

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR320 (HART, universal)

Overview



- 2-wire rail transmitter with and without HART communications interface
- Enclosure for DIN rail mounting
- Universal input for virtually any type of temperature sensor
- Can be configured via PC, HART 7

Benefits

- Compact design
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring wire break and short-circuit
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to EN 61326 and NE21
- SIL2/3 (with order note C20)

Application

SITRANS TR320 transmitters can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2-wire, 3-wire, 4-wire connection)
- Thermocouples
- Linear resistance, potentiometer and DC voltage sources

With HART communication interface:

- The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

Function

Without HART communications interface

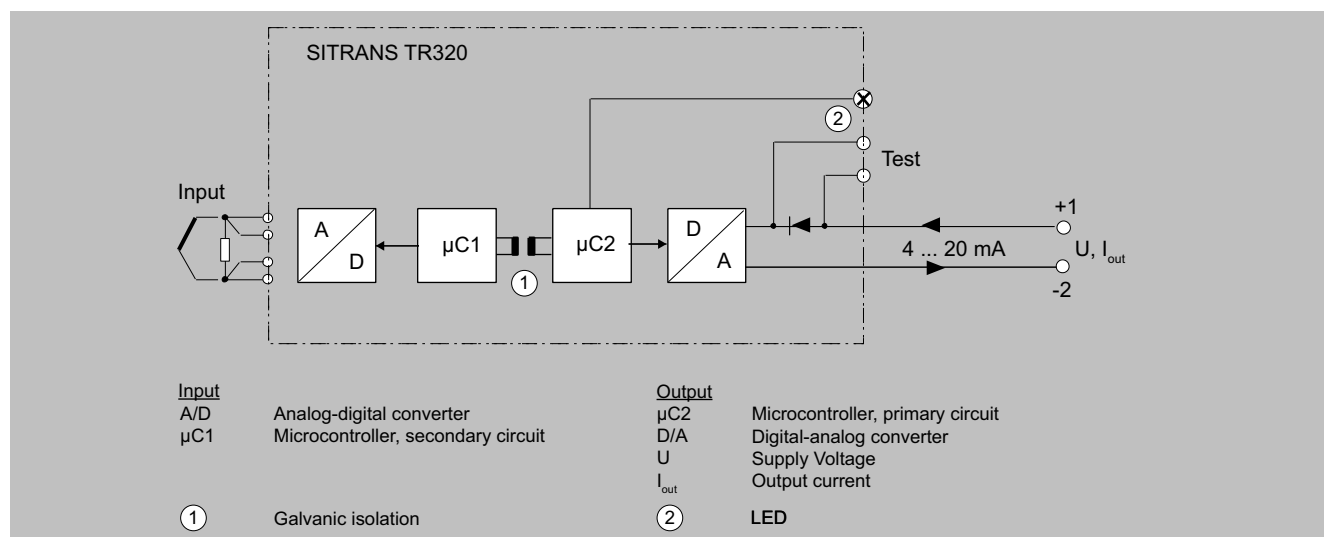
For the SITRANS TR320 without HART functionality, parameters are assigned with the PC. Available for this purpose are a special modem and the software tool SIPROM T.

With HART communications interface:

- The SITRANS TR320 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



SITRANS TR320 function block diagram

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Selection and ordering data

SITRANS TR320 DIN rail transmitter with 1 input	Article No. 7NG032			
	●	-	●	●
Click the article number for online configuration in the PIA Life Cycle Portal.				
Communication				
With HART	0			
2-wire, 4 ... 20 mA	7			
Primary value output				
Input 1		0		
Input 1, type				
RTD				
• Pt100 (IEC), 3-wire			B	
• Pt100 (IEC), 4-wire			C	
• Pt1000 (IEC), 3-wire			D	
• Pt1000 (IEC), 4-wire			E	
TC				
• Type B			F	
• Type E			G	
• Type J			H	
• Type K			J	
• Type L			K	
• Type N			L	
• Type R			N	
• Type S			P	
• Type T			Q	
Potentiometer, 4-wire			R	
Input 1, type customer-specific				
Define customer-specific input configurations with V options			Y	
Input 2, type				
Without input 2			A	
CJC configuration for TC				
Without CJC			0	
Internal CJC			1	
External CJC Pt100 (IEC), 3-wire			3	
External CJC Ni100 (DIN), 3-wire			6	
Define fixed CJC value with option Y60			8	
Materials not in contact with media				
None			0	
Type of protection				
General safety (non-Ex); CE, RCM, FM, KCC, EAC, CSA, UK				A
Intrinsic safety (Ex i) / non-incendive field wiring (NIFW) / increased safety zone 2 (Ex ec) / non-incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro, UKEx)				N
Electrical connection/cable entries				
None				A
Local HMI				
Without display				0

Options	Order code
Add "-Z" to article number, specify order code and, if applicable, free text	
Manufacturer's declarations	
Inspection certificate EN 10204-3.1: Manufacturer test certificate for transmitters (5 measured values)	C11
Certificates for functional safety	
Functional safety SIL2/3 (IEC 61508)	C20
Device options	
PDF file with device settings	D10
Without labeling of the measuring range on the TAG plate	D41

Selection and ordering data (continued)

