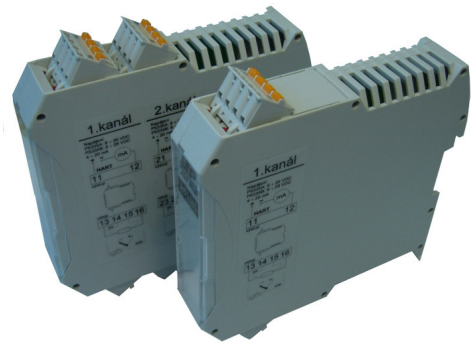
P5335
Single-channel and Double-channel
Universal HART Transmitter for a DIN Rail

- **Universal input for all common resistance and thermoelectric temperature sensors, linear resistance and mV.**
- **Accuracy 0,05 %.**
- **Measurement of difference or average of two sensors.**
- **Unified current output signal 4 to 20 mA with HART® protocol.**
- **Galvanic isolation 1,5 kVAC.**
- **High resistance against interference acc. to EN 61326.**
- **Removable spring or screw terminals.**
- **Width from 12 mm per channel.**
- **Intrinsically safe model (Ex) II (1) GD [Ex ia] IIC.**



Application

Transmitters P5335 can be used to convert resistance or voltage temperature signals from resistance or thermoelectric temperature sensors into linearized current output signals of a current loop 4 to 20 mA with digital communication HART. Transmitters P5335 include galvanic isolation of input and output and can be also used for applications with many measuring points and for thermocouples. High measurement accuracy and the option of calculations of differences or averages from two input sensors predetermine use of the instrument in the most demanding applications.

Description

The transmitter P5335 can be ordered in two alternatives, single-or double-channel version for installation on a DIN rail. In both alternatives this includes a box with removable terminals. These are available as spring or threaded terminals or threaded terminals with a compensation terminal for measurement of thermocouples (see the ordering table. Individual terminals are fitted with locks for unique determination of position.

Input signals are processed by an A/D converter and converted into a digital signal that is transferred to a microcomputer and according to the preset configuration all the measured values are calculated. These values are then used for further calculation of a primary quantity (temperature) and according to the preset range also the output current. Other quantities are accessible through digital HART communication.

One resistance sensor (two-, three- or four-wire) or two sensors (two-wire) can be connected to the input. Resistance of the input wires of the two-wire connection can be compensated by entering a constant value of the loop resistance when configuring the converter, even for two resistance sensors. In other cases the resistance of input wires is compensated automatically. In case of three- and four-wire connection there can be entered the maximal values of resistance of the line and the measured resistance of the line is then compared during measurement. A thermocouple can also be connected to the input. Compensation of temperature of the comparative thermocouple connection is carried out according to the configuration, by a constant temperature of the cold end, external sensor Pt100 or Ni100 or using a compensation terminal for measurement of the thermocouple. The compensation terminal includes a built-in sensor Pt100A and is designed for direct connection of an extension or compensation line. The compensation terminal is included in designs P5335 L10 and L20 and can be ordered independently, separately for each channel (code CTB, see the ordering table).

The transmitter provides analog output signal of the current loop 4 to 20mA with HART digital communication. The current output can be also used for tests of the current loop and the following equipment. The converter allows connecting more instruments on one current loop - multidrop mode. For the mode multidrop it is necessary to set and unique address within the range 1 to 15 within the common loop. In this mode the analog output of the converter is constant (4 mA) and the measured quantities can be obtained only through digital communication HART. The converter can be configured using the tools that are usual for the HART interface. Such configuration can be carried out e.g. using a manual configurator HART or using a PC with a program and HART modem.

Technical specifications

Supply voltage:
standard version 8,0 to 35 VDC
version EI1 8,0 to 30 VDC

Range of ambient temperatures:
-40 to +85 °C

Humidity:
< 95% RH (without condensation)

Working position:
arbitrary

Maximal cross section of wires:
2,5 mm^2

Housing:
case without terminals IP 00
case with terminals IP 20

Dimensions:
107 x 120 x 23 mm

Weight (case with terminals):
P5335 L1x 135 g
P5335 L2x 205 g

Case material:
polyamide

Ignitability class:
V0 (according to UL 94)

Reference ambient temperature:
20 to 28 °C

Input

Input signal:
resistance signal of temperature sensor or potentiometer, voltage signal of thermocouple, difference and diameter of resistance signals, difference and diameter of voltage signals

