**2**

## Overview



### The user-friendly transmitters for the control room

The SITRANS TW universal transmitter is a further development of the service-proven SITRANS T for the 4-wire system in a mounting rail housing. With numerous new functions it sets new standards for temperature transmitters.

With its diagnostics and simulation functions the SITRANS TW provides the necessary insight during commissioning and operation. And using its HART interface the SITRANS TW can be conveniently adapted with SIMATIC PDM to every measurement task.

All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

## Application

The SITRANS TW transmitter is a four-wire rail-mounted device with a universal input circuit for connection to the following sensors and signal sources:

- Resistance thermometer
- Thermocouples
- Resistance-based sensors/potentiometers
- mV sensors
- As special version:
  - V sources
  - Current sources

The 4-wire rail-mounted SITRANS TW transmitter wire is designed for control room installation. It must not be mounted in potentially explosive atmospheres.

All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.
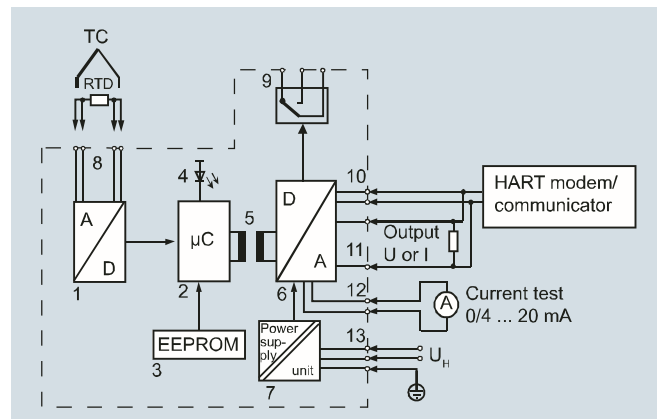
## Function

### Features

- Transmitter in four-wire system with HART interface
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Screw plug connector
- All circuits electrically isolated
- Output signal: 0/4 to 20 mA or 0/2 to 10 V
- Power supplies: 115/230 V AC/DC or 24 V AC/DC
- Explosion protection [EEx ia] or [EEx ib] for measurements with sensors in the hazardous area
- Temperature-linear characteristic for all temperature sensors

- Temperature-linear characteristic can be selected for all temperature sensors
- Automatic correction of zero and span
- Monitoring of sensor and cable for open-circuit and short-circuit
- Sensor fault and/or limit can be output via an optional sensor fault/limit monitor
- Hardware write protection for HART communication
- Diagnostic functions
- Slave pointer functions
- SIL1

### Mode of operation



The signal output by a resistance-based sensor (two-wire, three-wire, four-wire system), voltage source, current source or thermocouple is converted by the analog-to-digital converter (1, function diagram) into a digital signal. This is evaluated in the microcontroller (2), corrected according to the sensor characteristic, and converted by the digital-to-analog converter (6) into an output current (0/4 to 20 mA) or output voltage (0/2 to 10 V). The sensor characteristics as well as the electronics data and the data for the transmitter parameters are stored in the non-volatile memory (3).

AC or DC voltages can be used as the power supply (13). Any terminal connections are possible for the power supply as a result of the bridge rectifier in the power supply unit. The PE conductor is required for safety reasons.

A HART modem or a HART communicator permit parameterization of the transmitter using a protocol according to the HART specification. The transmitter can be directly parameterized at the point of measurement via the HART output terminals (10).

The operation indicator (4) identifies a fault-free or faulty operating state of the transmitter. The limit monitor (9) enables the signaling of sensor faults and/or limit violations. In the case of a current output, the current can be checked on a meter connected to test socket (12).

### Diagnosis and simulation functions

The SITRANS TW comes with extensive diagnosis and simulation functions.

Physical values can be defined with the simulation function. It is thus possible to check the complete signal path from the sensor input to inside the control system without additional equipment. The slave pointer functions are used to record the minimum and maximum of the plant's process variable.
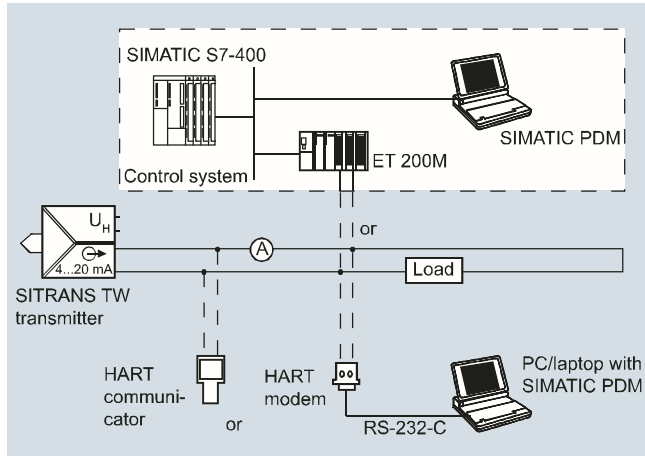
# Temperature Measurement
## Transmitters for rail mounting

**SITRANS TW**
**four-wire system, universal, HART**

## ■ Integration

### *System configuration*



Possible system configurations

The SITRANS TW transmitter as a four-wire rail-mounted device can be used in a number of system configurations: as a stand-alone version or as part of a complex system environment, e.g. with SIMATIC S7. All device functions are available via HART communication.

Communication options through the HART interface:

- HART communicator
- HART modem connected to PC/laptop on which the appropriate software is available, e.g. SIMATIC PDM
- HART-compatible control system (e.g. SIMATIC S7-400 with ET 200M)

## ■ Technical specifications

| Input | |
|---|---|
| Selectable filters to suppress the line frequency | 50 Hz, 60 Hz, also 10 Hz for special applications (line frequency filter is similar with measuring frequency) |
| Resistance thermometer | |
| Measured variable | Temperature |
| Measuring range | Parameterizable |
| Measuring span | min. 25 °C (45 °F) x 1/scaling factor |
| Sensor type | |
| • Acc. to IEC 751 | Pt100 (IEC 751) |
| • Acc. to JIS C 1604-81 | Pt100 (JIS C1604-81) |
| • to DIN 43760 | Ni100 (DIN 43760) |
| • Special type ($R_{RTD} \leq 500 \ \Omega$) | Multiples or parts of the defined characteristic values can be parameterized (e.g. Pt500, Ni120) |
| Characteristic curve | Temperature-linear, resistance-linear or customer-specific |
| Type of connection | • Normal connection |
| | • Sum or parallel connection |
| | • Mean-value or differential connection |
| Interface | 2, 3 or 4-wire circuit |
| Measuring range limits | Depending on type of connected thermometer (defined range of resistance thermometer) |
| Sensor breakage monitoring | Monitoring of all connections for open-circuit (function can be switched off) |
| Sensor short-circuit monitoring | Parameterizable response threshold (function can be switched off) |
| Resistance-based sensor, potentiometer | |
| Measured variable | Actual resistance |
| Measuring range | Parameterizable |
| Measuring span | min. 10 Ω |
| Characteristic curve | Resistance-linear or customer-specific |
| Type of connection | • Normal connection |
| | • Differential connection |
| | • Mean-value connection |
| Interface | 2, 3 or 4-wire circuit |
| Input range | 0 ... 6000 Ω; with mean-value and difference circuits: 0 ... 3000 Ω |
| Sensor breakage monitoring | Monitoring of all connections for open-circuit (function can be switched off) |
| Sensor short-circuit monitoring | Parameterizable response threshold (function can be switched off) |

