of safety, all simulation data is held only in the user memory (RAM). This means that when the device is restarted any simulation which may be active will be shut down.

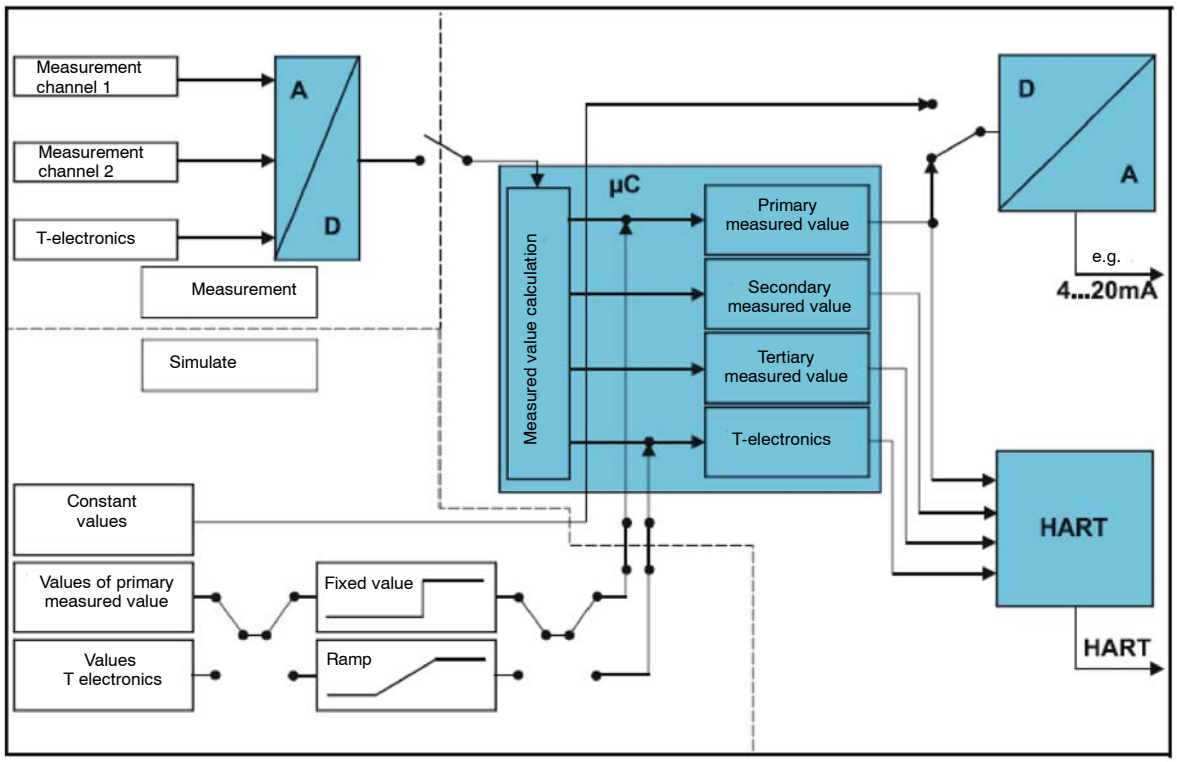


Fig. 16 Block diagram of simulation

☞ **NOTE**

- While simulation is activated, the transmitter will not react to changes in the sensor input signals.
- If the internal electronics temperature is to be simulated, the device parameters are not allowed to be set to “Thermocouple with internal cold junction compensation” for this purpose. In this case, the internal electronics temperature is a measured variable and cannot be replaced by a simulation value.

Simulation measurement input

- Simulation as fixed value

  Fixed simulation values can be set in the parameters for both simulation paths (primary measured value and electronics temperature) with regard for the physical unit. The analog output adopts a value according to the specification for the primary measured value.

- Simulation with a periodic ramp function

  As well as the adjustable fixed values, it is also possible to set a periodically recurring ramp function in the parameters for both simulation paths. Adjustable initial and final values together determine the limits between which the simulation values with a rising or falling tendency can move. The step width can be calculated with the step number, which is also adjustable.

$$Increment = \frac{Final\ value - Initial\ value}{Step\ number}$$

The duration between two successive simulation values is defined by the step duration. The analog output follows the simulated values in the simulation for the primary measured value.

9 Operation

9.1 Operation with PC/laptop and modem

9.1.1 SITRANS TH200

ATTENTION

Parameters may only be assigned to the SITRANS TH200 when “offline” using the parameter assignment modem and the SIPROM T operating software. Any 4 to 20 mA current loop connected to the transmitter needs to be disconnected before parameters are assigned.

