

Temperature Measurement

Transmitters for field mounting

SITRANS TF fieldbus transmitter

Overview



Our field devices for heavy industrial use

- FOUNDATION fieldbus
- PROFIBUS PA

The SITRANS TF temperature transmitter works where others can't cope.

Benefits

- For universal use as a transmitter for resistance thermometers, thermocouple elements, Ω or mV signals
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Degree of protection IP66/67/68
- Can be mounted elsewhere if the measuring point
 - is hard to access,
 - is subject to high temperatures,
 - is subject to vibrations from the system,
 - or if you want to avoid long neck tubes and/or protective tubes.
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres. "Intrinsically safe, non-sparking and flameproof" type of protection, for Europe and USA

Application

The SITRANS TF can be used everywhere where temperatures need to be measured under particularly harsh conditions. For that reason users from all industries have opted for this field device.

The rugged enclosure protects the electronics. The stainless steel model is almost completely resistant to sea water and other aggressive elements.

The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Features

- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Electrically isolated
- Version for use in hazardous areas
- Special characteristic
- Sensor redundancy

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

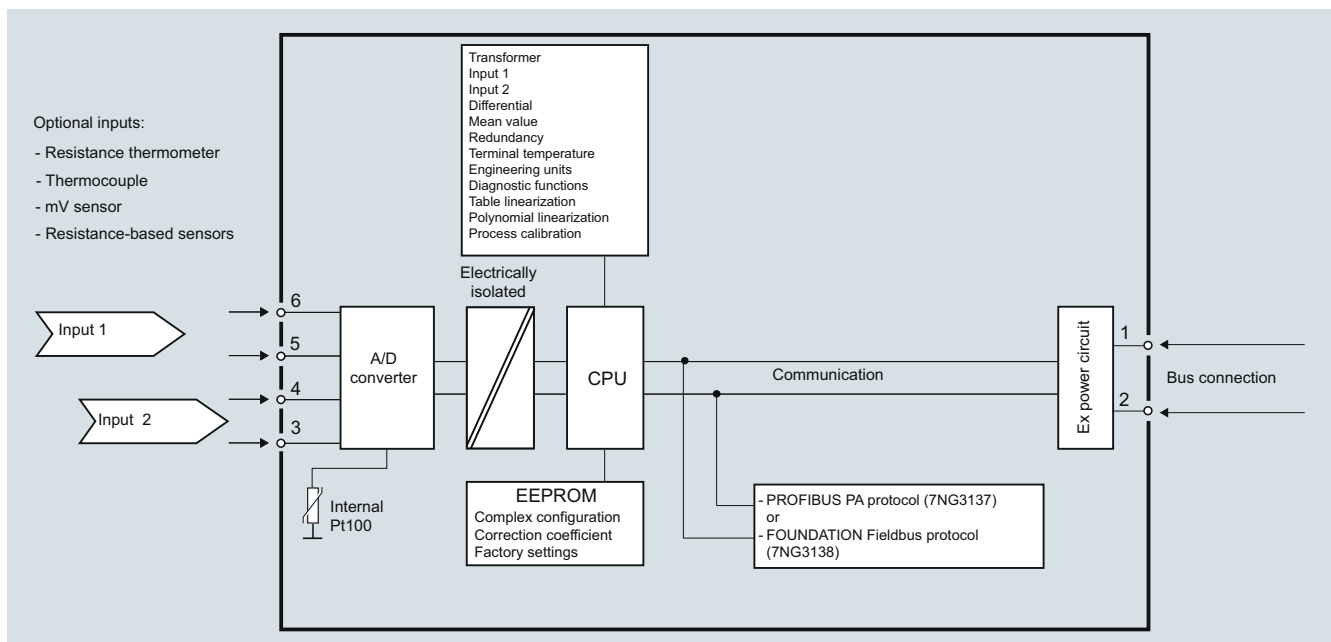
Transmitter with FOUNDATION fieldbus communication

