

P5310 and P5311

Low-Cost Programmable Transmitters with LHP Communication

- Universal transmitter for all standard resistance and thermocouple sensors.
- Linearized output signal 4 to 20 mA.
- Accuracy from 0.1% for ranges down to 1/5 of the input range.
- Span adjustability from 1% to 100% of the input range.
- Galvanic isolation 1000 VAC (P5311).
- Adjustability by PC, LHPWinConf program and standard HART modem or by handheld configurator LHPConf (HARTConf).
- High resistance to interference (industrial environment).
- Intrinsically safe version (Ex) II 1GD.



Application

Transmitters P5310 and P5311 are used for conversion of a resistance or voltage temperature signal from a resistance or thermocouple temperature sensor to a linearised current loop output signal 4 to 20 mA. The transmitter type H1x is designed for installation into an industrial sensor head type A or B according to DIN 43729. Inputs and outputs of the transmitters type P5310 are not galvanic-isolated, these types are suitable for resistance temperature sensors and simple systems. The transmitters type P5311 includes galvanic isolation of inputs and outputs and are suitable for also in applications with many measuring points and for thermocouples.

Description

Input signal, switched over according to the input configuration are processed by an A/D transmitter and transformed into a digital signal that is transferred to a micro-computer; according to the preset configuration and after filtration of noise there are calculated all measured variables. These values are then used for calculation of the primary variable (temperature) and according to selected range, the output current is also calculated.

One resistance sensor (two-, three- or four-wire) can be connected to the input. In case of a two-wire connection, entering of a constant value of the loop resistance compensation during configuration of the transmitter can compensate the resistance of input leads. In other cases, the leads resistance is compensated automatically.

A thermocouple can be also connected to the input. Temperature of the thermocouple cold junction is compensated according to configuration, either by the inner sensor of terminal block temperature or by the entered constant temperature. The inner sensor guarantees maximum accuracy and stability of cold junction temperature measurement. If required, compensation using an external sensor can be configured as well.

In addition to standard resistance sensors, there may be also processed signals of potentiometer positions that are measured in percents. One limit position is 0 % and the other is 100 %, independently on the value of the total resistance. In case there is necessary to measure position of the potentiometer as a resistance, there may be used the configuration for measurement of the resistance.

Output of the transmitter is analogue signal of the current loop 4 to 20 mA. The current output can be also used for testing of the current loop and associated apparatus. Communication is used mostly for configuration of the transmitter and is not designed for distances over approx. 10 m. The transmitter can be set up using a manual configurator LHPConf (HARTConf) or a PC with the program LHPWinConf and HART modem HARTMod (MH-02) or equivalent communication interface. The transmitter communicates through an own protocol LHP that is partially compatible with the protocol HART, uses the same connection, however, communication is guaranteed only for short distances and there are implemented only few commands. This interface is designed for changes of configuration. Continuous communication may influence accuracy of measurement.

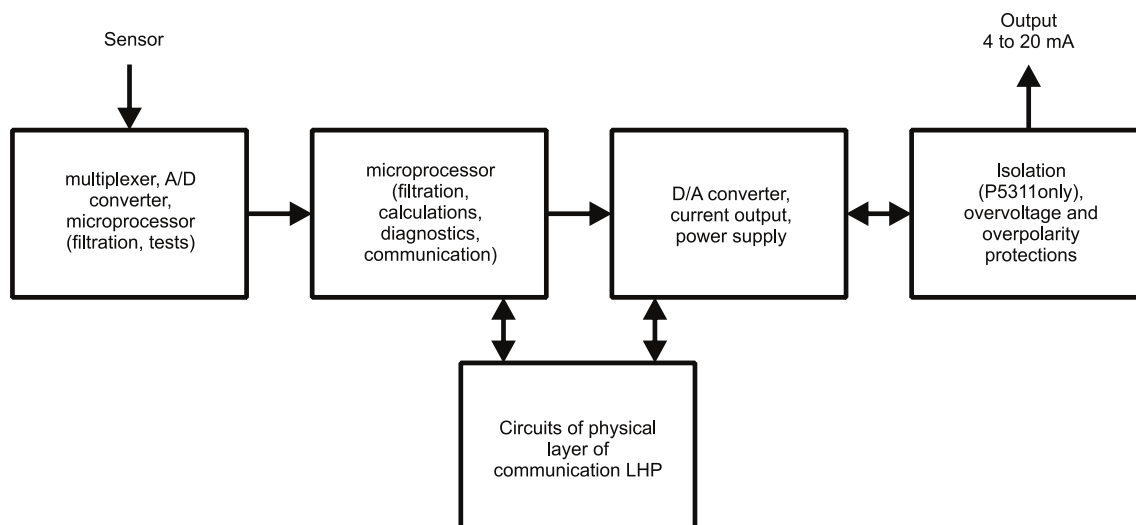
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Block diagram of the transmitter P531x