The transmitter can be configured using a PC and the SIPROM T parameter assignment software together with the modem for SITRANS TH100/TH200. To do so, connect the transmitter to the PC via the modem. The power required by the transmitter is provided via:

– the USB interface on the PC (in the case of a USB modem)
– an external power adapter (in the case of an RS232 modem)

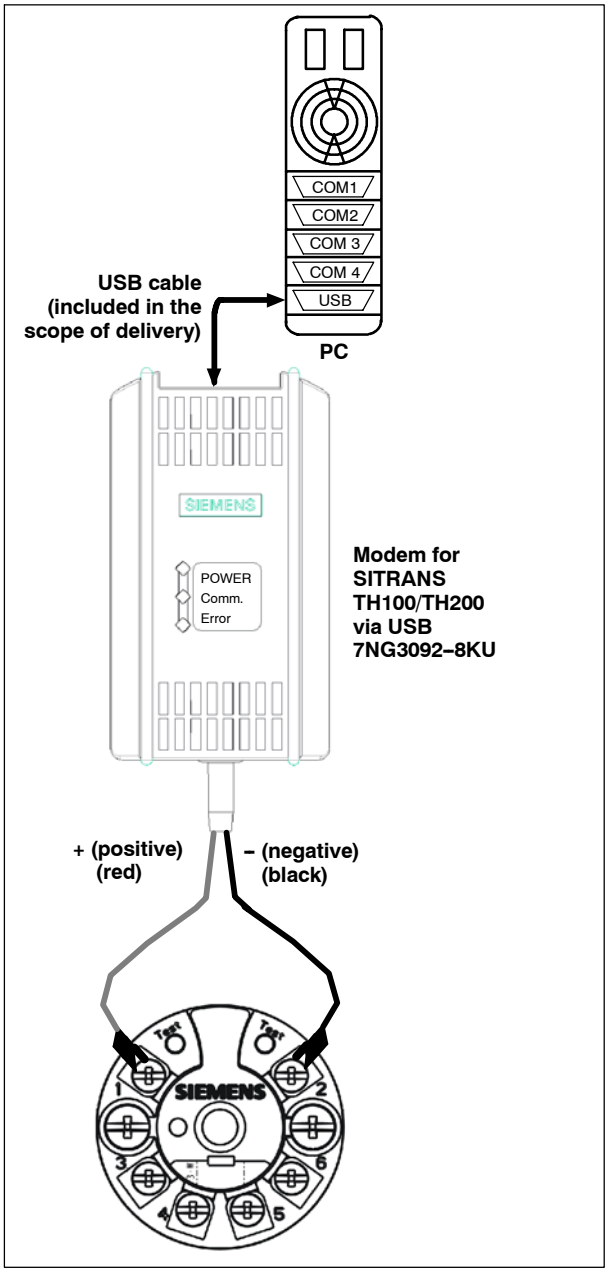


Fig. 17 SITRANS TH200 parameter assignment via USB modem

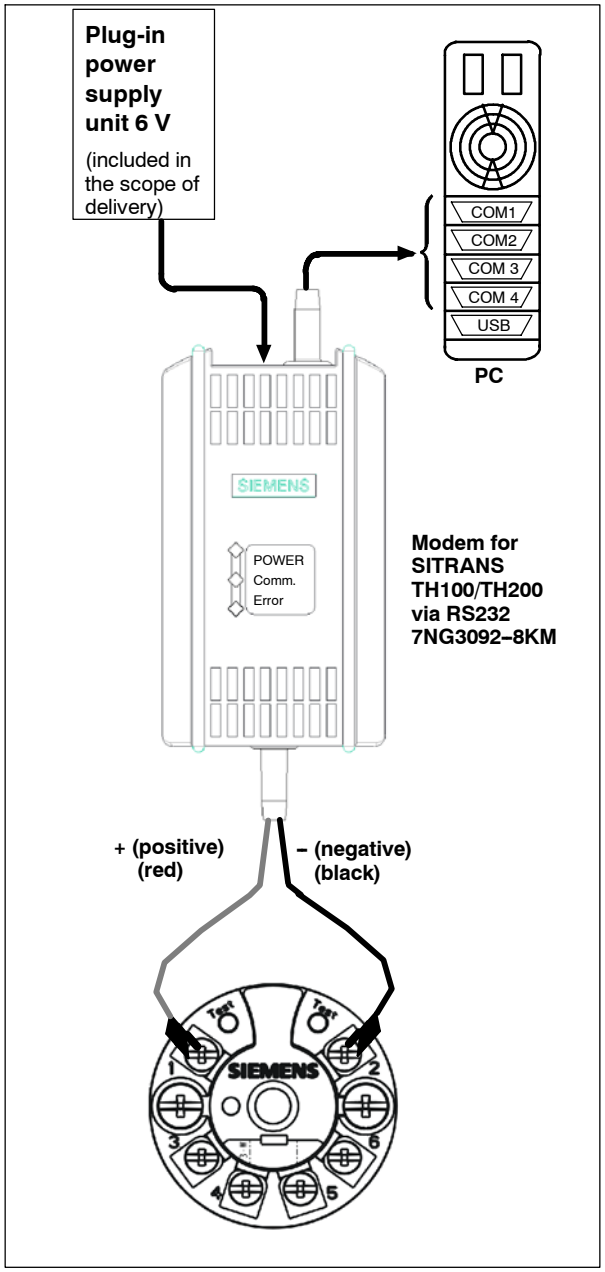


Fig. 18 SITRANS TH200 parameter assignment via RS232 modem

For detailed information on assigning parameters to the transmitter, please refer to the instruction manual for the following products:

- Modem for SITRANS TH100 and SITRANS TH200 and parameter assignment software SIPROM T (order number: 7NG3092-8KM and 7NG3092-8KU, respectively)
- CD “sitrans t – temperature transmitters”, order number A5E00364512

9.1.2 SITRANS TH300

The transmitter can be operated and have its parameters set via the PC using the SIMATIC PDM parameter assignment software and the coupling module (HART modem). The coupling module must be connected to the output circuit for this purpose. The power supply of the transmitter must be switched on and the load in the circuit must be at least 250 ohm (see also Fig. 10, page 21).

9.2 Operation with HART communicator

Action buttons

This button switches the HART communicator on and off. After switch-on, the handheld terminal automatically establishes communication with the transmitter. The online menu appears on the display.

This button moves the cursor up through the menu bar. The selected menu line is indicated.

This button moves the cursor down through the menu bar. The selected menu line is indicated.

This button moves the cursor to the right through the menu bar or branches into a subroutine. The name of the selected subroutine is displayed at the top edge of the display.

This button moves the cursor to the left through the menu bar or exits a subroutine.

Function buttons

Function buttons F1 to F4 are located below the digital display. The various functions of the buttons in the individual menus are displayed on the bottom edge of the display.

