The selection is detailed on page 8

S20-H/R

Head Mounted/rail Type Temperature Transmitter

Working principle

Temperature transmitter adopts thermocouple and thermal resistance as temperature measuring element, the output signal from the temperature measuring element is sent to the transmitter module, after voltage regulation filter, operation amplification, nonlinear correction, V/I conversion, constant current and reverse protection circuit processing, converted into a linear relationship with temperature 4-20mA current signal 0-5V/0-10V voltage signal. RS485 digital signal output.

Product application

Process industry

Machinery and equipment manufacturing

General industrial application

Product description

With high accuracy, electrical isolation and excellent electromagnetic interference (EMI) resistance, this series of temperature transmitters is widely used in the process industry. The S20 temperature transmitter supports the HART® protocol, so it can be configured with a variety of open source configuration tools. We can provide different types of sensors according to user requirements, such as sensors according to DIN EN 60751, JIS C1606, DIN 43760, IEC 60584 or DIN 43710. In addition, the user can also customize the characteristics of the sensor by entering the value (user can customize the linearity).

After redundant configuration of sensors (dual sensors), if one sensor fails, the transmitter automatically switches to another sensor that works properly. In addition, the sensor drift detection function can be activated. When the temperature deviation between sensor 1 and sensor 2 exceeds the user set value, the transmitter will send a fault signal.

The S20 transmitter also features a number of high-end management features such as sensor line resistance detection, sensor fault detection according to NAMUR NE89 standards, and measurement range monitoring. Moreover, the transmitter series can be fully self-tested on a regular basis.

The head-mounted transmitter can be installed in a standard type B DIN junction box。

Functional characteristics

TUV certified SIL type for protection equipment developed according to IEC 61508 (optional)

Supports almost all software and hardware tools for configuration

1 or 2 sensors can be connected

- Resistance thermometer, resistance sensor

- Thermocouple, mV sensor

- Potentiometer

Signal transmission meets the NAMUR NE43 standard, sensor fault detection meets the NE89 standard, and EMC meets the NE21 standard

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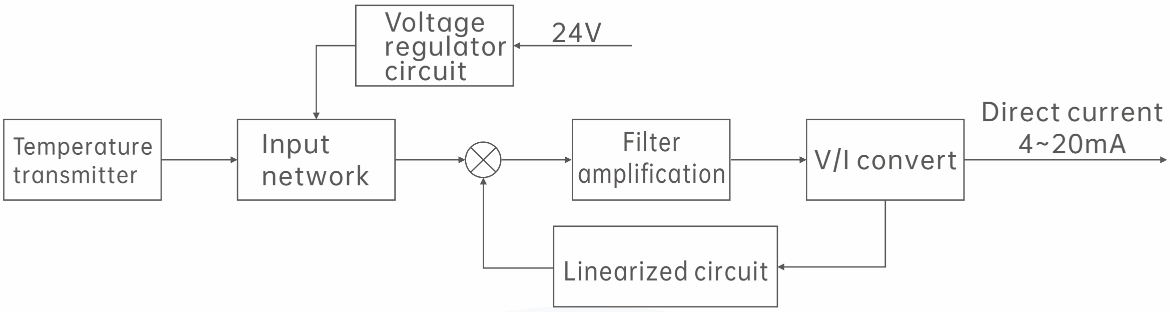
Schematic diagram