Technical specifications

Supply voltage:

P5310	9 to 35 VDC
P5311	11 to 35 VDC
Version EI1	11 to 30 VDC
(internally protected against polarity inversion and short-term overvoltage)	

Range of ambient temperatures:

-40 to 85 °C

Reference ambient temperature:

23 ± 5 °C

Housing:

Version H1x	IP 40, terminals IP 00 after installation to the head the housing is given by the design of the head
Version L1x	IP 20

Humidity:

Version H1x	0 to 100% RH with condensation after installation to the head
Version L1x	10 to 80% RH without condensation

Connection of wires:

Screw terminals for cross section 0.5 to 1.5 mm², torque 0.5 Nm.

Warm-up time:

5 s

Time for re-programming of range using a PC:

5 s

Time for re-programming of sensor type using a PC:

5 s

Type of DIN rail:

TS35 acc. to DIN 46277

Dimensions (HxWxD):

Version H1x	dia. 44 x 24 mm
Version L1x	17.5 x 62.5 x 64 mm

Material of cases:

Version H1x	polycarbonate
Version H1x	polyamide

Weight:

Version H1x, L1x	40 g
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Working position:

arbitrary

Input

Input ranges:

Input type	Basic range	Standard
RTD input	0 to 400 Ohm	---
RTD input	0 to 4000 Ohm	---
potentiometer	40 to 400 Ohm	---
potentiometer	400 to 4000 Ohm	---
voltage input	-15 to 70 mV	---
Pt100	-200 to 850 °C	IEC 60751
Pt500	-200 to 850 °C	IEC 60751
Pt1000	-200 to 850 °C	IEC 60751
Ni100	-60 to 250 °C	DIN 43760
Ni1000	-60 to 250 °C	DIN 43760
thermocouple "J"	-200 to 1200 °C	IEC 584-1
thermocouple "K"	-200 to 1300 °C	IEC 584-1
thermocouple "N"	-200 to 1300 °C	IEC 584-1
thermocouple "R"	-50 to 1700 °C	IEC 584-1
thermocouple "S"	-50 to 1700 °C	IEC 584-1
thermocouple "T"	-250 to 400 °C	IEC 584-1
thermocouple "B"	100 to 1800 °C*	IEC 584-1
thermocouple "E"	-200 to 950 °C	IEC 584-1
thermocouple "L"	-200 to 900 °C	DIN 43710
thermocouple "C"	0 to 2300 °C	N.I.S.T. Monograph 175R91

* ...range can be set from 0 °C

Digital accuracy:

Input 0 to 400 Ohm	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.08 \text{ Ohm}$ or corresponding temperature
Input 0 to 4000 Ohm	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.8 \text{ Ohm}$ or corresponding temperature
Input -15 to 70 mV	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.02 \text{ mV}$ corresponding temperature
(the greatest value is valid; SR ... Span of set range; accuracy of measured value of digital output LHP)	

Input signal:

resistance signal of temperature sensor or
potentiometer, voltage signal of thermocouple

Sensor connection:

resistance sensor	two-, three-, four-wire
voltage sensor (TC)	two-wire
potentiometer	three-wire or four-wire
compensation using an external sensor	two-wire

Maximum wire resistance for resistance ranges:

< 20 Ohm (each wire)

Current through resistance sensor:

< 0.15 mA

Input overloading:

max 24 VDC or max 18 mA between any inputs
(max 60 s)

Cold junction compensation error: < $\pm 1^\circ \text{C}$ **Effect of wire resistance for resistance ranges:**

two-wire connection	can be compensated by constant value
three-wire connection	no effect with identical values of wire resistance
four-wire connection	no effect with specified wire resistance range