# Temperature Measurement
## Transmitters for rail mounting
### SITRANS TW
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Thermocouples

| | |
|---|---|
| Measured variable | Temperature |
| Measuring range | Parameterizable |
| Measuring span | min. 50 °C (90 °F) x 1/scaling factor |
| Measuring range limits | Depend. on type of thermocouple element |
| Thermocouple element | Type B: Pt30 %Rh/Pt6 %Rh (DIN IEC 584) |
| | Type C: W5 %-Re (ASTM 988) |
| | Type D: W3 %-Re (ASTM 988) |
| | 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: Pt13 %Rh/Pt (DIN IEC 584) |
| | Type S: Pt10 %Rh/Pt (DIN IEC 584) |
| | Type T: Cu/CuNi (DIN IEC 584) |
| | Type U: Cu/CuNi (DIN 43710) |
| | Special type (-10 mV ≤ UTC ≤ 100 mV) |
| Characteristic curve | Temperature-linear, voltage-linear or customer-specific |
| Type of connection | • Normal connection |
| | • Averaging connection |
| | • Mean-value connection |
| | • Differential connection |
| Cold junction compensation | None, internal measurement, external measurement or predefined fixed value |
| Sensor breakage monitoring | Function can be switched off |

mV sensors

| | |
|---|---|
| Measured variable | DC voltage |
| Measuring range | Parameterizable |
| Measuring span | min. 4 mV |
| Input range | -120 ... +1000mV |
| Characteristic curve | Voltage-linear or customer-specific |
| Overload capacity of inputs | max. ± 3.5 V |
| Input resistance | ≥ 1 MΩ |
| Sensor current | Approx. 180 μA |
| Sensor breakage monitoring | Function can be switched off |

V sources

| | |
|---|---|
| Measured variable | DC voltage |
| Measuring range | Parameterizable |
| Characteristic curve | Voltage-linear or customer-specific |
| Input range/min. span | |
| • Devices with 7NG3242-xxxx**1** or 7NG3242-xxxx**0** with U/I plug | -1.2 ... + 10 V/0.04 V |
| • Devices with 7NG3242-xxxx**2** | -12 ... +100 V/0.4 V |
| • Devices with 7NG3242-xxxx**3** | -120 ... +140 V/4.0 V |
| Sensor breakage monitoring | Not possible |

μA-, mA sources

| | |
|---|---|
| Measured variable | DC voltage |
| Measuring range | Parameterizable |
| Characteristic curve | Current-linear or customer- specific |
| Input range/min. span | |
| • Devices with 7NG3242-xxxx**4** | -12 ... +100 μA/0.4 μA |
| • Devices with 7NG3242-xxxx**5** | -120 ... +1000 μA/4 μA |
| • Devices with 7NG3242-xxxx**6** | -1.2 ... +10 mA/0.04 mA |
| • Devices with 7NG3242-xxxx**7** or 7NG3242-xxxx**0** with U/I plug | -12 ... +100 mA/0.4 mA |
| • Devices with 7NG3242-xxxx**8** | -120 ... +1000 mA/4 mA |
| Sensor breakage monitoring | Not possible |

**Output**

| | |
|---|---|
| Output signal | Load-independent direct current 0/4 ... 20 mA, can be switched to load-independent DC voltage 0/2 ... 10 V using plug-in jumpers |
| Current 0/4 ... 20 mA | |
| • Overrange | -0.5 ... +23.0 mA, continuously adjustable |
| • Output range following sensor fault (conforming to NE43) | -0.5 ... +23.0 mA, continuously adjustable |
| • Load | ≤ 650 Ω |
| • No-load voltage | ≤ 30 V |
| Voltage 0/2 ... 10 V | |
| • Overrange | -0.25 ... +10.75 V, continuously adjustable |
| • Output range following sensor fault | -0.25 ... +10.75 V, continuously adjustable |
| • Load resistance | ≥ 1 kΩ |
| • Load capacitance | ≤ 10 nF |
| • Short-circuit current | ≤ 100 mA (not permanently short-circuit-proof) |
| • Electrical damping | |
| - adjustable time constant $T_{63}$ | 0 ... 100 s, in steps of 0.1 s |
| • Current source/voltage source | Continuously adjustable within the total operating range |
| Sensor fault/limit signalling | By operation indicator, relay output or HART interface |
| Operation indicator | Flashing signal |
| • Limit violation | Flashing frequency 5 Hz |
| • Sensor fault monitoring | Flashing frequency 1 Hz |
| Relay outputs | Either as NO or NC contact with 1 changeover contact |
| • Switching capacity | ≤ 150 W, ≤ 625 VA |
| • Switching voltage | ≤ 125 V DC, ≤ 250 V AC |
| • Switching current | ≤ 2.5 A DC |
| Sensor fault monitoring | Signalling of sensor or line breakage and sensor short-circuit |
| Limit monitoring | |
| • Operating delay | 0 ... 10 s |
| • Monitoring functions of limit module | • Sensor fault (breakage and/or short-circuit) |
| | • Lower and upper limit |
| | • Window (combination of lower and upper limits) |
| | • Limit and sensor fault detection can be combined |
| • Hysteresis | Parameterizable between 0 and 100 % of measuring range |

