SITRANS T Temperature Transmitters
SITRANS I Supply Units

SITRANS T family

Transmitters for temperature, resistance, DC voltage and DC current

Overview

Types

	Connection	Parameterization software	Type	Connection to	Transmitter without Ex. protection	Transmitter with Ex. protection		
					Type	**Type**	Installation	
							Transmitter	Sensor
	**Four-wire system**	TransWin	Mounting rail assembly Page 2/3	Resistance thermometer, resistance-based sensor, thermocouples, DC voltages and DC currents	**7NG3040-3**	**7NG3041-3**	Safe area	Zone 1, Zone 0
			Plug-in module (19-inch) Page 2/11		**7NG3040-1**	**7NG3041-1**	Safe area	Zone 1, Zone 0
			ES 902 packaging system Page 2/19		**7NG3040-0**	**-**	-	-
	**Two-wire system**	TransWin	Mounting rail assembly Page 2/27	Resistance thermometer, resistance-based sensor, thermocouples, DC voltages and DC currents	**7NG3020**	**7NG3022**	Zone 1	Zone 1, Zone 0
		SIPROM TK for SITRANS TK SIMATIC PDM for SITRANS TK-H	Mounting in sensor head Page 2/42	Resistance thermometer, resistance-based sensor, thermocouples and DC voltages up to 1.1 V	**7NG3120-1** **7NG3120-2**	**7NG3121-1** **7NG3122-1** **7NG3121-2** **7NG3122-2**	Zone 2 Zone 1 Zone 2 Zone 1	Zone 2 Zone 1, Zone 0 Zone 2 Zone 1, Zone 0
			Housing for field mounting Page 2/45		**7NG313■-0**	**7NG313■-1** **7NG313■-2**	Zone 1 Zone 2	Zone 1, Zone 0 Zone 2
	**PROFIBUS-PA system**	SIMATIC PDM	Mounting in sensor head Page 2/37	Resistance thermometer, resistance-based sensor, thermocouples and DC voltages up to 1 V	**7NG3213-0**	**7NG3213-1**	Zone 1	Zone 1, Zone 0

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040 and 7NG3041
Four-wire system / Mounting rail assembly

Fig. 2/1 SITRANS T transmitter for rail mounting

Application

"Intelligent" transmitter with universal input circuit for connecting to the following sensors:

- Resistance thermometers
- Thermocouples
- Resistance-based sensors/potentiometers
- DC voltage sources
- DC current sources

One transmitter is suitable for the connection of all sensors. The input signal is converted into a standard signal.

Features

- Four-wire transmitter
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Plug-in screw terminals for electrical connections
- Low self-heating via electronics with extremely low power consumption
- All circuits electrically isolated
- Explosion proof to EEx ia IIC (7NG3041)
- Measuring ranges and operating parameters freely selectable
- Temperature-linear characteristic can be selected for all temperature sensors
- User-specific characteristics
- Automatic correction of zero point
- Output signal 0/4 to 20 mA or 0 to 10 V (switched by changing internal jumpers)
- Output signal clearly indicates mode of operation
  - normal operation
  - overrange
  - sensor fault
- Power pack 230/115 V AC/24 V AC/DC (switched by changing internal jumpers)
- Large tolerance range of power supply
- Optional sensor fault/limit monitor (pluggable)

Mode of operation (Fig. 2/2)

Transmitter operation can be broken down into the following function blocks and individual functions:

- Input
  - Input terminals (2)
  - Multiplexer (3)
  - Amplifier (4)
  - Constant current source (1) for resistance measurements
  - Calibration circuit (9) for drift compensation

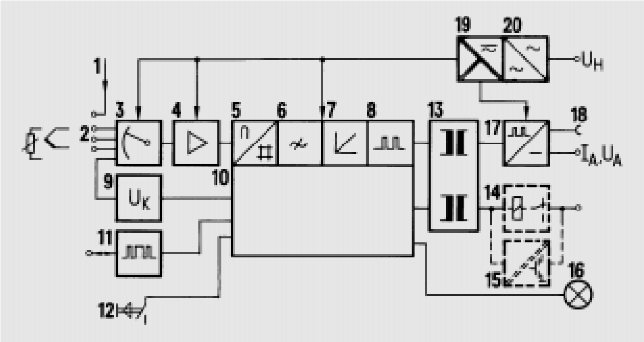

Fig. 2/2 Block diagram (see mode of operation for 1 to 20)

- Microcontroller (10)
  - Analog/digital converter (5)
  - Adjustable low-pass filter (6) for smoothing of result
  - Linearization function (7) for non-linear characteristics
  - Output with pulse width modulation (8) proportional to measured signal
- Output
  - Signals electrically isolated (13)
  - Output module (17) containing pulse width/analog converter
  - Test sockets (18) for monitoring output signal
  - Optional sensor fault/limit monitor with relay (14) or electronic output (15)
- Controls and displays
  - Serial interface (11) for setting and interrogating parameters
  - Calibration push-button (12) for calibration of resistance measurements in two-wire circuits and trimming of start of scale/ full scale values
  - Green LED (16) showing operational status (constant) or sensor fault or system malfunction (flashes)
- Power supply
  - Universal power pack 24 V AC/DC (19), power pack 230/ 115 V AC (20)

Parameterization

The following parameters can be set and interrogated via the serial interface:

- Type of sensor, e.g. Pt100 resistance thermometer or NiCr/Ni thermocouple, type K
- Measuring range
- Internal or external temperature compensation for thermocouples
- 2, 3 or 4-wire circuit for resistance thermometer and resistance-based sensor
- Reaction to sensor fault (short-circuit or line breakage), e.g. output signal forced to start of scale or full scale value
- Transmitter characteristic, e.g. voltage or temperature-linear
- Rising or falling characteristic
- Response time of transmitter
- Output signal, e.g. 0 to 20 mA or 4 to 20 mA
- Limits with hysteresis

The parameters are stored in a non-volatile memory (EEPROM).

The following are required during parameterization:

- Transmitter
- Off-line or on-line parameterization adapter
- Personal computer (PC)
- TransWin 7NG3080-8CA software package
- Printer for printing of rating plate and report

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040 and 7NG3041
Four-wire system / Mounting rail assembly

Technical data

Input

Resistance thermometer

• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω (9 Ω corresponds to approx. 25 °C for Pt100)
• Sensor type	Pt100 (DIN IEC 751) Pt100 (JIS C1604/ α=0.00392 Ω/K) Ni100 (DIN 43 760) Cu100 Multiples or parts of specified basic values (e.g. Pt500, Cu25) parameterizable
• Characteristic	Temperature or resistance-linear
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Averaging connection	Several resistance thermometers connected in series or parallel to produce average temp. or to adapt to other basic values. e.g. Pt1000 n=10, Cu25 n=0.25
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit; operating temperature can be parameterized
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω
• Short-circuit monitoring	The value below which a sensor fault is to be signalled is parameterizable

Resistance-based sensor, potentiometer

• Measured variable	Ohmic impedance
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω
• Start of scale	0 to 3141 Ω
• Full scale	3150 Ω
• Characteristic	Resistance-linear or according to a parameterizable linearization function
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω
• Short-circuit monitoring	The value below which a sensor fault is to be signalled is parameterizable

Thermocouple

• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	4 to 140 mV
• Sensor type	Type B: Pt30%Rh/Pt6%Rh (DIN IEC 584) 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 43 710) 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 43 710) Ni-NiMo (GE) Additional thermocouples can be parameterized by the customer.
• Characteristic	Temperature-linear or voltage-linear
• Type of connection	
- Normal connection	One thermocouple, internal or external temperature compensation
- Averaging connection	Several thermocouples connected in series to produce average temperature, internal or external temperature compensation
- Differential connection	Two identical thermocouples to produce temperature difference, temperature compensation not necessary; operating temperature parameterizable
• Temperature compensation	Internal or external
- Internal	Cold junction terminal option 7NG3090-8AV required (plug-in screw terminal with integrated Pt100)
- External	Temperature of external temperature compensation parameterizable

mV sensors

• Measured variable	DC voltage
• Measuring range	Parameterizable in following ranges: -59 to +81 mV, -20 to +120 mV -39 to +100 mV, 0 to +140 mV
• Measuring span (maximum)	4 to 140 mV
• Start of scale	-59 to +136 mV
• Full scale	140 mV
• Characteristic	Voltage-linear or according to a parameterizable linearization function
• Overload capacity of inputs	±3.5 V
• Input resistance	≥1 MΩ

V, µA, mA, A sensors (without sensor breakage monitoring)

• Measured variable	• DC voltage / DC current
• Measuring range	Parameterizable The voltage drop on the input impedance R15 or shunt resistance R11 should correspond to the measuring ranges of the mV sensor.
• Characteristic	Voltage or current-linear or according to a parameterizable linearization function
• Voltage measurement > 140 mV	Internal voltage divider with series resistance R12 and input impedance R15
• Current measurement	Internal shunt resistance R11

Technical data (continued)

Input (continued)

Order No. 7NG304■	Measuring span	Start of scale	Full scale	R12 MΩ	R15 kΩ	R11 Ω
- ■■■10	0.04 to 1.54 V	-0.5 to +1.5 V	1.54 V	0.1	10	-
- ■■■20	0.4 to 14.14 V	-5 to +13.74 V	14.14 V	1	10	-
- ■■■30	4 to 140.14 V	-50 to +136.14 V	140.14 V	1	1	-
- ■■■40	4 to 140 µA	-50 to +136 µA	140 µA	-	-	1000
- ■■■50	0.04 to 1.4 mA	-0.5 to +1.36 mA	1.40 mA	-	-	100
- ■■■60	0.40 to 14 mA	-5.0 to +13.6 mA	14.0 mA	-	-	10
- ■■■70	4 to 140 mA	-50 to +136 mA	140 mA	-	-	1
- ■■■80	0.04 to 1.00 A	-0.5 to +0.96 A	1.00 A	-	-	0.1

Common data	
• Characteristic	The parameterizable characteristic is generated by joining together up to 14 first, second or third degree polynominals. The starting point is defined for every polynomial.
• Sensor fault monitoring	Monitoring all terminations for breakages and short-circuits (function can be disabled)
• Response/drop threshold	≤3 kΩ/≥1.5 kΩ loop resistance
• Output following sensor fault	To full scale, to start of scale, retain most recent value, parameterizable safety value, no monitoring
• Temperature unit	°C, K, °F, °R parameterizable (°R (Rankine) = absolute °F)

Output

Output signal	0/4 to 20 mA, can be recon. to 0 to 10 V
• Nominal range 0 to 20 mA	≙ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.25 to +21.0 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.50 to +21.5 mA (=-2.5 to +107.5%), parameterizable
- Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 4 to 20 mA	≙ 0 to 100%
- Resolution	4700 steps (0 to 100%)
- Overrange	3.8 to +20.8 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.5 to +21.5 mA (=-28.1 to +109.7%), parameterizable
- Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 0 to 10 V	≙ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.125 to +10.5 V (=-1.25 to +105.0%)
- Output range following sensor fault	-0.25 to +10.75 V (=-2.50 to +107.5%), parameterizable
- Load resistance	≥ 1 kΩ
- Short-circuit current	≤ 40 mA
• Residual ripple U_{PP}/I_{PP}	≤ 1%; measured across a 1 MHz band
• Response time	
- Sample cycle	100 ms
• Electrical damping	
- Adjustable time constant T_{99}	0 to 100 s parameterizable (software filter with 1st order delay)
Sensor fault/limit signalling	Relay output or electronic output
• Relay output	Break circuit with 1 CO contact
- Switching capacity	≤ 90 W, ≤ 150 VA
- Switching voltage	≤ 75 V AC/DC
- Switching current	≤ 2 A AC/DC
• Electronic output	Active during normal operation
- Operating output	U_H = 18 to 75 V
- Residual volt, when I_L = 10 mA	$U_0 \leq$ 4.5 V
- Operating current	$I_L \leq$ 15 mA
- Short-circuit current	$I_K \leq$ 70 mA
• Sensor fault	Signalling of sensor or line breakage and sensor short-circuit
• Limit monitoring	Freely parameterizable are: - lower and upper limit - window (combination of lower and upper limits); Limit and sensor fault monitoring can be combined
• Hysteresis	Parameterizable

Accuracy

Measurement error	Sum of input error thresholds, output error thresholds and internal temperature compensation errors (if known)

Input error thresholds

Sensor	Range	Input error tolerance[1] with	without[2] compensation
• Resistance thermometer			
- Pt100	-200 to 150 °C	±0.08 K	±0.15 K
	-200 to 620 °C	±0.18 K	±0.35 K
	-200 to 850 °C	±0.33 K	±0.70 K
- Pt500	-200 to 110 °C	±0.07 K	±0.16 K
	-200 to 400 °C	±0.43 K	±0.88 K
	-200 to 850 °C	±0.75 K	±1.54 K
- Pt1000	-200 to 200 °C	±0.25 K	±0.56 K
	-200 to 600 °C	±0.75 K	±1.10 K
- Ni100	-60 to 90 °C	±0.04 K	±0.10 K
	-60 to 250 °C	±0.07 K	±0.14 K
- Cu100	-50 to 140 °C	±0.06 K	±0.12 K
	-50 to 180 °C	±0.10 K	±0.20 K
• Resistance-based sensor	0 to 160 Ω	±0.03 Ω	±0.06 Ω
	0 to 320 Ω	±0.06 Ω	±0.12 Ω
	0 to 710 Ω	±0.13 Ω	±0.33 Ω
	0 to 3160 Ω	±2.17 Ω	±3.58 Ω
• Thermocouples			
- Type B: Pt30%Rh/Pt6%Rh	400 to 1000 °C	±2.50 K	±2.95 K
	1000 to 1820 °C	±1.00 K	±1.32 K
- Type E: NiCr/CuNi	-200 to 0 °C	±0.40 K	±0.48 K
	0 to 500 °C	±0.18 K	±0.20 K
	500 to 1000 °C	±0.15 K	±0.16 K
- Type J: Fe/CuNi	-210 to 0 °C	±0.50 K	±0.63 K
	0 to 1200 °C	±0.20 K	±0.24 K
- Type K: NiCr/Ni	-180 to 0 °C	±0.50 K	±0.64 K
	0 to 1370 °C	±0.30 K	±0.35 K
- Type L: Fe-CuNi	-200 to 0 °C	±0.40 K	±0.42 K
	0 to 900 °C	±0.20 K	±0.25 K
- Type N: NiCrSi-NiSi	-180 to 0 °C	±0.90 K	±0.96 K
	0 to 500 °C	±0.40 K	±0.46 K
	500 to 1300 °C	±0.30 K	±0.33 K
- Type R: Pt13%Rh/Pt	-50 to 0 °C	±2.50 K	±3.24 K
	0 to 500 °C	±1.80 K	±2.27 K
	500 to 1000 °C	±1.00 K	±1.11 K
	1000 to 1760 °C	±0.80 K	±0.91 K
- Type S: Pt10%Rh/Pt	-50 to 0 °C	±2.50 K	±3.03 K
	0 to 500 °C	±1.80 K	±2.22 K
	500 to 1760 °C	±1.10 K	±1.21 K
- Type T: Cu/CuNi	-200 to 0 °C	±0.60 K	±0.76 K
	0 to 400 °C	±0.25 K	±0.31 K
- Type U: Cu-CuNi	-200 to 0 °C	±0.50 K	±0.63 K
	0 to 600 °C	±0.25 K	±0.30 K
Ni-NiMo	0 to 700 °C	±0.23 K	±0.32 K
	700 to 1310 °C	±0.19 K	±0.23 K
• Voltage source	-60 to +140 mV	±10 µV	±12 µV

Error threshold of output signal	±0.05 % of measuring span
Internal temperature comp. error	≤0.5 K

[1] Includes temperature sensor linearization error.

[2] Following change in measuring range or type of sensor.

Technical data (continued)

Accuracy (continued)	
Influencing effects	Referred to nominal current I_{AN}=20 mA nominal voltage U_{AN}=10 V
• of ambient temperature	
- during resistance measurement	
on start of scale	≤ (0.05 + 0.015 · (R_{Anf}/ΔR))%/10K
on span	≤ 0.16%/10K
- during voltage measurement	
on start of scale	≤ (0.05 + 0.05 · (U_{Anf}/ΔU))%/10K
on span	≤ 0.2%/10K
Additional influence	
- with internal cold junction compensation	≤ 0.1 K/10 K (temperature measurement using thermocouples)
- with internal voltage divider	≤ 0.05 %/10 K (voltage measurement > 140 mV)
- with internal shunt	≤ 0.025 %/10 K (current measurement)
• of load with current output	≤ for a change from 50 to 650 Ω
• of load with voltage output	≤ with a change of load current from 0 to 10 mA
• of power supply	≤ 0.05% within supply tolerance range
• of line resistance	≤ 0.02%/10 Ω
• long term effect on span and start of scale	≤ 0.03%/month
Rated operating conditions	
Installation condions:	
• Site of installation (explosion-proof instruments)	
- Transmitter	Outside potentially explosive area
- Sensor	Within potentially explosive area, zone 0 or zone 1
Ambient conditions	
• Permitted ambient temperature	
- Operating temperature	-10 to +65 °C
- Functional temperature	-25 to +70 °C
- Storage temperature	-40 to +85 °C
• Climatic category	HSF, DIN 40 040
- Relative humidity	5 to 95%, no condensation
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-1
- Emitted interference	According to EN 50 081-2
• Degree of protection to EN 60 529	IP 20
Design	
Weight	Approx. 0.3 kg
Enclosure material	PBT, glass-fibre reinforced
Electrical connection / process connection	Plug-in screw terminal, max. 2.5 mm^2
Displays and controls	
• Calibration pushbutton function	Line compensation for resistance measurement in two-wire circuit, calibration of start of scale and full scale. Function can be disabled during parameterization.
• Parameterization	using TransWin program (page 2/36) and serial interface
• Serial interface	
- Function	Parameterizing and interrogating of operating data
- Interface	Via online or offline V.24/V.28 (RS 232) parameterizing adapter
• Test sockets (front)	Monitoring output signal with a measuring instrument; permitted internal resistance of meas. instrument for current output ≤ 15 Ω

Power supply	
• Universal power pack	230 V AC and 24 V AC/DC or 115 V AC and 24 AC/DC V; can be changed via internal plug-in jumper from 230 V/115 V AC to 24 V AC/DC; can be changed from 230 V AC to 115 V AC by exchanging a capacitor
• Tolerance ranges	
- 230 V/115 V AC	±15%
- 24 V AC/DC	18 to 75 V DC (uninterruptible from 20.4 V upwards; 20 ms) 20.4 to 55.2 V AC
- Mains frequency 230 V AC	47 to 63 Hz
- Mains frequency 115 V AC	57 to 63 Hz
• Power consumption at 24 V DC	Approx. 1.4 W
Electrical isolation	All circuits (input/output/power supply/sensor fault and limit monitor) are electrically isolated
• Test voltages	
- Input against output, power supply and sensor fault/limit monitor	U_{rms} = 4 kV, 50 Hz, 1 min
- Output and sensor fault/limit monitor against power supply	U_{rms} = 2.5 kV, 50 Hz, 1 min
- Output against sensor fault/limit monitor	U_{rms} = 500 V, 50 Hz, 1 min
• Permitted impulse voltages	
- Input, output and power supply against one another, input and power supply against sensor fault/limit monitor	$\hat{u}$ = ±1.5 kV, 1 µs/50 µs, R_i = 500 Ω
- Output against sensor fault/limit monitor, series mode voltage to all inputs and outputs	$\hat{u}$ = ±500 V, 1 µs/50 µs, R_i = 500 Ω
Certificates and approvals	
Explosion protection for the input measuring circuit	
• "Intrinsically safe" type of protection	EEx ia IIC
- Conformity certificate	PBT No. Ex-91.C.2091 X ASEV 92.1 C10162 X
External standards and guidelines	
Insulation	
• Protection of input circuit against all the other circuits	Functional extra-low voltage with safe isolation to VDE 0100 part 410
• Protection of all the other circuits against input circuit	250 V AC, overvoltage class III to VDE 0100 part 410
Protective measures	DIN 57 411 /VDE 0411 part 1
Vibration resistance	DIN 57 411 /VDE 0411 part 1 (rail-mounted)

Ordering information

The order number structure shown below is used to specify a fully functioning transmitter.

The stock items can be easily adapted to the measuring task by the user himself. Usually the adaptation is carried out using the TransWin software for parameterization and possibly by changing plug-in jumpers and installation of accessory devices. Thus the stock items of the SITRANS T transmitter have the shortest delivery time and are the low-price versions of the SITRANS T transmitter.

The parameterization of operating data (sensor type, measuring range, characteristic etc.) takes place as follows:

- Parameters preset in factory.
  A list of the parameters as set in the factory is shown on pages 2/8 and 2/9. The presets can be modified by the customer to match the requirements precisely.
- Parameterization defined in the order.
  Add "–Z" and the order code "Y01" to the order number.
  The parameterization required can be selected from the list shown on pages 2/8 and 2/9. Only specify codes A■■ to J■■ for parameters that deviate from the factory settings.
  The factory setting will be used for any parameters that are not specified.

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

Ordering examples

Customer requirement	**Ordering data**	**Standard parameter**
Example 1: Four-wire transmitter		
- rail mounted		
- Ex-proof		
- power supply 230 V AC		
- output signal 0/4 to 20 mA		
- without sensor fault/limit monitor		
- input for temperature sensor	7NG3041-3JN00 (stock item)	
Sensor PT100, three-wire circuit		X
Measuring range 0 to 150 °C		X
Characteristic rising, temperature-linear		X
Output 4 to 20 mA		X
Response to sensor breakage to full scale		X
Example 2: Four-wire transmitter		
- rail mounted		
- not Ex-proof		
- power supply 230 V AC		
- output signal 0 to 10 V		
- without sensor fault/limit monitor		
- input for temperature sensor rating plate in English	7NG3040-3UN00-Z Y01 + S76	
Sensor NiCr/Ni, type K	AA2	
Cold junction internal		X
Measuring range 0 to 900°C	EB8	
Characteristic rising, temperature-linear		X
Accessories: cold junction terminal	7NG3090-8AV	
Example 3: Four-wire transmitter		
- rail mounted		
- not Ex-proof		
- power supply 230 V AC		
- output signal 0/4 to 20 mA		
- without sensor fault/limit monitor		
- input for DC voltage 0 to 1 V	7NG3040-3JN10-Z Y01	
Sensor voltage signal	AE0	
Measuring range 0 to 1 V		X
Characteristic falling, sensor proportional	FA1	
Filter period 15 s	GS0	
Output 0 to 20 mA	HB3	
(no sensor breakage monitoring)	GS0: T99 = 15 s	

Ordering data

Ordering data	Order No.
SITRANS T universal transmitter for rail mounting in four-wire circuit for temperature, resistance, DC voltage and DC current	**7NG304■ - ■■■■0**
Explosion protection	
• Not Ex-proof	**0**
• Ex-proof, for inputs EEx ia IIC	**1**
Power supply (adjusted/selectable to)	
• AC 47 to 63 Hz 230 V AC / 24 V AC/DC	**3**
• AC 47 to 63 Hz 24 V AC/DC / 230 V AC	**4**
• AC 57 to 63 Hz 115 V AC / 24 V AC/DC	**5**
• AC 57 to 63 Hz 24 V AC/DC / 115 V AC	**6**
Output signal (adjusted/selectable to)	
• 0/4 to 20 mA / 0 to 10 V	**J**
• 0 to 10 V / 0/4 to 20 mA	**U**
Sensor fault/limit monitor	
• Not present (can be retrofitted)	**N**
• Relay with NO contact	**A**
• Relay with CO contact	**B**
• Electronic output	**C**
Input for temperature sensor, resistance-based sensor and mV sensor	**0**
Input with additional circuitry[1])	
• for DC voltage, measuring span	
0.04 to 1.5 V	**1**
0.4 to 14 V	**2**
4 to 140 V	**3**
• for DC current, measuring span	
4 to 140 µA	**4**
0.04 to 1.4 mA	**5**
0.4 to 14 mA	**6**
4 to 140 mA	**7**
0.04 to1 A	**8**
Suffixes	**Order code**
Add "-Z" and the order code to the order number and specify any plain text (see pages 2/8 and 2/9).	
Parameterization specified in order	**Y01**
Language of rating plate (together with Y01 order code only)	
• Italian	**S72**
• English	**S76**
• French	**S77**
• Spanish	**S78**
Accessories (if required)	**Order No.**
Sensor fault/limit monitor	
• With relay output	**7NG3090-8AB**
• With electronic output	**7NG3090-8AC**
Cold junction terminal	**7NG3090-8AV**
Off-line parameterization adapter	**7NG3090-8AK**
On-line parameterization adapter for parameterization during operation	**7NG3090-8EK**
TransWin program (see page 2/36)	**7NG3080-8CA**
Conversion kit for SITRANS T One resistor each of 0.1 Ω, 1.0 Ω, 10.0 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ and one capacitor for 115 V AC power pack	**7NG3090-8AW**
Operating instructions for SITRANS T (7NG304■-3/4/5/6, in 5 languages, included in scope of supply)	**C73000-B7164-C155**

■ Stock items

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[1]) Without sensor breakage monitoring. In Ex-proof instruments, observe maximum permitted currents and voltages as specified in conformance certificate.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040 and 7NG3041
Four-wire system / Mounting rail assembly

Parameter list (coded text A ■■ to J ■■)

▨ Parameters set in factory

Order No. with order code: 7NG304 ■ - ■■■■ 0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A ■■ + B ■■ to J ■■ — ■■■ + ■■■ + ■■■ + ■■■ + ■■■

Sensor

Thermocouples Type			Connection			Cold junction compensation	
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**	Normal	n³) = 1	▨ **BA1**	Cold junction compensation	
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**	Averag.⁴)	n = 2	**BA2**	internal ⁶)	▨ **CA3**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**		n = 3	**BA3**	external	
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**		n = 4	**BA4**	0 °C	**CB0**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**		n = 5	**BA5**	20 °C	**CB2**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**		n = 6	**BA6**	50 °C	**CB5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**		n = 7	**BA7**	60 °C	**CB6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**		n = 8	**BA8**	70 °C	**CB7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**		n = 9	**BA9**	Others ¹²)	**CS0**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**		n = 10	**BB0**		
Ni-Ni18%Mo (GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**	Differential ¹²)		**BS0**		

Resistance thermometer ¹) (R_{max} + R_L < 1140 (3150) Ω ²))			Connection						
			Normal	n³) = 1	▨ **BA1**	Connection		Line resistance ⁷)	
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	▨ **AC0**	Averag.⁵)	n		Two-wire	**CA2**	0 Ω	**DA0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**		n = 2 to	**BA2**	Three-wire	▨ **CA3**	10 Ω	**DA1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**		n = 10	**BB0**	Four-wire	**CA4**	20 Ω	▨ **DA2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**		Others ¹²)	**BS1**			100 Ω	**DB1**
			Differential ¹²)		**BS2**			Others ¹²)	**DS0**

Measuring ranges	
-30 to +60 °C	**EA0**
-20 to +20 °C	**EA1**
0 to 40 °C	**EA2**
0 to 60 °C	**EA3**
0 to 80 °C	**EA4**
0 to 100 °C	**EA5**
0 to 120 °C	**EA6**
0 to 150 °C	▨ **EA7**
0 to 200 °C	**EA8**
0 to 250 °C	**EA9**
0 to 300 °C	**EB0**
0 to 350 °C	**EB1**
0 to 400 °C	**EB2**
0 to 450 °C	**EB3**
0 to 500 °C	**EB4**
0 to 600 °C	**EB5**
0 to 700 °C	**EB6**
0 to 800 °C	**EB7**
0 to 900 °C	**EB8**
0 to 1000 °C	**EB9**
0 to 1200 °C	**EC0**
0 to 1400 °C	**EC1**
0 to 1600 °C	**EC2**
0 to 1800 °C	**EC3**
50 to 100 °C	**EC4**
50 to 150 °C	**EC5**
100 to 200 °C	**EC6**
100 to 300 °C	**EC7**
100 to 400 °C	**EC8**
200 to 300 °C	**EC9**
200 to 400 °C	**ED0**
200 to 500 °C	**ED1**
300 to 600 °C	**ED2**
500 to 1000 °C	**ED3**
600 to 1200 °C	**ED4**
800 to 1600 °C	**ED5**
Other ranges¹²)	**ES0**

Resistance-based sensor, potentiometer (R_{max} + R_L < 1140 (3150) Ω ²)	**AD0**	Connection						Measuring ranges	
		Normal n³) = 1	▨ **BA1**	Connection		Line resistance ⁷)		0 to 100 Ω	▨ **EE1**
		Differential ¹²)	**BS3**	Two-wire	**CA2**	0 Ω	**DA0**	0 to 200 Ω	**EE2**
				Three-wire	▨ **CA3**	10 Ω	**DA1**	0 to 500 Ω	**EE5**
				Four-wire	**CA4**	20 Ω	▨ **DA2**	0 to 1000 Ω	**EF1**
						100 Ω	**DB1**		
						Others ¹²)	**DS0**	Other ranges¹²)	**ES1**

mV sensor (V, µA, mA, A sensor ¹⁰)) **AE0**

Measuring range for Order No. 7NG 304 ■ - ■■■■ 0

0 mV	1¹¹) V	2¹¹) V	3¹¹) V	4¹¹) µA	5¹¹) mA	6¹¹) mA	7¹¹) mA	8¹¹) A	
-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-0.5 to +0.5	**EG0**
-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-0.2 to +0.2	**EG1**
-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-0.1 to +0.1	**EG2**
0 to 10	0 to 0.1	0 to 1	0 to 10	0 to 10	0 to 0.1	0 to 1	2 to 10	0 to 0.1	**EG3**
0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 0.2	**EG4**
0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 0.5	**EG5**
0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 1.0	▨ **EG6**
		1 to 5	2 to 10			1 to 5	4 to 20		**EG7**
Other ranges ¹²)									**ES2**

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1) For other basis values see Connection Averaging (e.g. Pt500: *n* = 5 ≙ BA5).
2) With 4-wire connection no sensor fault monitoring.
3) *n* = number of sensors to be connected.
4) The sum of the thermovoltages must not exceed 140 mV.
5) The sum of the resistances must not exceed 3150 Ω.
6) The cold junction terminal 7NG3090-8AV must be ordered separately.
7) For 2-wire connection the indicated loop resistance must be obeyed or determined by calibration; for 3 and 4-wire connection the expectable maximum value per wire has to be stated.
10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
11) Without sensor fault monitoring.
12) See page 2/10 for operational data and special parameters.