Technical parameter

Temperature transmitter input							
Sensor type	Input signal	Maximum configurable measurement Radius[1]	Standard	α value	Minimum range[14]	Typical measurement deviation[2]	Typical value of temperature coefficient per ° C[3]
Resistance sensor	Pt100	-200...+850℃	IEC 60751:2008	α = 0.00385	10 K or 3.8 Ω (whichever is larger)	≤±0.12 ℃[5]	≤±0.0094℃[6,7]
	Pt(x)4)	-200...+850℃	IEC 60751:2008	α = 0.00385		≤±0.12 ℃[5]	≤±0.0094℃[6,7]
	JPt100	-200...+500℃	JIS C1606:1989	α = 0.003916		≤±0.12 ℃[5]	≤±0.0094℃[6,7]
	Ni100	-60...+250℃	DIN 43760:1987	α = 0.00618		≤±0.12 ℃[5]	≤±0.0094℃[6,7]
	Resistance sensor	0...8,370Ω	-	-	4 Ω	≤±1.68 Ω[8]	≤±0.1584 Ω[8]
	Potentiometer 9)	0...100 %	-	-	10 %	≤0.50 %[10]	≤±0.0100 %[10]
The measured current at the time of measurement		Max. 0.3mA (Pt100)					
Connection mode		1 sensor 2-/4-/3- wire connection or 2 sensors 2- wire connection					
		(For more information, see "Naming Terminals")					
Maximum lead resistance		50 per wire, 3-/ 4-wire system					
Thermoelectric couple	Type J (Fe-CuNi)	-210...+1,200℃	IEC 60584-1: 1995		50 K or 2 mV (whichever is larger)	≤±0.91 ℃[11]	≤±0.0217℃[7,11]
	Type K (NiCr-Ni)	-270...+1,300℃	IEC 60584-1: 1995			≤±0.98 ℃[11]	≤±0.0238℃[7,11]
	L-type (Fe-CuNi)	-200...+900℃	DIN 43760: 1987			≤±0.91 ℃[11]	≤±0.0203℃[7,11]
	E type (NiCr-Cu)	-270...+1,000℃	IEC 60584-1: 1995			≤±0.91 ℃[11]	≤±0.0224℃[7,11]
	N-type (NiCrSi-NiSi)	-270...+1,300℃	IEC 60584-1: 1995			≤±1.02 ℃[11]	≤±0.0238℃[7,11]
	T-type (Cu-CuNi)	-270...+400℃	IEC 60584-1: 1995			≤±0.92 ℃[11]	≤±0.0191℃[7,11]
	U-shaped (Cu-CuNi)	-200...+600℃	DIN 43710: 1985			≤±0.92 ℃[11]	≤±0.0191℃[7,11]
	Type R (PtRh-Pt)	-50...+1,768℃	IEC 60584-1: 1995		150 K	≤±1.66 ℃[11]	≤±0.0338℃[7,11]
	Type S (PtRh-Pt)	-50...+1,768℃	IEC 60584-1: 1995		150 K	≤ ±1.66 ℃[11]	≤±0.0338℃[7,11]
	Type B (PtRh-Pt)	0...+1,820℃[15]	IEC 60584-1: 1995		200 K	≤ ±1.73 ℃[11]	≤±0.0500℃[7,12]
		-500...+1,800mV	-		4 mV	≤ ±0.33 mV[13]	≤±0.0311mV[7,13]
Connection mode		1 sensor or 2 sensors					
		(For more information, see "Naming Terminals")					
Maximum lead resistance		Each line is 5 kΩ					
Cold end compensation, configurable		Internal compensation or use Pt100 external compensation, with thermostat or off					

1)Other units can also be used (such as ℉ and K)
2) Measurement deviation (input + output) at 23℃ ±3 K ambient temperature, without considering the influence of lead resistance
3) Temperature coefficient per ℃ (input + output)
4) x is available in 10... The value between 1000 is configured
5) Based on 3-wire Pt100, Ni100, 150℃ MV
6) Based on 150℃ MV
7) At -40... +85 ° C ambient temperature range
8) Based on one sensor (Max. 5 kΩ)
9) Total resistance value Rtotal: 10... 100 kΩ
10) Based on 50% of the potentiometer value
11) Based on 400 ℃ MV, with cold end compensation error
12) Based on 1000 ℃ MV, with cold end compensation error
13) Based on 0... 1 V measuring range, 400 mV MV
14) Transmitters can be configured below these limits, but this is not recommended because of the loss of accuracy.
15) Specifications only apply to 450... Measuring range between 1820 ° C

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User linearization

Specific sensor characteristics can be saved to the transmitter through software so that more other types of sensors can be used. Number of data points: minimum 2; Up to 30

Connect 2 sensors (dual sensors) for monitoring function

If an error occurs in one of the two sensors (sensor damage, lead resistance is too high, or out of sensor measurement range, etc.), the process value will depend only on the sensor that did not fail. After the error is corrected, the process value is re-calculated based on either the two sensors or sensor 1.