**SITRANS TW**
**four-wire system, universal, HART**

| Auxiliary power | |
|---|---|
| Universal power supply unit | 115/230 V AC/DC or 24 V AC/DC |
| Tolerance range for power supply | |
| • With 115/230 V AC/DC PSU | 80 ... 300 V DC; 90 ... 250 V AC |
| • With 24 V AC/DC PSU | 18 ... 80 V DC; 20.4 ... 55.2 V AC (in each case interruption-resistant up to 20 ms in the complete tolerance range) |
| Tolerance range for mains frequency | 47 ... 63 Hz |
| Power consumption with | |
| • 230 V AC | $\leq$ 5 VA |
| • 230 V DC | $\leq$ 5 W |
| • 24 V AC | $\leq$ 5 VA |
| • 24 V DC | $\leq$ 5 W |

| Electrically isolated | |
|---|---|
| Electrically isolated circuits | Input, output, power supply and sensor fault/limit monitoring output are electrically isolated from one another. The HART interface is electrically connected to the output. |
| Working voltage between all electrically isolated circuits | The voltage $U_{rms}$ between any two terminals must not exceed 300 V |

| Measuring accuracy | |
|---|---|
| Accuracy | |
| • Error in the internal cold junction | $\leq$ 3 °C ± 0.1 °C / 10 °C ($\leq$ 5.4 °F ± 0.18 °F / 18 °F) |
| • Error of external cold junction terminal 7NG3092-8AV | $\leq$ 0.5 °C ± 0.1 °C / 10 °C ($\leq$ 0.9 °F ± 0.18 °F / 18 °F) |
| • Digital output | See "Digital error" |
| • Analog output $I_{AN}$ or $U_{AN}$ | $\leq$ 0.05 % of the span plus digital error |
| Influencing effects (referred to the digital output) | Compared to the max. span: |
| • Temperature drift | $\leq$ 0.08 % / 10 °C ($\leq$ 0.08 % /18 °F) $\leq$ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F) |
| • Long-term drift | $\leq$ 0.1 % / year |
| Influencing effects referred to the analog output $I_{AN}$ or $U_{AN}$ | Compared to the span: |
| • Temperature drift | $\leq$ 0.08 % / 10°C ($\leq$ 0.08 % / 18 °F) $\leq$ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F) |
| • Power supply | $\leq$ 0.05 % / 10 V |
| • Load with current output | $\leq$ 0.05 % on change from 50 $\Omega$ to 650 $\Omega$ |
| • Load with voltage output | $\leq$ 0.1 % on change in the load current from 0 mA to 10 mA |
| • Long-term drift (start-of-scale value, span) | $\leq$ 0.03 % / month |
| Response time ($T_{63}$ without electrical damping) | $\leq$ 0.2 s |

| Electromagnetic compatibility | According to EN 61 326 and NAMUR NE21 |
|---|---|

| Certificates and approvals | |
|---|---|
| ATEX | To DIN EN 50014: 1997, EN 50020: 1994 |
| Intrinsic safety to EN 50 020 | |
| • for 7NG3242-x**A**xxx | II (1) G D [EEx ia/ib ] IIB |
| • for 7NG3242-x**B**xxx | II (1) G D [EEx ia/ib ] IIC |
| EC type-examination certificate | TÜV (German Technical Inspectorate) 01 ATEX 1675 |
| Other certificates | GOST, NEPSI |

| Conditions of use | |
|---|---|
| Installation conditions | |
| Location (for devices with explosion protection) | |
| • Transmitters | Outside the potentially explosive atmosphere |
| • Sensor | Within the potentially explosive atmosphere zone 1 (also in zone 0 in conjunction with the prescribed protection requirements for the sensor) |
| Ambient conditions | |
| Permissible ambient temperature | -25 ... +70 °C (-13 ... +158 °F) |
| Permissible storage temperature | -40 ... +85 °C (-40 ... +185 °F) |
| Climatic class | |
| • Relative humidity | 5 ... 95 %, no condensation |

| Design | |
|---|---|
| Weight | Approx. 0.24 kg (0.53 lb) |
| Enclosure material | PBT, glass-fibre reinforced |
| Degree of protection to IEC 529 | IP20 |
| Degree of protection to VDE 0100 | Protection class I |
| Type of installation | 35-mm DIN rail (1.38 inch) (EN 50022) or 32-mm G-type rail (1.26 inch) (EN 50035) |
| Electrical connection / process connection | Screw plug connectors, max. 2.5 mm$^2$ (0.01 inch$^2$) |

| Parameterization interface | |
|---|---|
| Protocol | HART, version 5.9 |
| Load with connection of | |
| • HART communicator | 230 ... 650 $\Omega$ |
| • HART modem | 230 ... 500 $\Omega$ |
| Software for PC/laptop | SIMATIC PDM version V5.1 and later |

## *Digital error*

### Resistance thermometer

| Input | Measuring range | Max. permissible line resistance | Digital error |
|---|---|---|---|
| | °C / (°F) | Ω | °C / (°F) |
| **IEC 751** | | | |
| • Pt10 | -200 ... +850 (-328 ... +1562) | 20 | 3.0 (5.4) |
| • Pt50 | -200 ... +850 (-328 ... +1562) | 50 | 0.6 (1.1) |
| • Pt100 | -200 ... +850 (-328 ... +1562) | 100 | 0.3 (0.5) |
| • Pt200 | -200 ... +850 (-328 ... +1562) | 100 | 0.6 (1.1) |
| • Pt500 | -200 ... +850 (-328 ... +1562) | 100 | 1.0 (1.8) |
| • Pt1000 | -200 ... +850 (-328 ... +1562) | 100 | 1.0 (1.8) |
| **JIS C 1604-81** | | | |
| • Pt10 | -200 ... +649 (-328 ... +1200) | 20 | 3.0 (5.4) |
| • Pt50 | -200 ... +649 (-328 ... +1200) | 50 | 0.6 (1.1) |
| • Pt100 | -200 ... +649 (-328 ... +1200) | 100 | 0.3 (0.5) |
| **DIN 43760** | | | |
| • Ni50 | -60 ... +250 (-76 ... +482) | 50 | 0.3 (0.5) |
| • Ni100 | -60 ... +250 (-76 ... +482) | 100 | 0.3 (0.5) |
| • Ni120 | -60 ... +250 (-76 ... +482) | 100 | 0.3 (0.5) |
| • Ni1000 | -60 ... +250 (-76 ... +482) | 100 | 0.3 (0.5) |

### Resistance-based sensors

| Input | Measuring range | Max. permissible line resistance | Digital error |
|---|---|---|---|
| | Ω | Ω | Ω |
| Resistance (linear) | 0 ... 24 | 5 | 0.08 |
| | 0 ... 47 | 15 | 0.06 |
| | 0 ... 94 | 30 | 0.06 |
| | 0 ... 188 | 50 | 0.08 |
| | 0 ... 375 | 100 | 0.1 |
| | 0 ... 750 | 100 | 0.2 |
| | 0 ... 1500 | 75 | 1.0 |
| | 0 ... 3000 | 100 | 1.0 |
| | 0 ... 6000 | 100 | 2.0 |

### Thermocouples

| Input | Measuring range | Digital error [1] |
|---|---|---|
| | °C / (°F) | °C (°F) |
| Type B | 0 ... +1820 (+32 ... +3308) | 3 (5.4) |
| Type C | 0 ... +2300 (+32 ... +4172) | 2 (3.6) |
| Type D | 0 ... +2300 (+32 ... +4172) | 1 (1.8) |
| Type E | -200 ... +1000 (-328 ... +1832) | 1 (1.8) |
| Type J | -210 ... +1200 (-346 ... +2192) | 1 (1.8) |
| Type K | -200 ... +1372 (-328 ... +2501) | 1 (1.8) |
| Type L | -200 ... +900 (-328 ... +1652) | 2 (3.6) |
| Type N | -200 ... +1300 (-328 ... +2372) | 1 (1.8) |
| Type R | -50 ... +1760 (-58 ... +3200) | 2 (3.6) |
| Type S | -50 ... +1760 (-58 ... +3200) | 2 (3.6) |
| Type T | -200 ... +400 (-328 ... +752) | 1 (1.8) |
| Type U | -200 ... +600 (-328 ... +1112) | 2 (3.6) |