Options	Order code
Add "-Z" to article number, specify order code and, if applicable, free text	
Jumper plug set on device for write protection	D81
Jumper plug set on device set for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	D82
Noise damping	
Noise damping 60 Hz instead of 50 Hz	P10
Input 1: TC	
Type C W5	V01
Type D W3	V02
Type U	V03
Type Lr	V04
Input 1: Callendar-Van Dusen	
2-wire (define wire resistance value in option Y51 and Callendar-Van Dusen parameter in option Y35)	V50
3-wire (define Callendar-Van Dusen parameter in option Y35)	V51
4-wire (define Callendar-Van Dusen parameter in option Y35)	V52
Input 1: RTD	
Pt × (IEC 60751), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V60
Pt × (IEC 60751), 3-wire, define RTD factor × in option Y21	V61
Pt × (IEC), 4-wire, define RTD factor × in option Y21	V62
Pt × (JIS C1604), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V63
Pt × (JIS C1604-81), 3-wire, define RTD factor × in option Y21	V64
Pt × (JIS C1604-81), 4-wire, define RTD factor × in option Y21	V65
Pt × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V66
Pt × (GOST 6651-2009), 3-wire, define RTD factor × in option Y21	V67
Pt × (GOST 6651-2009), 4-wire, define RTD factor × in option Y21	V68
Ni × (DIN 43760-87), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V69
Ni × (DIN 43760-87), 3-wire, define RTD factor × in option Y21	V70
Ni × (DIN 43760-87), 4-wire, define RTD factor × in option Y21	V71
Ni × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V72
Ni × (GOST 6651-2009), 3-wire, define RTD factor × in option Y21	V73
Ni × (GOST 6651-2009), 4-wire, define RTD factor × in option Y21	V74
Cu × (ECW-15), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V75
Cu × (ECW-15), 3-wire, define RTD factor × in option Y21	V76
Cu × (ECW-15), 4-wire, define RTD factor × in option Y21	V77
Cu × (GOST 6651-94), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V78
Cu × (GOST 6651-94), define 3-wire, define RTD factor × in option Y21	V79
Cu × (GOST 6651-94), define 4-wire, define RTD factor × in option Y21	V80
Cu × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V81
Cu × (GOST 6651-2009), define 3-wire, define RTD factor × in option Y21	V82

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Options Add "-Z" to article number, specify order code and, if applicable, free text	Order code
Cu × (GOST 6651-2009), define 4-wire, define RTD factor × in option Y21	V83
Device settings	
Measuring range setting temperature input: Lower range value (max. 5 characters), upper range value (max. 5 characters), unit (°C, °F, °Ra, K)	Y01
Customer-specific programming in plain text (n-lines)	Y09
Tag (device parameters, max. 32 characters), adhesive label	Y15
Measuring point description (device parameters, max. 32 characters), adhesive label	Y16
Descriptor (device parameters, max. 16 characters), adhesive label	Y18
Tag (device parameters, max. 16 characters), adhesive label on front	Y19
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	Y21
Fault current for input circuit short-circuit & interruption instead of 22.4 mA (short-circuit) and 22.8 mA (interruption) e.g. 3.6 mA and 22.4 mA [3.6 - 3.6; 3.6 - 22.8; 22.4 - 3.6]	Y31
CvD Sensor matching factors input 1 R0, A, B, C, Beta, Delta Selection: CVDR - R0 (format for example 100.0), CVDA - A (format for example 0.003908), CVDB - B (format for example -5.775E-07), CVDC - C (format for example -4.183E-12)	Y35
Wire resistance value input 1 in ohms (0 ... 100 ohms)	Y51
Input 1: CJC sensor, fixed value (see measuring range for unit)	Y60
ID number of special design	Y99

Accessories

	Article No.
Other accessories for assembly, connection and transmitter configuration, see page 2/198.	
Modems	
HART modem with USB interface	7MF4997-1DB
Modem with USB interface and SIPROM T software	7NG3092-8KN
SIMATIC PDM parameterization software	See Catalog FI 01 section 8

Ordering example

7NG0320-0BA00-OAA0-Z Y01
Y01: -10 ... +100 °C

Factory setting

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
 - Device fault: < 3.6 mA
 - Input circuit wire break: 22.8 mA
 - Input circuit short-circuit: 22.4 mA
 - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Technical specifications

SITRANS TR320 (HART, universal)

General	
Supply voltage ^{1) 2)}	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• With explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	$(V_{\text{supply}} - 37 \text{ V})/23 \text{ mA}$
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• With explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Wire jumpers or software
Warm-up time	< 5 min
Starting time	< 2.75 s
Programming	HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: <ul style="list-style-type: none"> • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	4 ... 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
<u>Resistance thermometer (RTD)</u>	
Input type	
• Pt10 ... 10000	<ul style="list-style-type: none"> • IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	<ul style="list-style-type: none"> • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	<ul style="list-style-type: none"> • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Connection type	2-wire, 3-wire or 4-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms
<u>Thermocouples (TC)</u>	

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Technical specifications (continued)

SITRANS TR320 (HART, universal)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold Junction Compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire or 3-wire
• External CJC, wire resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total wire resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Connection type	2-wire, 3-wire or 4-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Connection type	3-wire or 4-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

Technical specifications (continued)

SITRANS TR320 (HART, universal)	
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
<u>Voltage input</u>	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V _{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of measuring span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short-circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Operating conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP20
• Terminals	IP20
Structural design	
Weight	122 g (0.27 lb)
Maximum core cross-section	2.5 mm ² (AWG 13)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inches)
• 25 ... 100 Hz	± 4 g

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Technical specifications (continued)

SITRANS TR320 (HART, universal)	
Certificates and approvals	
<u>Explosion protection ATEX/IECEx and others</u>	
Certificates ³⁾	<ul style="list-style-type: none"> • DEKRA 17ATEX0116 X • IECEx DEK 17.0054X • A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
<ul style="list-style-type: none"> • ATEX 	<ul style="list-style-type: none"> • II 1 G Ex ia IIC T6 ... T4 Ga • II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb • II 2 D Ex ia IIIC Db • I M1 Ex ia I Ma
<ul style="list-style-type: none"> • IECEx and others 	<ul style="list-style-type: none"> • Ex ia IIC T6 ... T4 Ga • Ex ib [ia Ga] IIC T6 ... T4 Gb • Ex ia IIIC Db • Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
<ul style="list-style-type: none"> • ATEX 	<ul style="list-style-type: none"> • II 3 G Ex ic IIC T6...T4 Gc • II 3 D Ex ic IIIC Dc
<ul style="list-style-type: none"> • IECEx and others 	<ul style="list-style-type: none"> • Ex ic IIC T6 ... T4 Gc • Ex ic IIIC Dc
"Non-sparking/increased safety nA/lec" type of protection	For use in Zones 2 and 22
<ul style="list-style-type: none"> • ATEX 	<ul style="list-style-type: none"> • II 3 G Ex nA IIC T6...T4 Gc • II 3 G Ex ec IIC T6...T4 Gc
<ul style="list-style-type: none"> • IECEx and others 	<ul style="list-style-type: none"> • Ex nA IIC T6 ... T4 Gc • Ex ec IIC T6 ... T4 Gc
<u>Explosion protection CSA/FM for Canada and USA</u>	
Certificates	<ul style="list-style-type: none"> • CSA 1861385 • FM18CA0024 • FM18US0046
"Intrinsic safety ia" type of protection	<ul style="list-style-type: none"> • IS, CL I, Div 1, GP ABCD, T6 ... T4 • Ex ia IIC T6 ... T4 Ga, AEx ia IIC T6 ... T4 Ga or Ex ib [ia Ga] IIC T6...T4 Gb, AEx ib [ia Ga] IIC T6...T4 Gb
"Non incandive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incandive NI" type of protection	<ul style="list-style-type: none"> • NI, CL I, Div 2, GP ABCD T6...T4 • Ex nA IIC T6 ... T4 Gc • AEx nA IIC T6 ... T4 Gc

¹⁾ Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TR320. All external voltage drops must be taken into account.

