SITRANS TW four-wire system, universal, HART

Overview

The user-friendly transmitters for the control room

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

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

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

Application

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

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

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

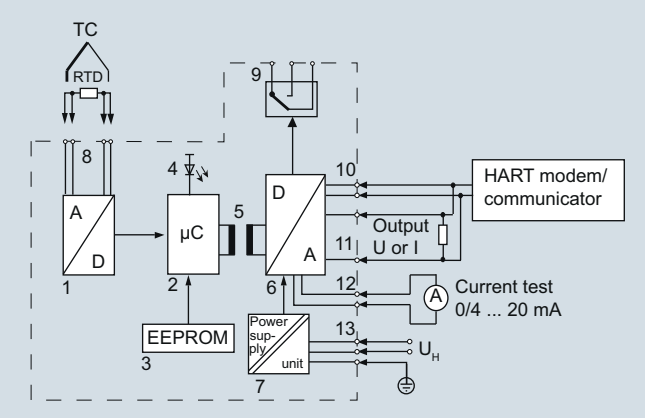
All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

Function

Features

- Transmitter in four-wire system with HART interface
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Screw plug connector
- All circuits electrically isolated
- Output signal: 0/4 to 20 mA or 0/2 to 10 V
- Power supplies: 115/230 V AC/DC or 24 V AC/DC
- Explosion protection [EEx ia] or [EEx ib] for measurements with sensors in the hazardous area
- Temperature-linear characteristic for all temperature sensors
- Temperature-linear characteristic can be selected for all temperature sensors
- Automatic correction of zero and span
- Monitoring of sensor and cable for open-circuit and short- circuit
- Sensor fault and/or limit can be output via an optional sensor fault/limit monitor
- Hardware write protection for HART communication
- Diagnostic functions
- Slave pointer functions
- SIL1

Mode of operation



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

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

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

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

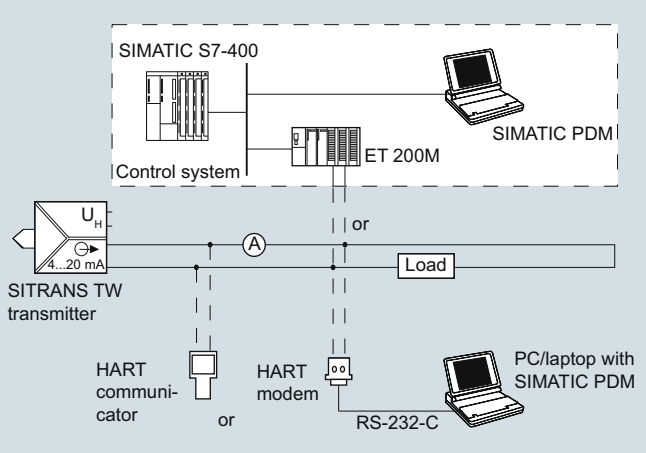
Diagnosis and simulation functions

The SITRANS TW comes with extensive diagnosis and simulation functions.

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

Integration

System configuration



Possible system configurations

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

Communication options through the HART interface:

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

Technical specifications

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

SITRANS TW four-wire system, universal, HART

Thermocouples	
Measured variable	Temperature
Measuring range	Parameterizable
Measuring span	min. 50 °C (90 °F) x 1/scaling factor
Measuring range limits	Depend. on type of thermocouple element
Thermocouple element	Type B: Pt30 %Rh/Pt6 %Rh (DIN IEC 584)
	Type C: W5 %-Re (ASTM 988)
	Type D: W3 %-Re (ASTM 988)
	Type E: NiCr/CuNi (DIN IEC 584)
	Type J: Fe/CuNi (DIN IEC 584)
	Type K: NiCr/Ni (DIN IEC 584)
	Type L: Fe-CuNi (DIN 43710)
	Type N: NiCrSi-NiSi (DIN IEC 584)
	Type R: Pt13 %Rh/Pt (DIN IEC 584)
	Type S: Pt10 %Rh/Pt (DIN IEC 584)
	Type T: Cu/CuNi (DIN IEC 584)
	Type U: Cu/CuNi (DIN 43710)
	Special type (-10 mV ≤ UTC ≤ 100 mV)
Characteristic curve	Temperature-linear, voltage-linear or customer-specific
Type of connection	• Normal connection
	• Averaging connection
	• Mean-value connection
	• Differential connection
Cold junction compensation	None, internal measurement, external measurement or predefined fixed value
Sensor breakage monitoring	Function can be switched off
mV sensors	
Measured variable	DC voltage
Measuring range	Parameterizable
Measuring span	min. 4 mV
Input range	-120 ... +1000mV
Characteristic curve	Voltage-linear or customer-specific
Overload capacity of inputs	max. ± 3.5 V
Input resistance	≥ 1 MΩ
Sensor current	Approx. 180 µA
Sensor breakage monitoring	Function can be switched off
V sources	
Measured variable	DC voltage
Measuring range	Parameterizable
Characteristic curve	Voltage-linear or customer-specific
Input range/min. span	
• Devices with 7NG3242-xxxx**1** or 7NG3242-xxxx**0** with U/I plug	-1.2 ... + 10 V/0.04 V
• Devices with 7NG3242-xxxx**2**	-12 ... +100 V/0.4 V
• Devices with 7NG3242-xxxx**3**	-120 ... +140 V/4.0 V
Sensor breakage monitoring	Not possible

µA-, mA sources	
Measured variable	DC voltage
Measuring range	Parameterizable
Characteristic curve	Current-linear or customer- specific
Input range/min. span	
• Devices with 7NG3242-xxxx**4**	-12 ... +100 µA/0.4 µA
• Devices with 7NG3242-xxxx**5**	-120 ... +1000 µA/4 µA
• Devices with 7NG3242-xxxx**6**	-1.2 ... +10 mA/0.04 mA
• Devices with 7NG3242-xxxx**7** or 7NG3242-xxxx**0** with U/I plug	-12 ... +100 mA/0.4 mA
• Devices with 7NG3242-xxxx**8**	-120 ... +1000 mA/4 mA
Sensor breakage monitoring	Not possible
Output	
Output signal	Load-independent direct current 0/4 ... 20 mA, can be switched to load-independent DC voltage 0/2 ... 10 V using plug-in jumpers
Current 0/4 ... 20 mA	
• Overrange	-0.5 ... +23.0 mA, continuously adjustable
• Output range following sensor fault (conforming to NE43)	-0.5 ... +23.0 mA, continuously adjustable
• Load	≤ 650 Ω
• No-load voltage	≤ 30 V
Voltage 0/2 ... 10 V	
• Overrange	-0.25 ... +10.75 V, continuously adjustable
• Output range following sensor fault	-0.25 ... +10.75 V, continuously adjustable
• Load resistance	≥ 1 kΩ
• Load capacitance	≤ 10 nF
• Short-circuit current	≤ 100 mA (not permanently short-circuit-proof)
• Electrical damping	
- adjustable time constant T_{63}	0 ... 100 s, in steps of 0.1 s
• Current source/voltage source	Continuously adjustable within the total operating range
Sensor fault/limit signalling	By operation indicator, relay output or HART interface
Operation indicator	Flashing signal
• Limit violation	Flashing frequency 5 Hz
• Sensor fault monitoring	Flashing frequency 1 Hz
Relay outputs	Either as NO or NC contact with 1 changeover contact
• Switching capacity	≤ 150 W, ≤ 625 VA
• Switching voltage	≤ 125 V DC, ≤ 250 V AC
• Switching current	≤ 2.5 A DC
Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
Limit monitoring	
• Operating delay	0 ... 10 s
• Monitoring functions of limit module	• Sensor fault (breakage and/or short-circuit) • Lower and upper limit • Window (combination of lower and upper limits) • Limit and sensor fault detection can be combined
• Hysteresis	Parameterizable between 0 and 100 % of measuring range