[1] Accuracy data refer to the largest error in the complete measuring range

### Voltage/current sources

| Input | Measuring range | Digital error |
|---|---|---|
| **mV sources (linear)** | mV | μV |
| | -1 ... +16 | 35 |
| | -3 ... +32 | 20 |
| | -7 ... +65 | 20 |
| | -15 ... +131 | 50 |
| | -31 ... +262 | 100 |
| | -63 ... +525 | 200 |
| | -120 ... +1000 | 300 |
| **V sources (linear)** | V | mV |
| | -1.2 ... +10 | 3 |
| | -12 ... +100 | 30 |
| | -120 ... +140 | 300 |
| **μA/mA sources (linear)** | μA/mA | μA |
| | -12 ... +100 μA | 0.05 |
| | -120 ... +1000 μA | 0.5 |
| | -1.2 ... +10 mA | 5 |
| | -12 ... + 100 mA | 50 |
| | -120 ... +1000 mA | 500 |

# Temperature Measurement
## Transmitters for rail mounting

### SITRANS TW
### four-wire system, universal, HART

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## ■ Ordering examples

| Desired transmitter | Parameter: | | Ordering design |
|---|---|---|---|
| | Standard | Special | |
| **Example 1:** | | | |
| SITRANS TW, transmitter in four-wire system | | | |
| • with explosion protection ATEX | | | |
| • 230 V AC/DC power supply | | | |
| • current output | | | |
| • without sensor fault/limit monitor | | | 7NG3242-1AA00 (stock item) |
|   - Sensor PT100, three-wire circuit | X | | |
|   - Measuring range 0 ... 150 °C | X | | |
|   - Temperature-linear characteristic | X | | |
|   - Filter time 1 s | X | | |
|   - Output 4 ... 20 mA, line filter 50 Hz | X | | |
|   - Output driven to full-scale in event of like breakage | X | | |
| **Example 2:** | | | |
| SITRANS TW, transmitter in four-wire system | | | |
| • without explosion protection | | | |
| • 24 V AC/DC power supply | | | |
| • Voltage output | | | 7NG3242-0BB10-Z |
| • Sensor fault/limit monitor | | | Y01 + S76 + A05 + Y30 + H10 |
|   - Rating plate in English | | S76 | Y01: see Order code |
|   - Sensor NiCr/Ni, type K | | A05 | Y30: MA=0; ME= 950; D=C |
|   - Cold junction internal | X | | |
|   - Measuring range 0 ... 950 °C | | Y30 | |
|   - Temperature-linear characteristic | X | | |
|   - Filter time 1 s | X | | |
|   - Output 0 ... 10 V, line filter 50 Hz | | H10 | |
|   - Output driven to full-scale in event of like breakage | X | | |
|   - Limit monitoring switched off | X | | |
| **Example 3:** | | | |
| SITRANS TW, transmitter in four-wire system | | | |
| • without explosion protection | | | |
| • 24 V AC/DC power supply | | | 7NG3242-0BA01-Z |
| • Current output | | | Y01 + A40 + Y32 + G07 + H11 + J03 |
| • without sensor fault/limit monitor | | | Y01: see Order code |
|   - Voltage input, measuring range -1.2 V ... +10 V | | A40 | Y32: MA=0; ME= 5; D=V |
|   - Measuring range 0 ... 5 V | | Y32 | |
|   - Source-proportional characteristic | X | | |
|   - Filter time 10 s | | G07 | |
|   - Output 0 ... 20 mA, line filter 60 Hz | | H11 | |
|   - No monitoring for sensor fault | (X) | J03 | |

## ■ Ordering information

The article number structure shown below is used to specify a fully functioning transmitter. The selection of the operating data (type of source, measuring range, characteristic etc.) is made according to the following rules:

• Operating data already set in factory to default values:
The default settings can be obtained from the list of parameterizable operating data (see "Special operating data"). The presets can be modified by the customer to match the requirements precisely.

• Operating data set on delivery according to customer requirements:
Supplement the Article No. by "-**Z**" and add the Order code "Y01". The operating data to be set can be obtained from the list of parameterize operating data. The Order codes A ■■ to K ■■ for operating data to be set need only be specified in the order if they deviate from the default setting.
The default setting is used if no Order code is specified for operating data.

The selected parameters are printed on the transmitter's rating plate.

# Temperature Measurement
## Transmitters for rail mounting
### SITRANS TW
#### four-wire system, universal, HART

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## Selection and Ordering data — Article No.

| SITRANS TW universal transmitter | Article No. |
|---|---|
| for rail mounting, in four-wire system (order instruction manual separately) | 7NG3242-▪▪▪▪▪ |

**Explosion protection**
| | |
|---|---|
| Without ►● | 0 |
| For inputs [EEx ia] or [EEx ib] ►● | 1 |

**Power supply**
| | |
|---|---|
| 115/230 V AC/DC ►● | A |
| 24 V AC/DC ►● | B |

**Output signal**
| | |
|---|---|
| 0/4 ... 20 mA (can be switched to 0/2 ... 10 V) ►● | A |
| 0/2 ... 10 V (can be switched to 0/4 ... 20 mA) | B |

**Sensor fault/limit monitor**
| | |
|---|---|
| Without (retrofitting not possible) ►● | 0 |
| Relay with changeover contact | 1 |

**Input for**
Temperature sensor, resistance-based sensor and mV sensor with measuring range -120 ... +1000 mV DC and with U/I plug ►● — 0

Voltage input (V sources) [1]
Measuring range:
| | |
|---|---|
| • -1.2 ... +10 V DC | 1 |
| • -12 ... +100 V DC (not Ex version) | 2 |
| • -120 ... +140 V DC (not Ex version) | 3 |

Current input (µA, mA sources) [1]
Measuring range:
| | |
|---|---|
| • -12 ... +100 µA DC | 4 |
| • -120 ... +1000 µA DC | 5 |
| • -1.2 ... +10 mA DC | 6 |
| • -12 ... +100 mA DC | 7 |
| • -120 ... +1000 mA DC | 8 |

### Further designs — Order code

Please add "-Z" to Article No. and specify Order code(s) (see "List of parameterizable operating data").

| | |
|---|---|
| Customer-specific setting of operating data (see "List of parameterizable operating data") **Note:** specify in plain text: „see Order code" | Y01 |
| Meas. point description (max. 16 char.) | Y23 |
| Text on front of device (max. 32 char.) | Y24 |
| HART tag (max. 8 characters) | Y25 |
| With test report | P01 |
| With shorting plug to HART communication for 0 mA or 0 V | S01 |
| With plug for external cold junction compensation | S02 |
| With U/I plug (-1.2 ... +10 V DC or -12 ... +100 mA) | S03 |

Language of rating plate (together with Y01 Order Code only)
| | |
|---|---|
| Italian | S72 |
| English | S76 |
| French | S77 |
| Spanish | S78 |

[1] Observe max. values with Ex version.