²⁾ Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

³⁾ Additional available certificates are listed on the internet at <http://www.siemens.com/processinstrumentation/certificates>

Technical specifications (continued)

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in °C ⁻¹ (°F ⁻¹)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:20-03	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient ¹⁾
RTD		
Pt10	$\leq \pm 0.8$ °C (1.44 °F)	$\leq \pm 0.020$ °C/°C (°F/°F)
Pt20	$\leq \pm 0.4$ °C (0.72 °F)	$\leq \pm 0.010$ °C/°C (°F/°F)
Pt50	$\leq \pm 0.16$ °C (0.288 °F)	$\leq \pm 0.004$ °C/°C (°F/°F)
Pt100	$\leq \pm 0.04$ °C (0.072 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt200	$\leq \pm 0.08$ °C (0.144 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt500	$T_{\max.} < 180$ °C (356 °F) = $\leq \pm 0.08$ °C (0.144 °F) $T_{\max.} > 180$ °C (356 °F) = $\leq \pm 0.16$ °C (0.288 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt1000	$\leq \pm 0.08$ °C (0.144 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt2000	$T_{\max.} < 300$ °C (572 °F) = $\leq \pm 0.08$ °C (0.144 °F) $T_{\max.} > 300$ °C (572 °F) = $\leq \pm 0.4$ °C (0.72 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt10000	$\leq \pm 0.16$ °C (0.288 °F)	$\leq \pm 0.002$ °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	$\leq \pm 1.6$ °C (2.88 °F)	$\leq \pm 0.020$ °C/°C (°F/°F)

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Input type	Basic accuracy	Temperature coefficient ¹⁾
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 μV	≤ ±0.2 μV/°C (0.11 μV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 μV/°C (20 μV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 μV/°C (17.8 μV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B ²⁾	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B ³⁾	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B ⁴⁾	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B ⁵⁾	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.

2) Accuracy of the specification range > 400 °C (752 °F)

3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)

4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)

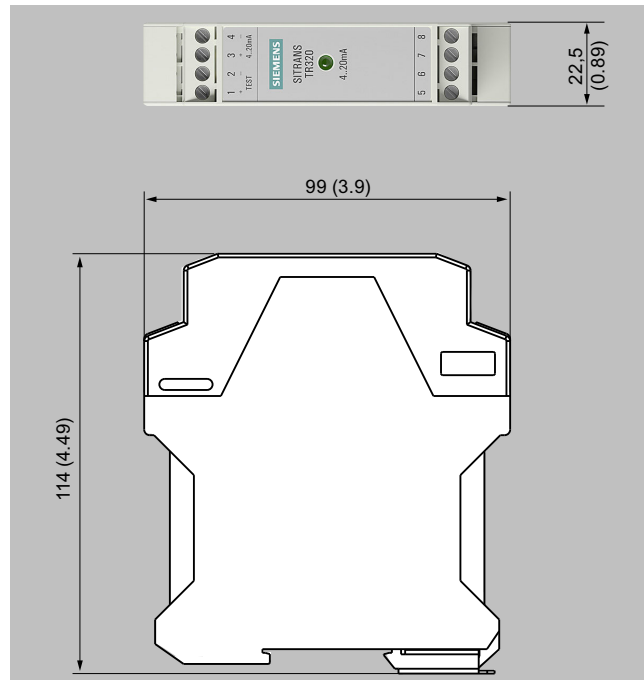
5) Accuracy of the specification range < 85 °C (185 °F)

Technical specifications (continued)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Analog output	$\leq \pm 1.6 \mu\text{A}$ (0.01% of the full output span)	$\leq \pm 0.48 \mu\text{A/K}$ ($\leq \pm 0.003\%$ of the full output span/K)

Dimensional drawings



SITRANS TR320, dimensions in mm (inch)

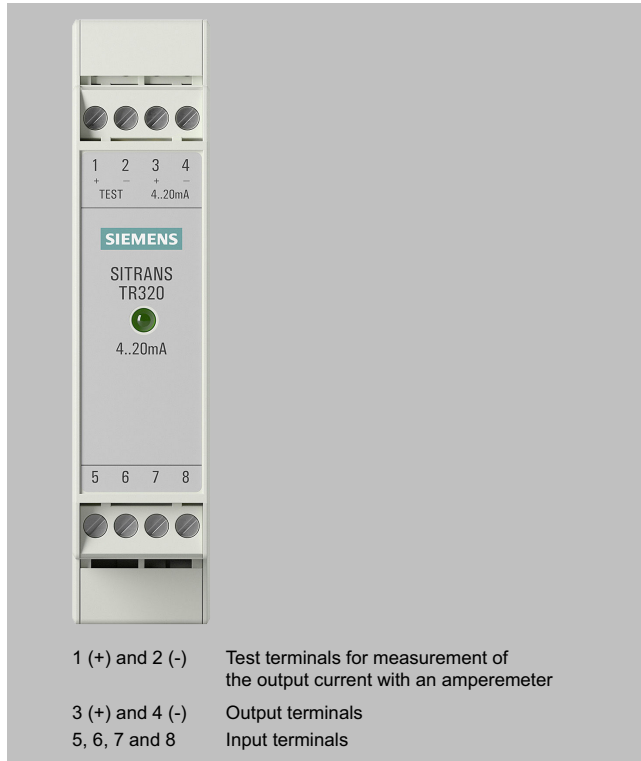
Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR320 (HART, universal)