Aging control (Sensor drift monitoring)

If the temperature deviation between sensor 1 and sensor 2 is greater than the set value (which can be selected by the user), the output activates an error signal. Only when both sensor values are valid and the temperature difference is higher than the selected limit will the monitoring mechanism send a corresponding signal.
(Limits cannot be selected when using the Difference sensor function because the output signal represents the difference between the two).

Remark

Transmitters can be configured below these limits, but this is not recommended to avoid loss of accuracy.

Difference value

4... The 20mA output signal transmits the difference between sensor 1 and sensor 2. If one sensor fails, an error signal is activated。

Connect 2 sensors (dual sensors) for monitoring function - Sensor 1, Sensor 2 redundancy

4... The 20mA output signal transmits the process value of sensor 1. If sensor 1 fails, the process value of sensor 2 is output (sensor 2 is a redundant sensor).

Mean value

4... The 20mA output signal transmits the average value of sensor 1 and sensor 2. If a sensor fails, the process value of the sensor that did not fail is output.

Minimum value

4... The 20mA output signal transmits the minimum values in Sensor 1 and Sensor 2. If a sensor fails, the process value of the sensor that did not fail is output.

Maximum value

4... The 20mA output signal transmits the maximum value in sensor 1 and Sensor 2. If a sensor fails, the process value of the sensor that did not fail is output.

Analog output, output limit, prompt signal		
Analog output, configurable	Linear with temperature (IEC 60751, JIS C1606, DIN 43760, resistive sensors) or linear with temperatureRelation (IEC 584 / DIN 43710 standard, thermocouple)	
	4... 20 mA or 20... 4 mA, 2 wire system	
Output limits, configurable	Lower limit value	Upper limit value
▪ NAMUR NE43 standard	3.8mA	20.5mA
▪ Can be adjusted according to user specific requirements	3.6 ... 4.0 mA	20.0 ... 21.5 mA
▪ SIL option	3.8 ... 4.0 mA	20.0 ... 20.5 mA
Output limits, configurable	Cut down	Expand
▪ NAMUR NE43 Standard	＜3.6mA (3.5mA)	＞21.0mA (21.5mA)
▪ Set range	3.5 ... 3.6 mA	21.0 ... 23.0 mA
▪ PV (Primary value; Digital HART® measurements)	The default value indicates that the sensor sends signals and hardware errors	
In analog mode, independent of the input signal, the analog value can be 3.5... The configuration is performed in the 23.0 mA range		
▪ Load RA (without HART®)	RA ≤ (UB -10.5 V) / 0.023 A，The unit of RA is Ω, and the unit of UB is V	
▪ Load RA (with HART®)	RA ≤ (UB -11.5 V) / 0.023 A，The unit of RA is Ω, and the unit of UB is V	
▪ Isolation voltage (between input and analog output)	AC 1200 V，(50 Hz / 60 Hz)；1 seconds	

Rise time, damping, measurement frequency	
Rise time t_{90}	About 0.8 seconds
Damping, configurable	Close; It can be configured in 1 to 60 seconds
Start-up time	Startup time (time required to obtain the first measurement)
Typical measurement frequency	Measurements are updated approximately 6 times per second