Input resistance: > 10 MOhm**Output****Output signal:**

two-wire 4 to 20 mA or 20 to 4 mA

Total measurement error on the analogue output of P5310:

range 0 to 400 Ohm	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.08 \text{ Ohm}$ or corresponding temperature
range 0 to 4000 Ohm	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.8 \text{ Ohm}$ or corresponding temperature
range -15 to 70 mV	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.02 \text{ mV}$ or corresponding temperature
range Pt100, Pt1000, Ni100, Ni1000	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.2^\circ \text{C}$
range Pt500	$\leq \pm 0.1\% \text{ SR or } \leq \pm 0.4^\circ \text{C}$
range TC J, K, T, E, L	typ. $\leq \pm 0.1\% \text{ SR or } 0.5^\circ \text{C}$
range TC R, S, B, C	typ. $\leq \pm 0.1\% \text{ SR or } 2^\circ \text{C}$
(the greatest value is valid)	

Total measurement error on the analogue output of P5311:

range 0 to 400 Ohm	$\leq \pm 0.15\% \text{ SR or } \leq \pm 0.12 \text{ Ohm}$ or corresponding temperature
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range 0 to 4000 Ohm	$\leq \pm 0.15\% \text{ SR or } \leq \pm 1.2 \text{ Ohm}$ or corresponding temperature
range -15 to 70 mV	$\leq \pm 0.15\% \text{ SR or } \leq \pm 0.03 \text{ mV}$ corresponding temperature
range Pt100, Pt1000, Ni100, Ni1000	$\leq \pm 0.15\% \text{ SR or } \leq \pm 0.3^\circ \text{C}$
range Pt500	$\leq \pm 0.15\% \text{ SR or } \leq \pm 0.6^\circ \text{C}$
range TC J, K, T, E, L	typ. $\leq \pm 0.15\% \text{ SR or } 0.5^\circ \text{C}$
range TC R, S, B, C	typ. $\leq \pm 0.15\% \text{ SR or } 2^\circ \text{C}$
(the greatest value is valid)	

Characteristics:

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

Adjustability of the range:

$\pm 1\%$ to $\pm 100\%$ of the input range

Adjustability:

Inside the input range (the given measurement errors
apply for suppression of the beginning $\leq 100\%$ of the
range)

Time constant (95 %):

adjustable 0.5 to 60 s (2 measurements per second)

Load resistance:

$R_L [\text{Ohm}] \leq (U_N [\text{V}] - 9) / 0.022$

Electric strength of galvanic isolation of P5311:

1000 VAC (test)

Isolation resistance of galvanic isolation of P5311:

min. 100 MOhm

Supplementary parameters**Output current limitation:**

Signal 3.8 to 20.5 mA acc. to NAMUR NE43
Limitation of error current to approx. 22 mA

Indication of sensor or transmitter error:

Optionally by current > 21 mA or < 3.6 mA
acc. to NAMUR NE43

Supply voltage effect:

$\leq \pm 0.005\% / \text{V}$

Influence of ambient temperature changes:

range 0 to 400 Ohm	$(\leq \pm 0.1\% \text{ SR or } \leq \pm 0.08 \text{ Ohm}$ or corresponding temperature) / 10°C
range 0 to 4000 Ohm	$(\leq \pm 0.1\% \text{ SR or } \leq \pm 0.8 \text{ Ohm}$ or corresponding temperature) / 10°C
range -15 to 70 mV	$(\leq \pm 0.1\% \text{ SR or } \leq \pm 0.02 \text{ mV}$ or corresponding temperature) / 10°C
(the greatest value is valid)	

Long-term stability:

$\leq \pm 0.1\%$ of the preset range per 2 years

Electromagnetic compatibility:

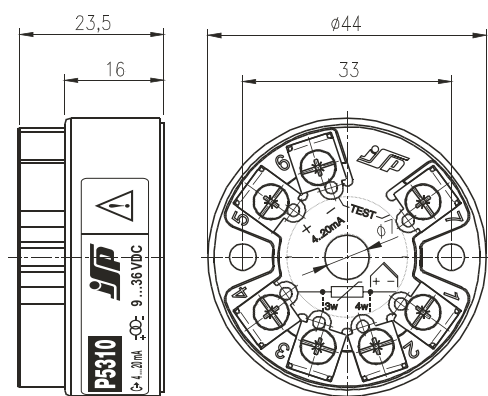
Radiation and immunity acc. to EN 61326-1
(Industrial environment)