Parameter list (coded text A ■ ■ to J ■ ■) (continued)

▨ Parameters set in factory

Order No. with order code: 7NG304 ■ - ■ ■ ■ ■ 0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A ■ ■ + B ■ ■ to J ■ ■   ■ ■ ■ ——+—— ■ ■ ■ ——+—— ■ ■ ■ ——+—— ■ ■ ■ ——+—— ■ ■ ■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo(GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**
Resistance thermometer [1] (R_{max} + R_L < 1140 (3150) Ω [2])		
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**
Resistance-based sensor, potentiometer (R_{max} + R_L < 1140 (3150) Ω [2])		**AD0**
mV sensor (V, µA, mA, A sensor [10])		**AE0**

Characteri-stic	
temperature-linear, rising	**FA0**
temperature-linear, falling	**FA1**
sensor proportional, rising	**FA2**
sensor proportional, falling	**FA3**

Characteristic	
sensor proportional, rising	**FA0**
sensor proportional, falling	**FA1**
programmed rising or falling [12]	**FS0**

Filter period [8]	
0 s	**GA0**
0.1 s	**GA1**
0.2 s	**GA2**
0.5 s	**GA3**
1 s	**GA4**
2 s	**GA5**
5 s	**GA6**
10 s	**GA7**
20 s	**GA8**
50 s	**GA9**
100 s	**GB0**
Other values [12]	**GS0**

Output signal	
4 to 20 mA following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring	**HA3**
- safety value [12]	**HS0**
0 to 20 mA following sensor fault	
- to full scale	**HB0**
- to start of scale	**HB1**
- retain most recent val.	**HB2**
- no monitoring	**HB3**
- safety value [12]	**HS1**
0 to 10 V following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring	**HA3**
- safety value [12]	**HS2**

Basic functions	
Mains Filter [9]	
50 Hz	
Calibr. pushb.	
- disabled	**JF0**
- enabled	**JF1**
60 Hz	
Calibr. pushb.	
- disabled	**JG0**
- enabled	**JG1**

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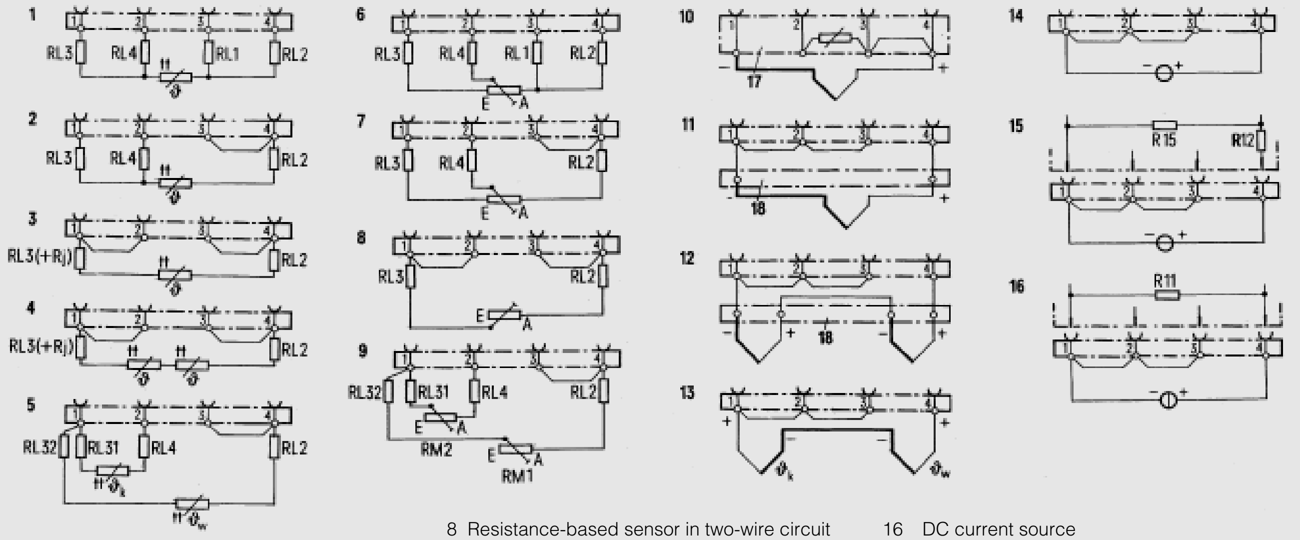
[1] For other basis values see Connection Averaging (e.g. Pt500: n = 5 ≘ BA5).
[2] With 4-wire connection no sensor fault monitoring.
[8] Software filter for smoothing result.
[9] Filter to suppress mains interference on the input.
[10] Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
[12] See page 2/10 for operational data and special parameters.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040 and 7NG3041
Four-wire system / Mounting rail assembly



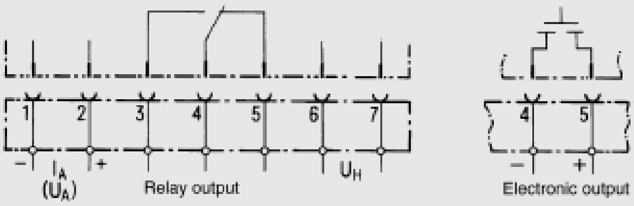
1 Resistance thermometer in four-wire circuit
2 Resistance thermometer in three-wire circuit
3 Resistance thermometer in two-wire circuit
4 Resistance thermometer in averaging circuit
5 Resistance thermometer in differential circuit
6 Resistance-based sensor in four-wire circuit
7 Resistance-based sensor in three-wire circuit
8 Resistance-based sensor in two-wire circuit
9 Resistance-based sensor in differential circuit
10 Thermocouple with internal cold junction
11 Thermocouple with external cold junction
12 Thermocouples in averaging circuit
13 Thermocouples in differential circuit
14 DC voltage source (full scale < 140 mV)
15 DC voltage source (full scale > 140 mV)
16 DC current source
17 Cold junction terminal 7NG3090-8AV
18 External temperature compensation
ϑ_W Warmer measuring point
ϑ_K Cooler measuring point
R11 Shunt resistance (internal)
R12 Series resistance (internal)
R15 Input impedance (internal)

Fig. 2/3 Connection diagram for input signal (terminal X1)

Special parameters

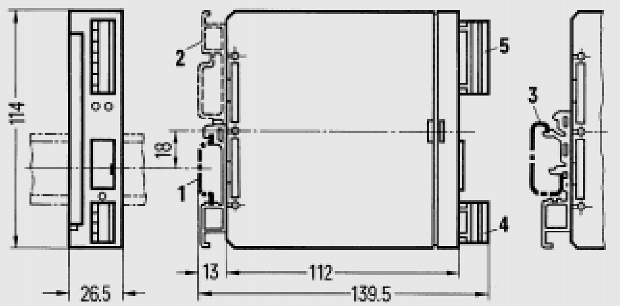
Code	Text	Options
BS0	TA=...	Working point Ta for differential temperature measurement using thermocouples
BS1	N=...	Factor n for multiplication with the basic values of the resistance thermometers or thermocouples Example: 3 x Pt500 parallel : BS1 : N = 1.667
BS2	TA=...	Working point Ta for differential temperature measurement using resistance thermometers
	N=...	Number n of resistance thermometers in each branch
	TMAX=...	Max. temperature Tmax (total of temperatures in both branches)
BS3	RMAX=...	Max. sum of the resistances of both branches T_{max}
CS0	TV=...	Temperature Tv of external cold junction
DS0	RL=...	Line resistance RL (resistance thermometer or potentiometer with 2-wire connection: loop resistance; with 3-wire and 4-wire connection: expectable maximum value per line)
ES0	MA=...	Start of scale Ma for resistance thermometer/ thermocouples
	ME=...	Full scale Me for resistance thermometer/thermocouples
	D=...	Unit (×C, ×K, ×F, ×R: ×R = Rankine = abs. Fahrenheit)
ES1	MA=...	Start of scale Ma for resistance-based sensor/ potentiometer
	ME=...	Full scale Me for resistance-based sensor/potentiometer
ES2	MA=...	Start of scale Ma for mV, V, µV, mA and A sensor
	ME=...	Full scale Me for mV, V, µA, mA and A sensor
	D=...	Unit (mV→MV, V, µA→UA, mA→MA,A)
FS0	E1=... A1=... EN=... AN=...	Pair of values En, An for user-specific characteristic (Up to 50 pairs can be specified) En: input (mV or Ω) An: output value (any unit)
	F=...	Approximation function F: L = linear; Q = quadratic; C = cubic
	K=...	Direction of action of characteristic S = rising; F = falling
GS0	T99=...	Response time T99 of software filter (0 to 100 s)

Code	Text	Options
HS0	S=...	Safety output value s following sensor fault (output 4 to 20 mA)
HS1	S=...	Safety output value s following sensor fault (output 0 to 20 mA)
HS2	S=...	Safety output value s following sensor fault (output signal 0 to 10 V)



I_A, U_A Output Signal
U_H Power supply

Fig. 2/4 Connection diagram for power supply and outputs (terminal X2)



1 35 mm DIN rail DIN EN 50 022
2 Alternative position for mounting plate
3 32 mm G rail DIN EN 50 035
4 Terminal X1
5 Terminal X2

Fig. 2/5 Dimensions for control room mounting, rail mounting

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-1 and 7NG3041-1
Four-wire system / Plug-in module (19-inch)

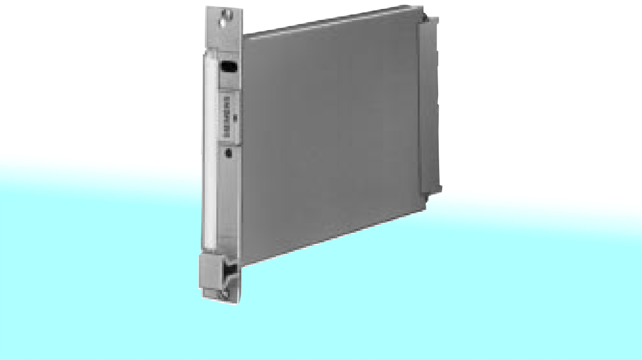


Fig. 2/6 SITRANS T transmitter as plug-in module (19-inch)

Application

"Intelligent" transmitter with universal input circuit for connecting to the following sensors:

- Resistance thermometers
- Thermocouples
- Resistance-based sensors/potentiometers
- DC voltage sources
- DC current sources

One transmitter is suitable for the connection of all sensors. The input signal is converted into a standard signal.

Features

- Four-wire transmitter
- Plug-in module (19-inch) 4 modules wide
- Low self-heating via electronics with extremely low power consumption
- All circuits electrically isolated
- Explosion proof to EEx ia IIC (7NG3041)
- Fully encapsulated housing facilitates the mounting of explosion-proof modules beside non-explosion-proof modules
- Measuring ranges and operating parameters freely selectable
- Temperature-linear characteristic can be selected for all temperature sensors
- User-specific characteristics
- Automatic correction of zero point
- Output signal 0/4 to 20 mA or 0 to 10 V (switched by changing internal jumpers)
- Output signal clearly indicates mode of operation
  - normal operation
  - overrange
  - sensor fault
- Power pack 24 V AC/DC
- Large tolerance range of power supply
- Optionally with up to 3 sensor fault/limit monitors (pluggable)

Mode of operation (Fig. 2/7)

Transmitter operation can be broken down into the following function blocks and individual functions:

- Input
  - Input terminals (2)
  - Multiplexer (3)
  - Amplifier (4)
  - Constant current source (1) for resistance measurements
  - Calibration circuit (9) for drift compensation

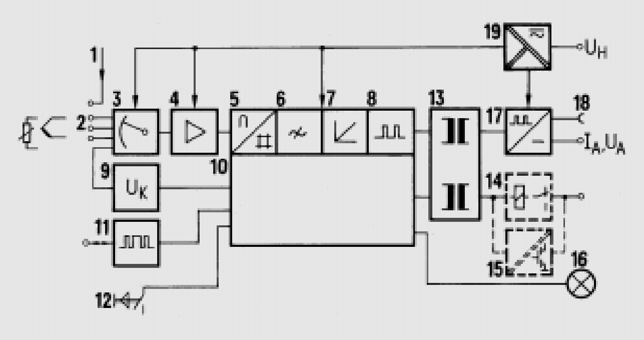


Fig. 2/7 Block diagram (see mode of operation for 1 to 19)

- Microcontroller (10)
  - Analog/digital converter (5)
  - Adjustable low-pass filter (6) for smoothing of result
  - Linearization function (7) for non-linear characteristics
  - Output with pulse width modulation (8) proportional to measured signal
- Output
  - Signals electrically isolated (13)
  - Output module (17) containing pulse width/analog converter
  - Test sockets (18) for monitoring output signal
  - Optional sensor fault/limit monitor with relay (14) or electronic output (15) (max. 3)
- Controls and displays
  - Serial interface (11) for setting and interrogating parameters
  - Calibration push-button (12) for calibration of resistance measurements in two-wire circuits and trimming of start of scale/ full scale values
  - Green LED (16) showing operational status (constant) or sensor fault or system malfunction (flashes)
- Power supply
  - Universal power pack 24 V AC/DC (19)

Parameterization

The following parameters can be set and interrogated via the serial interface:

- Type of sensor, e.g. Pt100 resistance thermometer or NiCr/Ni thermocouple, type K
- Measuring range
- Internal or external temperature compensation for thermocouples
- 2, 3 or 4-wire circuit for resistance thermometer and resistance-based sensor
- Reaction to sensor fault (short-circuit or line breakage), e.g. output signal forced to start of scale or full scale value
- Transmitter characteristic, e.g. voltage or temperature-linear
- Rising or falling characteristic
- Response time of transmitter
- Output signal, e.g. 0 to 20 mA or 4 to 20 mA
- Limits with hysteresis

The parameters are stored in a non-volatile memory (EEPROM).

The following are required during parameterization:

- Transmitter
- Off-line or on-line parameterization adapter
- Personal computer (PC)
- TransWin 7NG3080-8CA software package
- Printer for printing of rating plate and report

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-1 and 7NG3041-1
Four-wire system / Plug-in module (19-inch)

Technical data

Input

Resistance thermometer	
• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω (9 Ω corresponds to approx. 25 °C for Pt100)
• Sensor type	Pt100 (DIN IEC 751) Pt100 (JIS C1604/ α=0.00392 Ω/K) Ni100 (DIN 43 760) Cu100 Multiples or parts of specified basic values (e.g. Pt500, Cu25) parameterizable
• Characteristic	Temperature or resistance-linear
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Averaging connection	Several resistance thermometers connected in series or parallel to produce average temp. or to adapt to other basic values. e.g. Pt1000 n=10, Cu25 n=0.25
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit; operating temperature can be parameterized
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω
• Short-circuit monitoring	The value below which a sensor fault is to be signalled is parameterizable
Resistance-based sensor, potentiometer	
• Measured variable	Ohmic impedance
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω
• Start of scale	0 to 3141 Ω
• Full scale	3150 Ω
• Characteristic	Resistance-linear or according to a parameterizable linearisation function
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω
• Short-circuit monitoring	The value below which a sensor fault is to be signalled is parameterizable

Thermocouple	
• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	4 to 140 mV
• Sensor type	Type B: Pt30%Rh/Pt6%Rh (DIN IEC 584) 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 43 710) 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 43 710) Ni-NiMo (GE) Additional thermocouples can be parameterized by the customer.
• Characteristic	Temperature-linear or voltage-linear
• Type of connection	
- Normal connection	One thermocouple, internal or external temperature compensation
- Averaging connection	Several thermocouples connected in series to produce average temperature, internal or external temperature compensation
- Differential connection	Two identical thermocouples to produce temperature difference, temperature compensation not necessary; operating temperature parameterizable
• Temperature compensation	Internal or external
- internal	Cold junction terminal option 7NG3090-8AV required (plug-in screw terminal with integrated Pt100)
- external	Temperature of external temperature compensation parameterizable
mV sensors	
• Measured variable	DC voltage
• Measuring range	Parameterizable in following ranges: -59 to +81 mV, -20 to +120 mV -39 to +100 mV, 0 to +140 mV
• Measuring span (maximal)	4 to 140 mV
• Start of scale	-59 to +136 mV
• Full scale	140 mV
• Characteristic	Voltage-linear or according to a parameterizable linearization function
• Overload capacity of inputs	±3.5 V
• Input resistance	≥1 MΩ
V, µA, mA, A sensors (without sensor breakage monitoring)	
• Measured variable	DC voltage / DC current
• Measuring range	Parameterizable The voltage drop on the input impedance R15 or shunt resistance R11 should correspond to the measuring ranges of the mV sensor.
• Characteristic	Voltage or current-linear or according to a parameterizable linearization function
• Voltage measurement > 140 mV	Internal voltage divider with series resistance R12 and input impedance R15
• Current measurement	Internal shunt resistance R11

Technical data (continued)

Input (continued)

Order No. 7NG304■	Measuring span	Start of scale	Full scale	R12 MΩ	R15 kΩ	R11 Ω
-■■■10	0.04 to 1.54 V	-0.5 to +1.5 V	1.54 V	0.1	10	-
-■■■20	0.4 to 14.14 V	-5 to +13.74 V	14.14 V	1	10	-
-■■■30	4 to 140.14 V	-50 to +136.14 V	140.14 V	1	1	-
-■■■40	4 to 140 µA	-50 to +136 µA	140 µA	-	-	1000
-■■■50	0.04 to 1.4 mA	-0.5 to +1.36 mA	1.40 mA	-	-	100
-■■■60	0.40 to 14 mA	-5.0 to +13.6 mA	14.0 mA	-	-	10
-■■■70	4 to 140 mA	-50 to +136 mA	140 mA	-	-	1
-■■■80	0.04 to 1.00 A	-0.5 to +0.96 A	1.00 A	-	-	0.1

Common data	
• Characteristic	The parameterizable characteristic is generated by joining together up to 14 first, second or third degree polynominals. The starting point is defined for every polynomial.
• Sensor fault monitoring	Monitoring all terminations for breakages and short-circuits (function can be disabled)
• Response/drop threshold	≤3 kΩ/≥1.5 kΩ loop resistance
• Output following sensor fault	To full scale, to start of scale, retain most recent value, parameterizable safety value, no monitoring
• Temperature unit	°C, K, °F, °R parameterizable (°R (Rankine) = absolute °F)

Output

Output signal	0/4 to 20 mA, can be recon. to 0 to 10 V
• Nominal range 0 to 20 mA	≅ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.25 to +21.0 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.50 to +21.5 mA (=-2.5 to +107.5%), parameterizable
- Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 4 to 20 mA	≅ 0 to 100%
- Resolution	4700 steps (0 to 100%)
- Overrange	3.8 to +20.8 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.5 to +21.5 mA (=-28.1 to +109.7%), parameterizable
- Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 0 to 10 V	≅ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.125 to +10.5 V (=-1.25 to +105.0%)
- Output range following sensor fault	-0.25 to +10.75 V (=-2.50 to +107.5%), parameterizable
- Load resistance	≥ 1 kΩ
- Short-circuit current	≤ 40 mA
• Residual ripple U_{PP}/I_{PP}	≤ 1%, measured across a 1 MHz band
• Response time	
- Sample cycle	100 ms
• Electrical damping	
- Adjustable time constant T_{99}	0 to 100 s parameterizable (software filter with 1st order delay)
Sensor fault/limit signalling	Relay output or electronic output
• Relay output	Break circuit with 1 CO contact
- Switching capacity	≤ 90 W, ≤ 150 VA
- Switching voltage	≤ 75 V AC/DC
- Switching current	≤ 2 A AC/DC

• Electronic output	Active during normal operation
- Operating output	U_H = 18 to 75 V
- Residual volt, when I_L = 10 mA	U_0≤ 4.5 V
- Operating current	I_L ≤ 15 mA
- Short-circuit current	I_K ≤ 70 mA
• Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
• Limit monitoring	Freely parameterizable are: - lower and upper limit - window (combination of lower and upper limits); Limit and sensor fault monitoring can be combined
• Hysteresis	Parameterizable

Accuracy

Measurement error	Sum of input error thresholds, output error thresholds and internal temperature compensation errors (if known)

Input error thresholds

Sensor	Range	Range Input error tolerance[1]) with	without[2]) compensation
• Resistance thermometer			
- Pt100	-200 to 150 °C	±0.08 K	±0.15 K
	-200 to 620 °C	±0.18 K	±0.35 K
	-200 to 850 °C	±0.33 K	±0.70 K
- Pt500	-200 to 110 °C	±0.07 K	±0.16 K
	-200 to 400 °C	±0.43 K	±0.88 K
	-200 to 850 °C	±0.75 K	±1.54 K
- Pt1000	-200 to 200 °C	±0.25 K	±0.56 K
	-200 to 600 °C	±0.75 K	±1.10 K
- Ni100	-60 to 90 °C	±0.04 K	±0.10 K
	-60 to 250 °C	±0.07 K	±0.14 K
- Cu100	-50 to 140 °C	±0.06 K	±0.12 K
	-50 to 180 °C	±0.10 K	±0.20 K
• Resistance-based sensor	0 to 160 Ω	±0.03 Ω	±0.06 Ω
	0 to 320 Ω	±0.06 Ω	±0.12 Ω
	0 to 710 Ω	±0.13 Ω	±0.33 Ω
	0 to 3160 Ω	±2.17 Ω	±3.58 Ω
• Thermocouples			
- Type B: Pt30%Rh/Pt6%Rh	400 to 1000 °C	±2.50 K	±2.95 K
	1000 to 1820 °C	±1.00 K	±1.32 K
- Type E: NiCr/CuNi	-200 to 0 °C	±0.40 K	±0.48 K
	0 to 500 °C	±0.18 K	±0.20 K
	500 to 1000 °C	±0.15 K	±0.16 K
- Type J: Fe/CuNi	-210 to 0 °C	±0.50 K	±0.63 K
	0 to 1200 °C	±0.20 K	±0.24 K
- Type K: NiCr/Ni	-180 to 0 °C	±0.50 K	±0.64 K
	0 to 1370 °C	±0.30 K	±0.35 K
- Type L: Fe-CuNi	-200 to 0 °C	±0.40 K	±0.42 K
	0 to 900 °C	±0.20 K	±0.25 K
- Type N: NiCrSi-NiSi	-180 to 0 °C	±0.90 K	±0.96 K
	0 to 500 °C	±0.40 K	±0.46 K
	500 to 1300 °C	±0.30 K	±0.33 K
- Type R: Pt13%Rh/Pt	-50 to 0 °C	±2.50 K	±3.24 K
	0 to 500 °C	±1.80 K	±2.27 K
	500 to 1000 °C	±1.00 K	±1.11 K
	1000 to 1760 °C	±0.80 K	±0.91 K
- Type S: Pt10%Rh/Pt	-50 to 0 °C	±2.50 K	±3.03 K
	0 to 500 °C	±1.80 K	±2.22 K
	500 to 1760 °C	±1.10 K	±1.21 K
- Type T: Cu/CuNi	-200 to 0 °C	±0.60 K	±0.76 K
	0 to 400 °C	±0.25 K	±0.31 K
- Type U: Cu-CuNi	-200 to 0 °C	±0.50 K	±0.63 K
	0 to 600 °C	±0.25 K	±0.30 K
Ni-NiMo	0 to 700 °C	±0.23 K	±0.32 K
	700 to 1310 °C	±0.19 K	±0.23 K
• Voltage source	-60 to +140 mV	±10 µV	±12 µV

Error threshold of output signal	±0.05 % of measuring span
Internal temperature comp. error	≤0.5 K

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1) Includes temperature sensor linearization error.
2) Following change in measuring range or type of sensor.

7NG3040-1 and 7NG3041-1
Four-wire system / Plug-in module (19-inch)

Technical data (continued)

Accuracy (continued)	
Influencing effects	Referred to nominal current I_{AN}=20 mA nominal voltage U_{AN}=10 V
• of ambient temperature	
- during resistance measurement	
on start of scale	≤ (0.05 + 0.015 · ($R_{Anf}/\Delta R$))%/10K
on span	≤ 0.16%/10K
- during voltage measurement	
on start of scale	≤ (0.05 + 0.05 · ($U_{Anf}/\Delta U$))%/10K
on measuring span	≤ 0.2%/10K
Additional influence	
- with internal cold junction compensation	≤ 0.1 K/10 K (temperature measurement using thermocouples)
- with internal voltage divider	≤ 0.05 %/10 K (Voltage measurement > 140 mV)
- with internal shunt	≤ 0.025 %/10 K (Current measurement)
• of load with current output	≤ 0.1% for a change from 50 to 650 Ω
• of load with voltage output	≤ 0.1% with a change of load current from 0 to 10 mA
• of power supply	≤ 0.05% within supply tolerance range
• of line resistance	≤ 0.02%/10 Ω
• long term effect on span and start of scale	≤ 0.03%/month
Rated operating conditions	
Installation conditions	
• Site of installation (explosion-proof instruments)	
- Transmitter	Outside potentially explosive area
- Sensor	Within potentially explosive area, zone 0 or zone 1
Ambient conditions	
• Permitted ambient temperature	
- Operating temperature	-10 to +65 °C
- Functional temperature	-25 to +70 °C
- Storage temperature	-40 to +85 °C
• Climatic category	HSF, DIN 40 040
- Relative humidity	5 to 95%, no condensation
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-1
- Emitted interference	According to EN 50 081-2
• Degree of protection to EN 60 529	IP 20
Design	
Weight	Approx. 0.3 kg
Enclosure material	PBT, glass-fibre reinforced
Electrical connection / process connection	Plug connector, type F DIN 41 612 32 way, rows b and z
Displays and controls	
• Calibration pushbutton function	Line compensation for resistance measurement in two-wire circuit, calibration of start of scale and full scale. Function can be disabled during parameterization.
• Parameterization	using TransWin program (page 2/36) and serial interface
• Serial interface	
- Function	Parameterizing and interrogating of operating data
- Interface	Via online or offline V.24/V.28 (RS 232) parameterizing adapter
• Test sockets (front)	Monitoring output signal with a measuring instrument; permitted internal resistance of meas. instrument for current output ≤ 15 Ω

Power supply	
• Universal power pack	24 V AC/DC
• Tolerance ranges	
- Power supply	18 to 60 V DC (uninterruptible from 20.4 V upwards; 20 ms) 20.4 to 41.4 V AC
- Mains frequency	47 to 63 Hz
• Power consumption	
- At 24 V AC	Approx 1.8 W/2.2 VA
- At 24 V DC	Approx 1.4 W
Electrical isolation	All circuits (input/output/power supply/sensor fault and limit monitor) are electrically isolated
• Test voltages	
- Input against output, power supply and sensor fault/limit monitor	U_{rms} = 4 kV, 50 Hz, 1 min
- Power supply against output and sensor fault/limit monitor Output against sensor fault/limit monitor	U_{rms} = 500 V, 50 Hz, 1 min
• Permitted impulse voltages	
- Input against output, power supply and sensor fault/limit monitor	$\hat{u}$ = ±1.5 kV, 1 µs/50 µs, R_i = 500 Ω
- Power supply against output and sensor fault/limit monitor Output against sensor fault/limit monitor, series mode voltage to all inputs and outputs	$\hat{u}$ = ±500 V, 1 µs/50 µs, R_i = 500 Ω
Certificates and approvals	
Explosion protection for the input measuring circuit	
• "Intrinsically safe" type of protection	EEx ia IIC PBT Nr. Ex-91.C.2091 X
- Conformity certificate	ASEV 92.1 C10162 X
External standards and guidelines	
Insulation	
• Protection of input circuit against all the other circuits	Functional extra-low voltage with safe isolation to VDE 0100 part 410
• Protection of all the other circuits against input circuit	250 V AC, overvoltage class II to VDE 0100 part 410
Protective measures	DIN 57 411 /VDE 0411 part 1

Ordering information

The order number structure shown below is used to specify a fully functioning transmitter.

The stock items can be easily adapted to the measuring task by the user himself. Usually the adaptation is carried out using the TransWin software for parameterization and possibly by changing plug-in jumpers and installation of accessory devices. Thus the stock items of the SITRANS T transmitter have the shortest delivery time and are the low-price versions of the SITRANS T transmitter.

The parameterization of operating data (sensor type, measuring range, characteristic etc.) takes place as follows:

- Parameters preset in factory.
  A list of the parameters as set in the factory is shown on pages 2/16 and 2/17. The presets can be modified by the customer to match the requirements precisely.
- Parameterization defined in the order.
  Add "–Z" and the order code "Y01" to the order number.
  The parameterization required can be selected from the list shown on pages 2/16 and 2/17. Only specify codes A■■ to J■■ for parameters that deviate from the factory settings.
  The factory setting will be used for any parameters that are not specified.