Auxiliary power	
Universal power supply unit	115/230 V AC/DC or 24 V AC/DC
Tolerance range for power supply	
• With 115/230 V AC/DC PSU	80 ... 300 V DC; 90 ... 250 V AC
• With 24 V AC/DC PSU	18 ... 80 V DC; 20.4 ... 55.2 V AC (in each case interruption-resistant up to 20 ms in the complete tolerance range)
Tolerance range for mains frequency	47 ... 63 Hz
Power consumption with	
• 230 V AC	≤ 5 VA
• 230 V DC	≤ 5 W
• 24 V AC	≤ 5 VA
• 24 V DC	≤ 5 W
Electrically isolated	
Electrically isolated circuits	Input, output, power supply and sensor fault/limit monitoring output are electrically isolated from one another. The HART interface is electrically connected to the output.
Working voltage between all electrically isolated circuits	The voltage U_{rms} between any two terminals must not exceed 300 V
Measuring accuracy	
Accuracy	
• Error in the internal cold junction	≤ 3 °C ± 0.1 °C / 10 °C (≤ 5.4 °F ± 0.18 °F / 18 °F)
• Error of external cold junction terminal 7NG3092-8AV	≤ 0.5 °C ± 0.1 °C / 10 °C (≤ 0.9 °F ± 0.18 °F / 18 °F)
• Digital output	See "Digital error"
• Analog output I_{AN} or U_{AN}	≤ 0.05 % of the span plus digital error
Influencing effects (referred to the digital output)	Compared to the max. span:
• Temperature drift	≤ 0.08 % / 10 °C (≤ 0.08 % /18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Long-term drift	≤ 0.1 % / year
Influencing effects referred to the analog output I_{AN} or U_{AN}	Compared to the span:
• Temperature drift	≤ 0.08 % / 10°C (≤ 0.08 % / 18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Power supply	≤ 0.05 % / 10 V
• Load with current output	≤ 0.05 % on change from 50 Ω to 650 Ω
• Load with voltage output	≤ 0.1 % on change in the load current from 0 mA to 10 mA
• Long-term drift (start-of-scale value, span)	≤ 0.03 % / month
Response time (T_{63} without electrical damping)	≤ 0.2 s
Electromagnetic compatibility	According to EN 61 326 and NAMUR NE21

Certificates and approvals	
Intrinsic safety	
• for 7NG3242-x**A**xxx	II (1) G [Ex ia Ga] IIC
• for 7NG3242-x**B**xxx	II (1) D [Ex ia Da] IIIC
EC type-examination certificate	TÜV (German Technical Inspectorate) 01 ATEX 1675
Other certificates	EAC Ex(GOST)
Conditions of use	
Installation conditions	
Location (for devices with explosion protection)	
• Transmitters	Outside the potentially explosive atmosphere
• Sensor	Within the potentially explosive atmosphere zone 1 (also in zone 0 in conjunction with the prescribed protection requirements for the sensor)
Ambient conditions	
Permissible ambient temperature	-25 ... +70 °C (-13 ... +158 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Climatic class	
• Relative humidity	5 ... 95 %, no condensation
Design	
Weight	Approx. 0.24 kg (0.53 lb)
Enclosure material	PBT, glass-fibre reinforced
Degree of protection to IEC 529	IP20
Degree of protection to VDE 0100	Protection class I
Type of installation	35-mm DIN rail (1.38 inch) (EN 50022) or 32-mm G-type rail (1.26 inch) (EN 50035)
Electrical connection / process connection	Screw plug connectors, max. 2.5 mm^2 (0.01 $inch^2$)
Parameterization interface	
Protocol	HART, version 5.9
Load with connection of	
• HART communicator	230 ... 650 Ω
• HART modem	230 ... 500 Ω
Software for PC/laptop	SIMATIC PDM version V5.1 and later