- Function blocks: 2 x analog and 1 x PID
- Functionality: Basic or LAS

Mode of operation

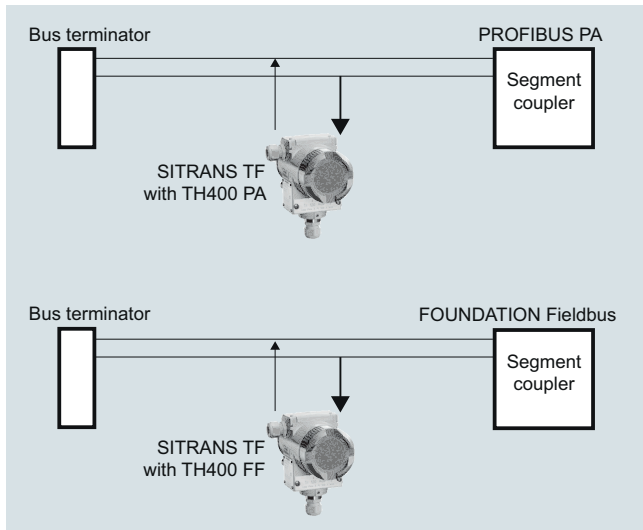
The following function diagram explains the mode of operation of the transmitter.

The only difference between the two versions of the SITRANS TF (7NG3137-... and 7NG3138-...) is the type of field bus protocol used (PROFIBUS PA or FOUNDATION fieldbus).



SITRANS TF with TH400, function diagram

System communication



SITRANS TF with TH400, communication interface

Technical specifications

Input

Analog/digital conversion

- Measurement rate < 50 ms
- Resolution 24-bit

Resistance thermometer

Pt25 ... 1000 to IEC 60751/JIS C 1604

- Measuring range -200 ... +850 °C (-328 ... +1562 °F)

Ni25 ... 1000 to DIN 43760

- Measuring range -60 ... +250 °C (-76 ... +482 °F)

Cu10 ... 1000, $\alpha = 0.00427$

- Measuring range -50 ... +200 °C (-58 ... +392 °F)

Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Resistance-based sensors

Measuring range 0 ... 10 k Ω Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Thermocouple

to IEC 584

- Type B Measuring range 400 ... 1820 °C (752 ... 3308 °F)
- Type E -100 ... +1000 °C (-148 ... +1832 °F)
- Type J -100 ... +1000 °C (-148 ... +1832 °F)
- Type K -100 ... +1200 °C (-148 ... +2192 °F)
- Type N -180 ... +1300 °C (-292 ... +2372 °F)
- Type R -50 ... +1760 °C (-58 ... +3200 °F)
- Type S -50 ... +1760 °C (-58 ... +3200 °F)
- Type T -200 ... +400 °C (-328 ... +752 °F)

to DIN 43710

- Type L -200 ... +900 °C (-328 ... +1652 °F)
- Type U -200 ... +600 °C (-328 ... +1112 °F)

to ASTM E988-90

- Type W3 0 ... 2300 °C (32 ... 4172 °F)
- Type W5 0 ... 2300 °C (32 ... 4172 °F)

External cold junction compensation -40 ... +135 °C (-40 ... +275 °F)

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 3 mV
- Sensor current in the event of open-circuit monitoring 4 μ A

mV sensor - voltage input

Measuring range -800 ... +800 mV

Input resistance 10 M Ω

Output

Filter time (programmable) 0 ... 60 s

Update time < 400 ms

Measuring accuracy

Accuracy is defined as the higher value of general values and basic values.

General values

Type of input	Absolute accuracy	Temperature coefficient
All	$\leq \pm 0.05$ % of the measured value	$\leq \pm 0.002$ % of the measured value/°C

Basic values

Type of input	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	$\leq \pm 0.1$ °C	$\leq \pm 0.002$ °C/°C
Ni100	$\leq \pm 0.15$ °C	$\leq \pm 0.002$ °C/°C
Cu10	$\leq \pm 1.3$ °C	$\leq \pm 0.02$ °C/°C
Resistance-based sensors	$\leq \pm 0.05$ Ω	$\leq \pm 0.002$ Ω /°C
Voltage source	$\leq \pm 10$ μ V	$\leq \pm 0.2$ μ V/°C
Thermocouple, type: E, J, K, L, N, T, U	$\leq \pm 0.5$ °C	$\leq \pm 0.01$ °C/°C
Thermocouple, type: B, R, S, W3, W5	$\leq \pm 1$ °C	$\leq \pm 0.025$ °C/°C
Cold junction compensation	$\leq \pm 0.5$ °C	