Sensor connection:

Resistance sensor:
Two-, three-, four-wire, difference or diameter (two-wire)

Voltage sensor (thermocouple):
Two-wire, difference or diameter (two-wire)

External compensation sensor:
Two-wire

Dynamic range of input signal:
22 bit

Max. Wire resistance:
5 Ω

Current through resistance sensor:
0,2 mA

Effect of wire resistance (3- / 4- wire):
< 0,002 Ω / Ω

Input resistance:
10 MΩ

Cold Junction Compensation:
< ± 1 °C

External compensation of cold junction with Ni100 or Pt100:
-40 ≤ Tamb ≤ 135 °C

Basic ranges:

Type	Minimal value	Maximal value	Minimal span	Note
Pt100, Pt1000	-200 °C	850 °C	10 °C	IEC751
Ni100	-60 °C	250 °C	10 °C	DIN 43760
Thermocouple B	+400 °C	1820 °C	100 °C	IEC584
Thermocouple E	-100 °C	1000 °C	50 °C	IEC584
Thermocouple J	-100 °C	1200 °C	50 °C	IEC584
Thermocouple K	-180 °C	1372 °C	50 °C	IEC584
Thermocouple L	-100 °C	900 °C	50 °C	DIN 43710
Thermocouple N	-180 °C	1300 °C	50 °C	IEC584
Thermocouple R	-50 °C	1760 °C	100 °C	IEC584
Thermocouple S	-50 °C	1760 °C	100 °C	IEC584
Thermocouple T	-200 °C	400 °C	50 °C	IEC584
Thermocouple U	-200 °C	600 °C	50 °C	DIN 43710
W3	0 °C	2300 °C	100 °C	ASTM E988-90
W5	0 °C	2300 °C	100 °C	ASTM E988-90
Linear resistance	0 Ohm	7000 Ohm	25 Ohm	
Voltage	-800 mV	800 mV	2,5 mV	

Output

Output signal:

Two-wire current 4 to 20 mA or 20 to 4 mA with HART protocol

Total accuracy (higher value applies):

Input	Basic accuracy	Temperature coefficient
all inputs	≤ ±0,05 % of span	≤ ±0,05 % of span
Pt100, Pt1000	≤ ±0,1 °C	≤ ±0,005 °C / °C
Ni100	≤ ±0,2 °C	≤ ±0,005 °C / °C
TC, typeE, J, K, L, N, T, U	≤ ±0,5 °C	≤ ±0,025 °C / °C
TC, typeB, R, S, W3, W5	≤ ±1 °C	≤ ±0,1 °C / °C
linear resistance	≤ ±0,1 Ω	≤ ±5 mΩ / °C
voltage	≤ ±10 µV	≤ ±0,5 µV / °C

Characteristics:

Linear with temperature or linear with input quantity, other upon request

Dynamic range of output signal:

16 bit

Adjustability of the range

1% to 100% of the basic range

Time constant (95%):

adjustable 1 to 60 s

Minimal output span:

16 mA

Renewal period

440 ms (660 ms for difference two sensors)

Fixed output:

in the range 4 to 20 mA

Load resistance of output:

≤ (Vsupply - 8) / 0,023 [Ω]

Output stability:

< ± 0,01 % of span / 100 Ω

Electrical strength of isolation between input and output circuit:

test 1,5 kVAC

constant 50 VAC

Electrical strength between channels (only for double-channel version):

test 2,5 kVAC

Supplementary parameters

Output current limitation:

Signal 3.8 to 20.5 mA acc. to NAMUR NE43

Limitation of error current to approx. 23 mA

Supply voltage effects:

< 0,005 % of span / VDC

EMC effects (immunity):

< 0,1 % of span

Extended EMC immunity (NAMUR NE21, A criterion, burst):

< 1 % of span

Indication of sensor error::

Optionally by current > 21 mA or < 3.6 mA acc. to NAMUR NE43, or optionally in range 3,5 to 23 mA

Current of sensor at sensor error detection:

33 µA

Sensor error detection:

resistance ranges:

if beginning of measure range > 30 Ω or adequate temperature

voltage ranges:

if beginning of measure range > 5 mV or adequate temperature

Warming time:

30 s

Error checking EEPROM:

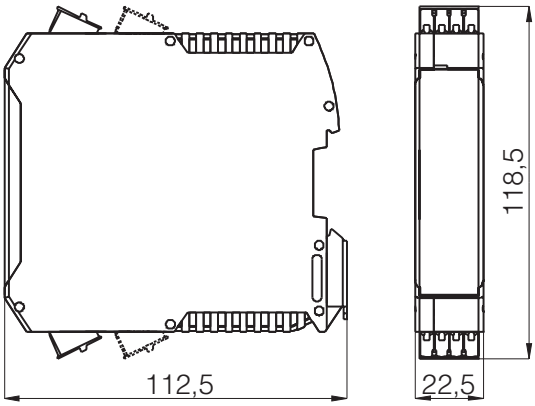
< 10 s

Output signal at EEPROM error:

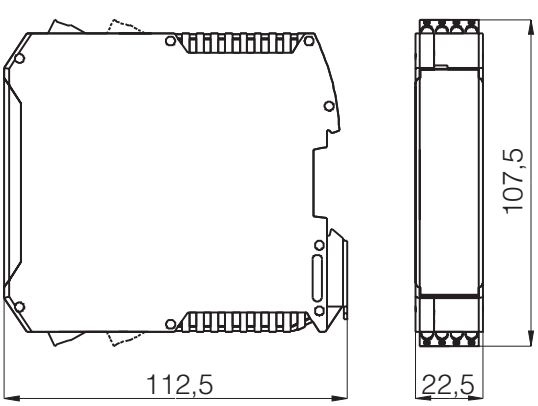
≤ 3,5 mA

Dimensional drawings

Case with mounted spring terminals:

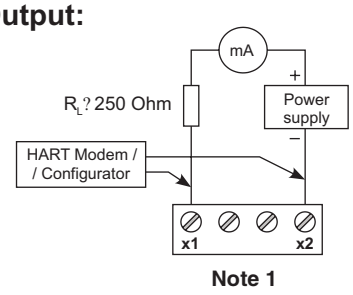


Case with mounted screw terminals:

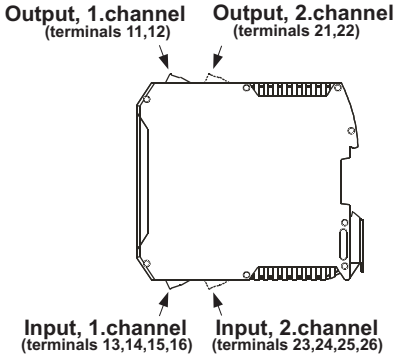


Electrical connection

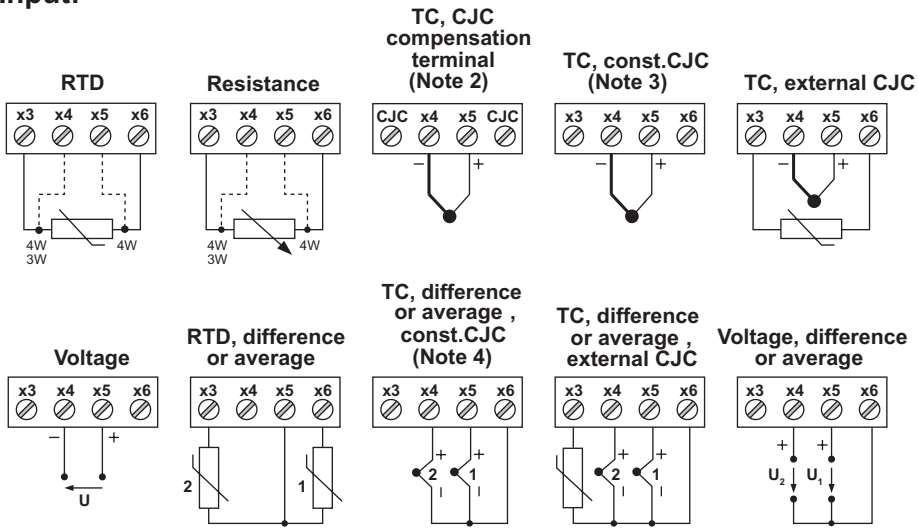
Output:



Note 1



Input:



Note 1) The symbol ”x“ in the description of terminal represents a channel number. In case of a single-channel design this symbol “x“ is always replaced by “1“ an in case of a double-channel design this represents the channel number, i.e. “1“ or “2“.