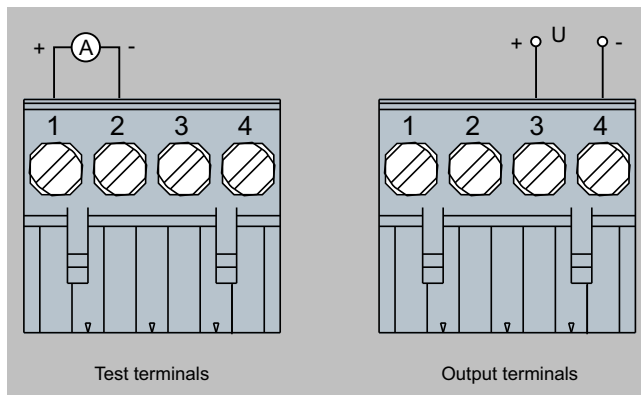
Circuit diagrams

Connections



SITRANS TR320, connector assignment

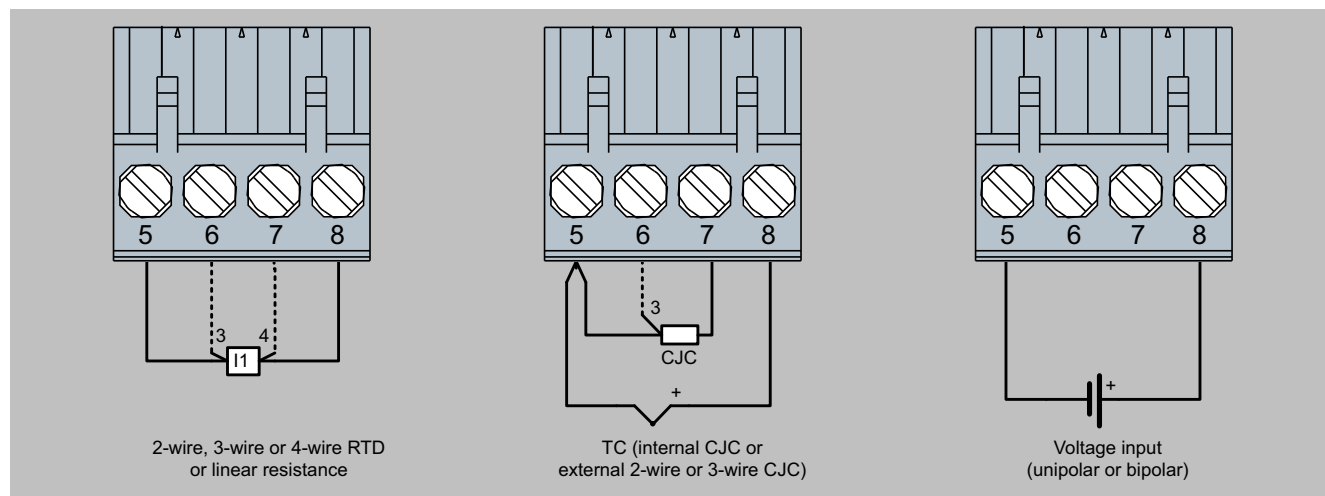
Output and test connection



SITRANS TR320, output connection assignment

Circuit diagrams (continued)

Input connection



SITRANS TR320, input connection assignment

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Overview



- 2-wire rail transmitter with HART communications interface
- Device for rail mounting
- Universal input for virtually any type of temperature sensor
- Connection of two independent input circuits for redundant operation (high input availability)
- Input drift detection
- Configurable via HART 7

Benefits

- Compact design
- Connection of two independent input circuits for redundant operation (high input availability)
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring wire break and short-circuit
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to EN 61326 and NE21
- SIL2/3 (with order note C20)

Application

SITRANS TR420 transmitters with two inputs can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 2 linear resistors, potentiometer and DC voltage sources

The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

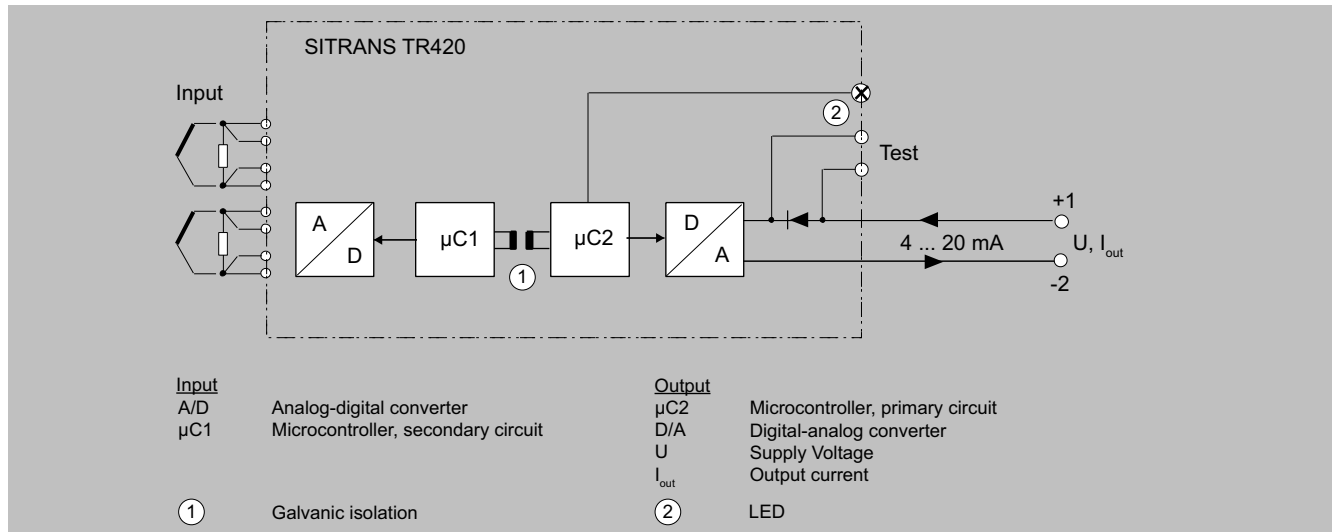
The dual input mode also supports drift detection of the inputs, whereby maintenance intervals can be more easily planned. Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