MV ... measured value

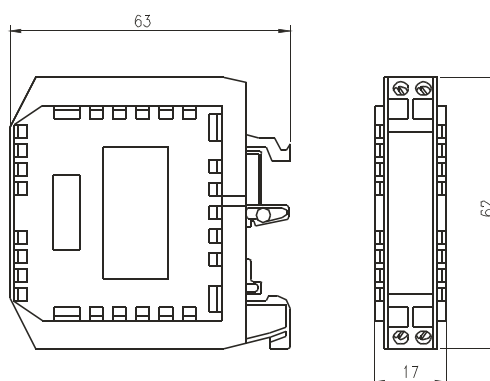
SR ... span of preset range

Dimensional drawings

Version P531x H1x

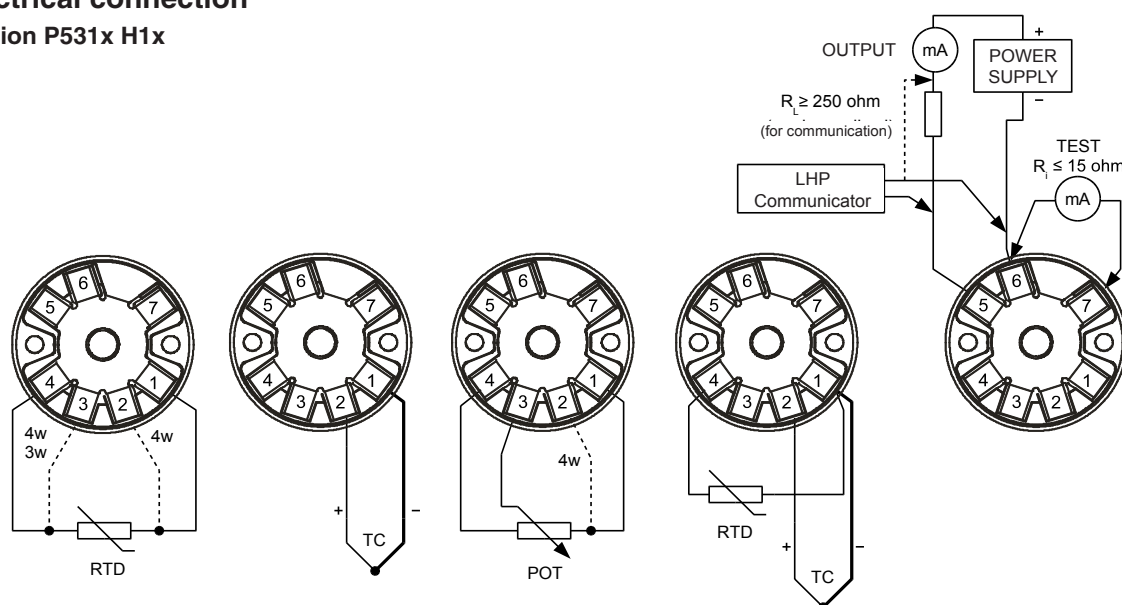


Version P531x L1x

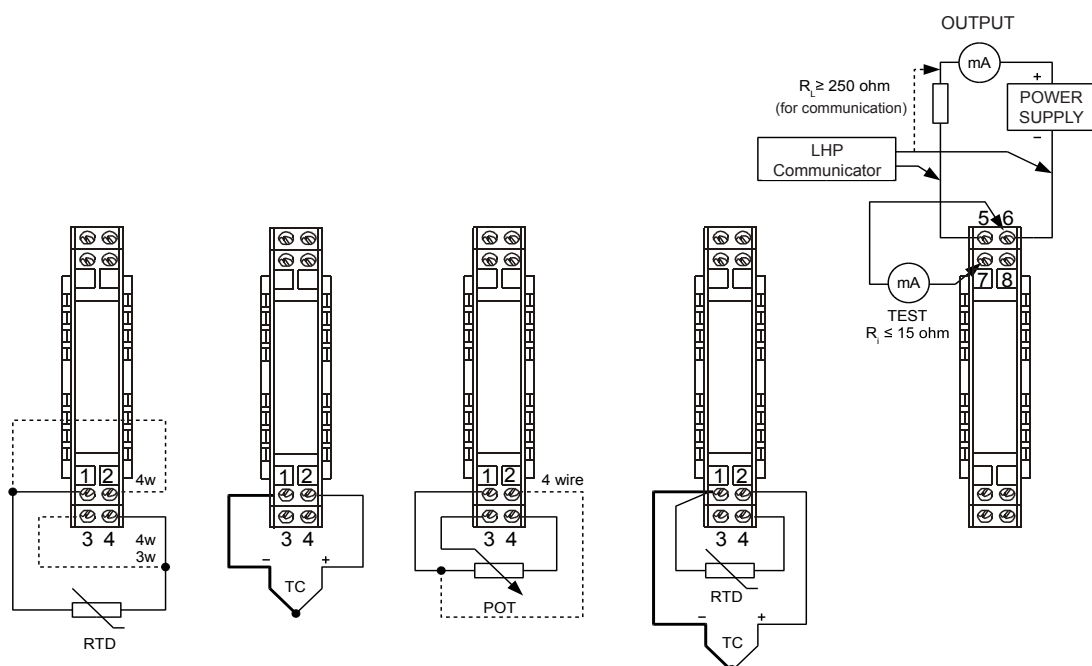


Electrical connection

Version P531x H1x



Version P531x L1x



Numerals or letters may mark the terminals of the version P531x L1x:

Numerals	1	2	3	4	5	6	7	8
Letters	C	D	A	B	H	G	F	E

Low-Cost Programmable Transmitters P5310, P5311 with LHP Communication

Type	Description
• P5310	Low-cost programmable transmitter with LHP protocol without galvanic isolation (accuracy 0,1 %)
• P5311	Low-cost programmable transmitter with LHP protocol with galvanic isolation (accuracy 0,15 %)
Code	Version
• H10	Into head B acc. to DIN, universal for resistance sensors and thermocouples
• H11	Into head B acc. to DIN, only for resistance sensors (codes R01 to R04, R11 to R15)
• L10	For a TS 35 rail, universal for resistance sensors and thermocouples
• L11	For a TS 35 rail, only for resistance sensors (codes R01 to R04, R11 to R15)
Code	Setting requirements
• NR	Without requirements for the range and input setting (preset - Pt100, 3-wire sensor connection, 0 to 100 °C)
• QR	Range and other parameters setting according to configuration sheet DB2298
Code	Calibration
KPP5	Certificate of calibration, transmitter calibration in five equally spaced points in the set range
Code	Optional version
◦ EI1	Intrinsic safety (Ex) II 1G Ex ia IIC T4-T6 Ga, (Ex) II 1D Ex ia IIIC T106°C Da (only version P5311 H1x)
• EN2	Non incandive version (Ex) II 3G Ex nA IIC T4 Gc