Alphanumeric button and shift buttons

Alphanumeric values can be entered using these buttons. The function (number or letter button) depends on the menu in question. Letters are selected by confirming the corresponding shift button first.

Please refer to the operating instructions of the HART communicator for all further information about operation and the technical data.

10 Technical data

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	Pt25 to Pt1000 according to IEC 60751 Pt25 to Pt1000 (JIS C 1604; a = 0.00392 K^{-1}) Ni25 to Ni1000 according to IEC 60751 Special type via special characteristic curve (max. 30 points)
Sensor factor	0.25 to 10 (Adaptation of the basic type, e.g. Pt100, to version Pt25 to Pt1000)
Units of measurement	°C or °F
Interface	
Standard connection	1 resistance thermometer (RTD) in two-wire, three-wire or four-wire connection
Averaging	2 equal resistance thermometers in two-wire connection for averaging the temperature
Differentiation	2 equal resistance thermometers (RTD) in two-wire connection (RTD1 – RTD2 or RTD2 – RTD1)
Connector	
Two-wire connection	Line resistance can be set in the parameters ≤ 100 Ω (loop resistance)
Three-wire connection	No trim necessary
Four-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short circuit monitoring	Can be switched off (value can be adjusted)
Measuring range	Can be set in the parameters (see table, page 48)
Min. measuring span	10°C (18°F)
Characteristic curve	Linear to temperature or special characteristic curve

Resistance-type transmitter

Measured variable	Ohmic resistance
Sensor type	Resistance, potentiometer
Units of measurement	Ω
Interface	
Standard connection	1 resistance-type transmitter (R) in two-wire, three-wire or four-wire connection
Averaging	2 resistance-type transmitters in two-wire connection for averaging
Differentiation	2 resistance-type transmitters in two-wire connection (R1 – R2 or R2 – R1)
Connector	
Two-wire connection	Line resistance can be set in the parameters ≤ 100 Ω (loop resistance)
Three-wire connection	No trim necessary
Four-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring

Break monitoring	Always active (cannot be switched off)
Short circuit monitoring	Can be switched off (value can be adjusted)
Measuring range	Can be set in the parameters max. 0 to 2,200 Ω (see table, page 48)
Min. measuring span	5 Ω to 25 Ω (see table, page 48)
Characteristic curve	Linear to resistance or special characteristic curve

Thermocouples

Measured variable	Temperature
Sensor type (thermo pairs)	Type B: Pt30Rh–Pt6Rh DIN IEC 584 Type C: W5%–Re ASTM 988 Type D: W3%–Re ASTM 998 Type E: NiCr–CuNi DIN IEC 584 Type J: Fe–CuNi DIN IEC 584 Type K: NiCr–Ni DIN IEC 584 Type L: Fe–CuNi DIN 43710 Type N: NiCrSi–NiSi DIN IEC 584 Type R: Pt13Rh–Pt DIN IEC 584 Type S: Pt10Rh–Pt DIN IEC 584 Type T: Cu–CuNi DIN IEC 584 Type U: Cu–CuNi DIN 43710
Units of measurement	°C or °F
Interface	
Standard connection	1 thermocouple (TC)
Averaging	2 equal thermocouples (TC)
Differentiation	2 equal thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time	≤250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Cold junction compensation	Internal: With integrated resistance thermometer Pt100 External: With external Pt100 IEC 60751 (two-wire or three-wire connection) External fixed: Cold junction temperature can be set as fixed value
Measuring range	Can be set in the parameters (see table, page 49)
Min. measuring span	Min. 50 to 100°C (90 to 180°F) (see table, page 49)
Characteristic curve	Linear to temperature or special characteristic curve

Millivolt transmitter

Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source is possible via a resistor that is connected externally)
Units of measurement	mV
Response time	≤250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	Can be set in the parameters max. –100 to 1100 mV (see table, page 49)
Min. measuring span	2 mV or 20 mV
Overload capacity of the input	DC –1.5 to 3.5 V
Input resistance	≥1 MΩ
Characteristic curve	Linear to voltage or special characteristic curve

Output

Output signal	4 to 20 mA, two-wire With SITRANS TH300, additionally with communication according to HART rev. 5.9
Auxiliary power	DC 11 to 35 V (to 30 V with EEx)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overload range	3.6 mA to 23 mA, infinitely adjustable (Default range: 3.84 mA to 20.50 mA)
Error signal (e.g. in case of sensor failure)	3.6 mA to 23 mA, infinitely adjustable (Default value: 22.8 mA)
Sampling cycle	0.25 s
Attenuation	Software filter 1st order 0 to 30 s (can be set in parameters)
Protection	Against reverse polarity
Electrical isolation	Input to output (1 $kV_{r.m.s.}$)

Measuring accuracy

Digital measuring error	See table, page 48 and 49
Reference conditions	
Auxiliary power	24 V ⩾1%
Load	500 Ω
Ambient temperature	23°C
Heat-up time	< 5 min
Analog output error (digital-to-analog conversion)	< 0.1% of the measuring span
Fault due to internal cold junction	< 0.5°C (0.9 °F)
Influence of temperature	< 0.1% of max. measuring span/10°C (18°F)
Influence of auxiliary power	< 0.005% of the measuring span/V
Influence of load	< 0.012% of maximum measuring span/100 ohm
Long-term drift	< 0.02% of the max. measuring span in the first month
	< 0.03% of the max. measuring span after one year
	< 0.04% of the max. measuring span after five years

Ambient conditions

Ambient temperature range	–40 to +85°C (–40 to +185°F)
Storage temperature range	–40 to +85°C (–40 to +185°F)
Relative humidity	≤ 98%, condensing

Electromagnetic compatibility	According to DIN EN 61326 and NAMUR recommendation NE21
Fault due to EMC influences when installed in connection head[1)]	
Electrostatic discharge (ESD) according to EN 61000–4–2	< 0.10% of the measuring span
HF irradiation according to EN 61000–4–3	< 0.10% of the measuring span
Burst according to EN 61000–4–4	< 0.10% of the measuring span
HF energizing according to EN 61000–4–6	< 0.20% of the measuring span

[1)] Greater measuring errors may occur if the transmitter is installed on a DIN rail in an environment with severe ESD interference.