Function

The SITRANS TR420 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



SITRANS TR420, function block diagram

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Selection and ordering data

SITRANS TR420 DIN rail transmitter with 2 inputs	Article No. 7NG042	Order code
Click the article number for online configuration in the PIA Life Cycle Portal.	● - ● ● ● ● ● - 0 ● ● ● ● ● ● ●	
Communication		
With HART	0	
Primary value output		
Input 1	0	
Input 1, input 2 as redundancy	1	
Input 2, input 1 as redundancy	2	
Mean value input 1 and input 2, both as redundancy	3	
Minimum input 1 and input 2, both as redundancy	4	
Maximum input 1 and input 2, both as redundancy	5	
Difference input 1 - input 2	6	
Difference input 2 - input 1	7	
Absolute difference	8	
Primary value output, customer-specific		
Minimum input 1 and input 2, without redundancy	9	H 1 A
Maximum input 1 and input 2, without redundancy	9	H 1 B
Mean value input 1 and input 2, without redundancy	9	H 1 C
Input 2	9	H 1 D
Input 1, type		
RTD		
• Pt100 (IEC), 3-wire		B
• Pt100 (IEC), 4-wire		C
• Pt1000 (IEC), 3-wire		D
• Pt1000 (IEC), 4-wire		E
TC		
• Type B		F
• Type E		G
• Type J		H
• Type K		J
• Type L		K
• Type N		L
• Type R		N
• Type S		P
• Type T		Q
Potentiometer, 4-wire		R
Input 1, type customer-specific		
Define customer-specific input configurations in V options		Y
Input 2, type		
Without input 2		A
RTD		
• Pt100 (IEC), 3-wire		B
• Pt100 (IEC), 4-wire		C
• Pt1000 (IEC), 3-wire		D
• Pt1000 (IEC), 4-wire		E
TC		
• Type B		F
• Type E		G
• Type J		H
• Type K		J
• Type L		K
• Type N		L
• Type R		N

Selection and ordering data (continued)

SITRANS TR420 DIN rail transmitter with 2 inputs	Article No. 7NG042	Order code
• Type S	P	
• Type T	Q	
Potentiometer, 4-wire	R	
Input 2, type customer-specific Define customer-specific input configurations in W options	Y	
CJC configuration for TC Input 1: no CJC; input 2: No CJC	0	
Input 1: internal CJC; input 2: internal CJC	1	
Input 1: external CJC; input 2: external CJC; define type in option Jxx	2	
Input 1: external CJC; define type in option Jxx; input 2: internal CJC	3	
Input 1: internal CJC; input 2: external CJC; define type in option Jxx	4	
Input 1: Internal CJC; Input 2: No CJC	5	
Input 1: External CJC (define type in option Jxx); input 2: No CJC	6	
CJC configuration for TC, customer-specific Input 1: Fixed CJC value (define value in option Y60); Input 2: Fixed CJC value (define value in option Y61)	9	L 1 A
Input 1: External CJC (define type in option Jxx); Input 2: Define fixed CJC value with option Y61	9	L 1 B
Input 1: Define fixed CJC value with option Y60; Input 2: External CJC (define type in option Jxx)	9	L 1 C
Input 1: Define fixed CJC value with option Y60; Input 2: Internal CJC	9	L 1 D
Input 1: Internal CJC; Input 2: Define fixed CJC value with option Y61	9	L 1 E
Materials not in contact with media None	0	
Type of protection General safety (non-Ex); CE, RCM, FM, KCC, EAC, CSA, UK		A
Intrinsic safety (Ex i) / non-incendive field wiring (NIFW) / increased safety zone 2 (Ex ec) / non-incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro, UKEx)		N
Electrical connection/cable entries None		A
Local HMI Without display		0

Options	Order code
Add "-Z" to article number, specify order code and, if applicable, free text	
Manufacturer's declarations Inspection certificate EN 10204-3.1: Manufacturer test certificate for transmitters (5 measured values)	C11
Certificates for functional safety Functional safety SIL2/3 (IEC 61508)	C20
Device options PDF file with device settings	D10
Without labeling of the measuring range on the TAG plate	D41
Jumper plug set on device for write protection	D81
Jumper plug set on device set for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	D82
External CJC types Pt100, IEC 60751, 3-wire	J02
Pt100, IEC 60751, 4-wire	J03
Ni100, DIN 43760-87, 3-wire	J05
Ni100, DIN 43760-87, 4-wire	J06
Noise damping Noise damping 60 Hz instead of 50 Hz	P10
Input 1: TC Type C W5	V01
Type D W3	V02
Type U	V03
Type Lr	V04

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Selection and ordering data (continued)

Options Add "-Z" to article number, specify order code and, if applicable, free text	Order code
Input 1: Callendar-Van Dusen	
2-wire (define wire resistance value in option Y51 and Callendar-Van Dusen parameter in option Y35)	V50
3-wire (define Callendar-Van Dusen parameter in option Y35)	V51
4-wire (define Callendar-Van Dusen parameter in option Y35)	V52
Input 1: RTD	
Pt × (IEC 60751), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V60
Pt × (IEC 60751), 3-wire, define RTD factor × in option Y21	V61
Pt × (IEC 60751), 4-wire, define RTD factor × in option Y21	V62
Pt × (JIS C1604), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V63
Pt × (JIS C1604-81), 3-wire, define RTD factor × in option Y21	V64
Pt × (JIS C1604-81), 4-wire, define RTD factor × in option Y21	V65
Pt × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V66
Pt × (GOST 6651-2009), 3-wire, define RTD factor × in option Y21	V67
Pt × (GOST 6651-2009), 4-wire, define RTD factor × in option Y21	V68
Ni × (DIN 43760-87), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V69
Ni × (DIN 43760-87), 3-wire, define RTD factor × in option Y21	V70
Ni × (DIN 43760-87), 4-wire, define RTD factor × in option Y21	V71
Ni × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V72
Ni × (GOST 6651-2009), 3-wire, define RTD factor × in option Y21	V73
Ni × (GOST 6651-2009), 4-wire, define RTD factor × in option Y21	V74
Cu × (ECW-15), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V75
Cu × (ECW-15), 3-wire, define RTD factor × in option Y21	V76
Cu × (ECW-15), 4-wire, define RTD factor × in option Y21	V77
Cu × (GOST 6651-94), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V78
Cu × (GOST 6651-94), define 3-wire, define RTD factor × in option Y21	V79
Cu × (GOST 6651-94), define 4-wire, define RTD factor × in option Y21	V80
Cu × (GOST 6651-2009), 2-wire (define wire resistance value in option Y51 and RTD factor × in option Y21)	V81
Cu × (GOST 6651-2009), define 3-wire, define RTD factor × in option Y21	V82
Cu × (GOST 6651-2009), define 4-wire, define RTD factor × in option Y21	V83
Input 2: TC	
Type C W5	W01
Type D W3	W02
Type U	W03
Type Lr	W04