Reference conditions

Warming-up time 30 s

Signal-to-noise ratio Min. 60 dB

Calibration condition 20 ... 28 °C (68 ... 82 °F)

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Conditions of use

Ambient conditions

Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation

Insulation resistance

• Test voltage	500 V AC for 60 s
• Continuous operation	50 V AC/75 V DC

Electromagnetic compatibility

NAMUR	NE21
EMC 2014/30/EU Emission and Noise Immunity	EN 61326-1, EN 61326-2-5

Construction

Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure materials	<ul style="list-style-type: none"> Die-cast aluminum, low in copper, GD-AISI 12 or stainless steel Polyester-based lacquer for GD AISI 12 enclosure Stainless steel rating plate
Electrical connection, sensor connection	<ul style="list-style-type: none"> screw terminals Cable inlet via M20 x 1.5 or ½ -14 NPT screwed gland Bus connection with M12 device plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP66/67 to EN 60529

Auxiliary power

Power supply	
• Standard, Ex "d", Ex "nA", Ex "nL", XP, NI	10.0 ... 32 V DC
• Ex "ia", Ex "ib"	10.0 ... 30 V DC
• In FISCO/FNICO installations	10.0 ... 17.5 V DC
Power consumption	< 11 mA
Max. increase in power consumption in the event of a fault	< 7 mA

Certificates and approvals

Explosion protection ATEX	
EC type test certificate	ZELM 11 ATEX 0471 X
• Type of protection "intrinsic safety i" (version: 7NG313x-1xxxx)	II 2 (1) G Ex ib [ia Ga] IIC T6 Gb II 2 G Ex ib IIC T6 Gb II 1D Ex ia IIIC T100 °C Da
Conformity statement	ZELM 11 ATEX 0471 X
• "Operating equipment that is non-ignitable and has limited energy" type of protection (version: 7NG313x-2xxxx)	II 3 G Ex ic IIC T6/T4 Gc II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA [ic] IIC T6/T4 Gc
EC type test certificate	ZELM 11 ATEX 0472 X
• "Flame-proof enclosure" type of protection (version: 7NG313x-4xxxx)	II 2 G Ex d IIC T6/T5 Gb II 2 D Ex tb IIIC T100 °C Db
Explosion protection: FM for USA	
• FM approval	FM 3017742
• Type of protection XP, DIP, NI and S (version 7NG313x-5xxxx)	XP / I / 1 / BCD / T5,T6; Type 4X DIP / II, III / 1 / EFG / T5,T6; Type 4X NI / I / 2 / ABCD / T5,T6; Type 4X S / II, III / 2 / FG T5,T6; Type 4X
Other certificates	EAC Ex(GOST), INMETRO, NEPSI, KOSHA

Communication

Parameterization interface

• PROFIBUS PA connection	
- Protocol	A&D profile, Version 3.0
- Protocol	EN 50170 Volume 2
- Address (for delivery)	126
- Function blocks	2 x analog
• FOUNDATION fieldbus connection	
- Protocol	FF protocol
- Protocol	FF design specifications
- Functionality	Basic or LAS
- Version	ITK 4.6
- Function blocks	2 x analog and 1 x PID

Factory setting

for SITRANS TH400 PA

Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific



for SITRANS TH400 FF

Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Temperature Measurement

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SITRANS TF fieldbus transmitter