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Digital error

Resistance thermometer

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

Resistance-based sensors

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

Thermocouples

Input	Measuring range	Digital error [1]
	°C / (°F)	°C (°F)
Type B	100 ... 1820 (212 ... 3308)	3 (5.4)
Type C	0 ... 2300 (32 ... 4172)	2 (3.6)
Type D	0 ... 2300 (32 ... 4172)	1 (1.8)
Type E	-200 ... +1000 (-328 ... +1832)	1 (1.8)
Type J	-210 ... +1200 (-346 ... +2192)	1 (1.8)
Type K	-200 ... +1372 (-328 ... +2501)	1 (1.8)
Type L	-200 ... +900 (-328 ... +1652)	2 (3.6)
Type N	-200 ... +1300 (-328 ... +2372)	1 (1.8)
Type R	-50 ... +1760 (-58 ... +3200)	2 (3.6)
Type S	-50 ... +1760 (-58 ... +3200)	2 (3.6)
Type T	-200 ... +400 (-328 ... +752)	1 (1.8)
Type U	-200 ... +600 (-328 ... +1112)	2 (3.6)

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

Voltage/current sources

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

Ordering examples

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

Ordering information

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

- Operating data already set in factory to default values:
  The default settings can be obtained from the list of parameterizable operating data (see "Special operating data"). The presets can be modified by the customer to match the requirements precisely.
- Operating data set on delivery according to customer requirements:
  Supplement the Article No. by "**-Z**" and add the Order code "Y01". The operating data to be set can be obtained from the list of parameterize operating data. The Order codes A■■ to K■■ for operating data to be set need only be specified in the order if they deviate from the default setting.
  The default setting is used if no Order code is specified for operating data.

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

2

Selection and Ordering data		Article No.
SITRANS TW universal transmitter for rail mounting, in four-wire system (order instruction manual separately) ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	↗	**7NG3242-** ■■■■
Explosion protection		
Without	►⬟	**0**
For inputs [EEx ia] or [EEx ib]	►⬟	**1**
Power supply		
115/230 V AC/DC	►⬟	**A**
24 V AC/DC	►⬟	**B**
Output signal		
0/4 ... 20 mA (can be switched to 0/2 ... 10 V)	►⬟	**A**
0/2 ... 10 V (can be switched to 0/4 ... 20 mA)		**B**
Sensor fault/limit monitor		
Without (retrofitting not possible)	►⬟	**0**
Relay with changeover contact		**1**
Input for		
Temperature sensor, resistance-based sensor and mV sensor with measuring range -120 ... +1000 mV DC and with U/I plug	►⬟	**0**
Voltage input (V sources) [1] Measuring range:		
• -1.2 ... +10 V DC		**1**
• -12 ... +100 V DC (not Ex version)		**2**
• -120 ... +140 V DC (not Ex version)		**3**
Current input (µA, mA sources) [1] Measuring range:		
• -12 ... +100 µA DC		**4**
• -120 ... +1000 µA DC		**5**
• -1.2 ... +10 mA DC		**6**
• -12 ... +100 mA DC		**7**
• -120 ... +1000 mA DC		**8**
Further designs Please add "-**Z**" to Article No. and specify Order code(s) (see "List of parameterizable operating data").		Order code
Customer-specific setting of operating data (see "List of parameterizable operating data") **Note:** specify in plain text: „see Order code“		**Y01**
Meas. point description (max. 16 char.)		**Y23**
Text on front of device (max. 32 char.)		**Y24**
HART tag (max. 8 characters)		**Y25**
With test report		**P01**
With shorting plug to HART communication for 0 mA or 0 V		**S01**
With plug for external cold junction compensation		**S02**
With U/I plug (-1.2 ... +10 V DC or -12 ... +100 mA)		**S03**
Language of rating plate (together with Y01 Order code only)		
• Italian		**S72**
• English		**S76**
• French		**S77**
• Spanish		**S78**

[1] Observe max. values with Ex version.