► Available ex stock.

● We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ●. For details see page 9/5 in the appendix.

## Selection and Ordering data — Article No.

**Accessories**

| | Article No. |
|---|---|
| CD for measuring instruments for temperature ► | A5E00364512 |

With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software

**Instruction Manual for SITRANS TW**
| | |
|---|---|
| German/English ► | A5E00054075 |
| French/Italian/Spanish ► | A5E00064515 |
| Cold junction terminal ► | 7NG3092-8AV |
| U/I plug (-1.2 ... +10 V DC pr -12 ... +100 mA) ► | 7NG3092-8AW |
| SIMATIC PDM operating software | see Chapter 8 |

**HART modem**
| | |
|---|---|
| With RS232 interface ► | 7MF4997-1DA |
| With USB interface ► | 7MF4997-1DB |

# Temperature Measurement
## Transmitters for rail mounting

**SITRANS TW**
**four-wire system, universal, HART**

## List of parameterizable operating data (Order codes A ■■ + B ■■ ... E ■■)

Operating data acc. to default setting    Article No. with Order code: 7NG3242 - ■■■■■ -Z Y01

Order codes: A ■■ ... E ■■    ■■■    +    ■■■    +    ■■■    +    ■■■    +    ■■■

### Sensor

| Thermocouples | | | | Connection | | Cold junction compensation | | | | Measuring ranges | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | Temperature range | | | | | | | | | | |
| B: Pt30 %Rh/Pt6 %Rh | 0 ... 1820 °C | A 0 0 | | Standard | B 0 1 | None | C 0 0 | | | -30 ... +60 °C | E 0 0 |
| C:W5 %Re | 0 ... 2300 °C | A 0 1 | | Sum n [1] | n = 2 | B 0 2 | Internal | C 1 0 | | -20 ... +20 °C | E 0 1 |
| D:W3 %Re | 0 ... 2300 °C | A 0 2 | | ... | ... | Fixed val.    0 °C | C 2 0 | | 0 ... 40 °C | E 0 2 |
| E:NiCr/CuNi | -200 ... +1000 °C | A 0 3 | | | n = 10 | B 1 0 | 20 °C | C 2 2 | | 0 ... 60 °C | E 0 3 |
| J:Fe/CuNi (IEC) | -210 ... +1200 °C | A 0 4 | | Difference [2] Diff1 | B 3 1 | 50 °C | C 2 5 | | 0 ... 80 °C | E 0 4 |
| K:NiCr/Ni | -200 ... +1372 °C | A 0 5 | | Diff2 | B 3 2 | 60 °C | C 2 6 | | 0 ... 100 °C | E 0 5 |
| L: Fe/CuNi (DIN) | -200 ... +900 °C | A 0 6 | | Mean-val. [2] MW | B 4 1 | 70 °C | C 2 7 | | 0 ... 120 °C | E 0 6 |
| N:NiCrSi/NiSi | -200 ... +1300 °C | A 0 7 | | | | Special value [7] | Y 1 0 | | 0 ... 150 °C | E 0 7 |
| R:Pt13 %Rh/Pt | -50 ... +1760 °C | A 0 8 | | | | External meas. | Y 1 1 | | 0 ... 200 °C | E 0 8 |
| S:Pt10 %Rh/Pt | -50 ... +1760 °C | A 0 9 | | | | (through Pt100 | | | 0 ... 250 °C | E 0 9 |
| T:Cu/CuNi (IEC) | -200 ... +400 °C | A 1 0 | | | | DIN IEC 751) [7] | | | 0 ... 300 °C | E 1 0 |
| U:Cu/CuNi (DIN) | -200 ... +600 °C | A 1 1 | | | | | | | 0 ... 350 °C | E 1 1 |

| Resistance thermometer | | | | Connection | | Connection | | Line resis-tance [3] | | Measuring ranges (cont.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (or max. permissible line resistance see „Technical specifications") | | | | | | | | | | 0 ... 400 °C | E 1 2 |
| | | | | | | | | | | 0 ... 450 °C | E 1 3 |
| Pt100 (DIN IEC) | -200 ... +850 °C | A 2 0 | | Standard | B 0 1 | 2-wire-system | C 3 2 | 0 Ω | D 0 0 | 0 ... 500 °C | E 1 4 |
| Pt100 (JIS) | -200 ... +649 °C | A 2 1 | | Sum n [4] n = 2 | B 0 2 | 3-wire-system | C 3 3 | 10 Ω | D 1 0 | 0 ... 600 °C | E 1 5 |
| Ni100 (DIN) | -60 ... +250 °C | A 2 2 | | ... | ... | 4-wire-system | C 3 4 | 20 Ω | D 2 0 | 0 ... 700 °C | E 1 6 |
| | | | | n = 10 | B 1 0 | | | 50 Ω | D 5 0 | 0 ... 800 °C | E 1 7 |
| | | | | Parallel n [5] n = 0.1 | B 2 1 | | | Special val. [7] | Y 2 0 | 0 ... 900 °C | E 1 8 |
| | | | | n= 0.2 | B 2 2 | | | | | 0 ... 1000 °C | E 1 9 |
| | | | | n= 0.5 | B 2 5 | | | | | 0 ... 1200 °C | E 2 0 |
| | | | | Special value [6] [7] | Y 0 0 | | | | | 0 ... 1400 °C | E 2 1 |
| | | | | Difference [2] Diff1 | B 5 1 | | | | | 0 ... 1600 °C | E 2 2 |
| | | | | Diff2 | B 5 2 | | | | | 0 ... 1800 °C | E 2 3 |
| | | | | Mean-val. [2] MW | B 6 1 | | | | | 50 ... 100 °C | E 2 4 |
| | | | | | | | | | | 50 ... 150 °C | E 2 5 |
| | | | | | | | | | | 100 ... 200 °C | E 2 6 |
| | | | | | | | | | | 100 ... 300 °C | E 2 7 |
| | | | | | | | | | | 100 ... 400 °C | E 2 8 |
| | | | | | | | | | | 200 ... 300 °C | E 2 9 |
| | | | | | | | | | | 200 ... 400 °C | E 3 0 |
| | | | | | | | | | | 200 ... 500 °C | E 3 1 |
| | | | | | | | | | | 300 ... 600 °C | E 3 2 |
| | | | | | | | | | | 500 ... 1000 °C | E 3 3 |
| | | | | | | | | | | 600 ... 1200 °C | E 3 4 |
| | | | | | | | | | | 800 ... 1600 °C | E 3 5 |
| | | | | | | | | | | Special range [7] | Y 3 0 |