Measurement deviation, temperature coefficient, long-term stability				
Load effect	immeasurable			
Power effect	immeasurable			
Preheating time	After about 5 minutes, the instrument will reach the requirements of the specification parameters (accuracy)			
Input	Measurement deviations under reference conditions (DIN EN 60770,NE 145 standard), suitable for 23 ° C ±3K	- 40... The average temperature coefficient corresponding to every 10 K change at ambient temperature of +85℃ (TC)[1]	Lead resistance effect	Long-term stability after 1 year
Thermal resistance thermometer	-200 °C ≤ MV ≤ 200 °C: ±0.10 K	±(0.06K+0.015% MV)	4-wire system: No impact (0 to 50Ω per wire) 3-wire system: ±0.02Ω /10Ω (0 to 50Ω per wire) 2-wire system: resistors connected by leads[4]	0.05 % of ±60mΩ or MV value (whichever is greater)
Pt100[2]/JPt100/ Ni100	MV > 200 °C:			
	±(0.1 K + 0.01 % |MV-200 K|)[3]			
Resistance sensor[5]	≤ 890 Ω: 0.053 Ω [6] or 0.015 % MV[7]	±(0.01Ω+0.01% MV)		
	≤ 2140 Ω: 0.128 Ω [6] or 0.015 % MV[7]			
	≤ 4390 Ω: 0.263 Ω [6] or 0.015 % MV[7]			
	≤ 8380 Ω: 0.503 Ω [6] or 0.015 % MV[7]			
potentiometer[5]	R_{part}/R_{total} Max for ±0.5 %	±(0.1% MV)	-	±20 μV or 0.05% of the MV value (whichever is greater)
Thermoelectric couple	-150 °C < MV < 0 °C:	E type:	6 μV/1,000Ω[8]	
E and J types	±(0.3 K + 0.2 % |MV|)	MV>-150°C: ±(0.1K+0.015% |MV|)		
	MV > 0 °C:	J-type:		
	±(0.3 K + 0.03 % MV)	MV>-150°C:±(0.07K+0.02% |MV|)		
T and U shapes	-150 °C < MV < 0 °C:	-150°C<MV<0°C:		
	±(0.4 K + 0.2 % |MV|)	±(0.07K+0.04% MV)		
	MV > 0 °C:	MV>0°C:		
	±(0.4 K + 0.01 % MV)	±(0.07K+0.01% MV)		
R and S	50 °C < MV < 400 °C:	Type R: 50°C<MV<1,600°C:		
	±(1.45 K + 0.12 % |MV - 400 K|)	±(0.3K+0.01% |MV-400K|)		
	400 °C < MV < 1600 °C:	Type S: 50°C<MV<1600 °C:		
	±(1.45 K + 0.01 % |MV - 400 K|)	±(0.3K+0.015% |MV-400K|)		
Type B	450 °C < MV < 1,000 °C:	450°C<MV<1,000°C:		
	±(1.7 K + 0.2 % |MV - 1,000 K|)	±(0.4K+0.02% |MV - 1,000 K|)		
	MV > 1,000 °C:	MV>1,000°C:		
	±1.7 K	±(0.4K+0.005% (MV-1,000K)		
Type K	-150 °C < MV < 0 °C:	-150°C<MV<1,300°C:		
	±(0.4 K + 0.2 % |MV|)	±(0.1K+0.02% |MV|)		
	0 °C < MV < 1,300 °C:	-		
	±(0.4 K + 0.04 % MV)	-		
L-shape	-150 °C < MV < 0 °C:	-150°C<MV<0°C:		
	±(0.3 K + 0.1 % |MV|)	±(0.07K+0.02% |MV|)		
	MV > 0 °C: ±(0.3 K + 0.03 % MV)	MV>0°C: ±(0.07K+0.015 % MV)		
N-type	-150 °C < MV < 0 °C:	-150°C<MV<0°C:		
	±(0.5 K + 0.2 % |MV|)	±(0.1K+0.05% |MV|)		
	MV > 0 °C: ±(0.5 K + 0.03 % MV)	MV>0°C: ±(0.1K+0.02% MV)		
mV sensor[5]	≤1,160 mV: 10 μV + 0.03 % |MV|	2μV+0.02% |MV|		
	>1,160 mV: 15 μV + 0.07 % |MV|	100μV+0.08% |MV|		
Cold end[9]	±0.8 K	±0.1K	-	±0.2 K
exportation	±0.03 % range	±0.03% range	-	±0.05% range

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Total measurement deviation	
Increment	Increase: Input + output, DIN EN 60770, 23 ° C ± 3 K
MV	MV = Measured value (temperature measured value in °C)
Range	Range = Final value of measuring range configuration - Initial value of measuring range configuration