Code	Optional accessories
• LHPWinCom	Set of configuration program LHPWinConf for PC (supported by WINXP/Vista/7/8) and modem HARTMod
• LHPConf	Field handheld configurator for LHP transmitters, function of transmitter supplying, without recharging
• HARTConf	HART-USB modem and field handheld configurator for LHP and HART transmitters, function of transmitter supplying, supplying from USB or battery, recharging by USB
• HARTMod	Miniature HART modem with galvanic isolation
• USB-RS232C	Interface for connection to a USB port
• PT1000A	Compensation sensor Pt1000 (-30 to +150 °C) for external compensation of the thermocouple
S51	Box for wall mounting of one transmitter to explosive atmosphere (Ex) II 2G Ex d IIC T6, T5 Gb + (Ex) II 2D Ex t IIIC T50/60/80°C Db
S52	Box for wall mounting of one transmitter with LED display to explosive atmosphere (Ex) II 2G Ex d IIC T6, T5 Gb + (Ex) II 2D Ex t IIIC T50/60/80°C Db
• S54	Box for wall mounting (100x100x58 mm), housing IP 65 (only for version with code H1x, not for EI1, EN2) ¹⁾
• S55	Box for wall mounting (170x145x85 mm), housing IP 65 (only for version with code L1x, not for EI1, EN2) ²⁾
• VH1	Lid for head type B for transmitter mounting (only for version with code H1x)
• APT1	Adapter for flat head

3 years warranty.

Example of order: P5311 H11 QR

For code QR configuration sheet DB2298 is required to the order.

• ... Ex stock version

¹⁾ ... For mounting up to two transmitters

◦ ... Marked version can be dispatched up to 5 working days

²⁾ ... For mounting up to three transmitters

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