Design

Material	Plastic, encapsulated
Weight	50 g

Dimensions	See Fig. 9, page 19
Cross section of the connecting cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection	According to IEC 60529
Casing	IP40
Terminals	IP00

Certificates and approvals

Operation in the territory of EC member states	
EC type examination certificate	PTB 05 ATEX 2040X The technical data listed in the EC type examination certificate apply exclusively for applications in potentially explosive areas.
Protection type “intrinsic safety” according to ATEX	II 1 G EEx ia IIC T6/T4 II 2 (1) G EEx ia/ib IIC T6/T4
Protection type “non-sparking and power-limited resources”	II 3G EEx nAL IIC T6/T4
Operation in the USA and in Canada	
FM approval PID 3024169, applies to USA and Canada (cFMus)	
Protection types	IS Cl I, II, III, Div 1, GP ABCDEFG T4/T5/T6 IS Cl I, ZN 0.1 AEx ia IIC T4/T5/T6 NI Cl I, II, III, Div 2, GP ABCDFG T4/T5/T6 Cl I, ZN 2, GP IIC T4/T5/T6

Refer to the FM Certificate of Compliance no. 3024169 and the corresponding Control Drawing C10145–A4–X2–33 for the electrical data, operating conditions and installation notes for operation in potentially explosive atmospheres.

Resistance thermometer

Input	Measuring range °C (°F)	Minimum measuring span °C (°F)	Digital accuracy °C (°F)
Pt25 (IEC 60751)	–200 to +850 (–328 to 1562)	10 (18)	0.2 (0.36)
Pt50 (IEC 60751)	–200 to +850 (–328 to 1562)	10 (18)	0.15 (0.27)
Pt100 to Pt200 (IEC 60751)	–200 to +850 (–328 to 1562)	10 (18)	0.1 (0.18)
Pt500 (IEC 60751)	–200 to +850 (–328 to 1562)	10 (18)	0.15 (0.27)
Pt1000 (IEC 60751)	–200 to +350 (–328 to 662)	10 (18)	0.15 (0.27)
Pt25 (JIS C1604–81)	–200 to +649 (–328 to 1200)	10 (18)	0.2 (0.36)
Pt50 (JIS C1604–81)	–200 to +649 (–328 to 1200)	10 (18)	0.15 (0.27)
Pt100 to Pt200 (JIS C1604–81)	–200 to +649 (–328 to 1200)	10 (18)	0.1 (0.18)
Pt500 (JIS C1604–81)	–200 to +649 (–328 to 1200)	10 (18)	0.15 (0.27)
Pt1000 (JIS C1604–81)	–200 to +350 (–328 to 662)	10 (18)	0.15 (0.27)
Ni25 to Ni1000	–60 to +250 (–76 to 482)	10 (18)	0.1 (0.18)

Resistance–type transmitter

Input	Measuring range Ω	Minimum measuring span Ω	Digital accuracy Ω
Resistor	0 to 390	5	0.05
Resistor	0 to 2200	25	0.25

Thermocouples

Input	Measuring range °C (°F)	Minimum measuring span °C (°F)	Digital accuracy °C (°F)
Type B	300 to 1820 (572 to 3308)[1)]	100 (180)	2 (3.60)
Type C (W5)	0 to 2300 (32 to 4172)	100 (180)	2 (3.60)
Type D (W3)	0 to 1750 (32 to 3182)[2)]	100 (180)	1 (1.80)
Type E	–200 to 1000 (–328 to 1832)	50 (90)	1 (1.80)
Type J	–210 to 1200 (–346 to 2192)	50 (90)	1 (1.80)
Type K	–200 to 1370 (–328 to 2498)	50 (90)	1 (1.80)
Type L	–200 to 900 (–328 to 1652)	50 (90)	1 (1.80)
Type N	–200 to 1300 (–328 to 2372)	50 (90)	1 (1.80)
Type R	–50 to 1760 (–58 to 3200)	100 (180)	2 (3.60)
Type S	–50 to 1760 (–58 to 3200)	100 (180)	2 (3.60)
Type T	–200 to 400 (–328 to 752)	40 (72)	1 (1.80)
Type U	–200 to 600 (–328 to 1112)	50 (90)	2 (3.60)

1) The digital accuracy in the range 0 to 300°C (32 to 572 °F) is 3°C (5.40°F)
2) The digital accuracy in the range 1750 to 2300°C (3182 to 4172°F) is 2°C (3.60°F)

Millivolt transmitter

Input	Measuring range mV	Minimum measuring span mV	Digital accuracy µV
Millivolt transmitter	–10 to 70	2	40
Millivolt transmitter	–100 to 1100	20	400

The digital accuracy is the accuracy following analog-to-digital conversion including linearization and measured value calculation.

Due to digital-to-analog conversion, the 4 to 20 mA output current is subject to an additional error max. 0.1% of the set measuring span (digital-to-analog error).