1) S10: Over a wider ambient temperature range (-50... Within -40°C), the value is doubled
2) For sensor Ptx (x = 10... 1,000) To say:
If x ≥ 100: The tolerance is the same as Pt100
If x < 100: The allowable error is the error of Pt100 multiplied by a factor (100/x)
3) Additional error of thermal resistance thermometer (3-wire configuration, with zero-balance cable) : 0.05K
4) Subtract the specified sensor cable resistance value from the calculated value of the sensor resistance。
5) This operation mode is not applicable to the SIL option
6) In a 3-wire configuration, this value is doubled
7) Suitable for larger values
8) At 0... 10 kΩ lead resistance range
9) Applicable to thermocouples only
Dual sensors: Each sensor can be configured individually

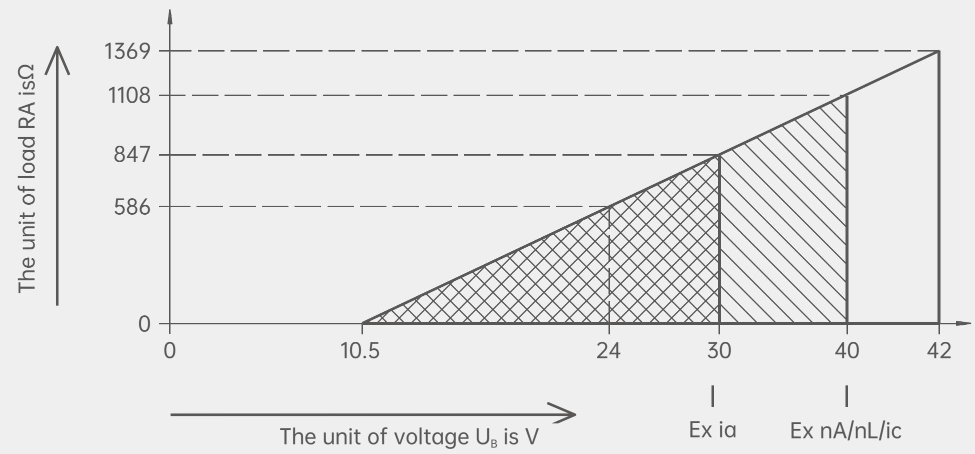
Monitor	
Test current during sensor monitoring [1]	The nominal value during the test cycle is 20 μA, otherwise 0 μA
NAMUR NE89 Monitoring function (Monitoring input lead resistance)	
▪ Resistance thermometer (Pt100, 4-wire system)	RL1 + RL4 > 100 Ω, and the hysteresis is 5 Ω
	RL2 + RL3 > 100 Ω, and the hysteresis is 5 Ω
▪ Thermoelectric couple	RL1 + RL4 + R thermocouple > 10 kΩ, hysteresis 100 Ω
Sensor damage monitoring	Always valid
self-monitoring	Permanently valid (e.g. RAM/ROM tests, logic program run checks and validity checks)
	Monitor the upper/lower deviation of the measurement range set value
Measuring range monitoring	Standard: Not activated
Input lead resistance monitoring (3-wire system)	Monitor the resistance difference between leads 3 and 4; If the difference in resistance between leads 3 and 4 is greater than 0.5 Ω, an error is displayed

1) Applicable to thermocouples only

Load curve

The allowable load depends on the loop supply voltage.

Load RA≤(UB-10.5V)/0.023A, where RA unit is Ω, UB unit is V (without HART®)