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

Ordering examples

Customer requirement	**Ordering data**	**Standard parameter**
Example 1: Four-wire transmitter - plug-in module 19-inch - Ex-proof - output signal 0/4 to 20 mA - without sensor fault/limit monitor - input for temperature sensor	7NG3041-1JD00 (stock item)	
Sensor PT100, three-wire circuit		X
Measuring range 0 to 150 °C		X
Characteristic rising, temperature-linear		X
Output 4 to 20 mA		X
Response to sensor breakage to full scale		X
Example 2: Four-wire transmitter - plug-in module 19-inch - not Ex-proof - output signal 0 to 10 V - without sensor fault/limit monitor - input for temperature sensor	7NG3040-1UD00-Z	
Rating plate in English	Y01 + S76	
Sensor NiCr/Ni, type K	AA2	
Cold junction internal		X
Measuring range 0 to 900°C	EB8	
Characteristic rising, temperature-linear		X
Accessories: cold junction terminal	7NG3090-8AV	
cold junction connection module	7NG3090-8AA	
Example 3: Four-wire transmitter - plug-in module 19-inch - not Ex-proof - output signal 0/4 to 20 mA - without sensor fault/limit monitor - input for DC voltage 0 to 1 V	7NG3040-1JD10-Z Y01	
Sensor voltage signal	AE0	
Measuring range 0 to 1 V		X
Characteristic falling, sensor proportional.	FA1	
Filter period 15 s	GS0	
Output 0 to 20 mA	HB3	
	GS0: T99 = 15 s	

Ordering data

Ordering data	Order No.
SITRANS T universal transmitter Plug-in module (19-inch), in four-wire circuit, for temperature, resistance, DC voltage and DC current	**7NG304■-1■■■0**
Explosion protection	
• Not Ex-proof	**0**
• Ex-proof, for inputs EEx ia IIC	**1**
Output signal (adjusted/selectable to)	
• 0/4 to 20 mA / 0 to 10 V	**J**
• 0 to 10 V / 0/4 to 20 mA	**U**
Sensor fault/limit monitor	
• Not present (can be retrofitted)	**D**
• 1 relay with CO contact	**E**
• 1 electronic output	**F**
• 2 relays with CO contact	**G**
• 2 electronic outputs	**H**
• 3 relays with CO contact	**K**
• 3 electronic outputs	**L**
• 1 relay, 1 electronic output	**M**
• 1 relay, 2 electronic outputs	**P**
• 2 relays, 1 electronic output	**Q**
Input for temperature sensor, resistance-based sensor and mV sensor	**0**
Input with additional circuitry[1]	
• for DC voltage, measuring span	
0.04 to 1.5 V	**1**
0.4 to 14 V	**2**
4 to 140 V	**3**
• for DC current, measuring span	
4 to 140 µA	**4**
0.04 to 1.4 mA	**5**
0.4 to 14 mA	**6**
4 to 140 mA	**7**
0.04 to 1 A	**8**
Suffixes	**Order code**
Add "-Z" and the order code to the order number and specify any plain text (see pages 2/16 and 2/17).	
Parameterization specified in order	**Y01**
Language of rating plate (together with Y01 order code only)	
• Italian	**S72**
• English	**S76**
• French	**S77**
• Spanish	**S78**
Accessories (if required)	**Order No.**
Sensor fault/limit monitor	
• With relay output	**7NG3090-8AB**
• With electronic output	**7NG3090-8AC**
Cold junction terminal	**7NG3090-8AV**
Cold junction connection module for 2 cold junction terminals with 1 end holder	**7NG3090-8AA**
End holder	**W73078-Z10**
Coding strip with 2 coding nipples	**W73070-Z53**
Off-line parameterization adapter	**7NG3090-8AK**
On-line parameterization adapter for parameterization during operation	**7NG3090-8EK**
TransWin program (see page 2/36)	**7NG3080-8CA**
Conversion kit for SITRANS T One resistor each of 0.1 Ω, 1.0 Ω, 10.0 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ and one capacitor for 115 V AC power pack	**7NG3090-8AW**
Conversion kit for SITRANS T ((7NG304■-1, in 5 languages, included in scope of supply)	**C73000-B7164-C157**

■ Stock items

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[1]) Without sensor breakage monitoring. In Ex-proof instruments, observe maximum permitted currents and voltages as specified in conformance certificate.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-1 and 7NG3041-1
Four-wire system / Plug-in module (19-inch)

Parameter list (coded text A■■ to J■■)

🟦 Parameters set in factory

Order No. with order code: 7NG304■-■■■■0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A■■ + B■■ to J■■

■■■ + ■■■ + ■■■ + ■■■ + ■■■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo (GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**

Connection		
Normal	n 3) = 1	🟦 **BA1**
Averag. 4)	n = 2	**BA2**
	n = 3	**BA3**
	n = 4	**BA4**
	n = 5	**BA5**
	n = 6	**BA6**
	n = 7	**BA7**
	n = 8	**BA8**
	n = 9	**BA9**
	n = 10	**BB0**
Differential 12)		**BS0**

Cold junction compensation	
internal 6)	🟦 **CA3**
external	
0 °C	**CB0**
20 °C	**CB2**
50 °C	**CB5**
60 °C	**CB6**
70 °C	**CB7**
Others 12)	**CS0**

Measuring ranges		
-30 to	+60 °C	**EA0**
-20 to	+20 °C	**EA1**
0 to	40 °C	**EA2**
0 to	60 °C	**EA3**
0 to	80 °C	**EA4**
0 to	100 °C	**EA5**
0 to	120 °C	**EA6**
0 to	150 °C	🟦 **EA7**
0 to	200 °C	**EA8**
0 to	250 °C	**EA9**
0 to	300 °C	**EB0**
0 to	350 °C	**EB1**
0 to	400 °C	**EB2**
0 to	450 °C	**EB3**
0 to	500 °C	**EB4**
0 to	600 °C	**EB5**
0 to	700 °C	**EB6**
0 to	800 °C	**EB7**
0 to	900 °C	**EB8**
0 to	1000 °C	**EB9**
0 to	1200 °C	**EC0**
0 to	1400 °C	**EC1**
0 to	1600 °C	**EC2**
0 to	1800 °C	**EC3**
50 to	100 °C	**EC4**
50 to	150 °C	**EC5**
100 to	200 °C	**EC6**
100 to	300 °C	**EC7**
100 to	400 °C	**EC8**
200 to	300 °C	**EC9**
200 to	400 °C	**ED0**
200 to	500 °C	**ED1**
300 to	600 °C	**ED2**
500 to	1000 °C	**ED3**
600 to	1200 °C	**ED4**
800 to	1600 °C	**ED5**
Other ranges 12)		**ES0**

Resistance thermometer 1) ($R_{\max} + R_L$ < 1140 (3150) Ω 2))		
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	🟦 **AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**

Connection		
Normal	n 3) = 1	🟦 **BA1**
Averag. 5) n		
	n = 2 to n = 10	**BA2** **BB0**
	Others 12)	**BS1**
Differential 12)		**BS2**

Connection	
Two-wire	**CA2**
Three-wire	🟦 **CA3**
Four-wire	**CA4**

Line resistance 7)	
0 Ω	**DA0**
10 Ω	**DA1**
20 Ω	🟦 **DA2**
100 Ω	**DB1**
Others 12)	**DS0**

Resistance-based sensor, potentiometer ($R_{\max} + R_L$ < 1140 (3150) Ω 2))	
	AD0

Connection		
Normal	n 3) = 1	🟦 **BA1**
Differential 12)		**BS3**

Connection	
Two-wire	**CA2**
Three-wire	🟦 **CA3**
Four-wire	**CA4**

Line resistance 7)	
0 Ω	**DA0**
10 Ω	**DA1**
20 Ω	🟦 **DA2**
100 Ω	**DB1**
Others 12)	**DS0**

Measuring ranges	
0 to 100 Ω	🟦 **EE1**
0 to 200 Ω	**EE2**
0 to 500 Ω	**EE5**
0 to 1000 Ω	**EF1**
Other ranges 12)	**ES1**

mV sensor (V, µA, mA, A sensor)	
	AE0

Measuring range for Order No. 7NG 304■-■■■■0

0 mV	1 11) V	2 11) V	3 11) V	4 11) µA	5 11) mA	6 11) mA	7 11) mA	8 11) A	
-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-0.5 to +0.5	**EG0**
-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-0.2 to +0.2	**EG1**
-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-0.1 to +0.1	**EG2**
0 to 10	0 to 0.1	0 to 1	0 to 10	0 to 10	0 to 0.1	0 to 1	2 to 10	0 to 0.1	**EG3**
0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 0.2	**EG4**
0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 0.5	**EG5**
0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 1.0	🟦 **EG6**
		1 to 5	2 to 10			1 to 5	4 to 20		**EG7**
Other ranges 12)									**ES2**

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1) For other basis values see Connection Averaging (e.g. Pt500: *n* = 5 ≙ BA5).
2) With 4-wire connection no sensor fault monitoring.
3) *n* = number of sensors to be connected.
4) The sum of the thermovoltages must not exceed 140 mV.
5) The sum of the resistances must not exceed 3150 Ω.
6) The cold junction terminal 7NG3090-8AV must be ordered separately.
7) For 2-wire connection the indicated loop resistance must be obeyed or determined by calibration; for 3 and 4-wire connection the expectable maximum value per wire has to be stated.
10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
11) Without sensor fault monitoring.
12) See page 2/18 for operational data and special parameters.

Parameter list (coded text A■■ to J■■) (continued)

🟦 Parameters set in factory

Order No. with order code: 7NG304■ - ■■■■0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A■■ + B■■ to J■■ ■■■ ——+—— ■■■ ——+—— ■■■ ——+—— ■■■ ——+—— ■■■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo(GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**
Resistance thermometer 1) ($R_{\max} + R_L < 1140\ (3150)\ \Omega$ 2))		
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**
Resistance-based sensor, potentiometer ($R_{\max} + R_L < 1140\ (3150)\ \Omega$ 2))		**AD0**
mV sensor (V, µA, mA, A sensor)		**AE0**

Character-istic	
temperature-linear, rising	**FA0**
temperature-linear, falling	**FA1**
sensor proportional, rising	**FA2**
sensor proportional, falling	**FA3**

Characteristic	
sensor proportional, rising	**FA0**
sensor proportional, falling	**FA1**
programmed rising or falling 12)	**FS0**

Filter period 8)	
0 s	**GA0**
0.1 s	**GA1**
0.2 s	**GA2**
0.5 s	**GA3**
1 s	**GA4**
2 s	**GA5**
5 s	**GA6**
10 s	**GA7**
20 s	**GA8**
50 s	**GA9**
100 s	**GB0**
Other values 12)	**GS0**

Output signal	
4 to 20 mA following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring 12)	**HA3**
- safety value 12)	**HS0**
0 to 20 mA following sensor fault	
- to full scale	**HB0**
- to start of scale	**HB1**
- retain most recent val.	**HB2**
- no monitoring 12)	**HB3**
- safety value 12)	**HS1**
0 to 10 V following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring 12)	**HA3**
- safety value 12)	**HS2**

Basic functions	
Mains filter 9)	
50 Hz	
Calibr. pushb.	
- disabled	**JF0**
- enabled	**JF1**
60 Hz	
Calibr. pushb.	
- disabled	**JG0**
- enabled	**JG1**

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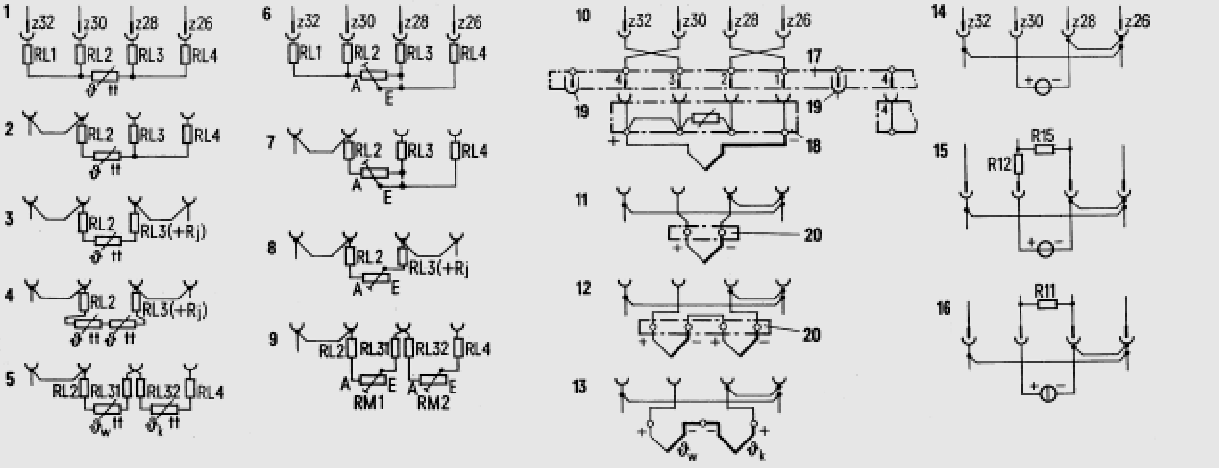
1) For other basis values see Connection Averaging (e.g. Pt500: $n = 5 \mathrel{\hat{=}}$ BA5).
2) With 4-wire connection no sensor fault monitoring.
8) Software filter for smoothing result.
9) Filter to suppress mains interference on the input.
10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
12) See page 2/18 for operational data and special parameters.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-1 and 7NG3041-1
Four-wire system / Plug-in module (19-inch)

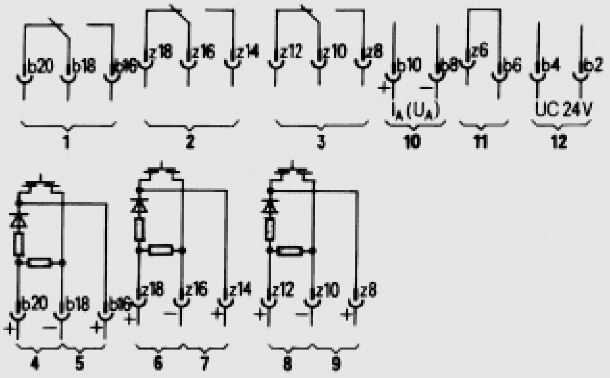


1 Resistance thermometer in four-wire
2 Resistance thermometer in three-wire circuit
3 Resistance thermometer in two-wire circuit
4 Resistance thermometer in averaging circuit
5 Resistance thermometer in differential circuit
6 Resistance-based sensor in four-wire circuit
7 Resistance-based sensor in three-wire circuit
8 Resistance-based sensor in two-wire circuit
9 Resistance-based sensor in differential circuit
10 Thermocouple with internal temperature comp.
11 Thermocouple with external temperature comp.
12 Thermocouples in averaging circuit
13 Thermocouples in differential circuit
14 DC voltage source (full scale < 140 mV)
15 DC voltage source (full scale > 140 mV)
16 DC current source
17 Cold junction connection module (7NG3090-8AA)
18 Cold junction terminal (7NG3090-8AV)
19 Dummy part
20 External temperature compensation
ϑ_W Warmer measuring point
ϑ_K Cooler measuring point
R11 Shunt resistance (internal)
R12 Series resistance (internal)
R15 Input impedance (internal)

Fig. 2/8 Connection diagram for input signal

Special parameters

Code	Text	Options
BS0	TA=...	Working point T_a for differential temperature measurement using thermocouples
BS1	N=...	Factor n for multiplication with the basic values of the resistance thermometers or thermocouples Example: 3 x Pt500 parallel : BS1 : N = 1.667
BS2	TA=...	Working point T_a for differential temperature measurement using resistance thermometers
	N=...	Number n of resistance thermom. in each branch
	TMAX=...	Max. temperature T_{max} (total of temperatures in both branches)
BS3	RMAX=...	Max. sum of the resist. of both branches R_{max}
CS0	TV=...	Temperature Tv of external cold junction
DS0	RL=...	Line resistance R_L (resistance thermometer or potentiometer with 2-wire connection: loop resistance; with 3-wire and 4-wire connection: expectable maximum value per line)
ES0	MA=...	Start of scale Ma for resistance thermometer/thermocouples
	ME=...	Full scale Me for resistance-based sensor/potentiometer
	D=...	Unit (°C, °K, °F, °R: °R = Rankine = abs. Fahrenh.)
ES1	MA=...	Start of scale Ma for resistance-based sensor/potentiometer
	ME=...	Full scale Me for resistance-based sensor/potentiometer
ES2	MA=...	Start of scale Ma for mV, V, µV, mA and A sensor
	ME=...	Full scale Me for resistance-based sensor/potentiometer
	D=...	Unit (mV -> MV, V, µA -> UA, mA -> MA, A)
FS0	E1=... A1=... EN=... AN=...	Pair of values E_n, A_n for user-specific character. (Up to 50 pairs can be specified) E_n: input (mV or Ω) A_n: output value (any unit)
	F=...	Approximation function F: L = linear; Q = quadratic; C = cubic
	K=...	Direction of action of characteristic S = rising; F = falling
GS0	T99=...	Response time T_{99} of software filter (0 to 100 s)
HS0	S=...	Safety output value S following sensor fault (output 4 to 20 mA)
HS1	S=...	Safety output value S following sensor fault (output 4 to 20 mA)
HS2	S=...	Safety output value S following sensor fault (Output signal 0 to 10 V)



1 Sensor fault/limit monitor 1 (relay contact) [1]
2 Sensor fault/limit monitor 2 (relay contact) [1]
3 Sensor fault/limit monitor 3 (relay contact) [1]
4 Sensor fault/limit monitor 1 to NAMUR [2]
5 Electronic sensor fault/limit monitor 1[2]
6 Sensor fault/limit monitor 2 to NAMUR [2]
7 Electronic sensor fault/limit monitor 2 [2]
8 Sensor fault/limit monitor 3 to NAMUR [2]
9 Electronic sensor fault/limit monitor 3 [2]
10 Output signal (I_A, U_A)
11 Plug-in test
12 Power supply

[1] Normal position shown = incident.
[2] High-resistance with malfunctions.

Fig. 2/9 Connection diagr. for output, power supply and signal outputs

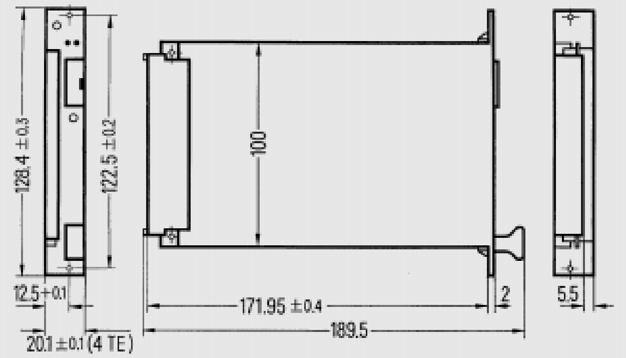


Fig. 2/10 Dimensions for plug-in module (19-inch)

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-0
Four-wire system / ES 902 packaging system

Fig. 2/11 SITRANS T transmitter as printed circuit board for the ES 902 packaging system

Application

"Intelligent" transmitter with universal input circuit for connecting to the following sensors:

- Resistance thermometers
- Thermocouples
- Resistance-based sensors/potentiometers
- DC voltage sources
- DC current sources

One transmitter is suitable for the connection of all sensors. The input signal is converted into a standard signal.

Features

- Four-wire transmitter
- Printed circuit board for ES 902 packaging system, 2 standard slots
- Compatible with the 7NG1204 and 7NG1205 transmitters (previous devices)
- Low self-heating via electronics with extremely low power consumption
- All circuits electrically isolated
- Measuring ranges and operating parameters freely selectable
- Temperature-linear characteristic can be selected for all temperature sensors
- User-specific characteristics
- Automatic correction of zero point
- Output signal 0/4 to 20 mA or 0 to 10 V (switched by changing internal jumpers)
- Output signal clearly indicates mode of operation
  - normal operation
  - overrange
  - sensor fault
- Power pack 24 V AC/DC
- Large tolerance range of power supply
- Optional sensor fault/limit monitor (pluggable)

Mode of operation (Fig. 2/12)

Transmitter operation can be broken down into the following function blocks and individual functions:

- Input
  - Input terminals (2)
  - Multiplexer (3)
  - Amplifier (4)
  - Constant current source (1) for resistance measurements
  - Calibration circuit (9) for drift compensation

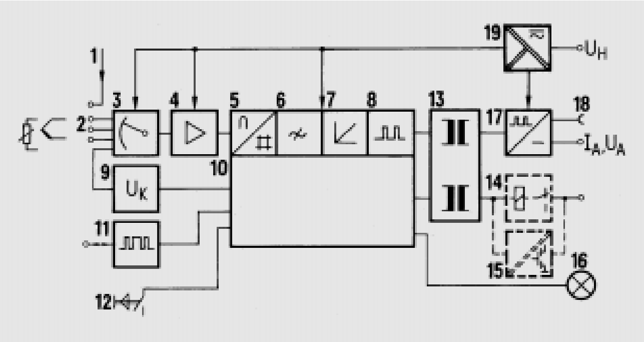


Fig. 2/12 Block diagram (see mode of operation for 1 to 19)

- Microcontroller (10)
  - Analog/digital converter (5)
  - Adjustable low-pass filter (6) for smoothing of result
  - Linearization function (7) for non-linear characteristics
  - Output with pulse width modulation (8) proportional to measured signal
- Output
  - Signals electrically isolated (13)
  - Output module (17) containing pulse width/analog converter
  - Test sockets (18) for monitoring output signal
  - Optional sensor fault/limit monitor with relay (14) or electronic output (15)
- Controls and displays
  - Serial interface (11) for setting and interrogating parameters
  - Calibration push-button (12) for calibration of resistance measurements in two-wire circuits and trimming of start of scale/ full scale values
  - Green LED (16) showing operational status (constant) or sensor fault or system malfunction (flashes)
- Power supply
  - Universal power pack 24 V AC/DC (19)

Parameterization

The following parameters can be set and interrogated via the serial interface:

- Type of sensor, e.g. Pt100 resistance thermometer or NiCr/Ni thermocouple, type K
- Measuring range
- Internal or external temperature compensation for thermocouples
- 2, 3 or 4-wire circuit for resistance thermometer and resistance-based sensor
- Reaction to sensor fault (short-circuit or line breakage), e.g. output signal forced to start of scale or full scale value
- Transmitter characteristic, e.g. voltage or temperature-linear
- Rising or falling characteristic
- Response time of transmitter
- Output signal, e.g. 0 to 20 mA or 4 to 20 mA
- Limits with hysteresis

The parameters are stored in a non-volatile memory (EEPROM).

The following are required during parameterization:

- Transmitter
- Off-line or on-line parameterization adapter
- Personal Computer (PC)
- TransWin 7NG3080-8CA software package
- Printer for printing of rating plate and report

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-0
Four-wire system / ES 902 packaging system

Technical data

Input

Resistance thermometer

• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω (9 Ω corresponds to approx. 25 °C for Pt100)
• Sensor type	Pt100 (DIN IEC 751) Pt100 (JIS C1604/ α=0.00392 Ω/K) Ni100 (DIN 43 760) Cu100 Multiples or parts of specified basic values (e.g. Pt500, Cu25) parameterizable
• Characteristic	Temperature or resistance-linear
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Averaging connection	Several resistance thermometers connected in series or parallel to produce average temp. or to adapt to other basic values. e.g. Pt1000 n=10, Cu25 n=0.25
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit; operating temperature can be parameterized
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω

Resistance-based sensor, potentiometer

• Measured variable	Ohmic impedance
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω
• Start of scale	0 to 3141 Ω
• Full scale	3150 Ω
• Characteristic	Resistance-linear or according to a parameterizable linearization function
• Type of connection	
- Normal connection	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω

Thermocouple

• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	4 to 140 mV
• Sensor type	Type B: Pt30%Rh/Pt6%Rh (DIN IEC 584) 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 43 710) 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 43 710) Ni-NiMo (GE) Additional thermocouples can be parameterized by the customer.
• Characteristic	Temperature-linear or voltage-linear
• Type of connection	
- Normal connection	One thermocouple, internal or external temperature compensation
- Averaging connection	Several thermocouples connected in series to produce average temperature, internal or external temperature compensation
- Differential connection	Two identical thermocouples to produce temperature difference, temperature compensation not necessary; operating temperature parameterizable
• Temperature compensation	Internal or external
- Internal	Cold junction terminal option 7NG3090-8AV required (plug-in screw terminal with integrated Pt100)
- External	Temperature of external temperature compensation parameterizable

mV sensors

• Measured variable	DC voltage
• Measuring range	Parameterizable in following ranges: -59 to +81 mV, -20 to +120 mV -39 to +100 mV, 0 to +140 mV
• Measuring span (maximal)	4 to 140 mV
• Start of scale	-59 to +136 mV
• Full scale	140 mV
• Characteristic	Voltage-linear or according to a parameteriz. linearization function
• Overload capacity of inputs	±3.5 V
• Input resistance	≥1 MΩ

V, µA, mA, A sensors
(without sensor breakage monitor.)

• Measured variable	DC voltage / DC current
• Measuring range	Parameterizable The voltage drop on the input impedance R15 or shunt resistance R11 should correspond to the measuring ranges of the mV sensor.
• Characteristic	Voltage or current-linear or according to a parameterizable linearization function
• Voltage measurement > 140 mV	Internal voltage divider with series resistance R12 and input impedance R15
• Current measurement	Internal shunt resistance R11

Technical data (continued)

Input (continued)

Order No. 7NG304■	Measuring span	Start of scale	Full scale	R12 MΩ	R15 kΩ	R11 Ω
- ■■■15	0.04 to 1.54 V	-0.5 to +1.5 V	1.54 V	0.1	10	-
- ■■■25	0.4 to 14.14 V	-5 to +13.74 V	14.14 V	1	10	-
- ■■■35	4 to 140.14 V	-50 to +136.14 V	140.14 V	1	1	-
- ■■■45	4 to 140 µA	-50 to +136 µA	140 µA	-	-	1000
- ■■■55	0.04 to 1.4 mA	-0.5 to +1.36 mA	1.40 mA	-	-	100
- ■■■65	0.40 to 14 mA	-5.0 to +13.6 mA	14.0 mA	-	-	10
- ■■■75	4 to 140 mA	-50 to +136 mA	140 mA	-	-	1
- ■■■85	0.04 to 1.00 A	-0.5 to +0.96 A	1.00 A	-	-	0.1

Common data	
• Characteristic	The parameterizable characteristic is generated by joining together up to 14 first, second or third degree polynominals. The starting point is defined for every polynomial.
• Sensor fault monitoring	Monitoring all terminations for breakages and short-circuits (function can be disabled)
• Response/drop threshold	≤3 kΩ/≥1.5 kΩ loop resistance
• Output following sensor fault	To full scale, to start of scale, retain most recent value, parameterizable safety value, no monitoring
• Temperature unit	°C, K, °F, °R parameterizable (°R (Rankine) = absolute °F)

Output

Output signal	0/4 to 20 mA, can be recon. to 0 to 10 V
• Nominal range 0 to 20 mA	≙ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.25 to +21.0 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.50 to +21.5 mA (=-2.5 to +107.5%), parameterizable
Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 4 to 20 mA	≙ 0 to 100%
- Resolution	4700 steps (0 to 100%)
- Overrange	3.8 to +20.8 mA (=-1.25 to +105.0%)
- Output range following sensor fault	-0.5 to +21.5 mA (=-28.1 to +109.7%), parameterizable
Impedance	≤ 650 Ω
- No-load voltage	≤ 25 V
• Nominal range 0 to 10 V	≙ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	-0.125 to +10.5 V (=-1.25 to +105.0%)
- Output range following sensor fault	-0.25 to +10.75 V (=-2.50 to +107.5%), parameterizable
Load resistance	≥ 1 kΩ
- Short-circuit current	≤ 40 mA
• Residual ripple U_{PP}/I_{PP}	≤ 1%, measured across a 1 MHz band
• Response time	
- Sample cycle	100 ms
• Electrical damping	
- Adjustable time constant T_{99}	0 to 100 s, parameterizable (software filter with 1st order delay)
Sensor fault/limit signalling	Relay output or electronic output
• Relay output	Break circuit with 1 CO contact
- Switching capacity	≤ 90 W, ≤ 150 VA
- Switching voltage	≤ UC 75 V
- Switching current	≤ UC 2 A
• Electronic output	Active during normal operation
- Operating output	U_H = 18 to 75 V
- Residual volt, when I_L=10 mA	U_0≤ 4.5 V
- Operating current	I_L ≤ 15 mA
- Short-circuit current	I_K ≤ 70 mA
• Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
• Limit monitoring	lower and upper limit - window (combination of lower and upper limits); - window (combination of lower and upper limits); Limit and sensor fault monitoring can be combined
• Hysteresis	Parameterizable

Accuracy

Measurement error	Sum of input error thresholds, output error thresholds and internal temperature compensation errors (if known)

Input error thresholds

Sensor	Range	Input error tolerance1) with compensation	without2) compensation
• Resistance thermometer			
- Pt100	-200 to 150 °C	±0.08 K	±0.15 K
	-200 to 620 °C	±0.18 K	±0.35 K
	-200 to 850 °C	±0.33 K	±0.70 K
- Pt500	-200 to 110 °C	±0.07 K	±0.16 K
	-200 to 400 °C	±0.43 K	±0.88 K
	-200 to 850 °C	±0.75 K	±1.54 K
- Pt1000	-200 to 200 °C	±0.25 K	±0.56 K
	-200 to 600 °C	±0.75 K	±1.10 K
- Ni100	-60 to 90 °C	±0.04 K	±0.10 K
	-60 to 250 °C	±0.07 K	±0.14 K
- Cu100	-50 to 140 °C	±0.06 K	±0.12 K
	-50 to 180 °C	±0.10 K	±0.20 K
• Resistance-based sensor	0 to 160 Ω	±0.03 Ω	±0.06 Ω
	0 to 320 Ω	±0.06 Ω	±0.12 Ω
	0 to 710 Ω	±0.13 Ω	±0.33 Ω
	0 to 3160 Ω	±2.17 Ω	±3.58 Ω
• Thermocouples			
- Type B: Pt30%Rh/Pt6%Rh	400 to 1000 °C	±2.50 K	±2.95 K
	1000 to 1820 °C	±1.00 K	±1.32 K
- Type E: NiCr/CuNi	-200 to 0 °C	±0.40 K	±0.48 K
	0 to 500 °C	±0.18 K	±0.20 K
	500 to 1000 °C	±0.15 K	±0.16 K
- Type J: Fe/CuNi	-210 to 0 °C	±0.50 K	±0.63 K
	0 to 1200 °C	±0.20 K	±0.24 K
- Type K: NiCr/Ni	-180 to 0 °C	±0.50 K	±0.64 K
	0 to 1370 °C	±0.30 K	±0.35 K
- Type L: Fe-CuNi	-200 to 0 °C	±0.40 K	±0.42 K
	0 to 900 °C	±0.20 K	±0.25 K
- Type N: NiCrSi-NiSi	-180 to 0 °C	±0.90 K	±0.96 K
	0 to 500 °C	±0.40 K	±0.46 K
	500 to 1300 °C	±0.30 K	±0.33 K
- Type R: Pt13%Rh/Pt	-50 to 0 °C	±2.50 K	±3.24 K
	0 to 500 °C	±1.80 K	±2.27 K
	500 to 1000 °C	±1.00 K	±1.11 K
	1000 to 1760 °C	±0.80 K	±0.91 K
- Type S: Pt10%Rh/Pt	-50 to 0 °C	±2.50 K	±3.03 K
	0 to 500 °C	±1.80 K	±2.22 K
	500 to 1760 °C	±1.10 K	±1.21 K
- Type T: Cu/CuNi	-200 to 0 °C	±0.60 K	±0.76 K
	0 to 400 °C	±0.25 K	±0.31 K
- Type U: Cu-CuNi	-200 to 0 °C	±0.50 K	±0.63 K
	0 to 600 °C	±0.25 K	±0.30 K
Ni-NiMo	0 to 700 °C	±0.23 K	±0.32 K
	700 to 1310 °C	±0.19 K	±0.23 K
• Voltage source	-60 to +140 mV	±10 µV	±12 µV

Error threshold of output signal	±0.05 % of measuring span
Internal temperature comp. error	≤0.5 K

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1) Includes temperature sensor linearization error.
2) Following change in measuring range or type of sensor.