| Resistance-based sensors, potentiome-ters | | Connection | | Connection | | Line resis-tance [3] | | Measuring ranges | |
|---|---|---|---|---|---|---|---|---|---|
| (or max. permissible line resistance see „Technical specifications") | A 3 0 | Standard | B 0 1 | 2-wire-system | C 3 2 | 0 Ω | D 0 0 | 0 ... 100 Ω | E 4 0 |
| | | Difference [2] Diff1 | B 5 1 | 3-wire-system | C 3 3 | 10 Ω | D 1 0 | 0 ... 200 Ω | E 4 1 |
| | | Diff2 | B 5 2 | 4-wire-system | C 3 4 | 20 Ω | D 2 0 | 0 ... 500 Ω | E 4 2 |
| | | Mean val. [2] MW | B 6 1 | | | 50 Ω | D 5 0 | 0 ... 1000 Ω | E 4 3 |
| | | | | | | Special val. [7] | Y 2 0 | 0 ... 2500 Ω | E 4 4 |
| | | | | | | | | 0 ... 5000 Ω [8] | E 4 5 |
| | | | | | | | | 0 ... 6000 Ω [8] | E 4 6 |
| | | | | | | | | Special range [7] | Y 3 1 |

| mV, V and μA, mA sensors [9] | | Meas. range with Article No.    7NG 3242 - ■■■■■ -Z Y01 | | |
|---|---|---|---|---|
| | A 4 0 | | | E 5 0 |
| | | 0 | -120 ... +1000 mV | |
| | | 1 | -1,2 ... +10 V [10] | |
| | | 2 | -12 ... +100 V [10] | |
| | | 3 | -120 ... +140 V [10] | |
| | | 4 | -12 ... +100 μA [10] | |
| | | 5 | -120 ... +1000 μA [10] | |
| | | 6 | -1,2 ... +10 mA [10] | |
| | | 7 | -12 ... +100 mA [10] | |
| | | 8 | -120 ... +1000 mA [10] | |
| | | | Special range [7] | Y 3 2 |

[1] n = number of thermocouple elements to be connected in series
[2] See „Circuit diagrams" for meaning of type circuit
[3] Line resistance of channels 1 and 2, for max. permissible line resistance see „Technical specifications" (only with C32, not with C33 and C34)
[4] n = number of resistance thermometers to be connected in series
[5] 1/n = number of resistance thermometers to be connected in parallel
[6] Combination of series and parallel connection of resistance thermometers
[7] Operating data: see „Special operating data"
[8] This range does not apply to mean-value and difference circuits.
[9] The max. permissible currents and voltages according to conformity certificate must be observed in devices with explosion protection.
[10] Without detection of line breakage

## List of parameterizable operating data (Order codes F ■ ■ ... K ■ ■)

Operating data according to default setting    Article No. with Order code: 7NG3242 - ■ ■ ■ ■ ■ -Z Y01

Order codes: F ■ ■ ... K ■ ■    ■ ■ ■    +    ■ ■ ■    +    ■ ■ ■    +    ■ ■ ■    +    ■ ■ ■    ■ ■ ■

### Sensor

| Thermocouple elements | | | Voltage measurement | | Filter time[1] | | Output signal and line filter[2] | | Failure signal | | Limit monitor[3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | Temperature range | | | | | | | | | | | |
| B: Pt30 %Rh/ | 0 ... 1820 °C | A 0 0 | Temperature-linear | F 0 0 | 0 s | G 0 0 | 4 ... 20 mA/ 2 ... 10 V | | with line breakage/fault: | | Limit monitoring ineffective (but sensor fault signalling with closed-circuit operation) | K 0 0 |
| C: W5 %Re | 0 ... 2300 °C | A 0 1 | | | 0.1 s | G 0 1 | with line filter: | | | | | |
| D: W3 %Re | 0 ... 2300 °C | A 0 2 | Voltage-linear | F 1 0 | 0.2 s | G 0 2 | 50 Hz | H 0 0 | to full scale | J 0 0 | | |
| E: NiCr/CuNi | -200 ... +1000 °C | A 0 3 | | | 0.5 s | G 0 3 | 60 Hz | H 0 1 | to start of scale | J 0 1 | | |
| J: Fe/CuNi (IEC) | -210 ... +1200 °C | A 0 4 | | | 1 s | G 0 4 | 10 Hz[4] | H 0 2 | hold last value | J 0 2 | | |
| K: NiCr/Ni | -200 ... +1372 °C | A 0 5 | | | 2 s | G 0 5 | | | | | | |
| L: Fe/CuNi (DIN) | -200 ... +900 °C | A 0 6 | | | 5 s | G 0 6 | 0 ... 20 mA/ 0 ... 10 V | | no monitoring | J 0 3 | | |
| N: NiCrSi/NiSi | -200 ... +1300 °C | A 0 7 | | | 10 s | G 0 7 | with line filter: | | | | Effective[5] | Y 7 0 |
| R: Pt13 %Rh/Pt | -50 ... +1760 °C | A 0 8 | | | 20 s | G 0 8 | 50 Hz | H 1 0 | Safety value[5] | Y 6 0 | | |
| S: Pt10 %Rh/Pt | -50 ... +1760 °C | A 0 9 | | | 50 s | G 0 9 | 60 Hz | H 1 1 | | | | |
| T: Cu/CuNi (IEC) | -200 ... +400 °C | A 1 0 | | | 100 s | G 1 0 | 10 Hz | H 1 2 | | | | |
| U: Cu/CuNi (DIN) | -200 ... +600 °C | A 1 1 | | | Special time[5] | Y 5 0 | | | | | | |

| Resistance thermometer (max. permissible line resistances see „Technical specifications") | | | Voltage measurement | | Filter time[1] | | Output signal and line filter[2] | | Failure signal | | Limit monitor[3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pt100 (DIN IEC) | -200 ... +850 °C | A 2 0 | Temperature-linear | F 0 0 | same as for thermocouple elements | | same as for thermocouple elements | | with line breakage/fault: | | same as for thermocouple elements | |
| Pt100 (JIS) | -200 ... +649 °C | A 2 1 | Resistance-linear | F 2 0 | | | | | to full scale | J 0 0 | | |
| Ni100 (DIN) | -60 ... +250 °C | A 2 2 | | | | | | | to start of scale | J 0 1 | | |
| | | | | | | | | | hold last value | J 0 2 | | |
| | | | | | | | | | no monitoring | J 0 3 | | |
| | | | | | | | | | Safety value[5] | Y 6 0 | | |
| | | | | | | | | | with line breakage or short-circuit/fault: | | | |
| | | | | | | | | | to full scale | J 1 0 | | |
| | | | | | | | | | to start of scale | J 1 1 | | |
| | | | | | | | | | hold last value | J 1 2 | | |
| | | | | | | | | | no monitoring | J 1 3 | | |
| | | | | | | | | | Safety value[5] | Y 6 1 | | |