Selection and Ordering data		Article No.
Accessories		
MiniDVD for temperature measuring instruments With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	►	**A5E00364512**
Instruction Manual for SITRANS TW		
German/English	►	**A5E00054075**
French/Italian/Spanish	►	**A5E00064515**
Cold junction terminal	►	**7NG3092-8AV**
U/I plug (-1.2 ... +10 V DC pr -12 ... +100 mA)	►	**7NG3092-8AW**
SIMATIC PDM operating software		**see Chapter 8**
HART modem		
With USB interface	►	**7MF4997-1DB**

► Available ex stock.

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

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

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

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

Sensor

Thermocouples

Type	Temperature range	
B: Pt30 %Rh/Pt6 %Rh	0 ... 1820 °C	A 0 0
C:W5 %Re	0 ... 2300 °C	A 0 1
D:W3 %Re	0 ... 2300 °C	A 0 2
E:NiCr/CuNi	-200 ... +1000 °C	A 0 3
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A 0 4
K:NiCr/Ni	-200 ... +1372 °C	A 0 5
L: Fe/CuNi (DIN)	-200 ... +900 °C	A 0 6
N:NiCrSi/NiSi	-200 ... +1300 °C	A 0 7
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A 0 8
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A 0 9
T:Cu/CuNi (IEC)	-200 ... +400 °C	A 1 0
U:Cu/CuNi (DIN)	-200 ... +600 °C	A 1 1

Resistance thermometer
(or max. permissible line resistance see „Technical specifications“)

Pt100 (DIN IEC)	-200 ... +850 °C	A 2 0
Pt100 (JIS)	-200 ... +649 °C	A 2 1
Ni100 (DIN)	-60 ... +250 °C	A 2 2

Resistance-based sensors, potentiometers
(or max. permissible line resistance see „Technical specifications“)

A 3 0

mV, V and µA, mA sensors [9]

A 4 0

Connection

Standard		B 0 1
Sum n [1]	n = 2	B 0 2
	...	. . .
	n = 10	B 1 0
Difference [2]	Diff1	B 3 1
	Diff2	B 3 2
Mean-val. [2]	MW	B 4 1

Resistance thermometer

Standard		B 0 1
Sum n [4]	n = 2	B 0 2
	...	. . .
	n = 10	B 1 0
Parallel n [5]	n = 0.1	B 2 1
	n= 0.2	B 2 2
	n= 0.5	B 2 5
Special value [6] [7]		Y 0 0
Difference [2]	Diff1	B 5 1
	Diff2	B 5 2
Mean-val. [2]	MW	B 6 1

Resistance-based sensors, potentiometers

Standard		B 0 1
Difference [2]	Diff1	B 5 1
	Diff2	B 5 2
Mean val. [2]	MW	B 6 1

Meas. range with Article No. 7NG 3242 - ■■■■■ -Z Y01

0	-120 ... +1000 mV
1	-1,2 ... +10 V [10]
2	-12 ... +100 V [10]
3	-120 ... +140 V [10]
4	-12 ... +100 µA [10]
5	-120 ... +1000 µA [10]
6	-1,2 ... +10 mA [10]
7	-12 ... +100 mA [10]
8	-120 ... +1000 mA [10]
	Special range [7]

E 5 0

Y 3 2

Cold junction compensation

None	C 0 0
Internal	C 1 0
Fixed val. 0 °C	C 2 0
20 °C	C 2 2
50 °C	C 2 5
60 °C	C 2 6
70 °C	C 2 7
Special value [7]	Y 1 0
External meas. (through Pt100 DIN IEC 751) [7]	Y 1 1

Resistance thermometer

2-wire-system	C 3 2
3-wire-system	C 3 3
4-wire-system	C 3 4

Resistance-based sensors, potentiometers

2-wire-system	C 3 2
3-wire-system	C 3 3
4-wire-system	C 3 4

Line resistance [3]