Technical data (continued)

Accuracy (continued)	
Influencing effects	Referred to nominal current I_{AN}=20 mA nominal voltage U_{AN}=10 V
• of ambient temperature	
- during resistance measurement	
on start of scale	≤ (0.05 + 0.015 · (R_{Anf}/ΔR))%/10K
on span	≤ 0.16%/10K
- during voltage measurement	
on start of scale	≤ (0.05 + 0.05 · (U_{Anf}/ΔU))%/10K
on span	≤ 0.2%/10K
Additional influence	
- with internal cold junction compensation	≤ 0.1 K/10 K (temperature measurement using thermocouples)
- with internal voltage divider	≤ 0.05 %/10 K (voltage measurement > 140 mV)
- with internal shunt	≤ 0.025 %/10 K (current measurement)
• of load with current output	≤ 0.1% for a change from 50 to 650 Ω
• of load with voltage output	≤ 0.1% with a change of load current from 0 to 10 mA
• of power supply	≤ 0.05% within supply tolerance range
• of power supply	≤ 0.02%/10 Ω
• long term effect on span and start of scale	≤ 0.03%/month
Rated operating conditions	
Ambient conditions	
• Permitted ambient temperature	
- Operating temperature	-10 to +65 °C
- Functional temperature	-25 to +70 °C
- Storage temperature	-40 to +85 °C
• Climatic category	HSF, DIN 40 040
- Relative humidity	5 to 95%, no condensation
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-1
- Emitted interference	According to EN 50 081-2
• Degree of protection to EN 60 529	IP 00
Design	
Weight	Approx. 0.3 kg
Enclosure material	PBT, glass-fibre reinforced
Electrical connection / process connection	Plug connector, type F DIN 41 612 32 way, rows b and z
Displays and controls	
• Calibration pushbutton function	Line compensation for resistance measurement in two-wire circuit, calibration of start of scale and full scale. Function can be disabled during parameterization.
• Parameterization	Using TransWin program (page 2/36) and serial interface
• Serial interface	
- Function	Parameterizing and interrogating of operating data
- Interface	Via online or offline V.24/V.28 (RS 232) parameterizing adapter
• Test sockets (front)	Monitoring output signal with a measuring instrument; permitted internal resistance of meas. instrument for current output ≤ 15 Ω

Power supply	
• Universal power pack	24 V AC/DC
• Tolerance ranges	
- Power supply	18 to 60 V DC (uninterruptible from 20.4 V upwards; 20 ms) 20.4 to 41.4 V AC
- Mains frequency	47 to 63 Hz
• Power consumption	
- 24 V AC	Approx. 1.8 W/2.2 VA
- 24 V DC	Approx. 1.4 W
Electrical isolation	All circuits (input/output/power supply/sensor fault and limit monitor) are electrically isolated
• Test voltages	
- Input against output, power supply and sensor fault/limit monitor	U_{rms} = 4 kV, 50 Hz, 1 min
- Power supply against output and sensor fault/limit monitor	
Output against sensor fault/limit monitor	U_{rms} = 500 V, 50 Hz, 1 min
• Permitted impulse voltages	
- Input against output, power supply and sensor fault/limit monitor	$\hat{u}$ = ±1.5 kV, 1 µs/50 µs, R_i = 500 Ω
- Power supply against output and sensor fault/limit monitor	
Output against sensor fault/limit monitor, series mode voltage to all inputs and outputs	$\hat{u}$ = ±500 V, 1 µs/50 µs, R_i = 500 Ω
External standards and guidelines	
Insulation	
• Protection of input circuit against all the other circuits	Functional extra-low voltage with safe isolation to VDE 0100 part 410
• Protection of all the other circuits against input circuit	250 V AC, overvoltage class III to VDE 0100 part 410
Protective measures	DIN 57 411 / VDE 0411 part 1

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-0
Four-wire system / ES 902 packaging system

Ordering information

The order number structure shown below is used to specify a fully functioning transmitter.

The stock items can be easily adapted to the measuring task by the user himself. Usually the adaptation is carried out using the TransWin software for parameterization and possibly by changing plug-in jumpers and installation of accessory devices. Thus the stock items of the SITRANS T transmitter have the shortest delivery time and are the low-price versions of the SITRANS T transmitter.

The parameterization of operating data (sensor type, measuring range, characteristic etc.) takes place as follows:

- Parameters preset in factory.
  A list of the parameters as set in the factory is shown on pages 2/24 and 2/25. The presets can be modified by the customer to match the requirements precisely.
- Parameterization defined in the order.
  Add "–Z" and the order code "Y01" to the order number.
  The parameterization required can be selected from the list shown on pages 2/24 and 2/25. Only specify codes A ▪▪ to J ▪▪ for parameters that deviate from the factory settings.
  The factory setting will be used for any parameters that are not specified.

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

Ordering examples

Customer requirement	Ordering data	Standard parameter
Example 1: Four-wire transmitter		
- ES 902 printed circuit board		
- output signal 0/4 to 20 mA		
- without sensor fault/limit monitor		
- input for temperature sensor		
- input in three-wire system	7NG3040-0JN02 (stock item)	
Sensor PT100, three-wire circuit		X
Measuring range 0 to 150 °C		X
Characteristic rising, temperature-linear		X
Output 4 to 20 mA		X
Response to sensor breakage to full scale		X
Example 2: Four-wire transmitter		
- ES 902 printed circuit board		
- output signal 0 to 10 V		
- without sensor fault/limit monitor		
- input for temperature sensor		
- internal cold junction	7NG3040-0UN04-Z	
rating plate in English	Y01 + S76	
Sensor NiCr/Ni, type K	AA2	
Cold junction internal		X
Measuring range 0 to 900°C	EB8	
Characteristic rising, temperature-linear		X
Accessories: cold junction terminal,	7NG3090-8AV	
cold junction connection module	7NG3090-8AA	
Example 3: Four-wire transmitter		
- ES 902 printed circuit board		
- output signal 0/4 to 20 mA		
- without sensor fault/limit monitor		
- input for DC voltage 0 to 1 V	7NG3040-0JN15-Z Y01	
Sensor voltage signal	AE0	
Measuring range 0 to 1 V		X
Characteristic falling, sensor proportional	FA1	
Filter period 15 s	GS0	
Output 0 to 20 mA	HB3	
(no monitoring)	GS0: T99 = 15 s	

🟦 Stock items

Ordering data

Ordering data	Order No.
SITRANS T universal transmitter for ES 902 packaging system in four-wire circuit for temperature, resistance, DC voltage and DC current	7NG3040 - 0 ▪ ▪ ▪ ▪
Output signal (adjusted/ selectable to)	
• 0/4 to 20 mA / 0 to 10 V	J
• 0 to 10 V / 0/4 to 20 mA	U
Sensor fault/limit monitor	
• Not present (can be retrofitted)	N
• Relay with CO contact	B
• Electronic output	C
Input for temperature sensor, resistance-based sensor and mV sensor	
• Input for resistance thermometer and resistance-based sensor	
- 4-wire system	0 1
- 3-wire system and differential circuit	0 2
- 2-wire system and averaging circuit	0 3
• Input for thermocouple	
- Internal cold junction [1]	0 4
- External cold junction or mV sensor for voltages up to 140 mV	0 5
Input for higher voltages; for currents, input with additional circuitry	
•for DC voltage [2], measuring span	
0.04 to 1.5 V	1 5
0.4 to 14.0 V	2 5
4 to 140 V	3 5
•for DC current [2], measuring span	
4 to 140 µA	4 5
0.04 to 1.4 mA	5 5
0.4 to 14 mA	6 5
4 to 140 mA	7 5
0.04 to 1 A	8 5
Suffixes	**Order code**
Add "-Z" and the order code to the order number and specify any plain text (see pages 2/24 and 2/25).	
Parameterization specified in order	**Y01**
Language of rating plate (together with Y01 order code only)	
• Italian	**S72**
• English	**S76**
• French	**S77**
• Spanish	**S78**
Accessories (if required)	**Order No.**
Sensor fault/limit monitor	
• With relay output	**7NG3090-8AB**
• With electronic output	**7NG3090-8AC**
Cold junction terminal	**7NG3090-8AV**
Cold junction connection module 2 cold junction terminals with 1 end holder	**7NG3090-8AA**
End holder	**W73078-Z10**
Coding strip with 2 coding nipples	**W73070-Z53**
Off-line parameterization adapter	**7NG3090-8AK**
On-line parameterization adapter for parameterization during operation	**7NG3090-8EK**
TransWin program (see page 2/36)	**7NG3080-8CA**
Conversion kit for SITRANS TT One resistor each of 0.1 Ω, 1.0 Ω, 10.0 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ and one capacitor for 115 V AC power pack	**7NG3090-8AW**
Operating instructions for SITRANS T (7NG3040-0, German/English, included in scope of supply)	**C73000-B7174-C158**

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[1] The cold junction terminal and cold junction connection module are to be ordered separately

[2] Without sensor breakage monitoring.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3040-0
Four-wire system / ES 902 packaging system

Parameter list (coded text A■■ to J■■)

■ Parameters set in factory

Order No. with order code: 7NG3040 - 0■■■■-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A■■ + B■■ to J■■ ■■■ + ■■■ + ■■■ + ■■■ + ■■■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo (GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**

Connection		
Normal	n 3) = 1	**BA1**
Averag. 4)	n = 2	**BA2**
	n = 3	**BA3**
	n = 4	**BA4**
	n = 5	**BA5**
	n = 6	**BA6**
	n = 7	**BA7**
	n = 8	**BA8**
	n = 9	**BA9**
	n = 10	**BB0**
Differential 12)		**BS0**

Cold junction compensation		
internal 6)		**CA3**
external		
	0 °C	**CB0**
	20 °C	**CB2**
	50 °C	**CB5**
	60 °C	**CB6**
	70 °C	**CB7**
Others 12)		**CS0**

Measuring ranges	
-30 to +60 °C	**EA0**
-20 to +20 °C	**EA1**
0 to 40 °C	**EA2**
0 to 60 °C	**EA3**
0 to 80 °C	**EA4**
0 to 100 °C	**EA5**
0 to 120 °C	**EA6**
0 to 150 °C	**EA7**
0 to 200 °C	**EA8**
0 to 250 °C	**EA9**
0 to 300 °C	**EB0**
0 to 350 °C	**EB1**
0 to 400 °C	**EB2**
0 to 450 °C	**EB3**
0 to 500 °C	**EB4**
0 to 600 °C	**EB5**
0 to 700 °C	**EB6**
0 to 800 °C	**EB7**
0 to 900 °C	**EB8**
0 to 1000 °C	**EB9**
0 to 1200 °C	**EC0**
0 to 1400 °C	**EC1**
0 to 1600 °C	**EC2**
0 to 1800 °C	**EC3**
50 to 100 °C	**EC4**
50 to 150 °C	**EC5**
100 to 200 °C	**EC6**
100 to 300 °C	**EC7**
100 to 400 °C	**EC8**
200 to 300 °C	**EC9**
200 to 400 °C	**ED0**
200 to 500 °C	**ED1**
300 to 600 °C	**ED2**
500 to 1000 °C	**ED3**
600 to 1200 °C	**ED4**
800 to 1600 °C	**ED5**
Other ranges 12)	**ES0**

Resistance thermometer 1) (R_{max} + R_L < 1140 (3150) Ω 2))		
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**

Connection		
Normal	n 3) = 1	**BA1**
Averag. 5) n		
	n = 2 to	**BA2**
	n = 10	**BB0**
	Others 12)	**BS1**
Differential 12)		**BS2**

Connection		Line resistance 7)	
Two-wire	**CA2**	0 Ω	**DA0**
Three-wire	**CA3**	10 Ω	**DA1**
Four-wire	**CA4**	20 Ω	**DA2**
		100 Ω	**DB1**
		Others 12)	**DS0**

Resistance-based sensor, potentiometer (R_{max} + R_L < 1140 (3150) Ω 2))	
	AD0

Connection		
Normal	n 3) = 1	**BA1**
Differential 12)		**BS3**

Connection		Line resistance 7)	
Two-wire	**CA2**	0 Ω	**DA0**
Three-wire	**CA3**	10 Ω	**DA1**
Four-wire	**CA4**	20 Ω	**DA2**
		100 Ω	**DB1**
		Others 12)	**DS0**

Measur. ranges	
0 to 100 Ω	**EE1**
0 to 200 Ω	**EE2**
0 to 500 Ω	**EE5**
0 to 1000 Ω	**EF1**
Other ranges 12)	**ES1**

mV sensor (V, µA, mA, A sensor 10)) **AE0**

Measuring range for Order No. 7NG 304 0 - 0■■■5

0 mV	1 11) V	2 11) V	3 11) V	4 11) µA	5 11) mA	6 11) mA	7 11) mA	8 11) A	
-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-0.5 to +0.5	**EG0**
-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-0.2 to +0.2	**EG1**
-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-0.1 to +0.1	**EG2**
0 to 10	0 to 0.1	0 to 1	0 to 10	0 to 10	0 to 0.1	0 to 1	2 to 10	0 to 0.1	**EG3**
0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 0.2	**EG4**
0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 0.5	**EG5**
0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 1.0	**EG6**
		1 to 5	2 to 10			1 to 5	4 to 20		**EG7**
Other ranges 12)									**ES2**

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1) For other basis values see Connection Averaging (e.g. Pt500: *n* = 5 ≙ BA5).

2) With 4-wire connection no sensor fault monitoring.

3) *n* = number of sensors to be connected.

4) The sum of the thermovoltages must not exceed 140 mV.

5) The sum of the resistances must not exceed 3150 Ω.

6) The cold junction terminal 7NG3090-8AV must be ordered separately.

7) For 2-wire connection the indicated loop resistance must be obeyed or determined by calibration; for 3 and 4-wire connection the expectable maximum value per wire has to be stated.

10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).

11) Without sensor fault monitoring.

12) See page 2/26 for operational data and special parameters.

Parameter list (coded text A■■ to J■■) (continued)

■ Parameters set in factory

Order No. with order code: 7NG3040 - 0■■■■-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A■■ + B■■ to J■■   ■■■ + ■■■ + ■■■ + ■■■ + ■■■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo(GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**

Resistance thermometer [1]
($R_{max} + R_L < 1140$ (3150) Ω [2])

Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**

Character.	
temperature-linear, rising	**FA0**
temperature-linear, falling	**FA1**
sensor proportional, rising	**FA2**
sensor proportional, falling	**FA3**

Resistance-based sensor, potentiometer ($R_{max} + R_L < 1140$ (3150) Ω [2])	**AD0**

Characteristic	
sensor proportional, rising	**FA0**
sensor proportional, falling	**FA1**
programmed rising or falling [12]	**FS0**

mV sensor (V, µA, mA, A sensor [10])	**AE0**

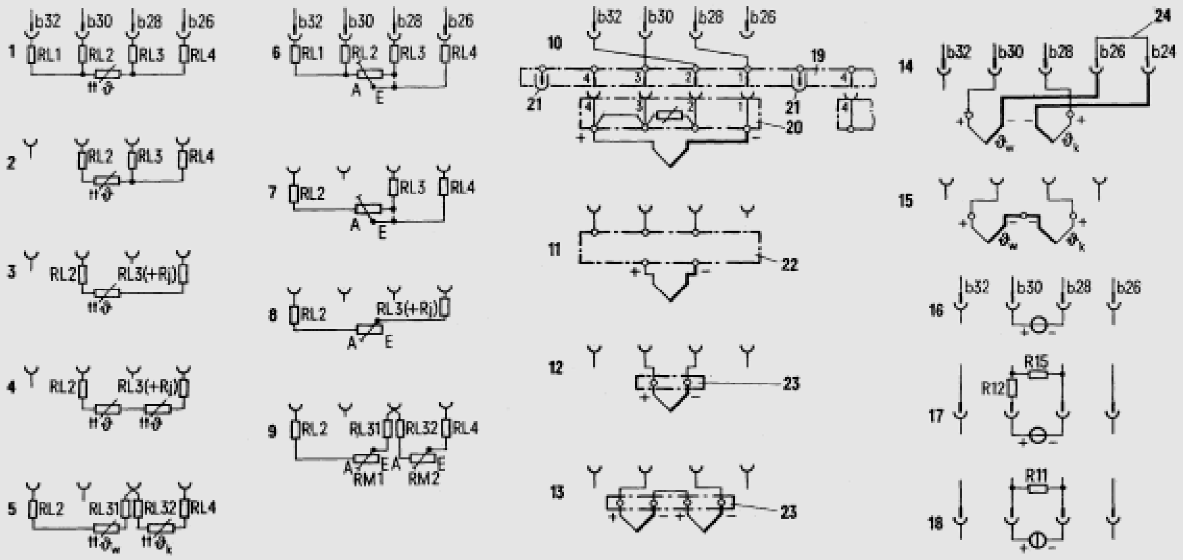
Filter period [8]	
0 s	**GA0**
0.1 s	**GA1**
0.2 s	**GA2**
0.5 s	**GA3**
1 s	**GA4**
2 s	**GA5**
5 s	**GA6**
10 s	**GA7**
20 s	**GA8**
50 s	**GA9**
100 s	**GB0**
Other values [12]	**GS0**

Output signal	
4 to 20 mA following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring [12]	**HA3**
- safety value [12]	**HS0**
0 to 20 mA following sensor fault	
- to full scale	**HB0**
- to start of scale	**HB1**
- retain most recent val.	**HB2**
- no monitoring [12]	**HB3**
- safety value [12]	**HS1**
0 to 10 V following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring [12]	**HA3**
- safety value [12]	**HS2**

Basic functions	
Mains filter [9]	
50 Hz	
Calibr. pushb.	
- disabled	**JF0**
- enabled	**JF1**
60 Hz	
Calibr. pushb.	
- disabled	**JG0**
- enabled	**JG1**

---

[1] For other basis values see Connection Averaging (e.g. Pt500: n = 5 ≙ BA5).
[2] With 4-wire connection no sensor fault monitoring.
[8] Software filter for smoothing result.
[9] Filter to suppress mains interference on the input.
[10] Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
[12] See page 2/26 for operational data and special parameters.

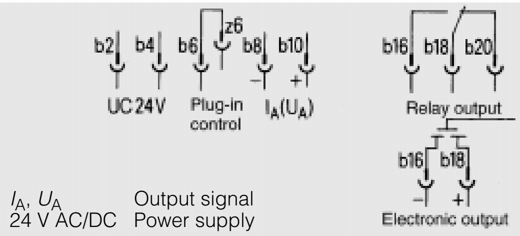


1 Resistance thermometer in four-wire circuit
2 Resistance thermometer in three-wire circuit
3 Resistance thermometer in two-wire circuit
4 Resistance thermometer in averaging circuit
5 Resistance thermometer in differential circuit
6 Resistance-based sensor in four-wire circuit
7 Resistance-based sensor in three-wire circuit
8 Resistance-based sensor in two-wire circuit
9 Resistance-based sensor in differential circuit
10 Thermocouple with internal cold junction 7NG3090-8AV
11 Thermocouple with internal cold junction C73458-A27-B30
12 Thermocouple with external cold junction
13 Thermocouples in averaging circuit with external cold junction
14 Thermocouples in differential circuit
15 Thermocouples in differential circuit
16 DC voltage source (full scale < 140 mV)
17 DC voltage source (full scale > 140 mV)
18 DC current source
19 Cold junction connection module 7NG3090-8AA
20 Cold junction terminal 7NG3090-8AV
21 Dummy part
22 Cold junction terminal C73458-A27-B30
23 External temperature compensation
24 Internal connection
ϑ_W Warmer measuring point
ϑ_K Cooler measuring point
R11 Shunt resistance (internal)
R12 Series resistance (internal)
R15 Input resistance (internal)

Fig. 2/13 Connection diagram for input signal

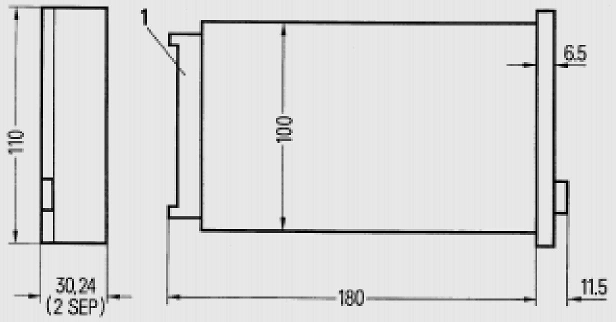
Special parameters

Code	Text	Options
BS0	TA=...	Working point T_a for differential temperature measurement using thermocouples
BS1	N=...	Factor n for multiplication with the basic values of the resistance thermometers or thermocouples Example: 3 x Pt500 parallel: BS1: N=1.667
BS2	TA=...	Working point T_a for differential temperature measurement using resistance thermometers
	N=...	Number n of resistance thermometers in each branch
	TMAX=...	Max. temperature T_{max} (total of temperatures in both branches)
BS3	RMAX=...	Max. sum of the resistances of both branches R_{max}
CS0	TV=...	Temperature T_v of external cold junction
DS0	RL=...	Line resistance R_L (resistance thermometer or potentiometer with 2-wire connection: loop resistance; with 3-wire and 4-wire connection: expectable maximum value per line)
ES0	MA=...	Start of scale Ma for resistance thermometer/ thermocouples
	ME=...	Full scale Me for resistance thermometer/thermocouples
	D=...	Unit (°C, K, °F, °R (°R (Rankine) = abs. °Fahrenh.)
ES1	MA=...	Start of scale Ma for resistance-based sensor/ potentiometer
	ME=...	Full scale Me for resistance-based sensor/ potentiometer
ES2	MA=...	Start of scale Ma for mV, V, µA, mA and A sensor
	ME=...	Full scale Me for mV, V, µA, mA and A sensor
	D=...	Unit (mV→MV, V, µA→UA, mA→MA,A)
FS0	E1=... A1=... EN=... AN=...	Pair of values E_n, A_n for user-specific characteristic (Up to 50 pairs can be specified.) E_n: input (mV or Ω) A_n: output (any unit)
	F=...	Approximation function F: L = linear; Q = quadratic; C = cubic
	K=...	Direction of action of characteristic S = rising; F = falling
GS0	T99=...	Response time T_{99} of software filter (0 to 100 s)
HS0	S=...	Safety output value S following sensor fault (output 4 to 20 mA)
HS1	S=...	Safety output value S following sensor fault (output 0 to 20 mA)
HS2	S=...	Safety output value S following sensor fault (output signal 0 to 10 V)



I_A, U_A Output signal
24 V AC/DC Power supply

Fig. 2/14 Connection diagram for power supply and outputs



1 Plug connector, type F DIN 41 612, 32 way

Fig. 2/15 Dimensions of ES 902 printed circuit board

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3020 and 7NG3022
Two-wire system / Mounting rail assembly

Fig. 2/16 SITRANS T transmitter for rail mounting

Application

"Intelligent" transmitter with universal input circuit for connecting to the following sensors:

- Resistance thermometers
- Thermocouples
- Resistance-based sensors/potentiometers
- DC voltage sources
- DC current sources

One transmitter is suitable for the connection of all sensors. The input signal is converted into a standard signal 4 to 20 mA.

Features

- Two-wire transmitter
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Plug-in screw terminals for electrical connections
- All circuits electrically isolated
- Explosion proof to EEx ib [ia] IIC P5/P6 (7NG3022)
- Measuring ranges and operating parameters freely selectable
- Temperature-linear characteristic can be selected for all temperature sensors
- User-specific characteristics
- Automatic correction of zero point
- Output signal clearly indicates mode of operation
  - normal operation
  - overrange
  - sensor fault
- Optional sensor fault/limit monitor (pluggable)

Mode of operation (Fig. 2/17)

Transmitter operation can be broken down into the following function blocks and individual functions:

- Input
  - Input terminals (2)
  - Multiplexer (3)
  - Amplifier (4)
  - Constant current source (1) for resistance measurements
  - Calibration circuit (9) for drift compensation
- Microcontroller (10)
  - Analog/digital converter (5)
  - Adjustable low-pass filter (6) for smoothing of result
  - Linearization function (7) for non-linear characteristics
  - Output with pulse width modulation (8) proportional to measured signal

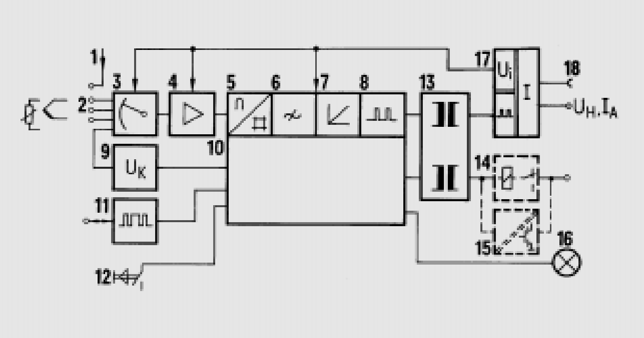


Fig. 2/17 Block diagram (see mode of operation for 1 to 18)

- Output
  - Signals electrically isolated (13)
  - Output module (17) containing pulse width/analog converter
  - Test sockets (18) for monitoring output signal
  - Optional sensor fault/limit monitor with relay (14) or NAMUR output (15)
- Controls and displays
  - Serial interface (11) for setting and interrogating parameters
  - Calibration push-button (12) for calibration of resistance measurements in two-wire circuits and trimming of start of scale/full scale values
  - Green LED (16) showing operational status (constant) or sensor fault or system malfunction (flashes)

Parameterization

The following parameters can be set and interrogated via the serial interface:

- Type of sensor, e.g. Pt100 resistance thermometer or NiCr/Ni thermocouple, type K
- Measuring range
- Internal or external temperature compensation for thermocouples
- 2, 3 or 4-wire circuit for resistance thermometer and resistance-based sensor
- Reaction to sensor fault (short-circuit or line breakage), e.g. output signal forced to start of scale or full scale value
- Transmitter characteristic, e.g. voltage or temperature-linear
- Rising or falling characteristic
- Response time of transmitter
- Limits with hysteresis

The parameters are stored in a non-volatile memory (EEPROM).

The following are required during parameterization:

- Transmitter
- Off-line or on-line parameterization adapter
- Personal computer (PC)
- TransWin 7NG3080-8CA software package
- Printer for printing of rating plate and report

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3020 and 7NG3022
Two-wire system / Mounting rail assembly

Technical data

Input

Resistance thermometer	
• Measured variable	Temperature
• Measured range	Parameterizable
• Measured span	9 to 3150 Ω (9 Ω corresponds to approx. 25 °C for Pt100)
• Sensor type	Pt100 (DIN IEC 751) Pt100 (JIS C1604/ α=0.00392 Ω/K) Ni100 (DIN 43 760) Cu100 Multiples or parts of specified basic values (e.g. Pt500, Cu25) parameterizable
• Characteristic	Temperature-linear or resistance-linear
• Type of connection	
- Normal conneciton	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Averaging connection	Several resistance thermometers connected in series or parallel to produce average temp. or to adapt to other basic values z.B. Pt1000 n=10, Cu25 n=0.25
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit; operating temperature can be parameterized
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω

Resistance-based sensor, potentiometer	
• Measured variable	Ohmic impedance
• Measuring range	Parameterizable
• Measuring span	9 to 3150 Ω
• Start of scale	0 to 3141 Ω
• Full scale	3150 Ω
• Characteristic	Resistance-linear or according to a parameterizable linearization function
• Type of connection	
- Normal conneciton	One resistance-based sensor in two, three or four-wire circuit
Two-wire circuit	Parameterized line resistance or line calibration using calibration pushbutton
Three-wire circuit	No line calibration necessary provided that $R_{L2} = R_{L4}$
Four-wire circuit	No calibration necessary
- Differential connection	Two identical resistance-based sensors to produce temperature difference in two-wire circuit
• Measured current	0.05 to 0.34 mA (depends on measuring range)
• Line resistance R_L	≤ 100 Ω

Thermocouple	
• Measured variable	Temperature
• Measuring range	Parameterizable
• Measuring span	4 to 140 mV
• Sensor type	Type B: Pt30%Rh/Pt6%Rh (DIN IEC 584) 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 43 710) 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 43 710) Ni-NiMo (GE) Additional thermocouples can be parameterized by the customer.
• Characteristic	Temperature-linear or voltage-linear
• Type of connection	
- Normal connection	One thermocouple, internal or external temperature compensation
- Averaging connection	Several thermocouples connected in series to produce average temperature, internal or external temperature compensation
- Differential connection	Two identical thermocouples to produce temperature difference, temperature compensation not necessary; operating temperature parameterizable
• Temperature compensation	internal or external
- Internal	Cold junction terminal option 7NG3090-8AV required (plug-in screw terminal with integrated Pt100)
- External	Temperature of external temperature compensation parameterizable

mV sensors	
• Measured variable	DC voltage
• Measuring range	Parameterizable in following ranges: -59 to +81 mV, -20 to +120 mV -39 to +100 mV, 0 to +140 mV
• Measuring span (maximal)	4 to 140 mV
• Start of scale	-59 to +136 mV
• Full scale	140 mV
• Characteristic	Voltage-linear or according to a parameterizable linearization function
• Overload capacity of inputs	±3.5 V
• Input resistance	≥1 MΩ

V, µA, mA, A sensors (without sensor breakage monitoring)	
• Measured variable	DC voltage / DC current
• Measuring range	Parameterizable, the voltage drop on the input impedance R15 or shunt resistance R11 should correspond to the measuring ranges of the mV sensor.
• Characteristic	Voltage or current-linear or according to a parameterizable linearization function
• Voltage measurement > 140 mV	Internal voltage divider with series resistance R12 and input impedance R15
• Current measurement	Internal shunt resistance R11

Technical data (continued)

Input (continued)

Order No. 7NG302■	Measuring span	Start of scale	Full scale	R12 MΩ	R15 kΩ	R11 Ω
-■■■10	0..04 toto 1.54 V	-0.5 to +1.5 V	1.54 V	0.1	10	-
-■■■20	0.4 to 14.14 V	-5 to +13.74 V	14.14 V	1	10	-
-■■■30	4 to 140.14 V	-50 to +136.14 V	140.14 V	1	1	-
-■■■40	4 to 140 µA	-50 to +136 µA	140 µA	-	-	1000
-■■■50	0.04 to 1.4 mA	-0.5 to +1.36 mA	1.40 mA	-	-	100
-■■■60	0.40 to 14 mA	-5.0 to +13.6 mA	14.0 mA	-	-	10
-■■■70	4 to 140 mA	-50 to +136 mA	140 mA	-	-	1
-■■■80	0.04 to 1.00 A	-0.5 to +0.96 A	1.00 A	-	-	0.1

Common data	
• Characteristic	The parameterizable characteristic is generated by joining together up to 14 first, second or third degree polynominals. The starting point is defined for every polynomial.
• Sensor fault monitoring	Monitoring all terminations for breakages and short-circuits (function can be disabled)
• Response/drop threshold	≤3 kΩ/≥1.5 kΩ loop resistance
• Output following sensor fault	To full scale, to start of scale, retain most recent value, parameterizable safety value, no monitoring
• Temperature unit	°C, K, °F, °R parameterizable (°R (Rankine) = absolute °F)

Output

Output signal	Standard DC current
• Nominal range 4 to 20 mA	≙ 0 to 100%
- Resolution	5888 steps (0 to 100%)
- Overrange	3.8 to +20.8 mA (=-1.25 to +105.0%)
- Output range following sensor fault	3.6 to +21.2 mA (=-2.5 to +107.5%), parameterizable
• Internal residual ripple I_{PP}	≤ 1%, measured across a 1 MHz band
• Ripple cause by pulsating supply voltage	≤ 70 µA/V (47 to 125 Hz)
• Response time	
- Sample cycle	100 ms
• Electrical damping	
- Adjustable time constant T_{99}	0 to 100 s parameterizable (software filter with 1st order delay)