| Resistance-based sensors, potentiometers (max. permissible line resistances see „Technical specifications") | | | Voltage measurement | | Filter time[1] | | Output signal and line filter[2] | | Failure signal | | Limit monitor[3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A 3 0 | Resistance-linear | F 2 0 | same as for thermocouple elements | | same as for thermocouple elements | | with line breakage/fault: | | same as for thermocouple elements | |
| | | | | | | | | | to full scale | J 0 0 | | |
| | | | | | | | | | to start of scale | J 0 1 | | |
| | | | | | | | | | hold last value | J 0 2 | | |
| | | | | | | | | | no monitoring | J 0 3 | | |
| | | | | | | | | | Safety value[5] | Y 6 0 | | |

| mV, V and µA, mA sources | | A 4 0 | Voltage measurement | | Filter time[1] | | Output signal and line filter[2] | | | | Limit monitor[3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Source proportional | F 3 0 | same as for thermocouple elements | | same as for thermocouple elements | | | | same as for thermocouple elements | |

[1] Software filter to smooth the result
[2] Filter to suppress line disturbances on the measured signal.
[3] If signalling relay present
[4] for special appliciations
[5] Operating data: see „Special operating data"

# Temperature Measurement
## Transmitters for rail mounting

**SITRANS TW**
**four-wire system, universal, HART**

**2**

### Special operating data

| Order code | Plain text required | Options |
|---|---|---|
| **Y00** | N=☐☐.☐☐ | Factor N for multiplication with the characteristic values of resistance thermometers |
| | | Range of values: 0.10 to 10.00 |
| | | 1. Example: 3 x Pt500 parallel: N = 5/3 = 1.667; 2. Example: Ni120: N = 1.2 |
| **Y10** | TV=☐☐☐.☐☐ | Temperature TV of the fixed cold junction |
| | D=☐ | Dimension; range of values: C, K, F, R |
| **Y11** | RL=☐☐☐.☐☐ | Line resistance RL in $\Omega$ for compensation of cold junction line of external Pt100 DIN IEC 751 |
| | | Range of values: 0.00 to 100.00 |
| **Y20** | RL1=☐☐☐.☐☐ RL2=☐☐☐.☐☐ | Line resistances RL of channel 1 (RL1) and channel 2 (RL2) in $\Omega$ if the resistance thermometer or the resistance-based sensor is connected in a two-wire system |
| | | Range of values depending on type of sensor: 0.00 to 100.00 |
| **Y30** | MA=☐☐☐☐.☐☐ ME=☐☐☐☐.☐☐ | Start-of-scale value MA and full-scale value ME for thermocouples and resistance thermometers |
| | | (Range of values depending on type of sensor) |
| | D=☐ | Dimension, range of values: C, K, F, R) |
| **Y31** | MA=☐☐☐☐.☐☐ ME=☐☐☐☐.☐☐ | Start-of-scale value MA and full-scale value ME for resistance-based sensors or potentiometers in $\Omega$ |
| | | Range of values: 0.00 to 6,000.00 |
| **Y32** | MA=☐☐☐☐☐.☐☐ ME=☐☐☐☐.☐☐ | Start-of-scale value MA and full-scale value ME for mV, V, µA and mA sources |
| | | Range of values depending on type of sensor: -120.00 to 1,000.00 |
| | D=☐☐ | Dimension (mV entered as MV, V as V, µA as UA, mA as MA) |
| **Y50** | T63=☐☐☐.☐ | Response time T63 of software filter in s |
| | | Range of values: 0.0 to 100.0 |
| | | Safety value S of signal output in mA or in V corresponding to the set type of output. Range of values - with current output: -0.50 to 23.00 - with voltage output: -0.25 to 10.75 |
| **Y60** | S=☐☐.☐☐ | Safety value S with line breakage of sensor |
| **Y61** | S=☐☐.☐☐ | Safety value S with line breakage or short-circuit of sensor |
| **Y70** | UG=☐☐☐☐.☐☐ | Lower limit value (dimension as defined by measuring range) |
| | OG=☐☐☐☐.☐☐ | Upper limit value (dimension as defined by measuring range) |
| | H=☐☐☐☐.☐☐ | Hysteresis (dimension as defined by measuring range) |
| | K=☐ | Switch on/off combination of limit function and sensor fault detection; J=on; N=off (standard: J) |
| | A=☐ | Type of relay output: A=open-circuit operation; R=closed-circuit operation (standard: R) |
| | T=☐☐.☐ | Switching delay T of relay output in s |
| | | Range of values: 0.0 to 10.0 (standard: 0.0) |