Note 2) Connection of the thermocouple to the compensation terminal - the compensation terminal includes a built sensor Pt100A for measurement of temperature of the cold end. When using the compensation terminal it is **necessary** to set a compensation of the cold end **by an external sensor Pt100** in configuration of the transmitter, i.e. by a sensor built-in in the compensation terminal!

The compensation terminal is included in the design P5335 L10 a L20 and can also be ordered independently, separately for each channel (code CTB, see the ordering table).

Note 3) This connection can be used only for measurement of a thermocouple with constant temperature of the cold end.

Note 4) This connection can be used only for measurement of differences of averages of temperatures of thermocouples with constant temperature of the cold end.

	Type	Description
•	**P5335**	**Single- and double-channel universal transmitter to DIN rail with HART communication**
	Code	**Version**
•	**L10**	**Single-channel transmitter with removable screw terminals (plus compensation terminal CTB1)**
•	**L11**	**Single-channel transmitter with removable screw terminals**
	L12	Single-channel transmitter with removable spring terminals
•	**L20**	**Double-channel transmitter with removable screw terminals (plus compensation terminals CTB1 and CTB2)**
•	**L21**	**Double-channel transmitter with removable screw terminals**
	L22	Double-channel transmitter with removable spring terminals
	Code	**Optional version**
○	**EI1 ***	**ATEX (Ex) II (1) GD [Ex ia] IIC**
	Code	**Calibration**
	KPP5	Transmitter calibration in in five equally spaced points of input range
	Code	**Optional accessories**
•	**CTB1**	**Compensation terminal for measuring thermocouple sensors, channel No.1**
•	**CTB2**	**Compensation terminal for measuring thermocouple sensors, channel No.2**
•	**HARTWinCom**	**Set of PC configuration software HARTWinConf (CZ+EN) and modem HARTMod**
•	**HARTConf**	**HART-USB modem and field communicator for LHP and HART transmitters, function of transmitter supply**
•	**HARTMod**	**Miniature HART modem with galvanic isolation**
	Example of order: P5335 L10 HARTConf NR	

• ... Ex stock version ○ ... Marked version can be dispatched up to 5 working days

* …Transmitter must not be placed in potentially explosive atmospheres. In a potentially explosive atmosphere can lead only input and output wires

Configuration table P5335 (SW settings)

(NOTE: Codes for single-channel design P5335 L1x or first channel of double-channel design P5335 L2x can be found in the first column with heading “P5335L1x”. Codes for the other channel of the double-channel design P5335L2x can be found in the second column marked “P5335 L2x”.)