Sensor fault/limit signalling	Relay output or NAMUR output
• Relay output	Break circuit with 1 CO contact (not to be used with 7NG3022)
- Switching capacity	≤ 90 W, ≤ 150 VA
- Switching voltage	≤ UC 75 V
- Switching current	≤ UC 2 A
• NAMUR output to DIN 19 234 for connection to switching amplifier with	Active during normal operation
- Open-circuit voltage	≤ 12 V
- Short-circuit voltage	≤ 16 mA
- Operating points Disabled	≤ 1.2 mA
Active	≤ 2.1 mA
• Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
• Limit monitoring	Freely parameterizable are: - lower and upper limit - window (combination of lower and upper limits) Limit and sensor fault monitoring can be combined
• Hysteresis	Freely parameterizable

Accuracy

Measurement error	Sum of input error thresholds, output error thresholds and internal temperature compensation errors (if known)
Input error thresholds	

Sensor	Range	Input error tolerance[1]	
		with compensation	without[2] compensation
• Resistance thermometer			
- Pt100	-200 to 150 °C	±0.08 K	±0.15 K
	-200 to 620 °C	±0.18 K	±0.35 K
	-200 to 850 °C	±0.33 K	±0.70 K
- Pt500	-200 to 110 °C	±0.07 K	±0.16 K
	-200 to 400 °C	±0.43 K	±0.88 K
	-200 to 850 °C	±0.75 K	±1.54 K
- Pt1000	-200 to 200 °C	±0.25 K	±0.56 K
	-200 to 600 °C	±0.75 K	±1.10 K
- Ni100	-60 to 90 °C	±0.04 K	±0.10 K
	-60 to 250 °C	±0.07 K	±0.14 K
- Cu100	-50 to 140 °C	±0.06 K	±0.12 K
	-50 to 180 °C	±0.10 K	±0.20 K
• Resistance-based sensor	0 to 160 Ω	±0.03 Ω	±0.06 Ω
	0 to 320 Ω	±0.06 Ω	±0.12 Ω
	0 to 710 Ω	±0.13 Ω	±0.33 Ω
	0 to 3160 Ω	±2.17 Ω	±3.58 Ω
• Thermocouples			
- Type B: Pt30%Rh/Pt6%Rh	400 to 1000 °C	±2.50 K	±2.95 K
	1000 to 1820 °C	±1.00 K	±1.32 K
- Type E: NiCr/CuNi	-200 to 0 °C	±0.40 K	±0.48 K
	0 to 500 °C	±0.18 K	±0.20 K
	500 to 1000 °C	±0.15 K	±0.16 K
- Type J: Fe/CuNi	-210 to 0 °C	±0.50 K	±0.63 K
	0 to 1200 °C	±0.20 K	±0.24 K
- Type K: NiCr/Ni	-180 to 0 °C	±0.50 K	±0.64 K
	0 to 1370 °C	±0.30 K	±0.35 K
- Type L: Fe-CuNi	-200 to 0 °C	±0.40 K	±0.42 K
	0 to 900 °C	±0.20 K	±0.25 K
- Type N: NiCrSi-NiSi	-180 to 0 °C	±0.90 K	±0.96 K
	0 to 500 °C	±0.40 K	±0.46 K
	500 to 1300 °C	±0.30 K	±0.33 K
- Type R: Pt13%Rh/Pt	-50 to 0 °C	±2.50 K	±3.24 K
	0 to 500 °C	±1.80 K	±2.27 K
	500 to 1000 °C	±1.00 K	±1.11 K
	1000 to 1760 °C	±0.80 K	±0.91 K
- Type S: Pt10%Rh/Pt	-50 to 0 °C	±2.50 K	±3.03 K
	0 to 500 °C	±1.80 K	±2.22 K
	500 to 1760 °C	±1.10 K	±1.21 K
- Type T: Cu/CuNi	-200 to 0 °C	±0.60 K	±0.76 K
	0 to 400 °C	±0.25 K	±0.31 K
- Type U: Cu-CuNi	-200 to 0 °C	±0.50 K	±0.63 K
	0 to 600 °C	±0.25 K	±0.30 K
Ni-NiMo	0 to 700 °C	±0.23 K	±0.32 K
	700 to 1310 °C	±0.19 K	±0.23 K
• Voltage source	-60 to +140 mV	±10 µV	±12 µV

Error threshold of output signal	±0.05 % of measuring span
Internal temperature comp. error	≤0.5 K

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[1] Includes temperature sensor linearization error.
[2] Following change in measuring range or type of sensor.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3020 and 7NG3022
Two-wire system / Mounting rail assembly

Technical data (continued)

Accuracy (continued)	
Influencing effects	Referred to nominal current I_{AN}=20 mA
• of ambient temperature	
- during resistance measurement	
on start of scale	$\leq (0.05 + 0.015 \cdot (R_{Anf}/\Delta R))\%/10\ K$
on full scale	$\leq 0.16\%/10\ K$
- during voltage measurement	
on start of scale	$\leq (0.05 + 0.05 \cdot (U_{Anf}/\Delta U))\%/10\ K$
on full scale	$\leq 0.2\%/10\ K$
Additional influence	
- with internal temperature compensation	$\leq$ 0.1 K/10 K (temperature measurement using thermocouples)
- with internal voltage divider	$\leq$ 0.05 %/10 K (voltage measurement > 140 mV)
- with internal shunt	$\leq$ 0.02 %/10 K (current measurement)
• of power supply	$\leq$ 0.1% for voltage fluctuations between 12 and 40 V
• of line resistance	$\leq 0.02\%/10\ \Omega$
• long term effect on span and start of scale	$\leq$ 0.03%/month
Rated operating conditions	
Installation conditions	
• Site of installation (explosion-proof instruments)	
- Transmitter	Within potentially explosive area, zone 1
- Sensor	Within potentially explosive area, zone 0 or zone 1
Ambient conditions	
• Permitted ambient temperature	
- Operating temperature	
Installed in zone 1, T6	-10 to +50 °C
Installed in zone 1, T5	-10 to +65 °C
Installed outside potentially explosive area	-10 to +65 °C
- Functional temperature for installation outside potentially explosive area	-25 to +70 °C
- Storage temperature	-40 to +85 °C
• Climatic category	HSF, DIN 40 040
- Relativ humidity	5 to 95%, no condensation
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-1
- Emitted interference	According to EN 50 081-2
• Degree of protection to EN 60 529	IP 20
Design	
Weight	Approx. 0.3 kg
Enclosure material	PBT, glass-fibre reinforced
Electrical connection / process connection	Plug-in screw terminal, max. 2.5 mm^2
Displays and controls	
• Calibration pushbutton function	Line compensation for resistance measurement in two-wire circuit, calibration of start of scale and full scale. Function can be disabled during parameterization.
• Parameterization	using TransWin program (page 2/36) and serial interface
• Serial interface	
- Function	Parameterizing and interrogating of operating data
- Interface	Via online or offline V.24/V.28 (RS 232) parameterizing adapter
• Test sockets (front)	Monitoring output signal with a measuring instrument; permitted internal resistance of meas. instrument for current output $\leq 15\ \Omega$

Power supply	
• Not Ex-proof version	12 to 45 V DC
• Ex-proof version	12 to 30 V DC (intrinsically safe)
• Permissible residual ripple of power supply	Peaks must lie within the above limits (47 to 125 Hz)
Electrical isolation	Input, output and sensor fault/limit monitor are electrically isolated
• Test voltages	
- All inputs and outputs against one-another	U_{eff} = 500 V, 50 Hz, 1 min
• Permitted impulse voltages	
- All inputs and outputs against one-another, series mode voltage to all inputs and outputs	$\hat{u} = \pm500$ V, 1 µs/50 µs, $R_i = 500\ \Omega$
Certificates and approvals	
Explosion protection for the input measuring circuit	
• "Intrinsically safe" type of protection	EEx ib [ia] IIC T5/T6
- Conformity certificate	PBT No. Ex-91.C.2078 X ASEV 92.1 C10162 X
External standards and guidelines	
Protective measures	DIN 57 411 / VDE 0411 part 1
Vibration resistance	DIN 57 411 / VDE 0411 part 1 (rail-mounted)

Ordering information

The order number structure shown below is used to specify a fully functioning transmitter.

The stock items can be easily adapted to the measuring task by the user himself. Usually the adaptation is carried out using the TransWin software for parameterization and possibly by installation of accessory devices. Thus the stock items of the SITRANS T transmitter have the shortest delivery time and are the low-price versions of the SITRANS T transmitter.

The parameterization of operating data (sensor type, measuring range, characteristic etc.) takes place as follows:

- Parameters preset in factory.
  A list of the parameters as set in the factory is shown on pages 2/32 and 2/33. The presets can be modified by the customer to match the requirements precisely.
- Parameterization defined in the order.
  Add "–Z" and the order code "Y01" to the order number.
  The parameterization required can be selected from the list shown on pages 2/32 and 2/33. Only specify codes A■■ to J■■ for parameters that deviate from the factory settings.
  The factory setting will be used for any parameters that are not specified.

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

Ordering examples

Customer requirement	Ordering data	Standard parameter
Example 1: Two-wire transmitter - rail mounted - Ex-proof - without sensor fault/limit monitor - input for temperature sensor	7NG3022-3JN00 (stock item)	
Sensor PT100, three-wire circuit		X
Measuring range 0 to 150 °C		X
Characteristic rising, temperature-linear		X
Output 4 to 20 mA		X
Response to sensor breakage to full scale		X
Example 2: Two-wire transmitter - rail mounted - Ex-proof - without sensor fault/limit monitor - input for temperature sensor rating plate in Spanish	7NG3022-3JN00-Z Y01 + S78	
Sensor NiCr/Ni, type K	AA2	
Cold junction internal		X
Measuring range 0 to 900 °C	EB8	
Characteristic rising, temperature-linear		X
Accessories: cold junction terminal	7NG3090-8AV	
Example 3: Two-wire transmitter - rail mounted - non Ex-proof - without sensor fault/limit monitor - input for DC voltage 0.4 to 14 V	7NG3020-3JN20-Z Y01	
Sensor voltage signal	AE0	
Measuring range 0 to 10 V		X
Characteristic falling, sensor proport.	FA1	
Filter period 15 s	GS0	
Output 4 to 20 mA	HA3	
(no monitoring)	GS0: T99 = 15 s	

Ordering data

Ordering data	Order No.
SITRANS T universal transmitter for rail mounting in two-wire circuit for temperature, resistance, DC voltage and DC current	**7NG302■ - 3J■■ 0**
Explosion protection	
• Not Ex-proof	**0**
• Ex-proof, for inputs EEx ib [ia] IIC T5/T6	**2**
Sensor fault/limit monitor	
• Not present (can be retrofitted)	**N**
• Relay with CO contact (only 7NG3020)	**B**
• NAMUR output	**C**
Input for temperature sensor, resistance-based sensor and mV sensor	**0**
Input with additional circuitry[1]	
• for DC voltage, measuring span	
0.04 to 1.5 V	**1**
0.4 to 14 V	**2**
4 to 140 V	**3**
• for DC current, measuring span	
4 to 140 µA	**4**
0.04 to 1.4 mA	**5**
0.4 to 14 mA	**6**
4 to 140 mA	**7**
0.04 to 1 A	**8**
Suffixes	**Order code**
Add "-Z" and the order code to the order number and specify any plain text (see pages 2/32 and 2/33).	
Parameterization specified in order	**Y01**
Language of rating plate (together with Y01 order code only)	
• Italian	**S72**
• English	**S76**
• French	**S77**
• Spanish	**S78**
Accessories (if required)	**Order No.**
Sensor fault/limit monitor	
• With relay output (only 7NG3020)	**7NG3090-8AB**
• With electronic output (NAMUR)	**7NG3090-8AC**
Cold junction terminal	**7NG3090-8AV**
Off-line parameterization adapter	**7NG3090-8AK**
On-line parameterization adapter for parameterization during operation	**7NG3090-8EK**
TransWin program (see page 2/36)	**7NG3080-8CA**
Conversion kit for SITRANS T One resistor each of 0.1 Ω, 1.0 Ω, 10.0 Ω, 100 Ω, 1 kΩ 10 kΩ, 100 kΩ, 1 MΩ and one capacitor for 115 V AC power pack	**7NG3090-8AW**
Operating instructions for SITRANS T (7NG302■, in 5 languages, included in scope of supply)	**C73000-B7164-C154**

■ Stock items.

See page 2/50 for **power supplies**.

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[1] Without sensor breakage monitoring. In Ex-proof instruments, observe maximum permitted currents and voltages as specified in conformance certificate.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3020 and 7NG3022
Two-wire system / Mounting rail assembly

Parameter list (coded text A▪▪ to J▪▪)

▨ Parameters set in factory

Order No. with order code: 7NG302 ▪ - 3J ▪ ▪ 0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A ▪ ▪ + B ▪ ▪ to J ▪ ▪   ▪▪▪ + ▪▪▪ + ▪▪▪ + ▪▪▪ + ▪▪▪

Sensor

Thermocouples Type			Connection			Cold junction compensation	
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**	Normal	n 3) = 1	**BA1** ▨		
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**	Averag. 4)	n = 2	**BA2**	internal 6)	**CA3** ▨
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**		n = 3	**BA3**	external	
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**		n = 4	**BA4**	0 °C	**CB0**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**		n = 5	**BA5**	20 °C	**CB2**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**		n = 6	**BA6**	50 °C	**CB5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**		n = 7	**BA7**	60 °C	**CB6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**		n = 8	**BA8**	70 °C	**CB7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**		n = 9	**BA9**	Others 12)	**CS0**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**		n = 10	**BB0**		
Ni-Ni18%Mo (GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**	Differential 12)		**BS0**		

Measur. ranges		
-30 to	+60 °C	**EA0**
-20 to	+20 °C	**EA1**
0 to	40 °C	**EA2**
0 to	60 °C	**EA3**
0 to	80 °C	**EA4**
0 to	100 °C	**EA5**
0 to	120 °C	**EA6**
0 to	150 °C	**EA7** ▨
0 to	200 °C	**EA8**
0 to	250 °C	**EA9**
0 to	300 °C	**EB0**
0 to	350 °C	**EB1**
0 to	400 °C	**EB2**
0 to	450 °C	**EB3**
0 to	500 °C	**EB4**
0 to	600 °C	**EB5**
0 to	700 °C	**EB6**
0 to	800 °C	**EB7**
0 to	900 °C	**EB8**
0 to	1000 °C	**EB9**
0 to	1200 °C	**EC0**
0 to	1400 °C	**EC1**
0 to	1600 °C	**EC2**
0 to	1800 °C	**EC3**
50 to	100 °C	**EC4**
50 to	150 °C	**EC5**
100 to	200 °C	**EC6**
100 to	300 °C	**EC7**
100 to	400 °C	**EC8**
200 to	300 °C	**EC9**
200 to	400 °C	**ED0**
200 to	500 °C	**ED1**
300 to	600 °C	**ED2**
500 to	1000 °C	**ED3**
600 to	1200 °C	**ED4**
800 to	1600 °C	**ED5**
Other ranges 12)		**ES0**

Resistance thermometer 1) ($R_{\mathrm{max}} + R_{\mathrm{L}} < 1140$ (3150) Ω 2))			Connection						
			Normal	n 3) = 1	**BA1** ▨	Connection		Line resistance 7)	
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0** ▨	Averag. 5)	n		Two-wire	**CA2**	0 Ω	**DA0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**		n = 2	**BA2**	Three-wire	**CA3** ▨	10 Ω	**DA1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**		to n = 10	**BB0**	Four-wire	**CA4**	20 Ω	**DA2** ▨
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**		Others 12)	**BS1**			100 Ω	**DB1**
			Differential 12)		**BS2**			Others 12)	**DS0**

Resistance-based sensor, potentiometer ($R_{\mathrm{max}} + R_{\mathrm{L}} < 1140$ (3150) Ω 2))		Connection							Measuring ranges	
	AD0	Normal	n 3) = 1	**BA1** ▨	Connection		Line resistance 7)		0 to 100 Ω	**EE1** ▨
		Differential 12)		**BS3**	Two-wire	**CA2**	0 Ω	**DA0**	0 to 200 Ω	**EE2**
					Three-wire	**CA3** ▨	10 Ω	**DA1**	0 to 500 Ω	**EE5**
					Four-wire	**CA4**	20 Ω	**DA2** ▨	0 to 1000 Ω	**EF1**
							100 Ω	**DB1**		
							Others 12)	**DS0**	Other ranges 12)	**ES1**

mV sensor (V, μA, mA, A sensor 10)) **AE0**

Measuring range for Order No. 7NG 302 ▪ - 3J ▪ ▪ 0

0 mV	1 11) V	2 11) V	3 11) V	4 11) μA	5 11) mA	6 11) mA	7 11) mA	8 11) A	
-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-50 to +50	-0.5 to +0.5	-5 to +5	-50 to +50	-0.5 to +0.5	**EG0**
-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-20 to +20	-0.2 to +0.2	-2 to +2	-20 to +20	-0.2 to +0.2	**EG1**
-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-10 to +10	-0.1 to +0.1	-1 to +1	-10 to +10	-0.1 to +0.1	**EG2**
0 to 10	0 to 0.1	0 to 1	0 to 10	0 to 10	0 to 0.1	0 to 1	2 to 10	0 to 0.1	**EG3**
0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 20	0 to 0.2	0 to 2	0 to 20	0 to 0.2	**EG4**
0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 50	0 to 0.5	0 to 5	0 to 50	0 to 0.5	**EG5**
0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 100	0 to 1.0	0 to 10	0 to 100	0 to 1.0	**EG6** ▨
		1 to 5	2 to 10			1 to 5	4 to 20		**EG7**
Other ranges 12)									**ES2**

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1) For other basis values see Connection Averaging (e.g. Pt500: *n* = 5 ≙ BA5).

2) With 4-wire connection no sensor fault monitoring.

3) *n* = number of sensors to be connected.

4) The sum of the thermovoltages must not exceed 140 mV.

5) The sum of the resistances must not exceed 3150 Ω.

6) The cold junction terminal 7NG3090-8AV must be ordered separately.

7) For 2-wire connection the indicated loop resistance must be obeyed or determined by calibration; for 3 and 4-wire connection the expectable maximum value per wire has to be stated.

10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).

11) Without sensor fault monitoring.

12) See page 2/34 for operational data and special parameters.

Parameter list (code A ■■ to J ■■) (continued)

■ Parameters set in factory

Order No. with order code: 7NG302 ■ - 3J ■■ 0-Z Y01

Note
Sensor fault/limit monitor:
Specify desired parameterization acc. to Technical Data in plain text if required.

Code: A ■■ + B ■■ to J ■■ ■■■ —+— ■■■ —+— ■■■ —+— ■■■ —+— ■■■

Sensor

Thermocouples Type		
L: Fe-CuNi (DIN)	-200 to + 900 °C, Δt ≥ 75 °C	**AA0**
J: Fe/CuNi (IEC)	-210 to +1200 °C, Δt ≥ 75 °C	**AA1**
K: NiCr/Ni	-270 to +1372 °C, Δt ≥ 100 °C	**AA2**
S: Pt10%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA3**
B: Pt30%Rh/Pt6%Rh	0 to 1820 °C, ΔU ≥ 4 mV	**AA4**
R: Pt13%Rh/Pt	-50 to +1769 °C, ΔU ≥ 4 mV	**AA5**
E: NiCr/CuNi	-270 to +1000 °C, Δt ≥ 65 °C	**AA6**
N: NiCrSi/NiSi	-270 to +1300 °C, ΔU ≥ 4 mV	**AA7**
T: Cu/CuNi (IEC)	-270 to + 400 °C, ΔU ≥ 4 mV	**AA8**
U: Cu/CuNi (DIN)	-200 to + 600 °C, ΔU ≥ 4 mV	**AA9**
Ni-Ni18%Mo(GE)	0 to +1310 °C, Δt ≥ 100 °C	**AB0**
Resistance thermometer 1) ($R_{max} + R_L < 1140$ (3150) Ω 2))		
Pt100 (DIN IEC)	-200 to +850 °C, Δt ≥ 25 °C	**AC0**
Pt100 (JIS)	-200 to +630 °C, Δt ≥ 25 °C	**AC1**
Ni100 (DIN)	-60 to +180 °C, Δt ≥ 20 °C	**AC2**
Cu100	-200 to +200 °C, Δt ≥ 25 °C	**AC3**
Resistance-based sensor, potentiometer ($R_{max} + R_L < 1140$ (3150) Ω 2))		**AD0**
mV sensor (V, µA, mA, A sensor 10))		**AE0**

Character.	
temperature-linear, rising	**FA0**
temperature-linear, falling	**FA1**
sensor proportional, rising	**FA2**
sensor proportional, falling	**FA3**

Characteristic	
sensor proportional, rising	**FA0**
sensor proportional, falling	**FA1**
programmed rising or falling 12)	**FS0**

Filter per. 8)	
0 s	**GA0**
0.1 s	**GA1**
0.2 s	**GA2**
0.5 s	**GA3**
1 s	**GA4**
2 s	**GA5**
5 s	**GA6**
10 s	**GA7**
20 s	**GA8**
50 s	**GA9**
100 s	**GB0**
Other values 12)	**GS0**

Output signal	
4 to 20 mA	
following sensor fault	
- to full scale	**HA0**
- to start of scale	**HA1**
- retain most recent val.	**HA2**
- no monitoring	**HA3**
- safety value 12)	**HS0**

Basic functions	
Mains filter 9)	
50 Hz	
Calibr. pushb.	
- disabled	**JF0**
- enabled	**JF1**
60 Hz	
Calibr. pushb.	
- disabled	**JG0**
- enabled	**JG1**

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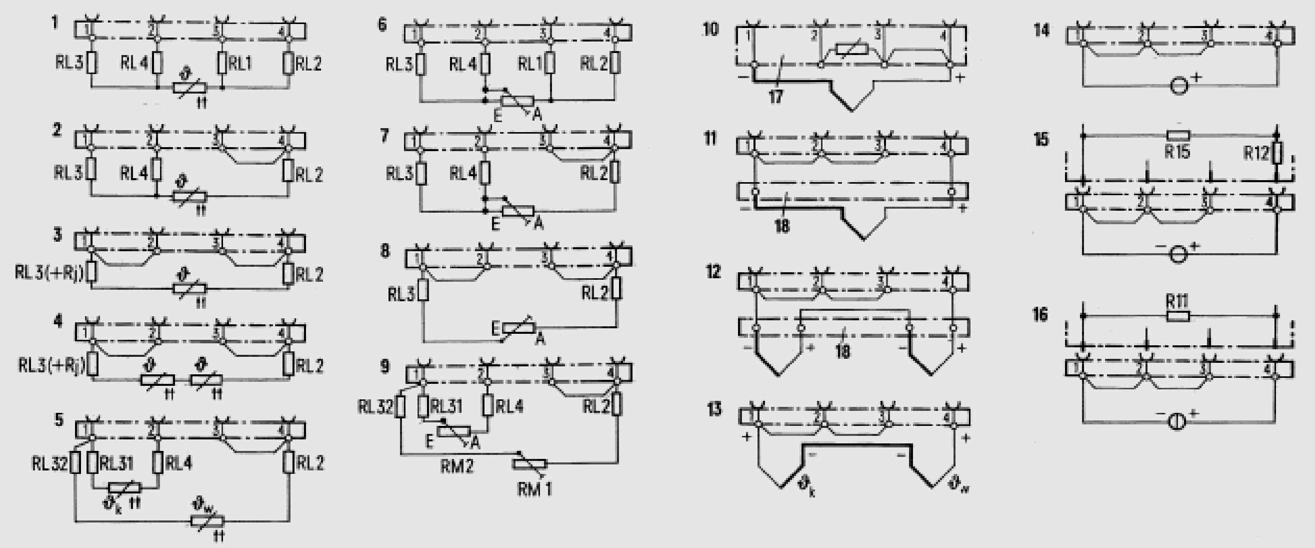
1) For other basis values see Connection Averaging (e.g. Pt500: $n = 5 \triangleq$ BA5).
2) With 4-wire connection no sensor fault monitoring.
8) Software filter for smoothing result.
9) Filter to suppress mains interference on the input.
10) Observe maximum permitted currents and voltages in explosion proof instrument (see conformance certificate).
12) See page 2/34 for operational data and special parameters.

SITRANS T universal transmitter
for temperature, resistance, DC voltage and DC current

7NG3020 and 7NG3022
Two-wire system / Mounting rail assembly

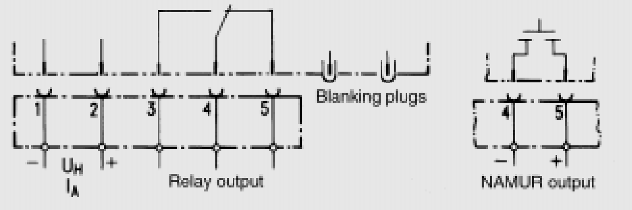


1 Resistance thermometer in four-wire circuit
2 Resistance thermometer in three-wire circuit
3 Resistance thermometer in two-wire circuit
4 Resistance thermometer in averaging circuit
5 Resistance thermometer in differential circuit
6 Resistance-based sensor in four-wire system
7 Resistance-based sensor in three-wire system
8 Resistance-based sensor in two-wire system
9 Resistance-based sensor in differential circuit
10 Thermocouple with internal temperature compensation
11 Thermocouple with external temperature compensation
12 Thermocouples in averaging circuit
13 Thermocouples in differential circuit
14 DC voltage source (full scale < 140 mV)
15 DC voltage source (full scale > 140 mV)
16 DC current source
17 Cold junction terminal 7NG3090-8AV
18 External temperature compensation
ϑ_W Warmer measuring point
ϑ_K Cooler measuring point
R11 Shunt resistance (internal)
R12 Series resistance (internal)
R15 Input resistance (internal)

Fig. 2/18 Connection diagram for input signal (terminal X1)

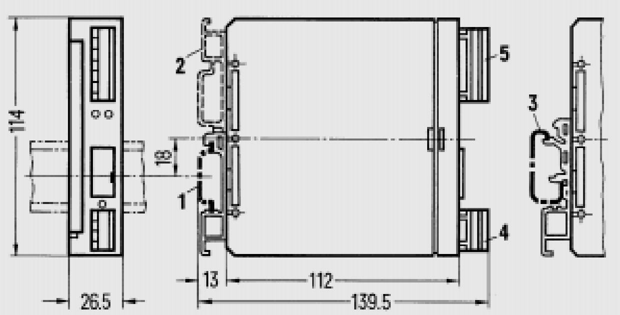
Special parameters

Code	Text	Options
BS0	TA=...	Working point T_a for differential temperature measurement using thermocouples [1]
BS1	N=...	Factor n for multiplication with the basic values of the resistance thermometers or thermocouples Example: 3 x Pt500 parallel: BS1: N=1.667
BS2	TA=...	Working point T_a for differential temperature measurement using resistance thermometers [1]
	N=...	Number n of resistance thermometers in each branch
	TMAX=...	Max. temperature T_{max} (total of temperatures in both branches)
BS3	RMAX=...	Max. sum of the resistances of both branches R_{max}
CS0	TV=...	Temperature Tv of external cold junction
DS0	RL=...	Line resistance RL (resistance thermometer or potentiometer with 2-wire connection: loop resistance; with 3-wire and 4-wire connection: expectable maximum value per line)
ES0	MA=...	Start of scale Ma for resistance thermometer/ thermocouples
	ME=...	Full scale Me for resistance thermometer/thermocouples
	D=...	Unit (°C, K, °F, °R (°R (Rankine) = abs. °Fahrenh.)
ES1	MA=...	Start of scale Ma for resistance-based sensor/ potentiometer
	ME=...	Full scale Me for resistance-based sensor/potentiometer
ES2	MA=...	Start of scale Ma for mV, V, µV, mA and A sensor
	ME=...	Full scale Me for mV, V, µA, mA and A sensor
	D=...	Unit (mV→MV, V, µA→UA, mA→MA,A)
FS0	E1=... A1=... EN=... AN=...	Pair of values E_n, A_n for user-specific characteristic (Up to 50 pairs can be specified.) E_n: input (mV or Ω) A_n: output value (any unit)
	F=...	Approximation function F: L = linear; Q=quadratic; C=cubic
	K=...	Direction of action of characteristic S = rising; F = falling
GS0	T99=...	Response time T_{99} of software filter (0 to 100 s)
HS0	S=...	Safety output value S following sensor fault (output 4 to 20 mA)



I_A Output signal U_H Power supply

Fig. 2/19 Connection diagram for power supply and outputs (terminal X2)



1 35 mm DIN rail EN 50 022
2 Alternative for mounting plate
3 32 mm G rail DIN EN 50 035
4 Terminal X1
5 Terminal X2

Fig. 2/20 Dimensions for control room mounting, rail mounting

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[1] The difference temperature measurement is based on the forming of the difference of resistances or thermovoltages. Therefore, for non-linear sensor characteristics, the result can only be approximative, except for difference = 0.
The transmitter forms the temperature difference from that difference and the slope of the straight line between Ta and Ta+(Ma-Me).

Rail mounted

Fig. 2/21 Rail-mounted transmitter in enclosure (supplied by customer) for field mounting

Plug-in module (19-inch)

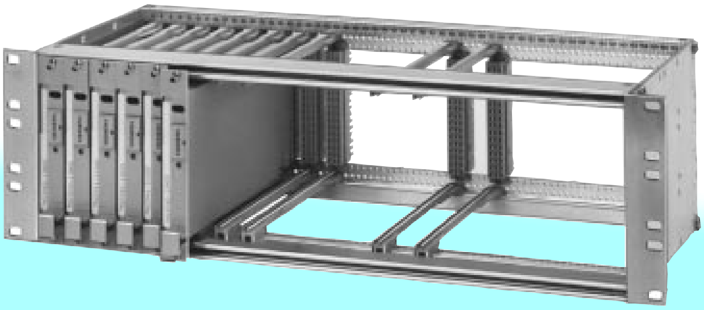

Fig. 2/22 Plug-in transmitters in 19-inch mounting rack

ES 902 C packaging system

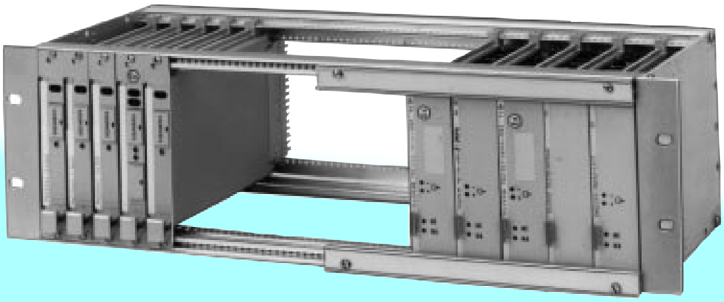

Fig. 2/23 Transmitters as PCB in mounting rack of ES 902 C packaging system

TransWin software
for parameterizing the SITRANS T universal transmitter

Brief description

Application

The TransWin program is used to parameterize the SITRANS T universal transmitter. The program is menu-driven and self-explanatory.