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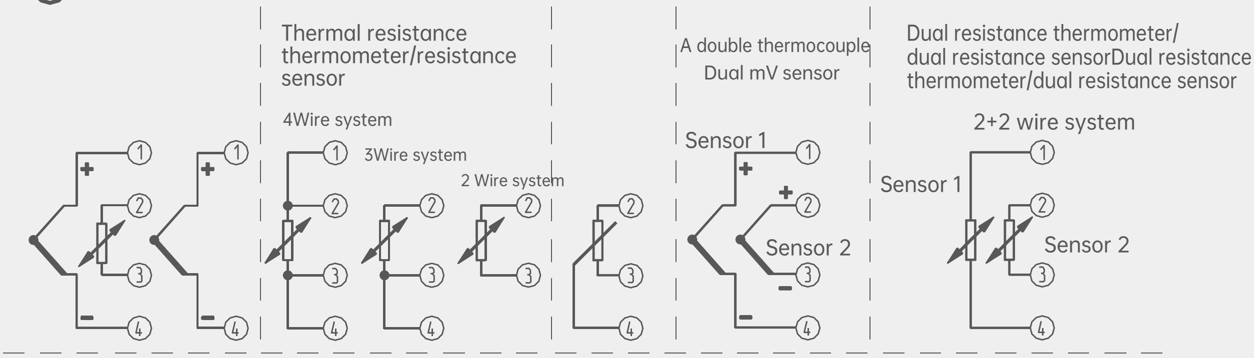
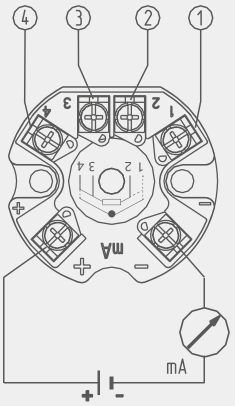
The name of the terminal

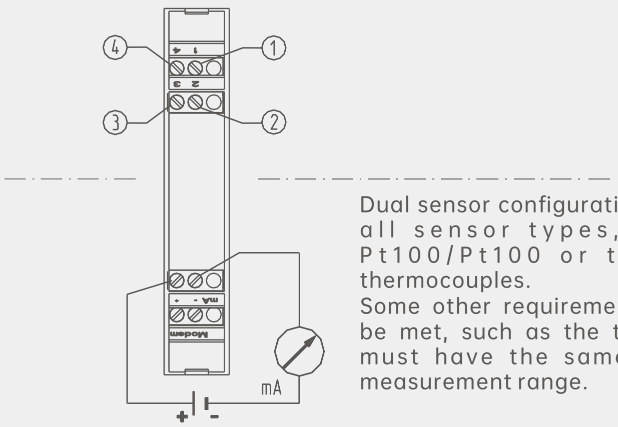
Sensor/thermocouple input resistance



Analog output

4... 20 mA circuit



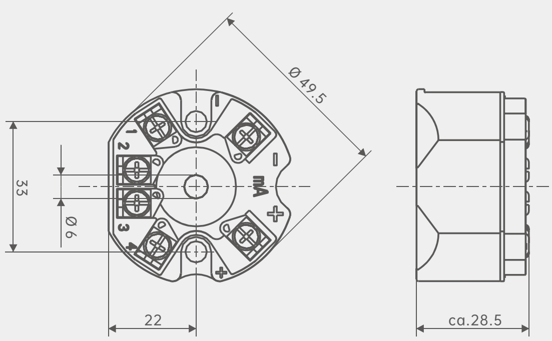


Dual sensor configuration supports all sensor types, such as Pt100/Pt100 or type K /K thermocouples.
Some other requirements need to be met, such as the two sensors must have the same unit and measurement range.

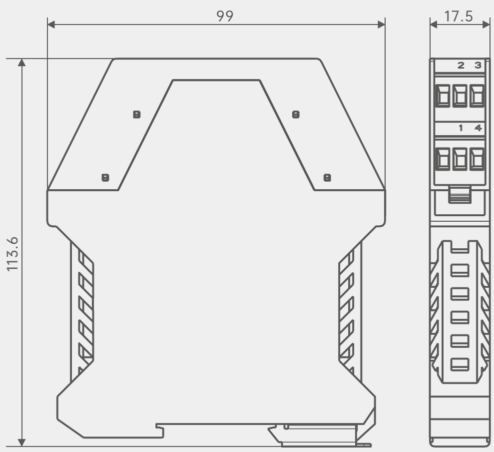
Terminals for HART® modems are available in both the measuring head and rail mounted housing.