P5335 L1x	P5335 L2x	Configuration	
NR	2NR	without any requirement for setting of the range and input	
		(preset - C02 R11 RL (0 °C) RH (100°C) DP (4 s) ROL (4 mA) ROH (20 mA) BEH SEH ADR (0) - similarly for the other channel)	
Code	**Code**	**Input configuration**	
C01 ()	2C01 ()	2-wire connection of a resistance sensor w ith constant correction of line resistance …… Ohm	
C02	2C02	3-wire connection of a resistance sensor	
C03	2C03	4-wire connection of a resistance sensor	
C04 ()	2C04 ()	difference of two 2-wire resistance sensor with constant correction of wire resistance …… Ohm, …… Ohm	
C05 ()	2C05 ()	average of two 2-wire resistance sensor with constant correction of wire resistance …… Ohm, …… Ohm	
C06	2C06	connection of a voltage sensor	
C07	2C07	resistance of a two voltage sensors	
C08	2C08	average of a two voltage sensors	
C09	2C09	connection of a thermoelectric sensor	
C10	2C10	resistance of a two thermocouple sensors	
C11	2C11	average of a two thermocouple sensors	
Code	**Code**	**Basic range and linearization**	**For input adjusting:**
R01	2R01	resistance input (0 to 7000 Ohm)	C01 - C05
R05	2R05	voltage input (-800 mV to 800 mV) without linearization	C06 - C08
R11	2R11	Pt100 (-200 °C to 850 °C) with linearization	C01 - C05
R13	2R13	Pt1000 (-200 °C to 850 °C) with linearization	C01 - C05
R14	2R14	Ni100 (-60 °C to 250 °C) with linearization	C01 - C05
R15	2R15	Ni1000 (-60 °C to 250 °C) with linearization	C01 - C05
R51	2R51	thermocouple "J" (-100 °C to 1200 °C) with linearization, IEC 584	C09 - C11
R52	2R52	thermocouple "K" (-180 °C to 1372 °C) with linearization, IEC 584	C09 - C11
R53	2R53	thermocouple "N" (-180 °C to 1300 °C) with linearization, IEC 584	C09 - C11
R54	2R54	thermocouple "R" (-50 °C to 1760 °C) with linearization, IEC 584	C09 - C11
R55	2R55	thermocouple "S" (-50 °C to 1760 °C) with linearization, IEC 584	C09 - C11
R56	2R56	thermocouple "T" (-200 °C to 400 °C) with linearization, IEC 584	C09 - C11
R57	2R57	thermocouple "B" (400 °C to 1820 °C) with linearization, IEC 584	C09 - C11
R58	2R58	thermocouple "E" (-100 °C to 1000 °C) with linearization, IEC 584	C09 - C11
R59	2R59	thermocouple "L" (-100 °C to 900 °C) with linearization, DIN 43710	C09 - C11
R61	2R61	thermocouple "U" (-200 °C to 600 °C) with linearization, DIN 43710	C09 - C11
R62	2R62	thermocouple "W3" (0 °C to 2300 °C) with linearization, ASTM E988-90	C09 - C11
R63	2R63	thermocouple "W5" (0 °C to 2300 °C) with linearization, ASTM E988-90	C09 - C11
R91	2R91	resistance input (0 to 7000 Ohm) user defined linearization (required add description of linearization in appendix of order)	C01 - C05
R95	2R95	voltage input (0 to 7000 Ohm) user defined linearization (required add description of linearization in appendix of order)	C06 - C08
Code	**Code**	**CJC compensation**	**For input adjusting:**
K01	2K01	compensation acc. to terminal temperature of transmitter (with application compensation terminal CTB1 or CTB2)	C09 - C11
K02 ()	2K02 ()	compensation of external sensor Pt100, 2-wire connection with constant correction of wire resistance …… Ohm	C09 - C11
K03 ()	2K03 ()	compensation of external sensor Ni100, 2-wire connection with constant correction of wire resistance …… Ohm	C09 - C11
K04 ()	2K04 ()	compensation of constant temperature (required add value of constant temperature cold junction in °C)	C09 - C11
Code	**Code**	**Setting of range value**	
RL ()	2RL ()	lower range value (specify value and units)	
RH ()	2RH ()	upper range value (specify value and units)	
Code	**Code**	**Set-up damping of output signal**	
DP ()	2DP ()	damping output (standards 4 sec)	
Code	**Code**	**Setting of range output signal**	
ROL ()	2ROL ()	lower range value (standards 4 mA or specify value …… mA)	
ROH ()	2ROH ()	upper range value (standards 20 mA or specify value …… mA)	
Code	**Code**	**Sensor error indications**	
BEO	2BEO	off	
BEL	2BEL	<3,6 mA (according to Namur NE43)	
BEH	2BEH	>21,0 mA (according to Namur NE43)	
BES ()	2BES ()	user defined (specify value in mA)	
Code	**Code**	**Indications of short-circuit sensor error**	
SEO	2SEO	off	
SEL	2SEL	< 3,6 mA (according to Namur NE43)	
SEH	2SEH	> 21,0 mA (according to Namur NE43)	
SES ()	2SES ()	user defined (specify value in mA)	
Code	**Code**	**HART**	
ADR ()	2ADR ()	HART address of transmitter (specify address at range 0 to 15), if address is other then 0, will constant current output 4mA !	
TAG ()	2TAG ()	optional text mark, max. 8 signs Packed ASCII, e.g TAG (A XR125-34)	
DES ()	2DES ()	optional text mark, max.16 signs Packed ASCII, e.g DES (TEMP145)	
MSG ()	2MSG ()	optional text message, max. 32 signs Packed ASCII	
DAT ()	2DAT ()	optional date, format day.month.year, e.g. DAT (19.12.2012)	
Example of order: P5335 L10 C09 R52 K01 RL (0°C) RH (600°C) DP (4s) BEL SEL			
Example of order: P5335 L20 C01 (2 Ohm) R11 RL (0°C) RH (200°C) DP (4s) BEH SEH 2C03 2R11 2RL (0°C) 2RH (200°C) 2DP (4s) 2BEL 2SEL			

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