- Enters transmitter parameters into the computer
- Loads operational parameters into the transmitter's non-volatile memory (EEPROM) from the computer
- Saves transmitter parameters in the computer
- Performs fine calibration of start of scale and full scale values
- Enters user-specific characteristics for transmitter
- Files parameters on diskette
- Documents transmitter parameters
- Generates the transmitter's rating plate in English, French, German, Italian or Spanish

An On-Line Help facility is provided. The help texts are provided in 5 languages (English, French, German, Italian and Spanish).

Parameterization

The following parameters can be set:

- Type of sensor, e.g. Pt100 resistance thermometer or NiCr/Ni thermocouple
- Measuring range
- Internal or external temperature compensation for thermocouples
- 2, 3 or 4-wire circuit for resistance thermometer and resistance-based sensor
- Reaction to sensor fault or line breakage, e.g. output signal forced to start of scale or full scale value
- Type of connection, e.g. averaging or differential circuit
- Transmitter characteristic, e.g. voltage or temperature-linear or user-specific
- Rising or falling characteristic
- Response time of transmitter
- Output signal, e.g. 0 to 20 mA or 4 to 20 mA
- Limits with hysteresis

The parameters are stored in the transmitter in a non-volatile memory (EEPROM).

The following are required during parameterization:

- Transmitter
- Off-line or on-line parameterization adapter
- Personal computer (PC) or SIMATIC programming unit (PG)
- TransWin 7NG3080-8CA software package
- Printer for printing of rating plate and report

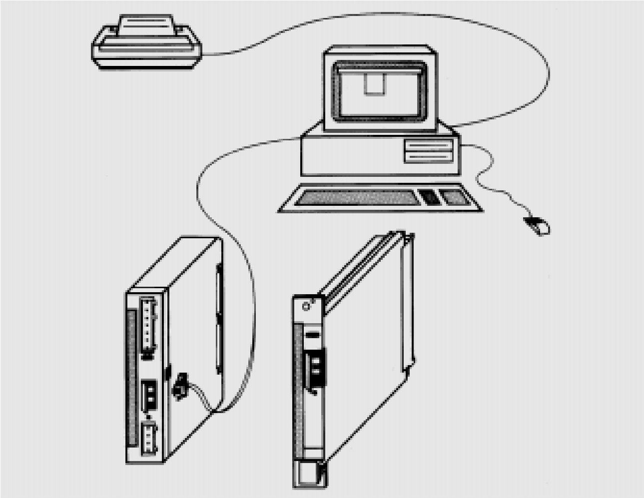

Fig. 2/24 Parameterizing the SITRANS T universal transmitter

Personal computer / programming unit configuration

- XT/AT compatible
- MS-DOS 3.0 operating system or higher (not Windows NT)
- 512 kbyte main memory
- V.24/V.28 serial interface (RS-232)
- 3½-inch (720 kbyte) floppy-disk drive
- Printer interface
- Mouse (optional)

Ordering data	Order No.
TransWin software, Version 3.02 for PC/PG (MS-DOS), 3½-inch diskette	**7NG3080-8CA**
Off-line parameterization adapter	**7NG3090-8AK**
On-line parameterization adapter to parameterize during operation	**7NG3090-8EK**

🟦 Stock items.

SITRANS T3K PA
Transmitters for temperature

7NG3213 with PROFIBUS-PA connection / Mounting in sensor head

Fig. 2/25 SITRANS T3K PA transmitter for temperature

Application

The SITRANS T3K PA transmitter can be used in all branches. Its compact size enables it to be installed in the sensor head type B (DIN 43 729) with raised cover or larger. The following sensors/ signal sources can be connected via its universal input module:

- Resistance thermometers
- Thermocouples
- Resistance-based sensors/potentiometers
- DC voltage sources

The useful data - measured values with status as a quality specification and other parameters - are provided on PROFIBUS-PA.

Transmitters with the "Non-incendive" type of protection can be mounted within potentially explosive atmospheres (zone 2).

Transmitters with the "Intrinsically safe" type of protection can be mounted within potentially explosive atmospheres (zone 1) and used for feeding sensors in zone 0. The conformity declarations comply with the European standard (CENELEC).

Features

- Transmitter with bus connection according to DIN 61 158-2 and EN 50 170, part 4
- Data transmission and transmitter supply via common bus link
- Assembly in connection head type B with raised cover (DIN 43 729) or larger
- Can communicate via PROFIBUS-PA (profile B, version 3.0); sensor, measuring range and much more can therefore be programmed
- Quality data for the measured values: status and limit values
- Fixed bus current limiting in the event of an error
- Electrical isolation (test voltage 500 V AC)
- Intrinsically safe version for use in potentially explosive areas

Mode of operation (Fig. 2/26)

The signal supplied by a resistance-based sensor (two, three or four-wire circuit) or thermocouple is amplified in the input stage. The voltage proportional to the input variable is then converted into digital signals in an analog/digital converter (1). These are converted according to the sensor characteristic in the microprocessor (2). Furthermore, the microprocessor interprets the bus commands, initiates device-internal actions and provides electrically-isolated (3) measured values, status and device data on the bus.

Integrated device protection functions:

- Electrical current limiting:
  avoids bus overloading in the event of a fault; the data traffic of the other, correctly operating nodes is maintained
- Reverse polarity protection:
  allows the bus lines to be connected as required
- EMC filter:
  Prevents malfunctions in the case of electromagnetic interference

Parameterization

SITRANS T transmitters with a PROFIBUS-PA interface (Fig. 2/26) are parameterized, starting from a master, using signals that are transmitted via PROFIBUS-DP. These signals are converted by a SIMATIC DP/PA coupler with power supply (5, 6) into a signal for PROFIBUS-PA. A bus terminator is required for cable lengths > 2 m. SIMATIC PDM is preferably used as parameterization software.

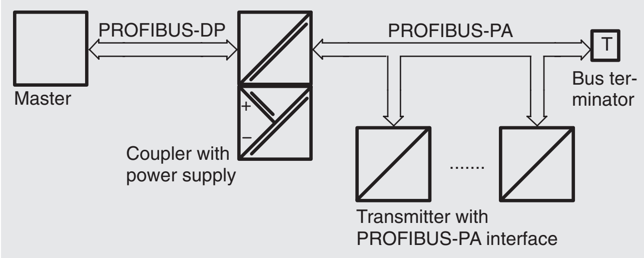

Fig. 2/27 Communication via PROFIBUS-PA interface

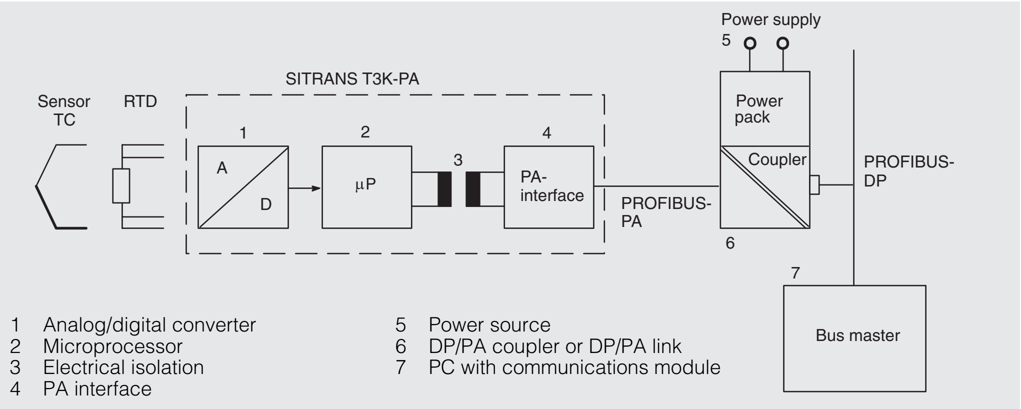

Fig. 2/26 Block diagram showing mode of operation of the SITRANS T3K PA

Technical data

Input

Selectable filters to suppress the line frequency	Selectable for 50/60 Hz (also 10 Hz for special applications)
Resistance thermometers	
• Measured variable	Temperature
• Measuring range limits	Depending on type of connected sensor (defined sensor range)
• Sensor type	
- acc. to DIN IEC 751, DIN 43 760 JIS C 1604-97, BS 1904	Pt10, Pt50, Pt100, Pt200, Pt1000
- acc. to JIS C 1604-81	Pt10, Pt50, Pt100
- acc. to DIN 43 760	Ni50, Ni100, Ni120, Ni1000
• Characteristic	Temperature-linear
• Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
- Standard	1 resistance thermometer in two, three or four-wire circuit
Two-wire circuit	Line resistance parameterizable ≤ 100 Ω (range dependent)
Three-wire circuit	No adjustment necessary. The line resistances must be equal between the respective sensor connection and the associated connection on the transmitter.
Four-wire circuit	No adjustment necessary.
- Generation of average values	Average value of two resistance thermometers in two-wire circuit, parameterizable default value behaviour (e.g. the value of the other channel is output if a channel is defective)
- Generation of difference	Difference between two resistance-based sensors in two-wire circuit, difference is parameterizable (e.g. channel 2 - channel 1).
- Series or parallel circuit	Series or parallel connection of several resistance-based sensors in two-wire circuit, e.g. to adapt other sensor types, is implemented as an additional function. This results in a scaling factor.
• Sensor current	≤ 0.55 mA
Resistance-based sensors	
• Measured variable	Ohmic impedance
• Input range (9 resistance measuring ranges can be selected)	0 to 24 Ω 0 to 47 Ω 0 to 94 Ω 0 to 188 Ω 0 to 375 Ω 0 to 750 Ω 0 to 1500 Ω 0 to 3000 Ω 0 to 6000 Ω
• Sensor type	Linear: 1 resistance-based sensor in two, three or four-wire circuit
• Characteristic	Resistance-linear
• Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
- Standard	1 resistance thermometer in two, three or four-wire circuit
Two-wire circuit	Line resistance parameterizable ≤ 100 Ω (range dependent)
Three-wire circuit	No adjustment necessary. The line resistances must be equal between the respective sensor connection and the associated connection on the transmitter.
Four-wire circuit	No adjustment necessary.
- Generation of average values	Average value of two resistance-based sensors in two-wire circuit, parameterizable default value behaviour (e.g. the value of the other channel is output if a channel is defective)
- Generation of difference	Difference between two resistance thermometers in two-wire circuit, difference is parameterizable (e.g. channel 2 - channel 1).
- Series or parallel circuit	Series or parallel connection of several resistance thermometers in two-wire circuit, e.g. to adapt other sensor types, is implemented as an additional function. This results in a scaling factor.
• Sensor current	≤ 0.55 mA
Thermocouples	
• Measured variable	Temperature
• Measuring range limits	Depending on type of connected sensor (defined sensor range)
• Sensor type	Thermocouples
	Type B: Pt30Rh-Pt6Rh (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 43 710) Type N: NiCrSi-NiSi (BS 4937 Part 2) Type R: Pt13Rh-Pt (DIN IEC 584) Type S: Pt10Rh-Pt (DIN IEC 584) Type T: Cu-CuNi (DIN 43 710) Type U: Cu-CuNi (DIN 43 710)
• Characteristic	Temperature-linear
• Type of connection	Standard with 1 thermocouple with cold junction compensation (logic channel 1) or generation of difference or average value
- Standard	1 thermocouple with or without cold junction compensation.
- Generation of average value	Average value of the temperatures of two thermocouples. The default value behaviour is parameterizable (e.g. the value of the other channel is output if a channel is defective). The internal sensor is used for cold junction compensation.
- Generation of difference	Difference between the temperatures of two thermocouples. The difference is parameterizable (e.g. channel 2 - channel 1). The internal sensor is used for cold junction compensation.

Technical data (continued)

Input (continued)	
• Cold junction compensation	Type specification - No compensation (2 channels) - Internal acquisition with integraed or external sensor:a manufacturer-specific PA parameter must be set for the "external sensor" case (default value: internal sensor) - Externally specified cold junction temperature can be set as a fixed value
mV sensors	
• Measured variable	DC voltage
• Input range (7 voltage ranges can be selected)	-1 to 16 mV -3 to 32 mV -7 to 65 mV -15 to 131 mV -31 to 262 mV -63 to 525 mV -120 to 1000 mV
• Sensor type	Linear
• Characteristic	Voltage-linear
• Type of connection	
- Standard	mV sensor (logic channel 1)
• Overload capacity of the input	max. 3.5 mV
• Input resistance	≥ 1 MΩ
• Sensor current	180 µA
Output	Digital bus signal
• Bus voltage	9 to 32 V (without Ex protection) 9 to 24 V for intrinsically safe operation (see Ex certificate) Active internal inductance Li < 10 nH (acc. to FISCO model) Active internal capacitance Ci < 5 nF (acc. to FISCO model)
• Communication	Layers 1 and 2 according to PROFIBUS-PA, transmission technique according to IEC 1158-2; slave function; layer 7 (protocol layer) according to PROFIBUS-DP, EN 50170 standard with the extended PROFIBUS functions (all data acyclic, measured value and status also cyclic)
- C2 connections	Four connections to master class 2 are supported; automatic connection setup 60 s after break in communication; response time to master message typ. 10 ms
- Device profile	PROFIBUS-PA profile B, version 3.0, more than 200 parameters
- Device address	126 when delivered
• Temperature units	°C, K, °F, °R parameterizable (°R (Rankine) = absolute °F)
Measuring accuracy	
• Reference conditions	
- Power supply	15 V ± 1 %
- Ambient temperature	23 °C
- Warming-up time	1 h
• Influencing effects	
- Error in the internal cold junction	< 0.25 °C ± 0.1 %/10° C
- Temperature drift	± 0.05 %/10 °C FSR, 0.1 % between -10 and 60 °C
- Influence of the power supply on the span	< 0.005 %/V FSR
- Long-term drift	< 0.1 %/year

• Accuracy

Resistance thermometers

Input	Measuring range °C	Max. parameterizable line resist. in Ω	Accuracy °C
IEC 751, DIN 43 760 JIS C 1604-97, MS 1904			
- Pt10 DIN-IEC	-200 to +850	2.35	1.5
- Pt50 DIN-IEC	-200 to +850	9.4	0.3
- Pt100 DIN-IEC	-200 to +850	18.75	0.15
- Pt200 DIN-IEC	-200 to +850	37.5	0.3
- Pt500 DIN-IEC	-200 to +850	37.5	0.5
- Pt1000 DIN-IEC	-200 to +850	300	0.5
JIS C 1604-81			
- Pt10	-200 to +649	2.35	1.5
- Pt50	-200 to +649	9.4	0.3
- Pt100	-200 to +649	18.75	0.15
DIN 43 760			
- Ni50	-60 to +250	9.4	0.15
- Ni100	-60 to +250	18.75	0.15
- Ni120	-60 to +250	18.75	0.15
- Ni1000	-60 to +250	150	0.15

Resistance-based sensors

Input	Measuring range Ω	Max. parameterizable line resist. in Ω	Accuracy Ω
- Resistance	0 to 24	1.2	0.04
	0 to 47	2.35	0.03
	0 to 94	4.7	0.03
	0 to 188	9.4	0.04
	0 to 375	18.75	0.05
	0 to 750	37.5	0.1
	0 to 1500	75	0.7
	0 to 3000	150	0.4
	0 to 6000	300	1.2

Thermocouples

Input	Measuring range °C	Accuracy °C 1)
- Type B	+100 to +1820	3
- Type C	0 to +2300	2
- Type D	0 to +2300	1
- Type E	-200 to +1000	1
- Type J	-210 to + 800	1
- Type K	-200 to +1372	1
- Type L	-200 to +900	2
- Type N	-200 to +1300	1
- Type R	-50 to +1760	2
- Type S	-50 to +1760	2
- Type T	-200 to +400	1
- Type U	-200 to +600	2

mV sensors

Input	Measuring range mV	Accuracy µV
- mV sensor	-1 to +16	10
	-3 to +32	10
	-7 to +65	10
	-15 to +131	25
	-31 to +262	50
	-63 to +525	100
	-120 to +1000	150

Rated operating conditions	
Ambient conditions	
• Permitted ambient temperatures	
- Ambient temperature	-40 to +85 °C for T4 -40 to +60 °C for intrinsically safe operation (T6)
- Storage temperature	-40 to +95 °C
• Relative humidity	≤ 98 % with condensation
• Electromagnetic compatibility Interference immunity	According to EN 50 082-2 and NAMUR NE21
- Emitted interference	According to EN 50 081-1

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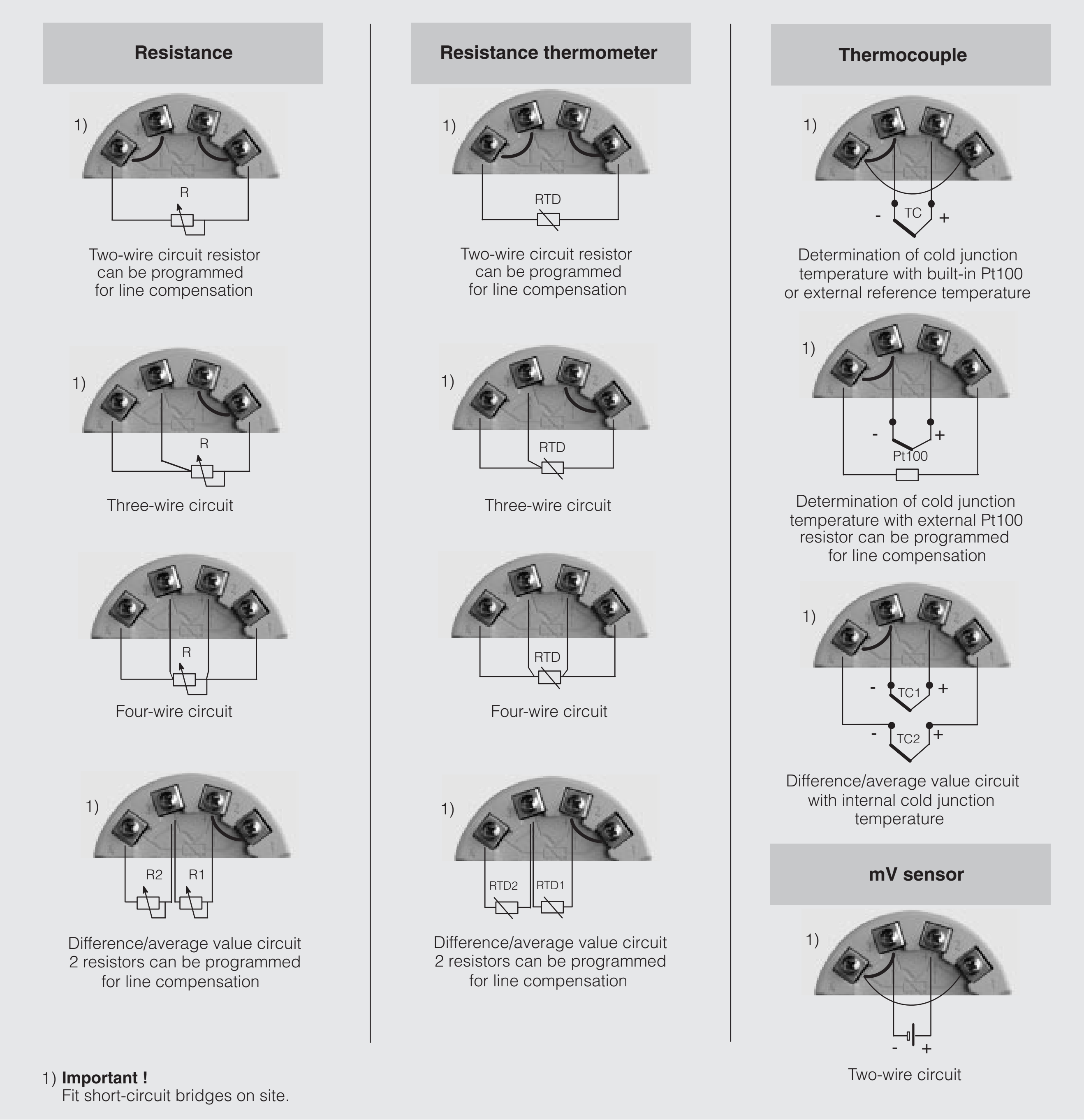
1) Specified accuracy value refers to the largest error of the total measuring range.

Technical data (continued)

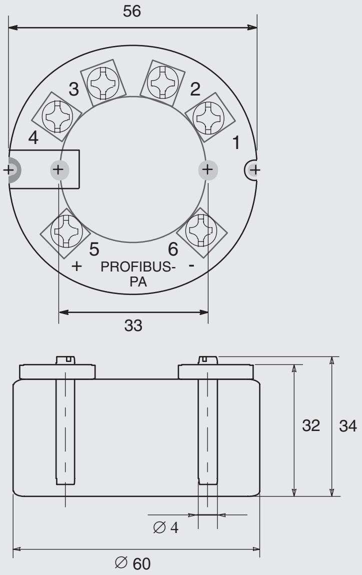
Design	
Weight	250 g
Dimensions	See page 2/41
Enclosure material	Plastic PA6 (polyam., moulded GF 20)
Electrical connection	Plug-in screw terminal, max. $2.5\ \text{mm}^2$
Power supply	
• Supply voltage	Bus infeed 9 to 32 V (9 to 24 for Ex version)
• Current consumption of device	11 mA
• Max. excess current in the event of a fault	$I_{max} \leq 3$ mA

Electrical isolation	Input and output are electrically isolated
• Test voltage	500 V AC, 50 Hz, 1 min
Certificates and approvals	
CENELEC	
• "Intrinsically safe" type of protection	II (1) 2G EEx ia IIB/IIC T4/T5/T6 II (1) 2G EEx ib IIB/IIC T4/T5/T6
- Conformity certificate	ZELM 99 ATEX 0001



1) **Important !**
Fit short-circuit bridges on site.

Fig. 2/28 Sensor terminal assignments



1 to 4 Sensors
5, 6 PROFIBUS-PA connection

All dimensions in mm

Fig. 2/29 Dimension drawing and connections

Ordering data	Order No.
SITRANS T3K PA temperature transmitter With PROFIBUS-PA for installation in terminal housing; with electrical isolation Operating instructions must be ordered separately	
• Without explosion protection	**7NG3213-0NN00**
• With explosion protection EEx ia und EEx ib	**7NG3213-1NN00**
Accessories	
Operating instructions SITRANS T3K PA (English/German)	**C79000-B7174-C55**
SIMATIC PDM software See section 6	
For additional PA components, see Catalog ST PI	

■ Stock items.

SITRANS TK/TK-H
Transmitters for temperature

7NG3120, 7NG3121, 7NG3122 (EEx ia)
Two-wire system / Mounting in sensor head

Fig. 2/30 SITRANS TK/TK-H transmitter for temperature

Application

The SITRANS TK/TK-H transmitter converts the signals from resistance thermometers, resistance-based sensors, thermocouples or voltage sensors into a load-independent direct current corresponding to the sensor characteristic. As a result of its compact design, the transmitter fits in the sensor head type B (DIN 43 729).

The communication capability (HART® protocol V 5.7) of the SITRANS TK-H permits parameterization using a PC or HART communicator (hand-held communicator).

Parameterization is carried out using a PC for the programmable SITRANS TK.

Transmitters of the "Non incendive" type of protection can be installed within potentially explosive atmospheres (zone 2).

Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres (zone 1).

Mode of operation (Fig. 2/31)

The measured signal supplied by a resistance-based sensor (2, 3 or 4-wire connection) or by a thermocouple is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by an analog/digital converter (1). These signals are forwarded electrically isolated (2) to the microprocessor (3). They are converted there in accordance with the sensor characteristic and further parameters (damping, ambient temperature etc.).

The signal prepared in this way is converted in a digital/analog converter (4) into a load-independent direct current of 4 to 20 mA. The power supply (5) is located in the output signal circuit.

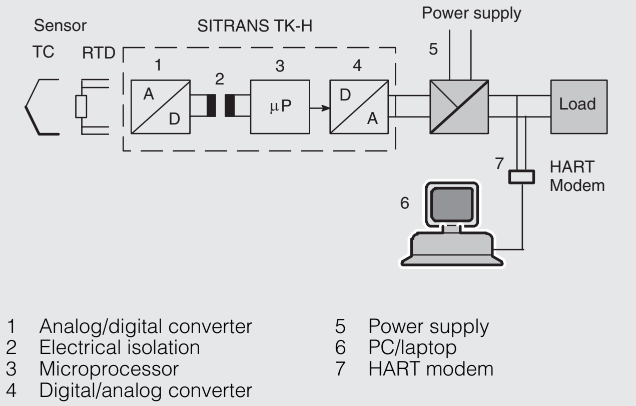


Fig. 2/31 Block diagram: operating principle of the SITRANS TK-H

The SITRANS TK-H transmitter is parameterized and operated using a PC (6) connected to the two-wire line via the interface module for SIPROM software (HART® modem) (7). A hand-held communicator can also be used for this purpose. The signals needed for communication in conformity with the HART® protocol V 5.7 are superimposed on the output current in accordance with the frequency shift keying (FSK) method.

Technical data

Input	
Resistance thermometer	
• Measured variable	Temperature
• Sensor type	Pt25 to Pt1000 (DIN IEC 751) Pt25 to Pt1000 (JIS C1604) Ni25 to Ni1000 (DIN IEC 751) Cu25 to Cu1000
• Characteristic	Temperature-linear
• Type of connection	2, 3 or 4-wire circuit
Resistance-based sensor	
• Measured variable	Ohmic impedance
• Measuring limit	2200 Ω
• Characteristic	Resistance-linear or programmable (TK)
• Type of connection	2, 3 or 4-wire circuit
Thermocouples	
• Measured variable	Temperature
• Input type	Type B, E, J, K, R, S, T (DIN IEC 584-1) Type L, U (DIN 43 710) Type N (BS 4937) Type C, D (ASTM 988)
• Characteristic	Temperature-linear
• Cold junction compensation	Internal, external with Pt100 or external with a fixed value
mV sensor	
• Measured variable	DC voltage
• Measuring limit	1100 mV
• Characteristic	Voltage-linear or programmable (TK)
• Overload capacity of the input	-0.5 to +35 V DC
• Input resistance	≥ 1 MΩ
Output	
Output signal	4 to 20 mA, two-wire
Communication for SITRANS TK-H	According to HART V 5.7
Accuracy	
• Digital measuring errors	

Resistance thermometers

Input	Measuring range °C	Min. measuring span °C	Dig. accuracy °C
- Pt25 to Pt500	-200 to +850	10	0.1
- Pt501 to Pt1000 IEC	-200 to +350	10	0.1
- Ni25 to Ni1000	-50 to +250	10	0.1
- Cu25 to Cu1000	-50 to +200	10	0.1

Resistance-based sensors

Input	Measuring range Ω	Min. measuring span Ω	Dig. accuracy Ω
- Resistance	0 to 390	5	0.05
- Resistance	0 to 2200	25	0.25

mV sensors

Input	Measuring range mV	Min. measuring span mV	Dig. accuracy µV
- mV sensor	-10 to +70	2	40
- mV sensor	-100 to +1100	20	400

Technical data (continued)

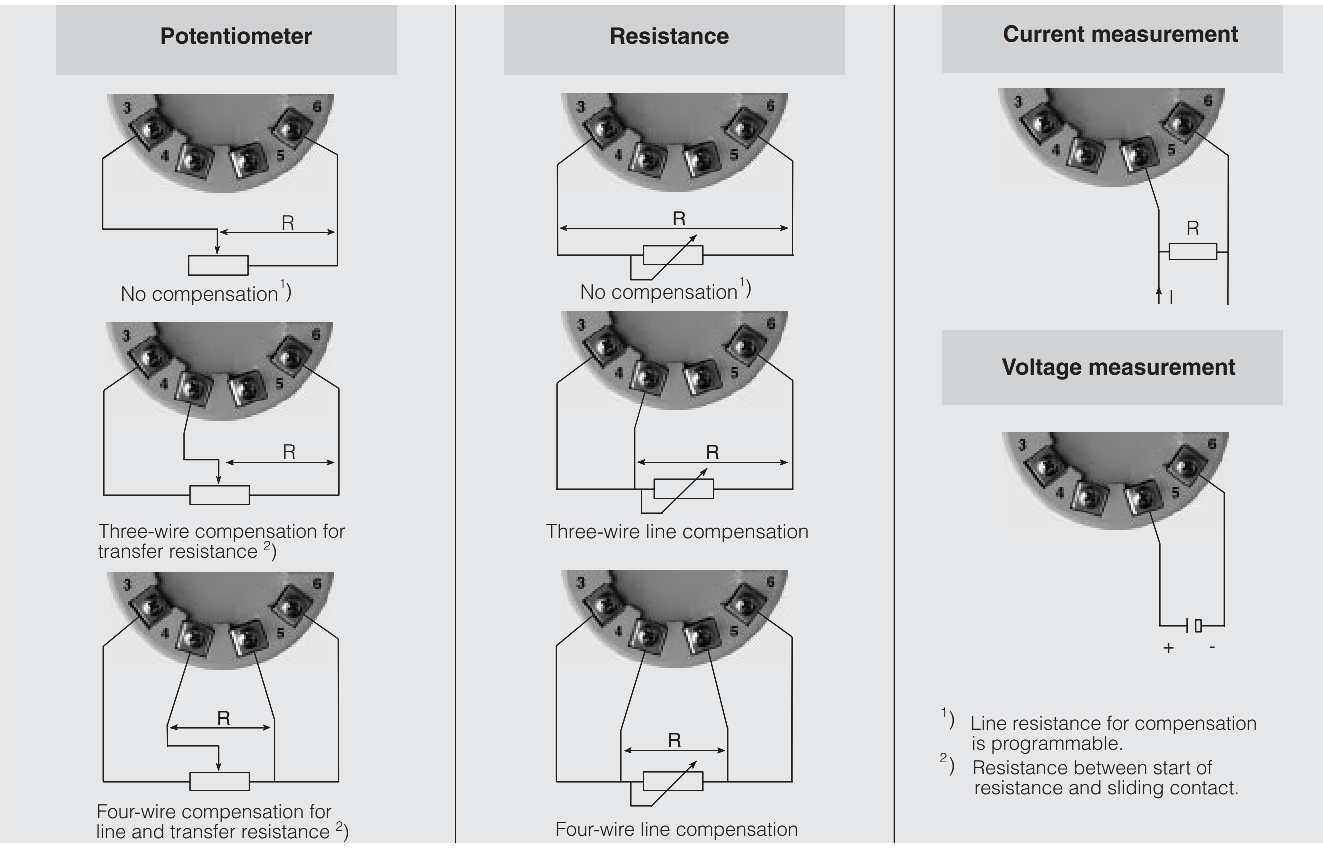
Accuracy (continued)