Size mm

Head-mounted version



Track-mounted version



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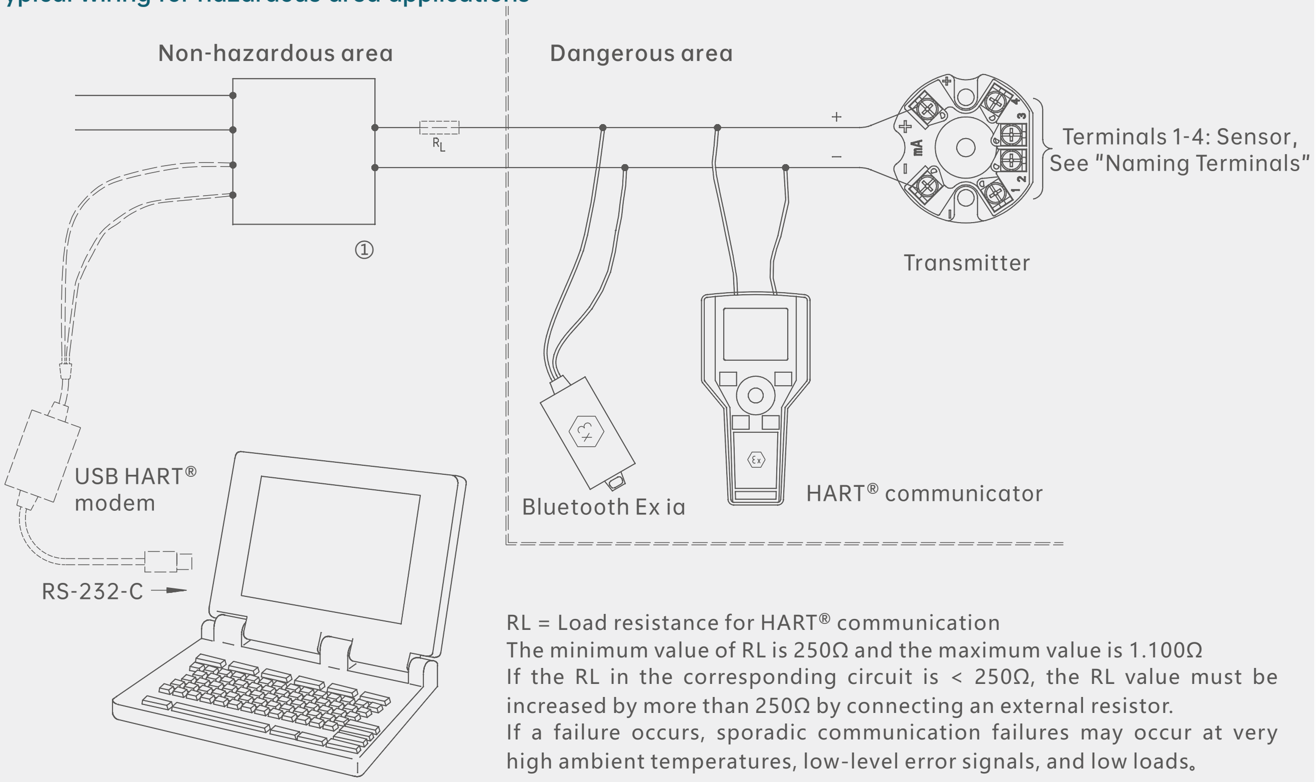
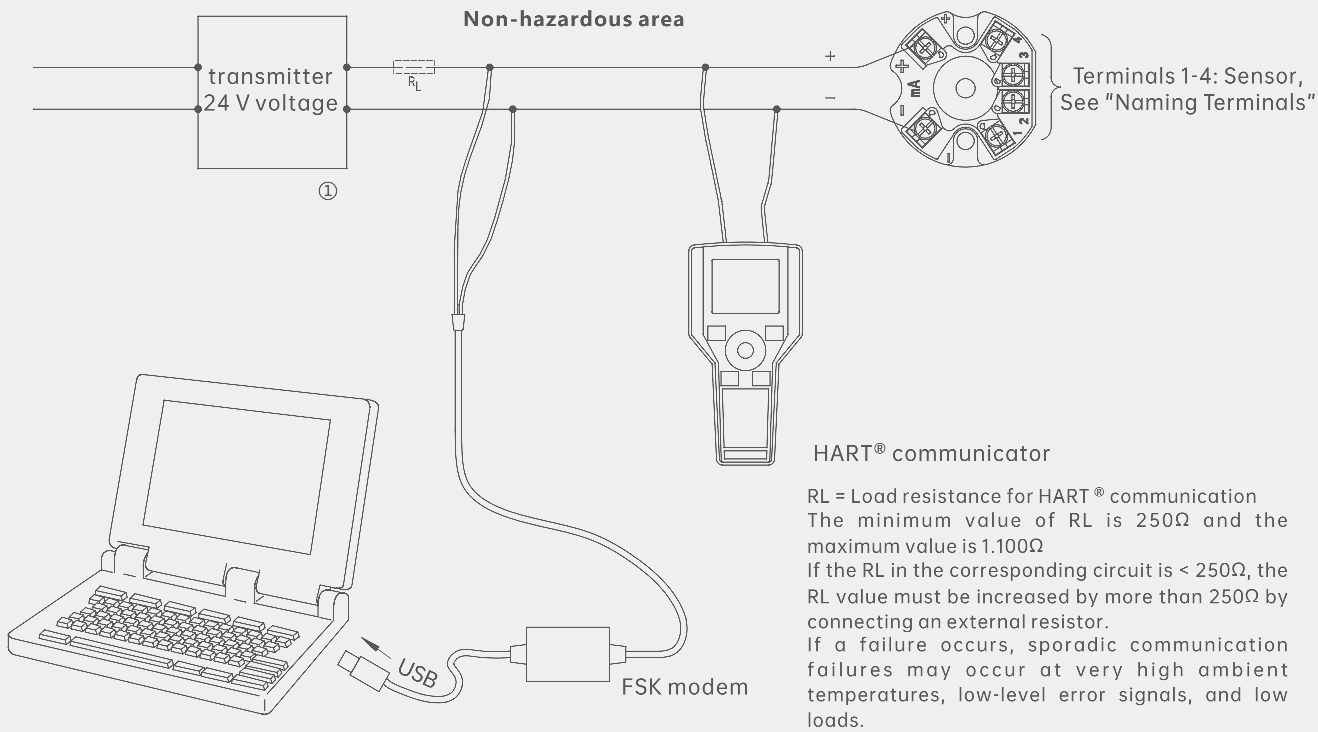
Connection mode