0 Ω	D 0 0
10 Ω	D 1 0
20 Ω	D 2 0
50 Ω	D 5 0
Special val. [7]	Y 2 0

Resistance-based sensors, potentiometers

0 Ω	D 0 0
10 Ω	D 1 0
20 Ω	D 2 0
50 Ω	D 5 0
Special val. [7]	Y 2 0

Measuring ranges

-30 ... +60 °C	E 0 0
-20 ... +20 °C	E 0 1
0 ... 40 °C	E 0 2
0 ... 60 °C	E 0 3
0 ... 80 °C	E 0 4
0 ... 100 °C	E 0 5
0 ... 120 °C	E 0 6
0 ... 150 °C	E 0 7
0 ... 200 °C	E 0 8
0 ... 250 °C	E 0 9
0 ... 300 °C	E 1 0
0 ... 350 °C	E 1 1
0 ... 400 °C	E 1 2
0 ... 450 °C	E 1 3
0 ... 500 °C	E 1 4
0 ... 600 °C	E 1 5
0 ... 700 °C	E 1 6
0 ... 800 °C	E 1 7
0 ... 900 °C	E 1 8
0 ... 1000 °C	E 1 9
0 ... 1200 °C	E 2 0
0 ... 1400 °C	E 2 1
0 ... 1600 °C	E 2 2
0 ... 1800 °C	E 2 3
50 ... 100 °C	E 2 4
50 ... 150 °C	E 2 5
100 ... 200 °C	E 2 6
100 ... 300 °C	E 2 7
100 ... 400 °C	E 2 8
200 ... 300 °C	E 2 9
200 ... 400 °C	E 3 0
200 ... 500 °C	E 3 1
300 ... 600 °C	E 3 2
500 ... 1000 °C	E 3 3
600 ... 1200 °C	E 3 4
800 ... 1600 °C	E 3 5
Special range [7]	Y 3 0

Resistance-based sensors, potentiometers

0 ... 100 Ω	E 4 0
0 ... 200 Ω	E 4 1
0 ... 500 Ω	E 4 2
0 ... 1000 Ω	E 4 3
0 ... 2500 Ω	E 4 4
0 ... 5000 Ω [8]	E 4 5
0 ... 6000 Ω [8]	E 4 6
Special range [7]	Y 3 1

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

2

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

Operating data according to default setting

Article No. with Order code: 7NG3242 - ■■■■■ -Z Y01

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

Sensor

Thermocouple elements

Type	Temperature range		Voltage measurement		Filter time[1]		Output signal and line filter[2]		Failure signal		Limit monitor[3]	
B: Pt30 %Rh/	0 ... 1820 °C	A00	Temperature-linear	F00	0 s	G00	4 ... 20 mA/		with line breakage/fault:		Limit monitoring ineffective (but sensor fault signalling with closed-circuit operation)	K00
C:W5 %Re	0 ... 2300 °C	A01			0.1 s	G01	2 ... 10 V					
D:W3 %Re	0 ... 2300 °C	A02	Voltage-linear	F10	0.2 s	G02	with line filter:					
E:NiCr/CuNi	-200 ... +1000 °C	A03			0.5 s	G03	50 Hz	H00	to full scale	J00		
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A04			1 s	G04	60 Hz	H01	to start of scale	J01		
K:NiCr/Ni	-200 ... +1372 °C	A05			2 s	G05	10 Hz [4]	H02	hold last value	J02		
L: Fe/CuNi (DIN)	-200 ... +900 °C	A06			5 s	G06	0 ... 20 mA/					
N:NiCrSi/NiSi	-200 ... +1300 °C	A07			10 s	G07	0 ... 10 V		no monitoring	J03		
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A08			20 s	G08	with line filter:				Effective [5]	Y70
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A09			50 s	G09	50 Hz	H10	Safety value [5]	Y60		
T:Cu/CuNi (IEC)	-200 ... +400 °C	A10			100 s	G10	60 Hz	H11				
U:Cu/CuNi (DIN)	-200 ... +600 °C	A11			Special time [5]	Y50	10 Hz	H12				