The overall error on the analog output under reference conditions is the total of the digital error and the digital-to-analog error (plus the cold junction error in the case of thermocouple measurements, if appropriate).

11 Ordering data

Description	Order number
Temperature transmitter SITRANS TH200 for installation in the connection head type B (DIN 43729), two-wire technology 4 to 20 mA, programmable, with electrical isolation	
without explosion protection	7NG3211–1NN00
with ”intrinsically safe” explosion protection	
– EEx ia (ATEX)	7NG3211–1AN00
– FM (cFMus)	7NG3211–1BN00
Temperature transmitter SITRANS TH300 for installation in connection heads of type B (DIN 43729), two-wire technology 4 to 20 mA, with communications capability according to HART® rev. 5.9, with electrical isolation	
without explosion protection	7NG3212–0NN00
with “intrinsically safe” explosion protection	
– EEx ia (ATEX)	7NG3212–0AN00
– FM (cFMus)	7NG3212–0BN00
Modem for SITRANS TH100 and TH200 incl. parameter assignment software SIPROM T	
with USB connection	7NG3092–8KU
with RS232 connection	7NG3092–8KM
CD “sitrans t – temperature transmitters” with documentation German/English/French/Spanish/Italian/Portuguese and parameter assignment software SIPROM T	A5E00364512
HART modem with RS232 serial port	7MF4997–1DA
HART modem with USB interface	7MF4997–1DB
DIN rail adapter for sensor head (packing unit = 5 pcs.)	7NG3092–8KA

Additional specifications Complete order no. with “–Z”, add abbreviated specification	Abbreviated specification
Adjust operational data as desired (operational data should be described in plain text)	Y01
with test report (five measurement points)	C11

Accessories and spare parts

SIMATIC PDM parameter assignment software
For operation and parameter assignment including communication via HART modem Please refer to our FI 01 catalog for information about more SIMATIC PDM options.

Factory setting

– Pt100	in three-wire connection
– Measuring range	0 to 100°C (32 to 212°F)
– Fault current	22.8 mA
– Sensor offset	0°C (0°F)
– Attenuation	0.0 s

You can obtain all instructions, catalogs and certificates for SITRANS T from the following Internet address: www.siemens.de/sitranst