## Schematics

### Sensor input connections
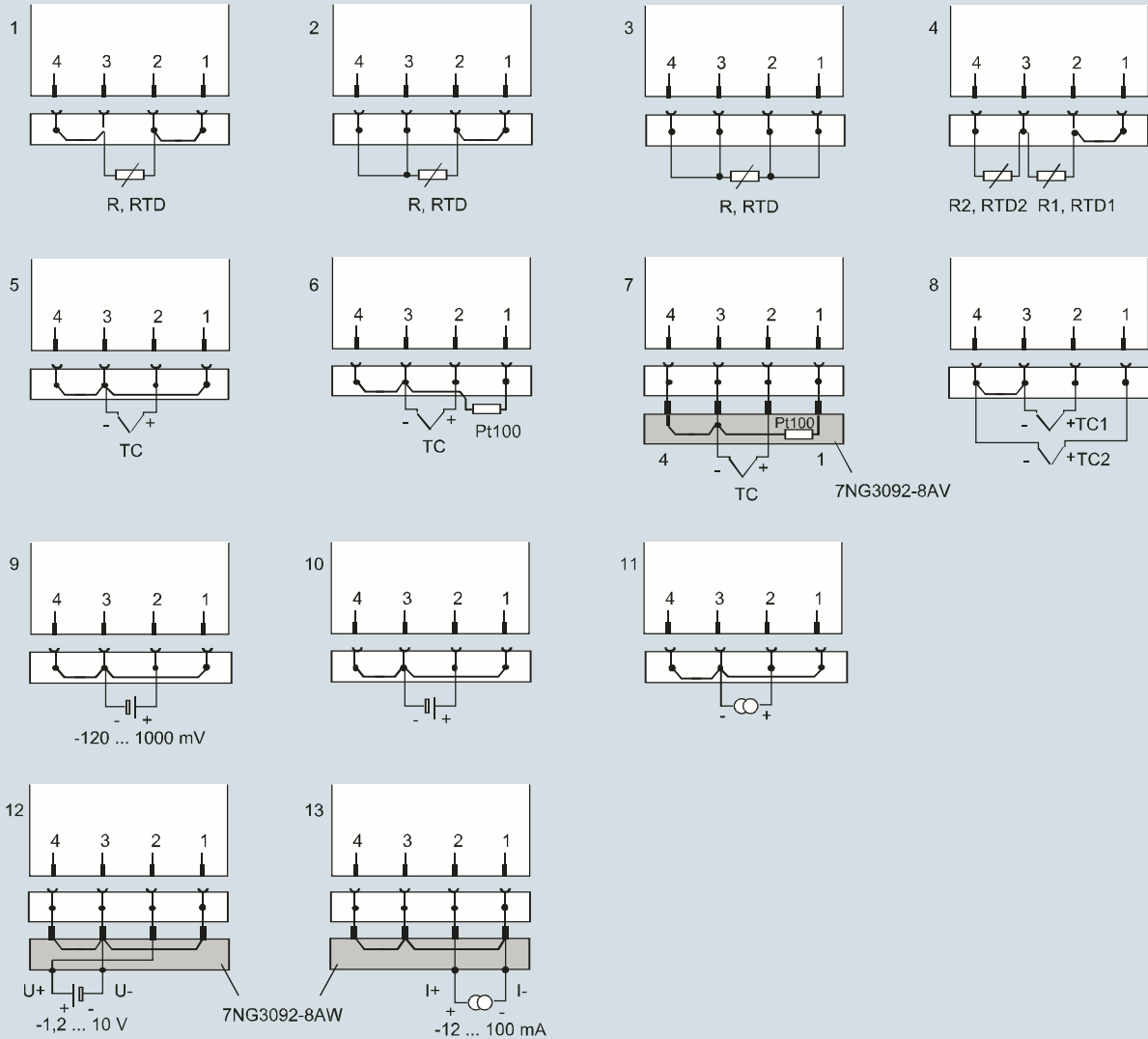


Resistance thermometers, resistance-based sensors, potentiometers:

1   Two-wire system; resistance can be parameterized for line compensation

2   Three-wire system

3   Four-wire system

4   Difference/mean-value circuit; 2 resistors can be parameterized for line compensation

Thermocouples:

5   Determination of cold junction temperature using built-in Pt100 or fixed reference temperature

6   Determination of cold junction temperature using external Pt100; resistance can be parameterized for line compensation

7   Determination of cold junction temperature using cold junction terminal 7NG3092-8AV

8   Difference/mean-value circuit with internal cold junction temperature

Further sources:

9   mV sources with two-wire system (7NG3242-xxxx0)

10   V sources with two-wire system (7NG3242-xxxx[1-3])

11   mA/mA sources with two-wire system (7NG3242-xxxx[4-8])

12   Voltage measurement -1,2 to 10 V with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

13   Current measurement -12 to 100 mA with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

Connection diagram for the input signal

Channel 1 is the measured variable between the terminals 2 and 3 on the input plug. With a difference or mean-value circuit, the calculation of the measured value is defined by the type of measurement. Otherwise the measured value is determined via channel 1. The following code is used for the type of measurement:
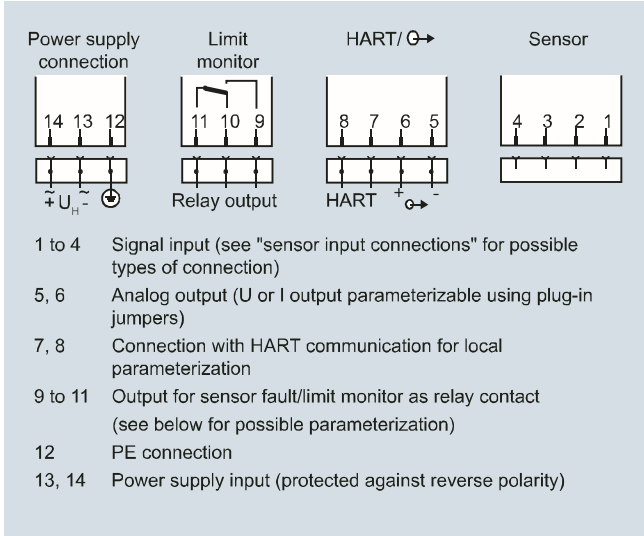
| type of measurement | Calculation of measured value |
|---|---|
| Single channel | Channel 1 |
| Differential connection 1 | Channel 1 - Channel 2 |
| Differential connection 2 | Channel 2 - Channel 1 |
| Mean-value 1 | $\frac{1}{2} \cdot$ (Channel 1 + Channel 2) |

The short-circuit jumpers shown in the circuits must be inserted in the respective system on site.

**SITRANS TW**
**four-wire system, universal, HART**



| 1 to 4 | Signal input (see "sensor input connections" for possible types of connection) |
| 5, 6 | Analog output (U or I output parameterizable using plug-in jumpers) |
| 7, 8 | Connection with HART communication for local parameterization |
| 9 to 11 | Output for sensor fault/limit monitor as relay contact (see below for possible parameterization) |
| 12 | PE connection |
| 13, 14 | Power supply input (protected against reverse polarity) |

Connection diagram for power supply, input and outputs

### Relay outputs

| | Connected terminals |
| --- | --- |
| Closed-circuit operation (relay opens when error) | |
| • Device switched off | 10 and 11 |
| • Device switched on and no error | 9 and 11 |
| • Device switched on and error | 10 and 11 |
| Open-circuit operation (relay closes when error) | |
| • Device switched off | 10 and 11 |
| • Device switched on and no error | 10 and 11 |
| • Device switched on and error | 9 and 11 |

### Dimensional drawings



① In devices with explosion protection
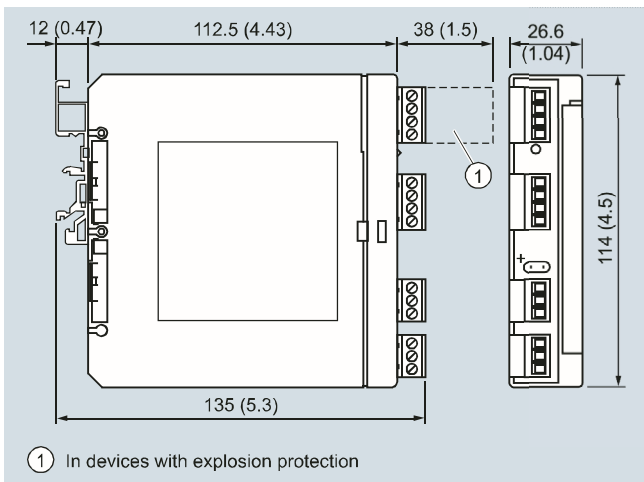
Dimensions for control room mounting, rail mounting in mm (inches)