Selection and Ordering data	Article No.	Further designs	Order code	
Temperature transmitter in field enclosure  with fieldbus communication and electrical isolation  Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	7NG313-0	Please add "-Z" to Article No. and specify Order code(s) and plain text. Test report (5 measuring points) Bus connection <ul style="list-style-type: none"> M12 device plug (metal), without mating connector M12 device plug (metal), with mating connector Explosion protection <ul style="list-style-type: none"> Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....) Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....) Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2...) Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...) Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....) Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2...) Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4...) Explosion protection Ex i according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-1...) Explosion protection Ex d according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-4...) Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2...) Marine approvals <ul style="list-style-type: none"> Det Norske Veritas Germanischer Lloyd (DNV GL) Bureau Veritas (BV) Lloyd's Register of Shipping (LR) American Bureau of Shipping (ABS) Two coats of lacquer on casing and cover (PU on epoxy) Transient protection Cable gland CAPRI 1/2 NPT ADE 4F, nickle-plated brass (CAPRI 848694 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	C11 M00 ²⁾ M01 ²⁾ E25 ³⁾ E26 ³⁾ E27 ³⁾ E55 ³⁾ E56 ³⁾ E57 ³⁾ E70 ³⁾ E81 ³⁾ E82 ³⁾ E83 ³⁾ D01 D02 D04 D05 G10 J01 D57 D58 D59 D60	
Integrated transmitter SITRANS TH400 with PROFIBUS PA <ul style="list-style-type: none"> Without Ex protection With Ex ia (ATEX) With Ex nAL for zone 2 (ATEX) Total device SITRANS TF Ex d (ATEX + IECEX)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ SITRANS TH400, with FOUNDATION fieldbus <ul style="list-style-type: none"> Without Ex protection With Ex ia (ATEX) With Ex nAL for zone 2 (ATEX) Total device SITRANS TF Ex d (ATEX + IECEX)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ 	7 0 7 1 7 2 7 4 7 5 8 0 8 1 8 2 8 4 8 5			
Enclosure Die-cast aluminium Stainless steel precision casting			A E	
Connections/cable inlet Screwed glands M20x1.5 Screwed glands 1/2-14 NPT			B C	
Mounting bracket and fastening parts None Made of steel Stainless steel				0 1 2