Resistance thermometer
(max. permissible line resistances see „Technical specifications“)

Pt100 (DIN IEC)	-200 ... +850 °C	A20	Temperature-linear	F00	same as for thermocouple elements		same as for thermocouple elements		with line breakage/fault:		same as for thermocouple elements	
Pt100 (JIS)	-200 ... +649 °C	A21										
Ni100 (DIN)	-60 ... +250 °C	A22	Resistance-linear	F20					to full scale	J00		
									to start of scale	J01		
									hold last value	J02		
									no monitoring	J03		
									Safety value [5]	Y60		
									with line breakage or short-circuit/fault:			
									to full scale	J10		
									to start of scale	J11		
									hold last value	J12		
									no monitoring	J13		
									Safety value [5]	Y61		

Resistance-based sensors, potentiometers

(max. permissible line resistances see „Technical specifications“)		A30	Voltage measurement		Filter time[1]		Output signal and line filter[2]		Failure signal		Limit monitor[3]	
			Resistance-linear	F20	same as for thermocouple elements		same as for thermocouple elements		with line breakage/fault:		same as for thermocouple elements	
									to full scale	J00		
									to start of scale	J01		
									hold last value	J02		
									no monitoring	J03		
									Safety value [5]	Y60		

mV, V and µA, mA sources

		A40	Voltage measurement		Filter time[1]		Output signal and line filter[2]				Limit monitor[3]	
			Source proportional	F30	same as for thermocouple elements		same as for thermocouple elements				same as for thermocouple elements	