Selection and ordering data (continued)

Options	Order code
Add "-Z" to article number, specify order code and, if applicable, free text	
Input 2: Callendar-Van Dusen	
2-wire (define wire resistance value in option Y52 and Callendar-Van Dusen parameter in option Y36)	W50
3-wire (define Callendar-Van Dusen parameter in option Y36)	W51
4-wire (define Callendar-Van Dusen parameter in option Y36)	W52
Input 2: RTD	
Pt × (IEC 60751), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W60
Pt × (IEC 60721), 3-wire, define RTD factor × in option Y22	W61
Pt × (IEC 60721), 4-wire, define RTD factor × in option Y22	W62
Pt × (JIS C1604), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W63
Pt × (JIS C1604-81), 3-wire, define RTD factor × in option Y22	W64
Pt × (JIS C1604-81), 4-wire, define RTD factor × in option Y22	W65
Pt × (GOST 6651-2009), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W66
Pt × (GOST 6651-2009), 3-wire, define RTD factor × in option Y22	W67
Pt × (GOST 6651-2009), 4-wire, define RTD factor × in option Y22	W68
Ni × (DIN 43760-87), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W69
Ni × (DIN 43760-87), 3-wire, define RTD factor × in option Y22	W70
Ni × (DIN 43760-87), 4-wire, define RTD factor × in option Y22	W71
Ni × (GOST 6651-2009), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W72
Ni × (GOST 6651-2009), 3-wire, define RTD factor × in option Y22	W73
Ni × (GOST 6651-2009), 4-wire, define RTD factor × in option Y22	W74
Cu × (ECW-15), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W75
Cu × (ECW-15), 3-wire, define RTD factor × in option Y22	W76
Cu × (ECW-15), 4-wire, define RTD factor × in option Y22	W77
Cu × (GOST 6651-94), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W78
Cu × (GOST 6651-94), 3-wire, define RTD factor × in option Y22	W79
Cu × (GOST 6651-94), 4-wire, define RTD factor × in option Y22	W80
Cu × (GOST 6651-2009), 2-wire (define wire resistance value in option Y52 and RTD factor × in option Y22)	W81
Cu × (GOST 6651-2009), 3-wire, define RTD factor × in option Y22	W82
Cu × (GOST 6651-2009), 4-wire, define RTD factor × in option Y22	W83
Device settings	
Measuring range setting temperature input: Lower range value (max. 5 characters), upper range value (max. 5 characters), unit (°C, °F, °Ra, K)	Y01
Customer-specific programming in plain text (n-lines)	Y09

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Selection and ordering data (continued)

Options	Order code
Add "-Z" to article number, specify order code and, if applicable, free text	
Tag (device parameters, max. 32 characters), adhesive label	Y15
Measuring point description (device parameters, max. 32 characters), adhesive label	Y16
Descriptor (device parameters, max. 16 characters), adhesive label	Y18
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	Y21
Input 2: RTD factor (e.g. factor "200" - RTD Pt200), adhesive label	Y22
Fault current for input circuit short-circuit & interruption instead of 22.4 mA (short-circuit) and 22.8 mA (interruption) e.g. 3.6 mA and 22.4 mA [3.6 - 3.6; 3.6 - 22.8; 22.4 - 3.6]	Y31
CvD Sensor matching factors input 1 R0, A, B, C, Beta, Delta Selection: CVDR - R0 (format for example 100.0), CVDA - A (format for example 0.003908), CVDB - B (format for example -5.775E-07), CVDC - C (format for example -4.183E-12)	Y35
CvD Sensor matching factors input 2 R0, A, B, C, Beta, Delta Selection: CVDR - R0 (format for example 100.0), CVDA - A (format for example 0.003908), CVDB - B (format for example -5.775E-07), CVDC - C (format for example -4.183E-12)	Y36
Wire resistance value input 1 in ohms (0 ... 100 ohms)	Y51
Wire resistance value input 2 in ohms (0 ... 100 ohms)	Y52
Input 1: CJC sensor, fixed value (see measuring range for unit)	Y60
Input 2: CJC sensor, fixed value (see measuring range for unit)	Y61
ID number of special design	Y99

Accessories

Article No.	
Other accessories for assembly, connection and transmitter configuration, see page 2/198.	
Modem	
HART modem with USB interface	7MF4997-1DB
SIMATIC PDM parameterization software	See Catalog FI 01 section 8

Ordering example

7NG0420-0BA00-0AA0-Z Y01
Y01: -10 ... +100 °C

Factory setting

- Input 1: Pt100 (IEC 751; 3-wire connection)
- Input 2: not configured (inactive)
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
 - Device fault: < 3.6 mA
 - Input circuit wire break: 22.8 mA
 - Input circuit short-circuit: 22.4 mA
 - Input circuit drift: 22 mA (active when input 2 is active)
 - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Technical specifications

SITRANS TR420 (HART, universal)

General	
Supply voltage ^{1) 2)}	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• With explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	$(V_{\text{supply}} - 37 \text{ V})/23 \text{ mA}$
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• With explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Wire jumpers or software
Warm-up time	< 5 min
Starting time	< 2.75 s
Programming	SIPROM T and HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: <ul style="list-style-type: none"> • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
<u>Resistance thermometer (RTD)</u>	
Input type	
• Pt10 ... 10000	<ul style="list-style-type: none"> • IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	<ul style="list-style-type: none"> • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	<ul style="list-style-type: none"> • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Connection type	2-wire, 3-wire or 4-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms
<u>Thermocouples (TC)</u>	

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Technical specifications (continued)

SITRANS TR420 (HART, universal)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold Junction Compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire, 3-wire or 4-wire
• External CJC, wire resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total wire resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Connection type	2-wire, 3-wire or 4-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Connection type	3-wire, 4-wire or 5-wire
Wire resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