Temperature Measurement

Transmitters for field mounting

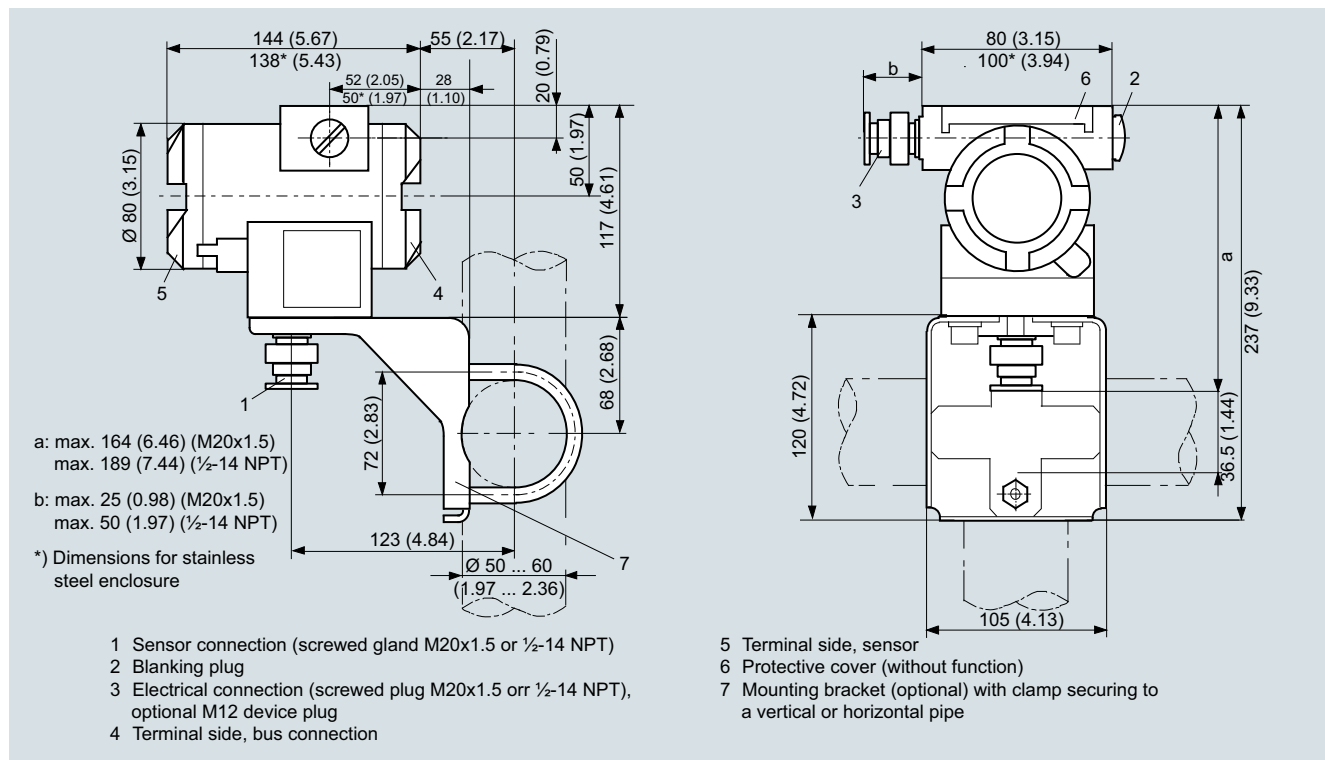
SITRANS TF fieldbus transmitter

Selection and Ordering data	Order code.
Customer-specific programming Add "-Z" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	Y01⁴⁾
Meas. point no. (TAG), max. 8characters	Y15⁵⁾
Meas. point descriptor, max. 16 characters	Y23⁵⁾
Meas. point message, max. 32 characters	Y24⁶⁾
Bus address, specify in plain text	Y25⁵⁾
Pt100 (IEC) 2-wire, R _L = 0 Ω	U02⁷⁾
Pt100 (IEC) 3-wire	U03⁷⁾
Pt100 (IEC) 4-wire	U04⁷⁾
Thermocouple type B	U20⁷⁾⁸⁾
Thermocouple type C (W5)	U21⁷⁾⁸⁾
Thermocouple type D (W3)	U22⁷⁾⁸⁾
Thermocouple type E	U23⁷⁾⁸⁾
Thermocouple type J	U24⁷⁾⁸⁾
Thermocouple type K	U25⁷⁾⁸⁾
Thermocouple type L	U26⁷⁾⁸⁾
Thermocouple type N	U27⁷⁾⁸⁾
Thermocouple type R	U28⁷⁾⁸⁾
Thermocouple type S	U29⁷⁾⁸⁾
Thermocouple type T	U30⁷⁾⁸⁾
Thermocouple type U	U31⁷⁾⁸⁾
With TC: CJC: external (Pt100, 3-wire)	U41
With TC: CJC: external with fixed value, specify in plain text	Y50
Special differing customer-specific programming, specify in plain text	Y09⁹⁾

- 1) Without cable gland
- 2) Not available for explosion protection Ex d or XP.
- 3) Option does not include ATEX/IECEx approval, only country-specific approval.
- 4) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
- 5) If only Y15, Y23 or Y25 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.
- 6) For this selection, Y01 or Y09 must also be selected.
- 7) For this selection, Y01 must also be selected.
- 8) Internal cold junction compensation is selected as the default for TC
- 9) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here

Selection and Ordering data	Article No.
Accessories Further accessories for assembly, connection and transmitter configuration, see page 2/238.	
SIMATIC PDM parameterization software also for SITRANS TF with TH400 PA	see Sec. 8
Mounting bracket and fastening parts Made of steel for 7NG313.-.B.. Made of steel for 7NG313.-.C.. Made of stainless steel for 7NG313.-.B.. Made of stainless steel for 7NG313.-.C..	7MF4997-1AC 7MF4997-1AB 7MF4997-1AJ 7MF4997-1AH
Connection board <u>Ordering example 1:</u> 7NG3137-0AB01-Z Y01+Y15+Y25+U03 Y01: -10 ... +100 °C Y15: TICA1234HEAT Y25: 33 <u>Ordering example 2:</u> 7NG3137-0AC01-Z Y01+Y15+Y25+U25 Y01: -10 ... +100 °C Y15: TICA 1234 ABC 5678 Y25: 35 <u>Factory setting:</u>	A5E02391790
<ul style="list-style-type: none"> • for SITRANS TH400 PA: <ul style="list-style-type: none"> - Pt100 (IEC) with 3-wire circuit - Unit: °C - Failure mode: last valid value - Filter time: 0 s - PA address: 126 - PROFIBUS Ident No.: manufacturer-specific • for SITRANS TH400 FF: <ul style="list-style-type: none"> - Pt100 (IEC) with 3-wire circuit - Unit: °C - Failure mode: last valid value - Filter time: 0 s - Node address: 22 	