Thermocouples

Input	Measuring range °C	Min. measuring span °C	Dig. accuracy °C
- Type B	+500 to +1820	50	2
- Type C	0 to +2300	100	2
- Type D	0 to +2300	100	2
- Type E	-250 to +900	50	1
- Type J	-210 to +1200	50	1
- Type K	-230 to +1370	50	1
- Type L	-200 to +900	50	1
- Type N	-200 to +1300	50	1
- Type R	0 to +1750	100	2
- Type S	0 to +1750	100	2
- Type T	-220 to +400	40	1
- Type U	-200 to +600	50	1

• Error in the analog output	< 0.1 % of measuring span
• Error in the internal cold junction	< 0.5 K
• Temperature drift	±0.01 %/°C, typ. ±0.003 %/°C
• Influence of the power supply on the span and zero point	<0.005 % of measuring span/V
• Long-term drift	<0.03 % in first month
Rated operating conditions	
Ambient conditions	
• Ambient temperature	-40 to +85 °C
• Relative humidity	< 98 %, with condensation
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-2
- Emitted interference	According to EN 50 081-2
Design	
Weight	50 g
Dimensions	See page 2/44
Material	Moulded plastic

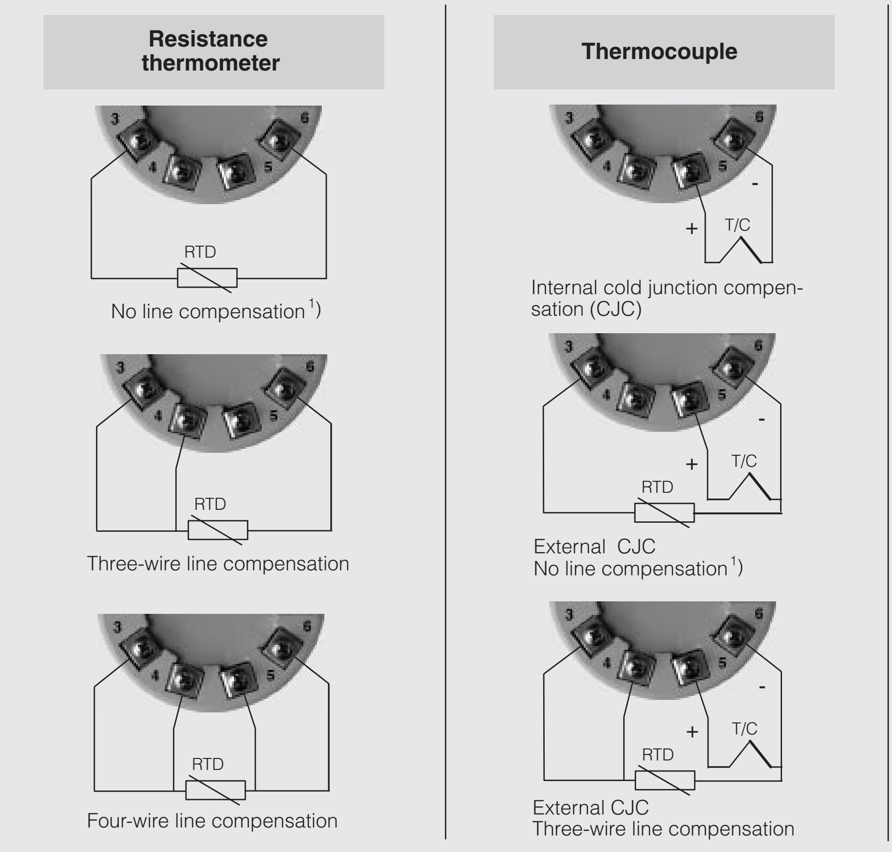
Power supply	
for SITRANS TK	6.5 to 35 V DC (28 V for EEx ia)
for SITRANS TK-H	12 to 35 V DC (28 V for EEx ia)
Electrical isolation	between input and output
• Test voltage	U_{eff}=3.75 kV, 50 Hz, 1 min
• Insulation	500 V_{ac}
Certificates and approvals	
Explosion protection (CENELEC)	
• "Intrinsic. safe" type of protection	EEx ia IIC T4
- Conformity certificate	
for TK	DEMKO-Nr.: 98D.124351X
for TK-H	DEMKO-Nr.: 98D.123803X
Explosion protection (German Technical Inspectorate)	
• EX tested for zone 2n	II 3 G Ex nA II T 4
- Conformity statement	TÜV 98 ATEX 1292 X
Hardware and software requirements for the parameteriz. software	
• **SIPROM TK for SITRANS TK**	
Personal computer	CPU of type 486 upwards, compatible with industrial standard 3½“ diskette drive Hard disk with 5 MB vacant space Min. 4 MB RAM VGA graphics adapter (or compatible) with at least 16 colours One vacant serial port Mouse or compatible pointer unit (recommended) Printer (recommended)
PC operating system:	MS-DOS V 5.0 upwards, MS-Windows V 3.1 upwards (not Wind. NT)
• **SIMATIC PDM für SITRANS TK-H**	
See section 6	



[1] Line resistance for compensation is programmable.

[2] Resistance between start of resistance and sliding contact.

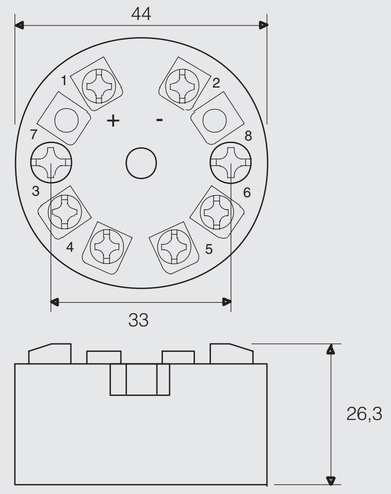
Fig. 2/32 Sensor pin assignments



Note:
Line resistance (per wire in the case of 3 and 4-wire connections)
T > 600 °C: max. 10 Ω
T < 600 °C: max. 30 Ω

1) Line resistance for compensation is programmable.

Fig. 2/33 Sensor pin assignments (continued)



1. 2	U_H, I_A
3, 4, 5, 6	Sensors
7. 8	Test (for measuring output current with a multimeter)

All dimensions in mm

Fig. 2/34 Dimensions and pin assignments

Ordering data	Order No.
SITRANS TK temperature transmitter	
for installation in the sensor head type B (DIN 43729), 2-wire connection 4 to 20 mA, programmable, with electrical isolation	
• Not explosion-proof	7NG3120-1JN00
• Explosion protection Ex n for zone 2	7NG3121-1JN00
• With explosion protect. EEx ia for zone 1	7NG3122-1JN00
SITRANS TK-H temperature transmitter	
for installation in the sensor head type B (DIN 43 729) 2-wire connection 4 to 20 mA capable of communication according to HART V 5.7, with electrical isolation	
• Not explosion-proof	7NG3120-2JN00
• Explosion protection Ex n for zone 2	7NG3121-2JN00
• With explosion protect. EEx ia for zone 1	7NG3122-2JN00
Accessories (if necessary)	
SIPROM TK parameterization software For SITRANS TK (German/English)	7NG3190-8KB
Modem for SITRANS TK	7NG3190-6KB
SITRANS TK/TK-H Operating Instructions (German/English) not included in scope of supply of device	C79000-B7174-C12
SIMATIC PDM parameterization softw. for SITRANS TK-H	See section 6
Interface for SIPROM software and SIMATIC PDM (HART modem)	7MF4997-1DA
HART communicator with battery charger for 230 V AC and carrying bag; type of prot.: intrinsically-safe EEx ia II C P4	
• German	7MF4998-8KF
• English	7MF4998-8KT

🟦 Available ex stock
For **power supplies** see page 2/50.

SITRANS TF
Transmitters for temperature
7NG3130, 7NG3131, 7NG3132
Two-wire system / Housing for field mounting


Fig. 2/35 SITRANS TF transmitter for temperature

Application

The SITRANS TF transmitter converts the signals from resistance thermometers, resistance-based sensors, thermocouples or voltage sensors into a load-independent direct current corresponding to the sensor characteristic.

The communication capability (HART® protocol V 5.7) of the SITRANS TF permits parameterization using a PC or HART communicator (hand-held communicator).

Parameterization is carried out using a PC for the programmable SITRANS TF with integrated SITRANS TK.

Transmitters of the "Non incendive" type of protection can be installed within potentially explosive atmospheres (zone 2).

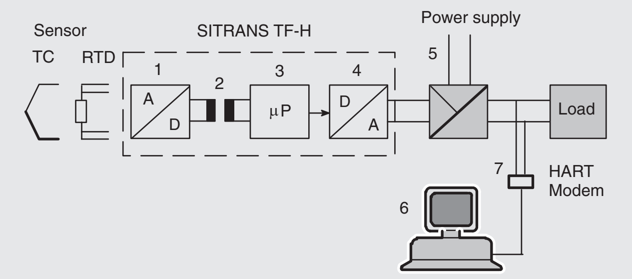
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres (zone 1).

Mode of operation (Fig. 2/36)

The measured signal supplied by a resistance-based sensor (2, 3 or 4-wire connection) or by a thermocouple is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by an analog/digital converter (1). These signals are forwarded electrically isolated (2) to the microprocessor (3). They are converted there in accordance with the sensor characteristic and further parameters (damping, ambient temperature etc.).

The signal prepared in this way is converted in a digital/analog converter (4) into a load-independent direct current of 4 to 20 mA. The power supply (5) is located in the output signal circuit.

The SITRANS TK-H transmitter is parameterized using a PC (6) connected to the two-wire line via the interface module (HART® modem) (7). A hand-held communicator can also be used for this purpose. The signals needed for communication in conformity with the HART® protocol V 5.7 are superimposed on the output current in accordance with the frequency shift keying (FSK) method.



1 Analog/digital converter
2 Electrical isolation
3 Microprocessor
4 Digital/analog converter
5 Power supply
6 PC/laptop
7 HART modem

Fig. 2/36 Block diagram: Operation of the SITRANS TF with an integrated SITRANS TK-H

Technical data

Input	
Resistance thermometer	
• Measured variable	Temperature
• Sensor type	Pt25 to Pt1000 (DIN IEC 751) Pt25 to Pt1000 (JIS C 1604) Ni25 to Ni1000 (DIN IEC 751) Cu25 to Cu1000
• Characteristic	Temperature-linear
• Type of connection	2, 3 or 4-wire circuit
Resistance-based sensor	
• Measured variable	Temperature
• Measuring limit	2200 Ω
• Characteristic	Resistance-linear or programmable (TK)
• Type of connection	2, 3 or 4-wire circuit
Thermocouples	
• Measured variable	Temperature
• Input type	Type B, E, J, K, R, S, T (DIN IEC 584-1) Type L, U (DIN 43 710) Type N (BS 4937) Type C, D (ASTM 988)
• Characteristic	Temperature-linear
• Cold junction compensation	Internal, external with Pt100 or external with a fixed value
mV sensor	
• Measured variable	Temperature
• Measuring limit	1100 mV
• Characteristic	Voltage-linear or programmable
• Overload capacity of the input	-0.5 to +35 V DC
• Input resistance	≥ 1 MΩ
Output	
Output signal	4 to 20 mA, two-wire
Communication for SITRANS TK-H	According to HART V 5.7
Accuracy	
Digital measuring errors	

Resistance-based sensors

Input	Measuring range Ω	Min. measuring span Ω	Dig. accuracy Ω
- Resistance	0 to 390	5	0.05
- Resistance	0 to 2200	25	0.25

Technical data (continued)

Accuracy (continued)

Resistance thermometers

Input	Measuring range °C	Min. measuring span °C	Dig. accuracy °C
- Pt25 to Pt500	-200 to +850	10	0.1
- Pt501 to Pt 1000 IEC	-200 to +350	10	0.1
- Ni25 to Ni1000	-50 to +250	10	0.1
- Cu25 to Cu1000	-50 to +200	10	0.1

Thermocouples

Input	Measuring range °C	Min. measuring span °C	Dig. accuracy °C
- Type B	+500 to +1820	50	2
- Type C	0 to +2300	100	2
- Type D	0 to +2300	100	2
- Type E	-250 to +900	50	1
- Type J	-210 to +1200	50	1
- Type K	-230 to +1370	50	1
- Type L	-200 to +900	50	1
- Type N	-200 to +1300	50	1
- Type R	0 to +1750	100	2
- Type S	0 to +1750	100	2
- Type T	-220 to +400	40	1
- Type U	-200 to +600	50	1

mV sensors

Input	Measuring range mV	Min. measuring span mV	Dig. accuracy µV
- mV sensor	-10 to +70	2	40
- mV sensor	-100 to +1100	20	400

• Error in the analog output	< 0.1 % of measuring span
• Error in the internal cold junction	< 0.5 K
• Temperature drift	± 0.01 %/°C, typ. ± 0.003 %/°C
• Influence of the power supply on the span and zero point	< 0.005 % of measuring span/V
• Long-term drift	< 0.03 % in first month

Rated operating conditions	
Ambient conditions	
• Ambient temperature	-40 to +85 °C
• Condensation	Permissible
• Electromagnetic compatibility	
- Interference immunity	According EN 50 082-2 and NAMUR NE21
- Emitted interference	According EN 50 081-2
• Degree of protection to EN 60 529	IP 65

Design	
Weight	Approx. 1.5 kg (without options)
Dimensions	See page 2/48
Housing material	Low-copper cast aluminium GD-AlSi 12, polyester-based coating, stainless steel rating plate
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT threaded gland
Mounting bracket (optional)	Steel, galvanised and chrome-plated or stainless steel

Power supply	
for SITRANS TK	6.5 to 35 V DC (28 V for EEx ia)
for SITRANS TK-H	12 to 35 V DC (28 V for EEx ia)

Electrical isolation	between input and output
• Test voltage	U_{eff} = 3.75 kV, 50 Hz, 1 min
• Insulation	500 V_{ac}

Certificates and approvals	
Explosion protection (CENELEC)	
• "Intrinsically safe" type of protection	II 2 (1) G EEx ia IIC T4
- Conformity certificate	ZELM 99 ATEX 0007
Explosion protection (German Technical Inspectorate)	
• Ex tested for zone 2n	II 3 G Ex nA II T 4
- Conformity statement	TÜV 98 ATEX 1292 X

Hardware and software requirements for the parameterization software	
SIPROM TK for SITRANS TK	
Personal computer with:	CPU of type 486 upwards, compatible with industrial standard
	3.5" diskette drive
	Hard disk with 5 MB vacant space
	Min. 4 MB RAM
	VGA graphics adapter (or compatible) with at least 16 colours
	One vacant serial port
	Mouse or compatible pointing device and printer (recommended)
PC operating system:	MS-DOS V 5.0 upwards, MS-Windows V 3.1 upwards (not Windows NT)
SIMATIC PDM for SITRANS TK-H	
See section 6	

Communication	
• Load for HART connection	230 to 1100 Ω
• Cable	Two-core shielded: ≤ 3 km Multi-core shielded: ≤ 1.5 km
• Protocol	HART protocol V 5.x
SIMATIC PDM for SITRANS TK-H	See section 6

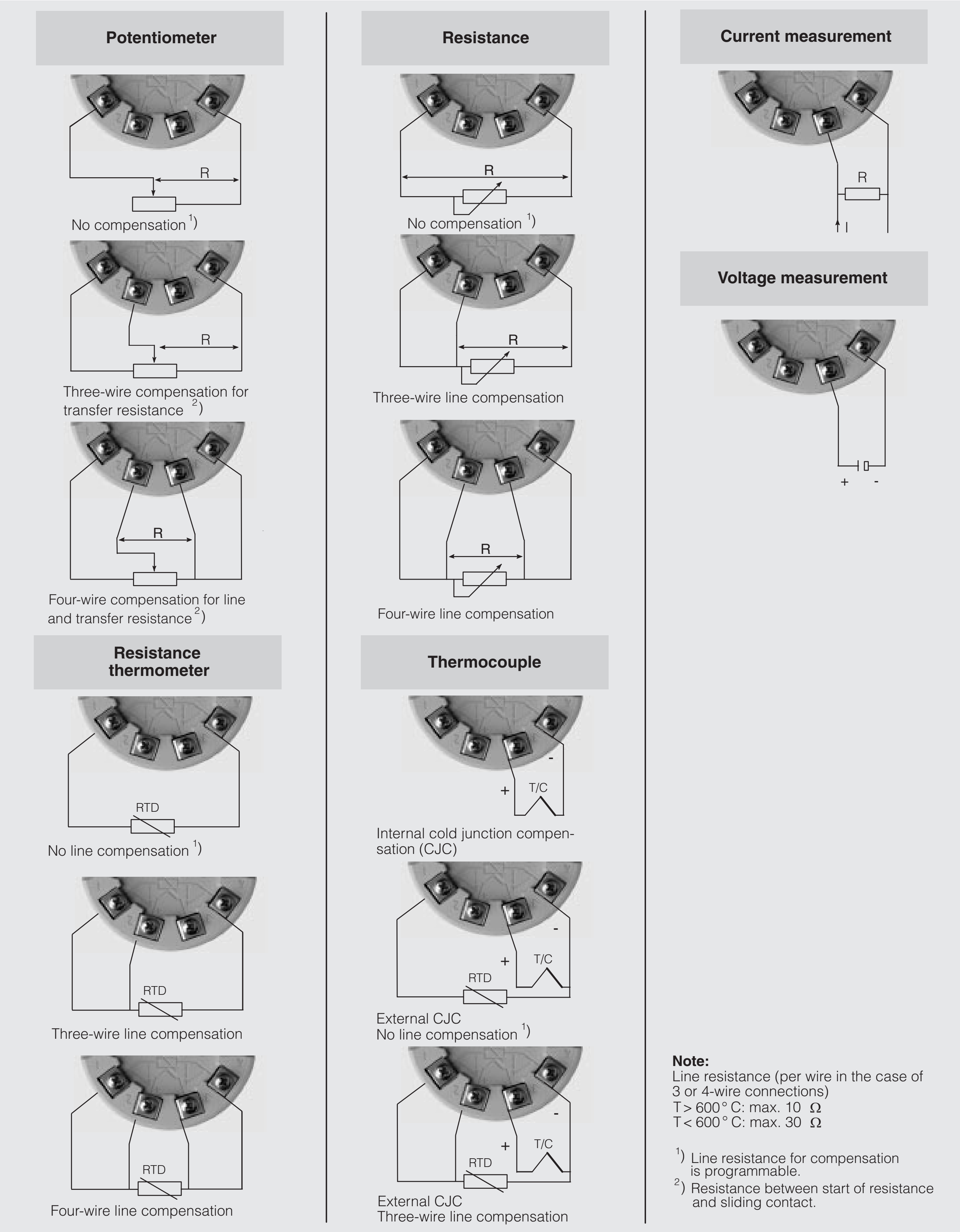


Fig. 2/37 Sensor pin assignments

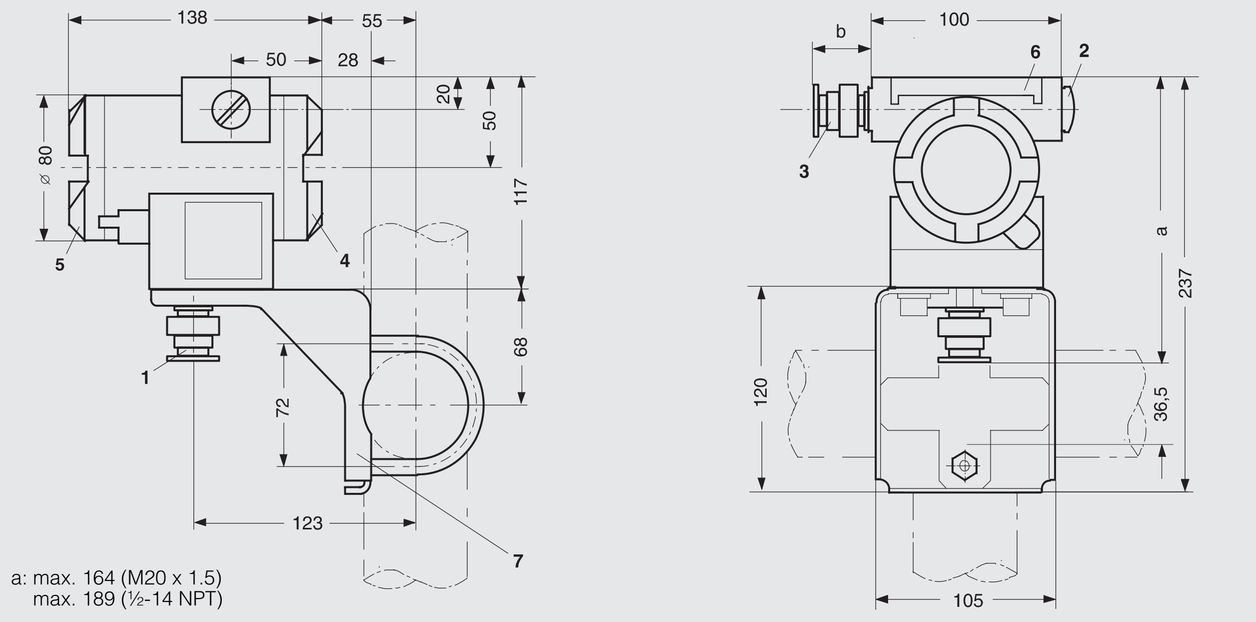
Note:
Line resistance (per wire in the case of 3 or 4-wire connections)
T > 600 °C: max. 10 Ω
T < 600 °C: max. 30 Ω

[1] Line resistance for compensation is programmable.

[2] Resistance between start of resistance and sliding contact.

SITRANS TF
Transmitters for temperature

7NG3130, 7NG3131, 7NG3132
Two-wire system / Housing for field mounting



a: max. 164 (M20 x 1.5)
max. 189 (½-14 NPT)

b: max. 25 (M20 x 1.5)
max. 50 (½-14 NPT)

1 Sensor connection (screwed gland M20 x 1.5 or ½-14 NPT)
2 Blanking plug
3 Electrical connection (screwed gland M20 x 1.5 or ½-14 NPT)
4 Terminal side, output signal
5 Terminal side, sensor
6 Protective cover (without function)
7 Mounting bracket (option) with clamp for securing to a vertical or horizontal pipe

Fig. 2/38 SITRANS TF, dimensions in mm

Ordering data	Order No.
Temperature transmitter in housing for field mounting Two-wire system 4 to 20 mA, with electrical isolation, without operating instructions	**7NG313■-■■■■■**
Integrated transmitter	
• without transmitter	0 0
• SITRANS TK, programmable	
- SITRANS TK, without Ex protection	1 0
- SITRANS TK, with EEx ia	1 1
- SITRANS TK, with EEx n (zone 2)	1 2
• SITRANS TK-H, communication capability according to HART V5.x	
- SITRANS TK-H, without Ex protection	2 0
- SITRANS TK-H, with EEx ia	2 1
- SITRANS TK-H, with EEx n (zone 2)	2 2
Housing	
• Die-cast aluminium	A
• Stainless steel precision casting	E
Connections/Cable inlet	
• 2 x screwed gland M20 x 1.5	B
• 2 x screwed gland ½-14 NPT	C
Indicator	
• Without	0
Mounting bracket and securing parts	
• Without	0
• Made of steel	1
• Made of stainless steel	2

Suffixes	**Order Code**
Add "-Z" and the order code to the order number and specify any plain text	
Inscription on measuring-point label	
• Measuring range (max. 27 characters)	Y22
• Measuring-point number/identification (max. 16 characters)	Y23
• Measuring-point text (max. 27 charac.)	Y24
Accessories (if necessary)	**Order No.**
SIPROM TK parameterization software For SITRANS TK (German/English)	**7NG3190-8KB**
Modem for SITRANS TK	**7NG3190-6KB**
SITRANS TK/TK-H Operating Instructions German/English (not included in scope of supply of device)	**C79000-B7174-C12**
SIMATIC PDM parameterization softw. for SITRANS TK-H	See section 6
Interface for SIPROM software and SIMATIC PDM (HART modem)	**7MF4997-1DA**
HART communicator with battery charger for 230 V AC and carrying bag; type of prot.: intrinsically-safe EEx ia II C P4	
• German	**7MF4998-8KF**
• English	**7MF4998-8KT**
Mounting bracket and securing parts	
• Steel for 7NG313■-■■B■■	**7MF4997-1AC**
• Steel for 7NG313■-■■C■■	**7MF4997-1AB**
• Stainl. steel for 7NG313■-■■B■■	**7MF4997-1AJ**
• Stainl. steel for 7NG313■-■■C■■	**7MF4997-1AH**

■ Available ex stock.

For power supplies, see page 2/50.

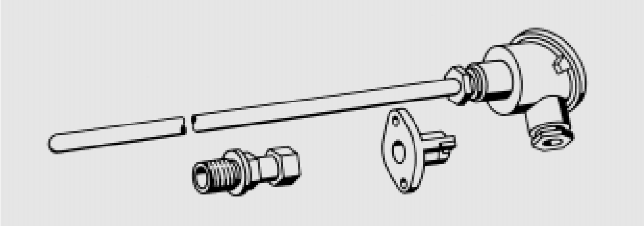
Resistance thermometers and thermocouples

Fig. 2/39 Resistance thermometers and thermocouples

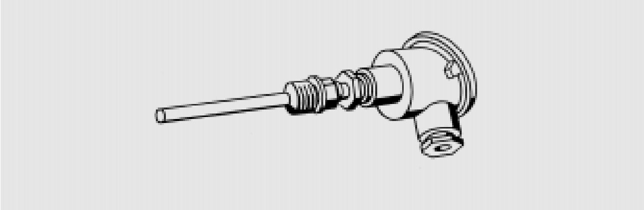
Application

Resistance thermometers and thermocouples are used in all areas of industrial temperature measurement. The wide range of materials, protective valves and process connections available make them easily adaptable to every measuring task.

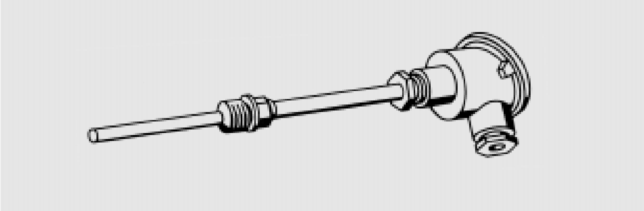
Examples of possible design variants



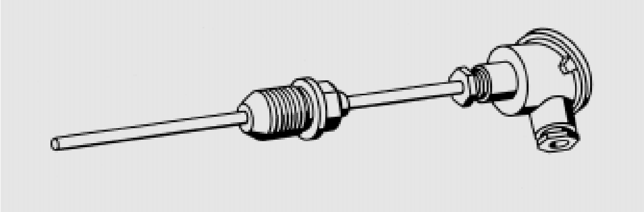
Smoke resistance thermometer / straight thermocouple



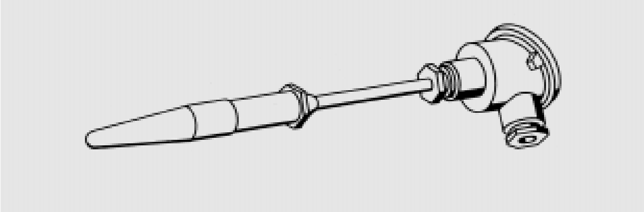
Low-pressure screw-in resistance thermometer / thermocouple (without neck tube)



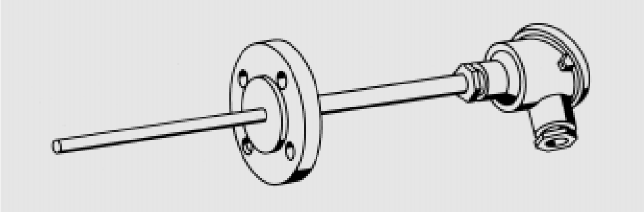
Low-pressure screw-in resistance thermometer / thermocouple (with neck tube)



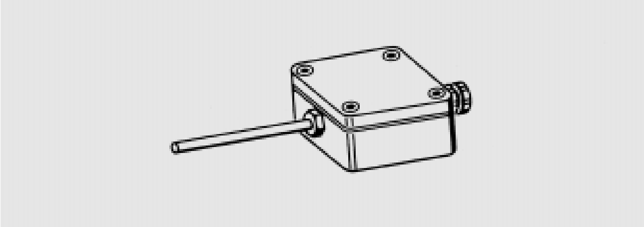
High-pressure screw-in resistance thermometer / thermocouple



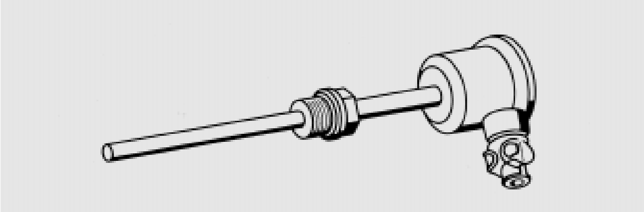
High-pressure weld-connection resistance thermometer / thermocouple



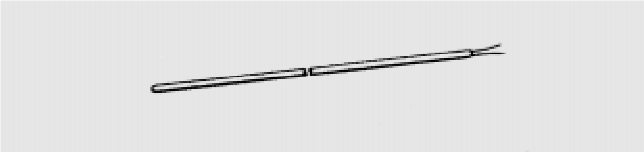
Flange resistance thermometer



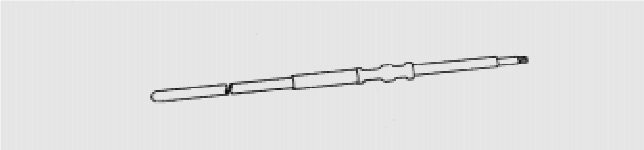
Resistance thermometer for humid conditions



Explosion-proof resistance thermometer / thermocouple for measuring the temperature of liquids and gases, also in potentially explosive areas (EEx d)



Shielded thermocouple with exposed connecting leads



Shielded thermocouple with compensating cable

Note:
These are only examples of possible design variants. Siemens supplies a complete range of temperature sensors. For further information, please contact your local Siemens office.

SITRANS I isolating power supply HART (FSK)

for supplying power to two-wire transmitters

7NG4122

Fig. 2/40 SITRANS I isolating power supply HART (FSK)

Application

The power supply for 7NG4122 SMART transmitters is used to supply two-wire transmitters that are operated in intrinsically safe areas. It supports communication with digital transmitters via a host computer or HART communicator (hand-held communicator).

Features

- Compact plastic housing (22.5/35 mm wide) with screw-type plug connector to IP 20 for mounting on 35 mm rail to DIN EN 50 022
- Power supply 24 V AC/DC (universal current) or
- Flexible low-voltage supply from wide-input-range power supply 95 to 253 V AC
- Power supply status indication via LED on front
- HART (FSK) communication via communication sockets on the front
- Electrical isolation between input, output and power supply
- Intrinsically safe input circuit

Mode of operation (Fig. 2/41)

The connected transmitter is supplied intrinsically safe via a limitation circuit (1), rectifier (2) and a transformer (3). The current is mirrored to the output.