12 Dimensional drawing

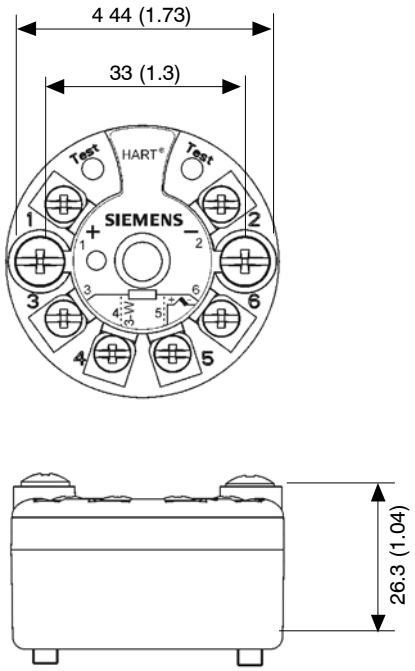


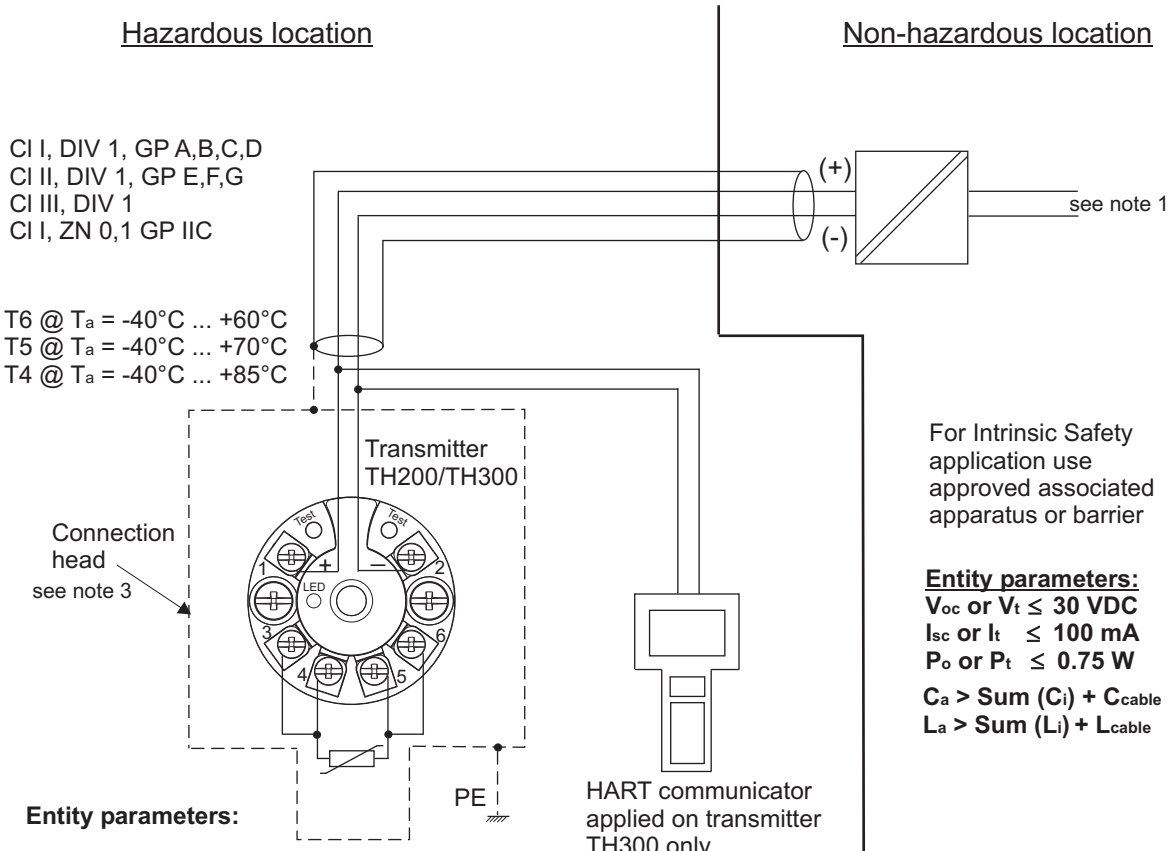
Fig. 19 Dimensions in mm (inch)

13 Maintenance

The transmitter is maintenance-free.

14 Certificates

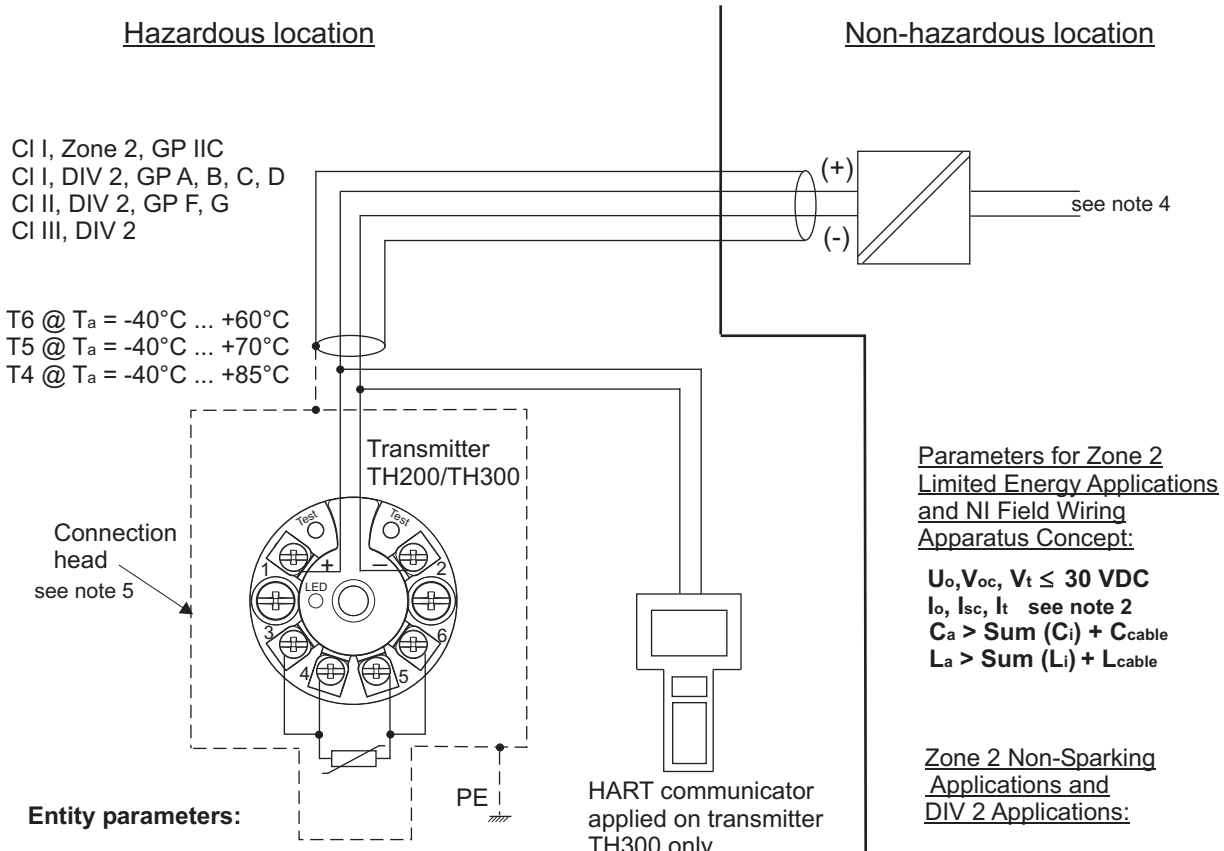
You can find the certificates on the “sitrans t – temperature transmitters” CD, ordered separately, order number A5E00364512; and on the Internet at www.siemens.de/sitranst.