Technical specifications (continued)

SITRANS TR420 (HART, universal)	
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
<u>Voltage input</u>	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V _{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of measuring span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short-circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Operating conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP20
• Terminals	IP20
Structural design	
Weight	122 g (0.27 lb)
Maximum core cross-section	2.5 mm ² (AWG 13)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inches)
• 25 ... 100 Hz	± 4 g

Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

Technical specifications (continued)

SITRANS TR420 (HART, universal)	
Certificates and approvals	
<u>Explosion protection ATEX/IECEX and others</u>	
Certificates ³⁾	<ul style="list-style-type: none"> • DEKRA 17ATEX0116 X • IECEx DEK 17.0054X • A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
• ATEX	<ul style="list-style-type: none"> • II 1 G Ex ia IIC T6 ... T4 Ga • II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb • II 2 D Ex ia IIIC Db • I M1 Ex ia I Ma
• IECEx and others	<ul style="list-style-type: none"> • Ex ia IIC T6 ... T4 Ga • Ex ib [ia Ga] IIC T6 ... T4 Gb • Ex ia IIIC Db • Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
• ATEX	<ul style="list-style-type: none"> • II 3 G Ex ic IIC T6...T4 Gc • II 3 D Ex ic IIIC Dc
• IECEx and others	<ul style="list-style-type: none"> • Ex ic IIC T6 ... T4 Gc • Ex ic IIIC Dc
"Non-sparking/increased safety nA/lec" type of protection	For use in Zones 2 and 22
• ATEX	<ul style="list-style-type: none"> • II 3 G Ex nA IIC T6...T4 Gc • II 3 G Ex ec IIC T6...T4 Gc
• IECEx and others	<ul style="list-style-type: none"> • Ex nA IIC T6 ... T4 Gc • Ex ec IIC T6 ... T4 Gc
<u>Explosion protection CSA/FM for Canada and USA</u>	
Certificates	<ul style="list-style-type: none"> • CSA 1861385 • FM18CA0024 • FM18US0046
"Intrinsic safety ia" type of protection	<ul style="list-style-type: none"> • IS, CL I, Div 1, GP ABCD, T6 ... T4 • Ex ia IIC T6 ... T4 Ga, AEx ia IIC T6 ... T4 Ga or Ex ib [ia Ga] IIC T6...T4 Gb, AEx ib [ia Ga] IIC T6...T4 Gb
"Non incandive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incandive NI" type of protection	<ul style="list-style-type: none"> • NI, CL I, Div 2, GP ABCD T6...T4 • Ex nA IIC T6 ... T4 Gc • AEx nA IIC T6 ... T4 Gc

1) Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TR420. All external voltage drops must be taken into account.

2) Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

3) Additional available certificates are listed on the internet at <http://www.siemens.com/processinstrumentation/certificates>

Technical specifications (continued)

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in °C ⁻¹ (°F ⁻¹)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2-003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML - R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient ¹⁾
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.} < 180 \text{ °C (356 °F)} = \leq \pm 0.08 \text{ °C (0.144 °F)}$ $T_{max.} > 180 \text{ °C (356 °F)} = \leq \pm 0.16 \text{ °C (0.288 °F)}$	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.} < 300 \text{ °C (572 °F)} = \leq \pm 0.08 \text{ °C (0.144 °F)}$ $T_{max.} > 300 \text{ °C (572 °F)} = \leq \pm 0.4 \text{ °C (0.72 °F)}$	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)

Temperature Measurement

Temperature transmitters

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Technical specifications (continued)

Input type	Basic accuracy	Temperature coefficient ¹⁾
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 μV	≤ ±0.2 μV/°C (0.11 μV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 μV/°C (20 μV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 μV/°C (17.8 μV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B ²⁾	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B ³⁾	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B ⁴⁾	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B ⁵⁾	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.

2) Accuracy of the specification range > 400 °C (752 °F)

3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)

4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)

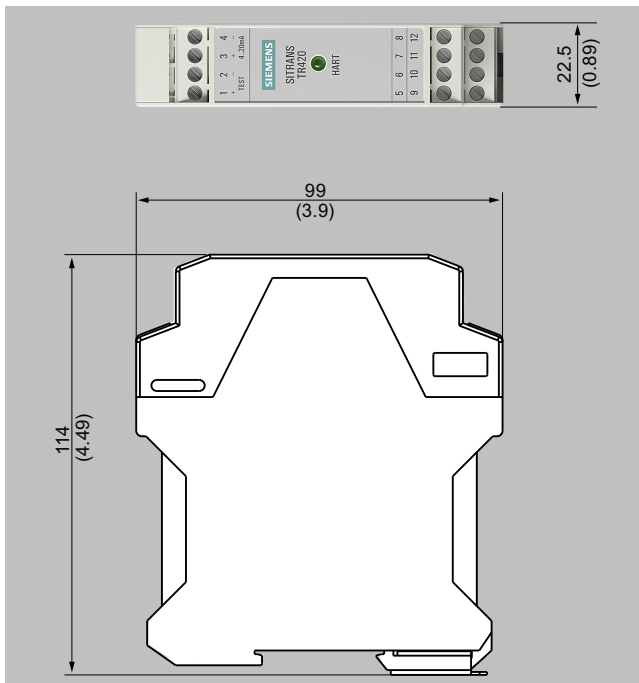
5) Accuracy of the specification range < 85 °C (185 °F)

Technical specifications (continued)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Average value measurement	Average of accuracy of input 1 and input 2	Average of temperature coefficient of input 1 and input 2
Differential measurement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	$\leq \pm 1.6 \mu\text{A}$ (0.01% of the full output span)	$\leq \pm 0.48 \mu\text{A/K}$ ($\leq \pm 0.003\%$ of the full output span/K)

Dimensional drawings



SITRANS TR420, dimensions in mm (inch)