For communication with the transmitter, a HART communicator or HART modem can either be connected across the output resistance (at least 250 Ω) or to the communication sockets connected in parallel with the output (HK). The three output terminals enable the output circuit to be connected with or without the internal communication resistance (250 Ω).

1	Limitation circuit
2	Rectifier
3	Transformer
4	Rectifier
5	Output amplifier
6	Power transformer
7	LED green (PWR)
8	Rectifier
E	Input signal
A	Output signal
HK	Connector for communication
PWR	Power supply

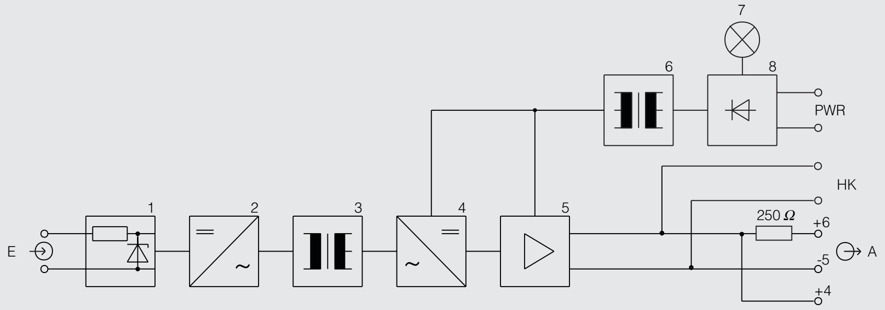


Fig. 2/41 Block diagram: Operation of SITRANS I isolating power supply HART (FSK)

Technical data

Input	
Input signal	4 to 20 mA
Input resistance	Approx. 320 Ω
Min. voltage available at 20 mA	16 V
Output	
Output signal	4 to 20 mA
Open circuit voltage	< 24 V
Characteristic	Linear
Load	
• between +4 and -5	≤ 750 Ω
• between -5 and +6	≤ 500 Ω
Communication	Bi-directional transfer of HART signals
• Communication range	3.6 to 23 mA
Input monitoring	
• Signal for input short circuit	23 to 30 mA
• Signal for open circuit	< 3.6 mA
Accuracy	
(related to full-scale value of output signal)	
Linearity	≤ 0.15 %
Output signal ripple	U_{PP} < 1 %
Rise time T_{90}	≤ 0.3 ms

Influencing effect	
• of ambient temperature	≤ 0.2 %/10 K
• of change in load resistance	≤ 0.1 %/100 %
• of change in supply	≤ 0.1 %/10 %
Rated operating conditions	
Ambient conditions	
• Ambient temperature	-20 to +65 °C
• Storage temperature	-40 to +85 °C
• Functional temperature	-25 to +70 °C
• Degree of protection to EN 60 529	IP 20
• Electromagnetic compatibility	
- Interference immunity	According to EN 50 082-2 and NAMUR NE21
- Emitted interference	According to EN 50 081-1
Design	
Construction	Compact plastic housing for rail mounting
Weight	Approx. 0.15 kg
Dimensions	See page 2/51
Enclosure material	PC/GV 25
Electrical connection	Plug-in screw terminals, max. 2.5 mm^2

SITRANS I isolating power supply HART (FSK)
for supplying power to two-wire transmitters

7NG4122

Technical data (continued)

Power supply	
Functional extra-low voltage	According to DIN 57 100, VDE 0100 Part 410
• With safe isolation	≤ 50 V AC, ≤ 120 V DC
Universal current 24 V AC/DC	24 V AC ± 15 %, 47 to 63 Hz 20 to 32 V DC
AC voltage	95 to 253 V AC, 47 to 63 Hz
Power consumption at rated voltage	24 V DC, < 2.5 W 24 V AC, < 3 VA 230 V AC, < 3.5 VA
Permitted residual ripple within the voltage limits	$U_{PP} \leq 2.5$ V
Electrical isolation between	Power supply and input Power supply and output Input and output
• Operational voltage acc. to DIN 61010	
- for 7NG4122-1BA10 (230 V)	250 V AC
- for 7NG4122-1AA10 (24 V)	150 V AC
• Pollution severity	2
• Overvoltage category	II
• Test voltage for 7NG4122-1AA10 (24 V) between	
- Power supply and input	1.5 kV AC
- Input and output	1.5 kV AC
- Power supply and output	500 V AC
• Test voltage for 7NG4122-1BA10 (230 V) between	
- Power supply and input	2.3 kV AC
- Input and output	2.3 kV AC
- Power supply and output	2.3 kV AC

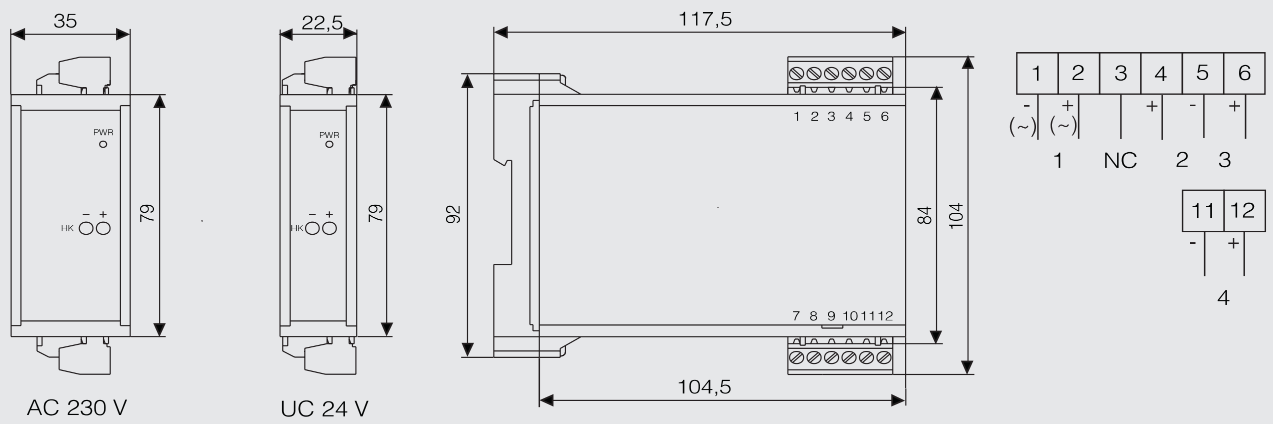
Certificates and approvals	
CENELEC	According to DIN EN 50 014 and DIN EN 50 020 Intrinsically safe input circuit
• "Intrinsically safe" type of protection	II (1) G EEx [ia/ib] IIB
- Maximum output voltage U_0	27.9 V
- Maximum output current I_0	89 mA
- Maximum output power P_0	620 mW
- Maximum external capacit. C_0	651 nF
- Maximum external inductance L_0	16 mH
• "Intrinsically safe" type of protect.	II (1) G EEx [ia/ib] IIC
- Maximum output voltage. U_0	27.9 V
- Maximum output current I_0	89 mA
- Maximum output power P_0	620 mW
- Maximum exter. capacitance C_0	81 nF
- Maximum external inductance L_0	2.3 mH
Conformity certificate	TÜV 99 ATEX 1498
Extern. standards and guidelines	
Low-voltage guideline	According to DIN EN 61 010

Ordering data

	Order No.
SITRANS I isolating power supply HART (FSK) Rail-mounted to supply two-wire transmitters, output 4 to 20 mA, intrinsically safe input 4 to 20 mA with EEx ia/ib IIB/IIC	**7NG4122 - 1 ■ A10**
Power supply	
• 24 V AC/DC (22.5 mm width)[1]	**A**
• 95 to 253 V AC (35 mm width)[2]	**B**

■ Stock items

For **power supplies**, see page 2/50.



1 Power supply (PWR)
2 Output with internal communication resistance (terminals +4 and -5)
3 Output with internal communication resistance (terminals -5 and +6)
4 Input
NC Not connected

Fig. 2/42 Dimension drawing and connections

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[1] Start of delivery planned for 12/99.
[2] Start of delivery planned for 01/00.

SITRANS I transmitter power supply / input isolator

7NG4123

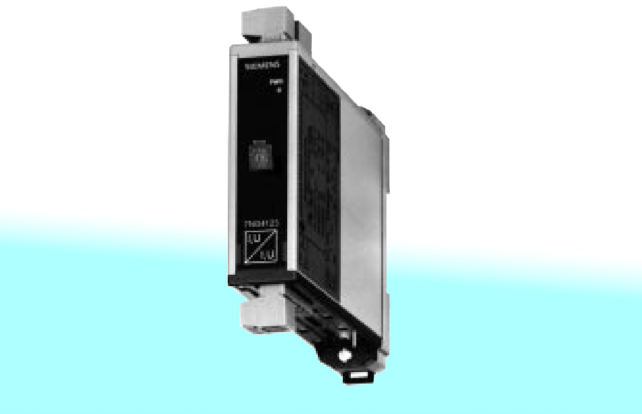


Fig. 2/43 SITRANS I transmitter power supply / input isolator

Application

The 7NG4123 transmitter power supply and input isolator is used for the transformation and electrical isolation of standard signals. When it is implemented as a transmitter power supply, it is used for supplying power and transferring signals to two-wire transmitters.

Features

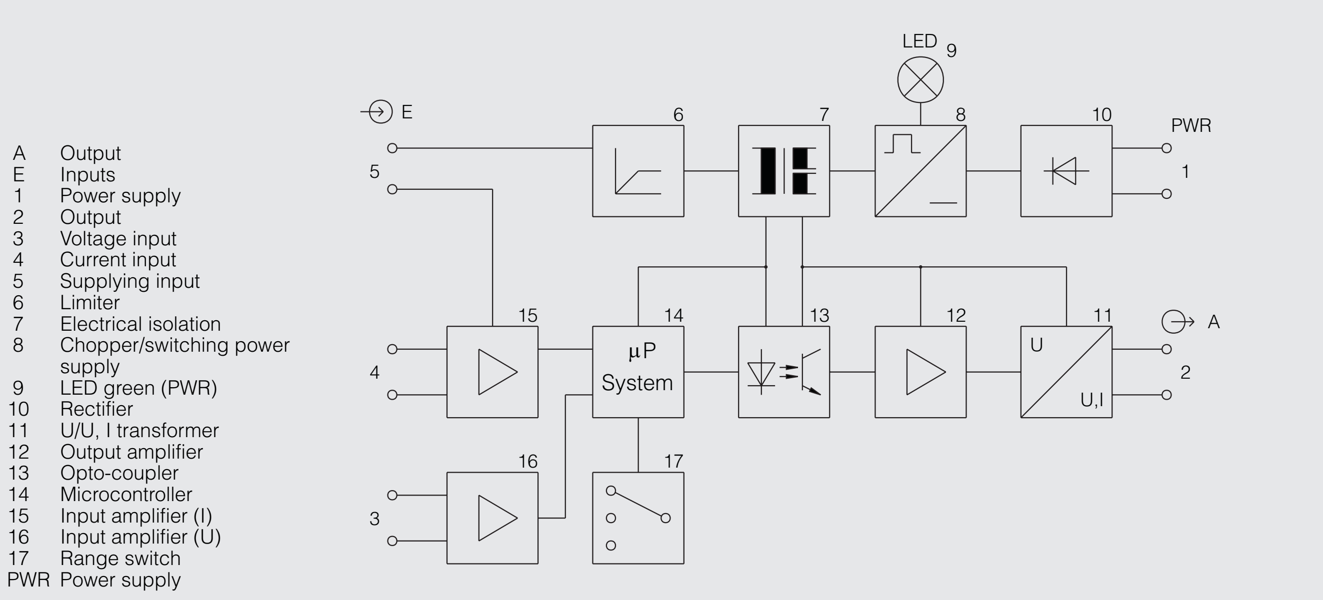
- Compact plastic housing (22.5/35 mm wide) with screw-type plug connector to IP 20 for mounting on 35 mm rail to DIN EN 50 022
- Power supply status indication via LED on front
- Input signal can be selected by appropriate connection of the input terminals (supplying, current input, voltage input)
- Output signal can be changed over (current output, voltage output) by means of plug-in jumpers below the housing base
- Two-wire transmitters are supplied
- Transfer function can be switched over 0/4 to 20 mA or 0/2 to 10 V / 0/4 to 20 mA or 0/2 to 10 V by means of a measuring range switch on the front
- Electrical isolation between input, output and power supply

Mode of operation

The input signal is applied to the respective input amplifier and converted by a microcontroller in accordance with the transfer function before reaching the output amplifier via an opto-coupler. The signal is amplified and output again as a standard signal (current/voltage).

When operating as a transmitter power supply, the connected transmitter is supplied and the transmitter load current is applied to the input amplifier (1). The transfer function can be switched over (0/4 to 20 mA or 0/2 to 10 V / 0/4 to 20 mA or 0/2 to 10 V) by means of a measuring range switch. Calibration is not necessary because all characteristics are stored in the microcontroller.

The electrical isolation ensures that the power supply, input circuits and output circuits are completely decoupled for low-current transfer of the measured values.



A	Output
E	Inputs
1	Power supply
2	Output
3	Voltage input
4	Current input
5	Supplying input
6	Limiter
7	Electrical isolation
8	Chopper/switching power supply
9	LED green (PWR)
10	Rectifier
11	U/U, I transformer
12	Output amplifier
13	Opto-coupler
14	Microcontroller
15	Input amplifier (I)
16	Input amplifier (U)
17	Range switch
PWR	Power supply

Fig. 2/44 Block diagram: Operation of SITRANS I transmitter power supply and input isolator

SITRANS I transmitter power supply / input isolator

7NG4123

Technical data

Input	
Input isolator	
• Input signal	
- Current	0/4 to 20 mA
- Voltage	0/2 to 10 V
• Input resistance	
- Current	60 Ω
- Voltage	≥ 1 MΩ
• Max. permissible input current	30 mA
• Max. permissible input voltage	15 V
Transmitter power supply	
• Input signal	
- Current	4 to 20 mA
• Supplied voltage	≥ 15 V at 20 mA
• Input resistance	100 Ω
• Signal limiting	
- Current	≤ 30 mA
- Voltage	≤ 21 V
Output	
Output signal	
• Current	0/4 to 20 mA
• Voltage	0/2 to 10 V
Characteristic	Rising, linear
Load	
• with current	≤ 750 Ω
• with voltage	≥ 2 kΩ
Signal limiting	
• Current	≤ 30 mA
• Voltage	≤ 21 V
Output response	
• to short-circuit or open-circuit input	
- output 4-20 mA or 2-10 V:: (input 4-20 mA or 2-10 V)	3.4 to 3.6 mA or 1.7 to 1.8 V
- output 4-20 mA or 2-10 V: (input 0-20 mA or 0-10 V)	4 mA or 2 V
- output 0-20 mA or 0-10 V: (input not relevant)	0 mA or 0 V
• to short-circuit across input (supplying)	≥ 21 mA
- for load ≤ 600 Ω	≥ 22 mA or ≥ 11 V
Accuracy	
(related to full-scale value of output signal)	
Linearity	≤ 0.1 %
Zero point / amplification	≤ 0.1 %
Long-term stability	≤ 0.05 % / year
Output signal ripple	≤ 1 %
Rise time T_{90}	≤ 150 ms
Influencing effect	
• of ambient temperature	≤ 0.15 %/10 K
• of change in load resistance	≤ 0.1 %/100 %
• of change in supply	≤ 0.05 %/10 %
Design	
Construction	Plastic housing
Weight	Approx. 0.2 kg
Dimensions	See page 2/54
Enclosure material	PC/GV 25
Electrical connection	Plug-in screw terminals, max 2.5 mm^2
Rated operating conditions	
Ambient conditions	
• Ambient temperature	-20 to +65 °C
• Storage temperature	-40 to +85 °C
• Functional temperature	-25 to +70 °C
• Degree of protection EN 60 529	IP 20
• Electromagnetic compatibility	
- Interference immunity	According to DIN EN 50 082-2 and NAMUR NE21
- Emitted interference	According to DIN EN 50 081-2
Power supply	
Functional extra-low voltage	DIN 57 100, VDE 0100 Part 410
• With safe isolation	< 50 V AC, < 120 V DC
• Universal current 24 V AC/DC	24 V AC ± 10 %, 47 to 63 Hz 18 to 32 V DC
• AC voltage	95 to 253 V AC, 47 to 63 Hz
Power consumption at rated voltage	24 V, 1.9 W DC 24 V AC, 2 VA 230 V AC, 3.5 VA
Residual ripple within the voltage limits (DC)	U_{PP} ≤ 2.5 V
Electrical isolation between	Power supply and input Input and output Power supply and output
• Operational voltage acc. to DIN 61 010	
- for 24 V	50 V AC
- for 230 V	50 V AC
• Pollution severity	2
• Overvoltage category	II
• Test voltage for 24 V AC/DC between	
- Input and output	500 V AC
- Power supply and output	500 V AC
- Power supply and input	500 V AC
• Test voltage for 230 V AC between	
- Input and output	500 V AC
- Power supply and output	2.3 kV AC
- Power supply and input	2.3 kV AC
External standards and guidelines	
Low-voltage guideline	According to DIN EN 61 010

Ordering data

	Order No.
SITRANS I transmitter power supply / input isolator Rail-mounted to supply two-wire transmitters and electrical isolation and transformation of standard signals Input/output signals can be selected as required via measuring range switch on front	**7NG4123 - 1 ◻ N00**
Power supply	
• 24 V AC/DC (22.5 mm width)[1]	**A**
• 95 to 253 V AC (35 mm width)[1]	**B**

🟦 Stock items

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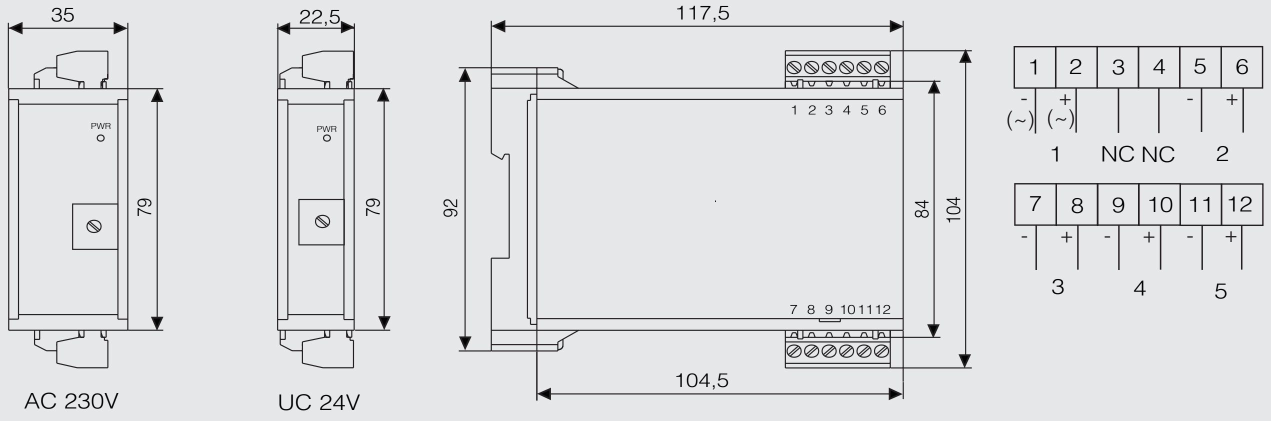
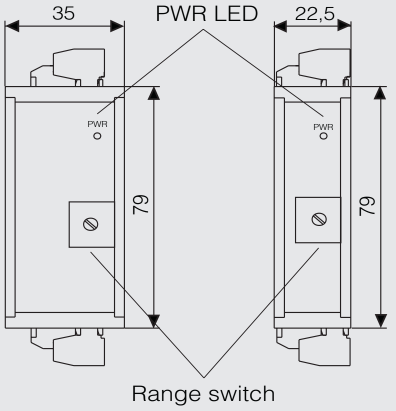
[1]) Start of delivery planned for 11/99

7NG4123



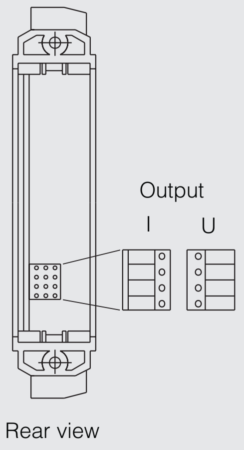
1	Power supply (PWR)		4	Current input 0/4 to 20 mA
2	Output		5	Loop powered input 4 to 20 mA
3	Voltage input 0/2 to 10 V		NC	Not connected

Fig. 2/45 Dimension drawing and connections



Range switch (on front plate)

Position	Input	Output “I”	Output “U“
0	4 to 20 mA	4 to 20 mA	2 to 10 V
1	4 to 20 mA	0 to 20 mA	0 to 10 V
2	0 to 20 mA	4 to 20 mA	2 to 10 V
3	0 to 20 mA	0 to 20 mA	0 to 10 V
4	2 to 10 V	4 to 20 mA	2 to 10 V
5	2 to 10 V	0 to 20 mA	0 to 10 V
6	0 to 10 V	4 to 20 mA	2 to 10 V
7	0 to 10 V	0 to 20 mA	0 to 10 V
8	Not used		
9	Not used (on delivery)		



Plug-in jumpers

The plug-in jumpers are accessed by unscrewing the housing socket.

Output I: All jumpers in position "I" (on delivery)

Output U: All jumpers in position "U"

Fig. 2/46 Plug-in jumpers

SITRANS I output isolator HART (FSK)
with intrinsically safe output circuit

7NG4130

Fig. 2/47 SITRANS I output isolator HART (FSK)

Application

The 7NG4130 output isolator electrically isolates an input current signal which originated in the non-intrinsically safe area from the intrinsically safe output circuit. It supports bi-directional communication between an actuator and a host computer or HART communicator (hand-held communicator).

Features

- Compact plastic housing (22.5/35 mm wide) with screw-type plug connector to IP 20 for mounting on 35 mm rail to DIN EN 50 022
- Power supply 24 V AC/DC (universal current) or
- Flexible low-voltage supply from wide-input-range power supply 95 to 253 V AC
- Power supply status indication via LED on front
- Input or output signal 4 to 20 mA
- HART (FSK) communication via communication sockets on the front
- Electrical isolation between input, output and power supply
- Intrinsically safe input circuit

Mode of operation

The input current signal is filtered and amplified. After pulse-width modulation, the input signal is transferred to the output side via an opto-coupler. A low pass filter followed by an amplifier transforms the signal into a standardized output variable.

The communication signals of a connected HART communicator are separated from the signal at the input, transferred electrically isolated to the output and added to the output signal again. Transmission via frequency shift keying is bi-directional and independent of the signal path. The HART communicator can either be connected across the input resistance (at least 250 Ω) or to the communication socket on the non-intrinsically safe side.

1	Rectifier
2	LED green (PWR)
3	Chopper
4	Transformer
5	Communications resistor
6	Input amplifier
7	Electrical isolator
8	Output amplifier
9	Ex limiter
10	Communication isolator
11	Signal coupling
E	Input signal
A	Output signal
HK	Front connector for communication
PWR	Power supply

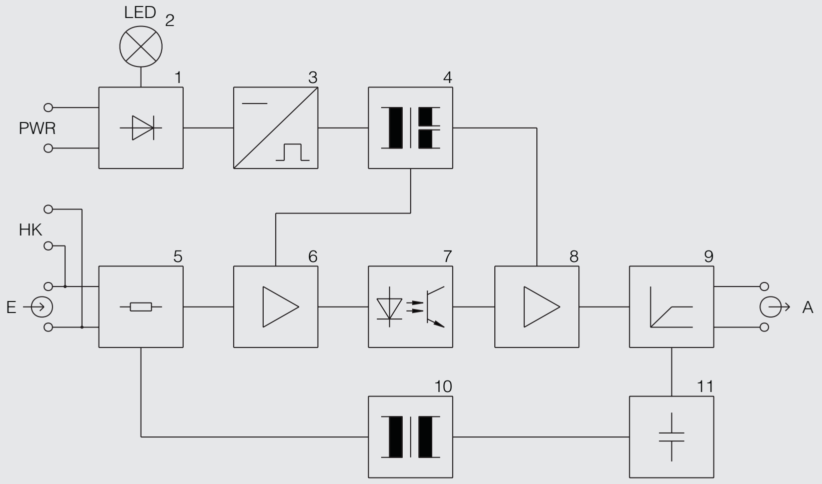


Fig. 2/48 Block diagram: SITRANS I output isolator HART (FSK)

SITRANS I output isolator HART (FSK)
with intrinsically safe output circuit

7NG4130

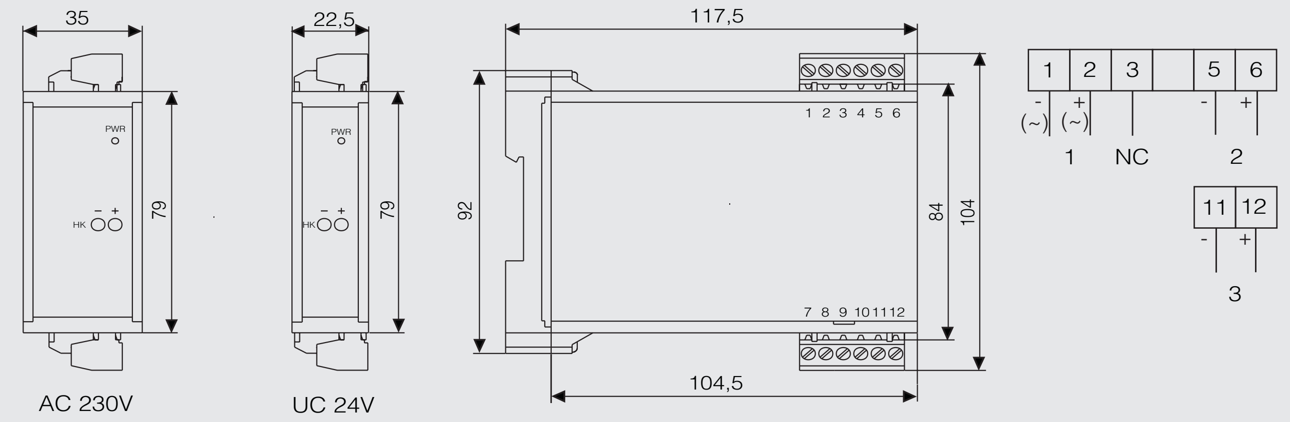
Technical data

Input	
Input signal	
• Current	4 to 20 mA
Transferred from HART (FSK) signals in the Ex zone	
Input resistance (current HART FSK)	≤ 270 Ω
Communication range	3.6 to 22 mA
Output	
Output signal	4 to 20 mA
Characteristic	Trapezoidal
Load	≤ 750 Ω
Output response	
• Setting	4 to 20 mA/4 to 20 mA
- for short circuit at input	0 mA
- for open-circuit input	0 mA
• Signal limiting	< 27 mA
Accuracy	
(related to full-scale value of output signal)	
Linearity	≤ 0.1 %
Output signal ripple	< 1 %
Rise time T_{90}	< 100 ms
Influencing effect	Related to full-scale value of output signal
• of ambient temperature	≤ 0.1 %/10 K
• of change in load resistance	≤ 0.1 %/100%
• of change in supply	≤ 0.01 %/15 %
Rated operating conditions	
Ambient conditions	
• Ambient temperature	-20 to +65 °C
• Storage temperature	-40 to +85 °C
• Functional temperature	-25 to +70 °C
• Degree of protection to EN 60 529	IP 20
• Electromagnetic compatibility	
- Interference immunity	According to DIN EN 50 082-2 and NAMUR NE21
- Emitted interference	According to DIN EN 50 081-2
Design	
Construction	Compact plastic housing for rail mounting
Weight	Approx. 0.15 kg
Dimensions	See page 2/57
Enclosure material	PC/GV 25
Electrical connection	Plug-in screw terminals, max 2.5 mm^2
Power supply	
Functional extra-low voltage	DIN 57 100, VDE 0100 Part 410
• With safe isolation	< 50 V AC, < 120 V DC
Universal current 24 V AC/DC	24 V AC ± 10 %, 47 to 63 Hz 18 to 32 V DC
AC voltage	95 to 253 V AC, 47 to 63 Hz
Power consumption at rated voltage	24 V DC, < 1.4 W 24 V AC, < 2 VA 230 V AC, < 3.2 VA
Residual ripple within the specified voltage limits (DC)	$U_{PP} \leq 2.5$ V

Electrical isolation between	Power supply and input Input and output Power supply and output
• Operational voltage acc. to DIN 61010	
- for 24 V	150 V AC
- for 230 V	250 V AC
• Pollution severity	2
• Overvoltage category	II
• Test voltage for 24 V AC/DC between	
- Input and output	1.5 kV AC
- Power supply and output	1.5 kV AC
- Power supply and input	500 V AC
• Test voltage for 230 V AC between	
- Input and output	2.3 kV AC
- Power supply and output	2.3 kV AC
- Power supply and input	2.3 kV AC
Certificates and approvals	
CENELEC	According to DIN EN 50 014 and DIN EN 50 020 Intrinsically safe output circuit
• "Intrinsically safe" type of protection	II (1) G EEx ia/ib IIB
- Maximum output voltage U_0	19.74 V
- Maximum output current I_0	87.1 mA
- Maximum output power P_0	571 mW
- Effective internal capacitance C_i	Approx. 3 nF
- Effective internal inductance L_i	Approx. 50 µH
- Internal resistance R_i	313 Ω
- Maximum voltage for safety U_m	253 V
- Maximum external capacitance C_0	Approx. 1.45 µF
- Maximum external inductance L_0	Approx. 15 mH
• "Intrinsically safe" type of protection	II (1) G EEx ia/ib IIC
- Maximum output voltage U_0	19.74 V
- Maximum output current I_0	87.1 mA
- Maximum output power P_0	571 mW
- Effective internal capacitance C_i	Approx. 3 nF
- Effective internal inductance L_i	Approx. 50 µH
- Internal resistance R_i	313 Ω
- Maximum voltage for safety U_m	253 V
- Maximum external capacitance C_0	Approx. 230 nF
- Maximum external inductance L_0	Approx. 4 mH
Conformity certificate	TÜV 99 ATEX 1480
External standards and guidelines	
Low-voltage guideline	According to DIN EN 61 010

SITRANS I output isolator HART (FSK)
with intrinsically safe output circuit

7NG4130



1 Power supply (PWR)
2 Input
3 Output
NC Not connected

Fig. 2/49 Dimension drawing and connections

Ordering data	Order No.
SITRANS I output isolator HART (FSK) Rail-mounted, input 4 to 20 mA, intrinsically safe output 4 to 20 mA, EEx ia/ib IIB/IIC	**7NG4130 - 1 ■ A11**
Power supply	
• 24 V AC/DC (22.5 mm width)[1]	**A**
• 95 to 253 V AC (35 mm width)[2]	**B**

🟦 Stock items

[1] Start of delivery planned for 11/99.
[2] Start of delivery planned for 01/00.