Notes:
1. The nonintrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than 250 Vrms or d.c. unless if has been determinated that the voltage has been adequately isolated.
2. The installation must meet the requirements of the National Electrical Code / Canadian Electrical Code
3. The SITRANS TH200/TH300 must be installed in a housing, e.g. Type B connection head

This document contains safety-relevant information based on technical standards (i.e. Norms, internal standards) or certifications that the apparatus is subject to and may only be altered with the approval of the norm expert (NFM)

Fab-Gr.:		Tol.:	Scale:	SAP No.:
			Engineering Obligation for Delivery	
Change No.:		Date: 03.03.2006	Product: Temperature Transmitter SITRANS TH200/TH300 Type 7NG3211-1B*** 7NG3212-0B***	
Revision: 1	FK:	Edited by: Barić		Sheet 1 of 2
Date of change:		Approved by: Sudeta		
Modify by:		A & D PD	Title: Control Drawing for DIV 1, Zone 0,1	
Change for:		Siemens d.d.	Document No.: C10145-A4-X2-33	Doc. Type:



Entity parameters:

Terminals 1(+), 2(-):
U_i, V_{max} = 30 VDC
I_i, I_{max} see note 2
L_i = 106 µH
C_i = 13 nF

Terminals 3, 4, 5, 6:
U_o, V_{oc}, V_t = 6 VDC
I_o, I_{sc}, I_t see note 2
L_o, L_a = 50 mH
C_o, C_a = 40 µF

Functional Ratings:
I_{normal} = 4 ... 20 mA

Parameters for Zone 2 Limited Energy Applications and NI Field Wiring Apparatus Concept:

U_o,V_{oc}, $V_t \leq$ 30 VDC
I_o, I_{sc}, I_t see note 2
C_a > Sum (C_i) + C_{cable}
L_a > Sum (L_i) + L_{cable}

Zone 2 Non-Sparking Applications and DIV 2 Applications:

Vmax = 30 VDC
Observe note 3!

Zone 2 and Division 2 Installations (for Current Controlled Circuits):

Note 1: The nonincendive field wiring concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus not specifically examined in combination.
Note 2: For current controlled circuits, the input current (I_{max}) of the receiving device need not match the output current (I_t or I_{sc}) of the barrier or associated nonincendive field wiring apparatus source.
Note 3: The installation must meet the requirements of the National Electrical Code / Canadian Electrical Code
Note 4: The supply terminals must not be connected to any device which uses or generates more than 250 Vrms or d.c. unless adequately isolattion is used.
Note 5: The SITRANS TH200/TH300 must be installed in a housing, e.g. Type B connection head

This document contains safety-relevant information based on technical standards (i.e. Norms, internal standards) or certifications that the apparatus is subject to and may only be altered with the approval of the norm expert (NFM)

Fab-Gr.:		Tol.:	Scale: / SAP No.:
			Engineering Obligation for Delivery
Change No.:		Date: 03.03.2006	Product: Temperature Transmitter SITRANS TH200/TH300 Type 7NG3211-1B*** 7NG3212-0B***
Revision: 1	FK:	Edited by: Barić	
Date of change:		Approved by: Sudeta	Sheet 2 of 2
Modify by:		A & D PD	Title: Control Drawing for DIV 2, Zone 2
Change for:		Siemens d.d.	Document No.: C10145-A4-X2-33 / Doc. Type:

A5E00393069-01

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