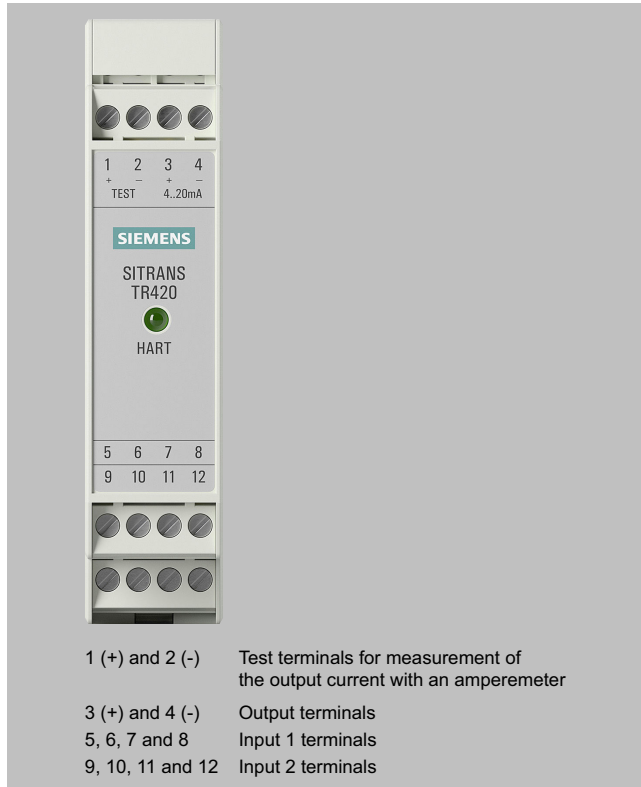
Temperature Measurement

Temperature transmitters

Rail transmitters / SITRANS TR420 (HART, universal)

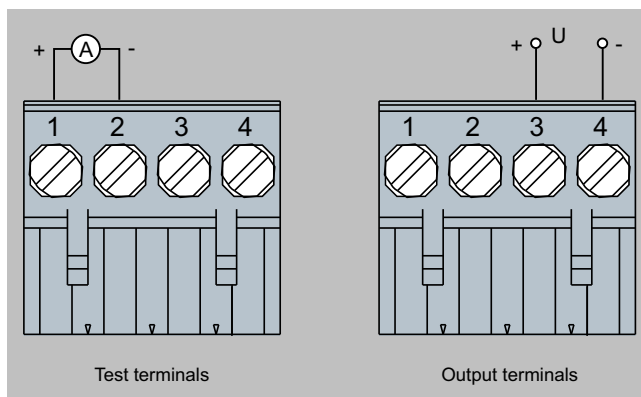
Circuit diagrams

Connections



SITRANS TR420, connector assignment

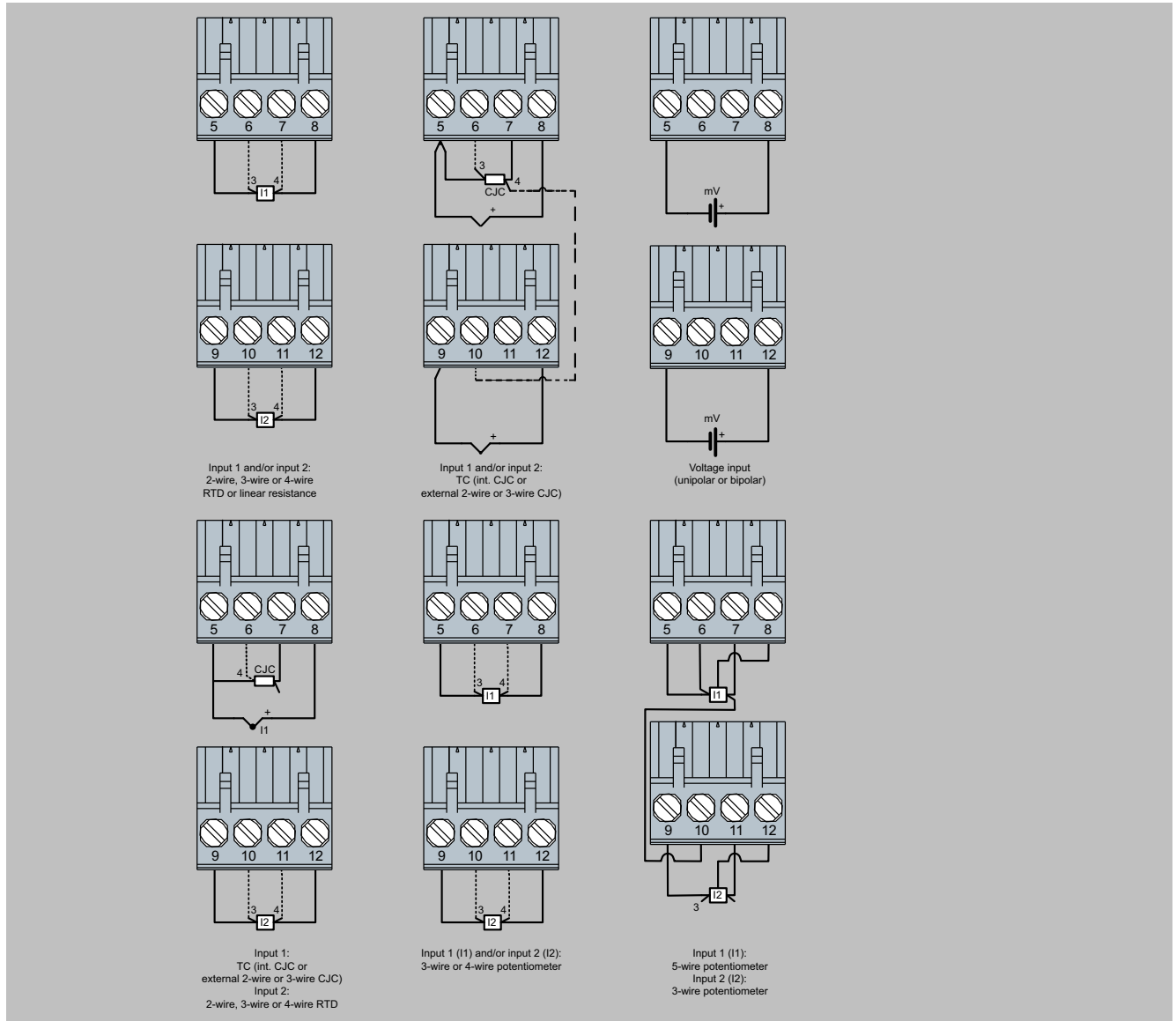
Output and test connection



SITRANS TR420, output connection assignment

Circuit diagrams (continued)

Input connection



SITRANS TR420, input connection assignment