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

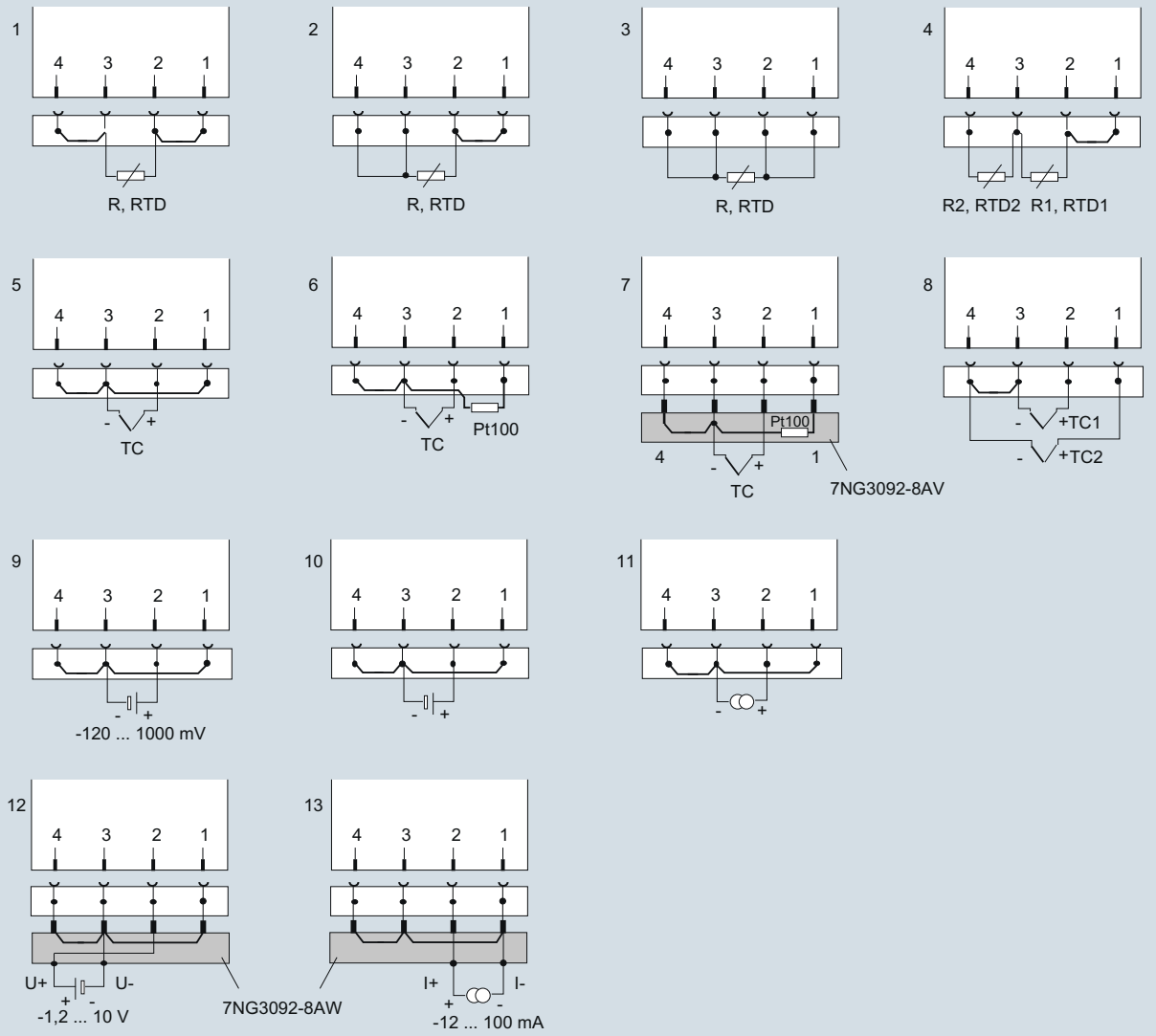
Special operating data

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

2

Schematics

Sensor input connections



Resistance thermometers, resistance-based sensors, potentiometers:

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

2 Three-wire system

3 Four-wire system

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

Thermocouples:

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

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

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

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

Further sources:

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

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

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

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

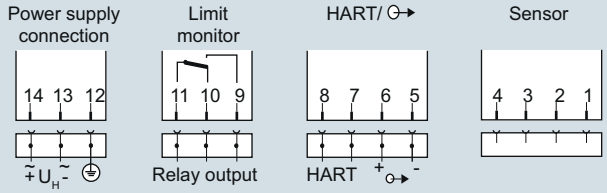
13 Current measurement -12 to 100 mA with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

Connection diagram for the input signal

Channel 1 is the measured variable between the terminals 2 and 3 on the input plug. With a difference or mean-value circuit, the calculation of the measured value is defined by the type of measurement. Otherwise the measured value is determined via channel 1. The following code is used for the type of measurement:

type of measurement	Calculation of measured value
Single channel	Channel 1
Differential connection 1	Channel 1 - Channel 2
Differential connection 2	Channel 2 - Channel 1
Mean-value 1	½ · (Channel 1 + Channel 2)

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



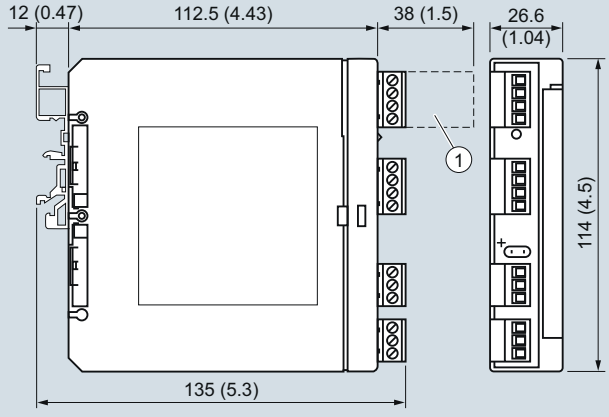
1 to 4	Signal input (see "sensor input connections" for possible types of connection)
5, 6	Analog output (U or I output parameterizable using plug-in jumpers)
7, 8	Connection with HART communication for local parameterization
9 to 11	Output for sensor fault/limit monitor as relay contact (see below for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

Connection diagram for power supply, input and outputs

Relay outputs

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

Dimensional drawings



(1) In devices with explosion protection

Dimensions for control room mounting, rail mounting in mm (inches)