Dimensional drawings



SITRANS TF with TH400, dimensions in mm (inches)

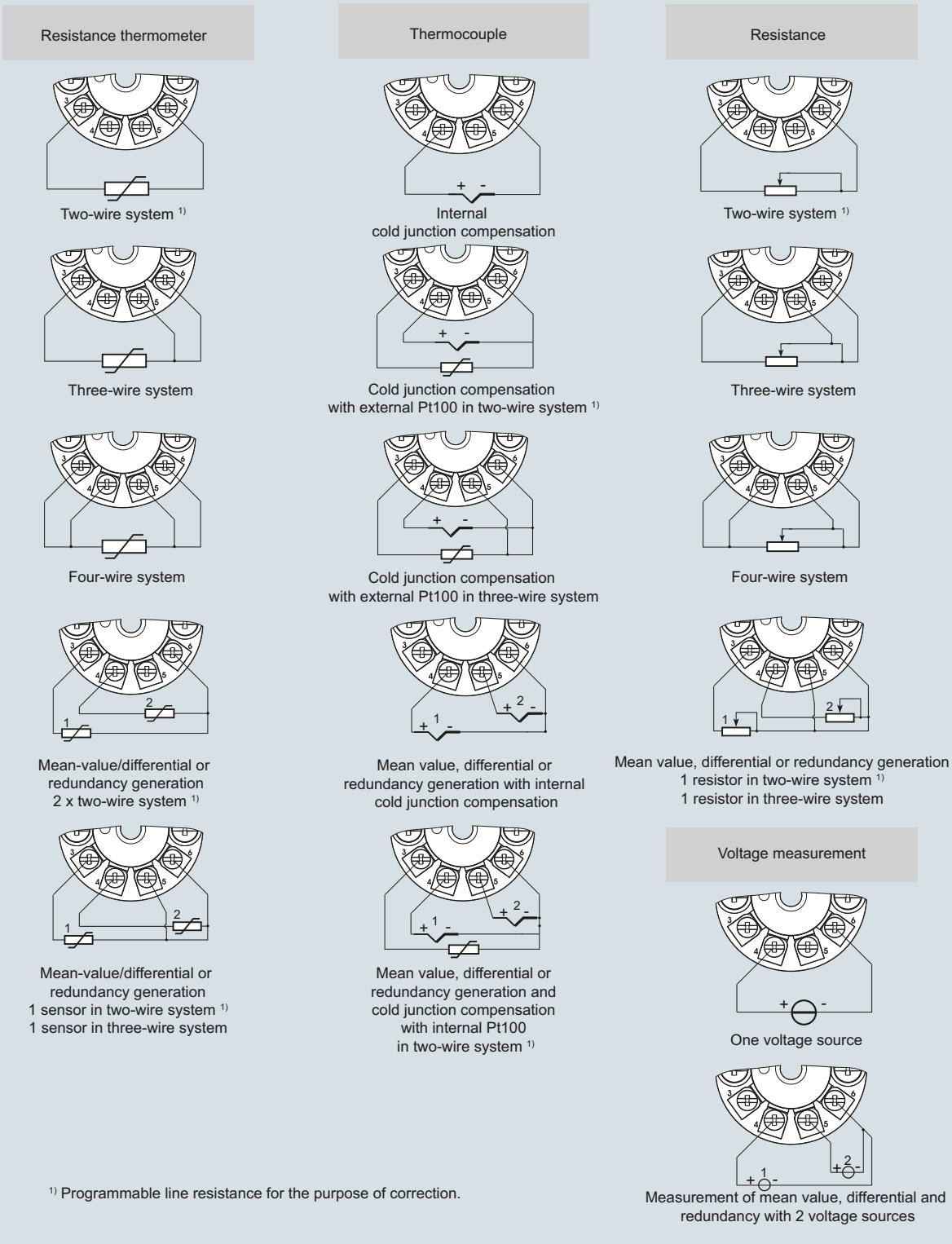
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Schematics

2



SITRANS TF with TH400, sensor connection assignment