Typical wiring for hazardous area applications



RL = Load resistance for HART® communication
The minimum value of RL is 250Ω and the maximum value is 1.100Ω
If the RL in the corresponding circuit is < 250Ω, the RL value must be increased by more than 250Ω by connecting an external resistor.
If a failure occurs, sporadic communication failures may occur at very high ambient temperatures, low-level error signals, and low loads。

Typical wiring for non-hazardous area applications



RL = Load resistance for HART ® communication
The minimum value of RL is 250Ω and the maximum value is 1.100Ω
If the RL in the corresponding circuit is < 250Ω, the RL value must be increased by more than 250Ω by connecting an external resistor.
If a failure occurs, sporadic communication failures may occur at very high ambient temperatures, low-level error signals, and low loads.

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S20-Selection composition

Selection example S20 A / D / G / O / 0-400
1 2 3 4 5

1.Selection description	A	S20-H
	B	S20-R
2.Output mode	D	4...20mA HART
	E	0...10V
	T( )	Other output modes
3.Input signal	G	Pt100
	H	Pt1000
	I	Type S thermocouple
	J	Type J thermocouple
	K	Type K thermocouple
	T( )	Other measuring elements
4.Wire system	N	Two-wire system
	O	Three-wire system
	P	Four-wire system
5.Temperature range	C( )	Set temperature range (unit: ℃)
	F( )	Set temperature range (unit: ℉)
6.Additional information	A	Additional information
	N	There is no

Instructions:

It means that the S20 temperature transmitter is head-mounted, output 4-20mA hart, input Pt100, three-wire system, temperature range 0-400℃, the sixth item is not required.

Product Certification

Compliance and approval; Rodeweig pressure gauges meet key standards and certifications for process measurement technology; Thus guaranteeing the highest reliability in such Settings;

Ludwig China Representative Office
Ludwig Automation Instrument (Guangzhou) Co., Ltd | Ludwig International Trade (Shanghai) Co., Ltd
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