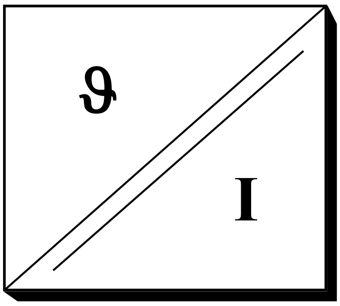
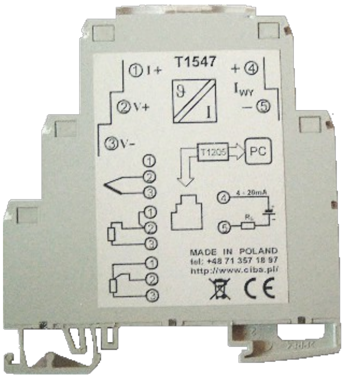
PROGRAMMABLE TRANSMITTER T1547

- sensor's temperature / 4÷20 mA
- accuracy class: 0.1
- input-output isolation of 2kV
- supplied from output current loop
- fully programmable
- rail-mounted enclosure of 6.2mm width





The temperature transmitter is fully programmable - both sensor type (RTD or thermo-couple) and temperature range may be redefined at any time. Free, user-friendly configuration software runs under Windows. All that is needed is an interface cable (T1501 or T1505) connected between PC's RS232 serial port or USB and the programming port of the transmitter. Separate power supply is not required. The input is constantly monitored during configuration and the user has additionally an option of adjusting transmitter's zero and gain (within ±2%) to a specific sensor. Output current may be set independently from input for testing purposes. Nine standard thermocouple types are implemented. Linearisation and internal CJC are provided and may be switched on and off. Non-standard sensor (like KTY) may be defined and linearized with power series approximation.

The transmitter provides galvanic isolation between temperature sensor and output current loop. Factory test isolation voltage equals 2kV. The conversion accuracy class of 0.1 is guaranteed.

The output part of the transmitter is supplied from output current loop forcing current flow proportional to the input signal. Thus, the T1547 may be used together with contemporary controllers equipped with two-wire inputs able to supply over 12V to the current loop.

One of the main advantages of the transmitter is a system of overvoltage and overcurrent protection preventing accidental damage during installation or malfunction of other automation elements during exploitation. Absolute maximum ratings are listed at the end of the data sheet.

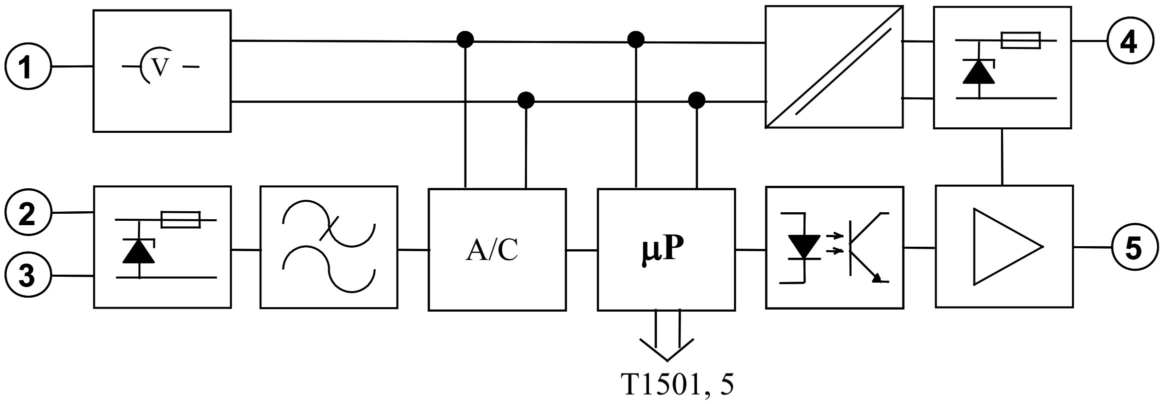
Externally, the T1249 does not differ from a conventional analog transmitter, but, apart from configuration possibilities, it offers some additional advantages in signal filtering and accuracy. For example, a 'spurious noise' filter allows to remove from signal asymmetric spikes of large amplitude, which would otherwise distort the output even if long averaging times were used. The averaging signal filter, in turn, has an intelligent option of quick adaptation to faster temperature changes while preserving long integration time constant for slowly changing signal. And the configuration PC program allows to observe the sensor behaviour and adjust the filter parameters to the properties of the object which temperature is being measured.

The value of the measured signal is being constantly compared with predefined limits to check if the sensor is working properly. Periodically, in about 10 seconds intervals, an additional sensor's test is applied. During normal operation the LED flashes at this moment. In case of sensor failure the LED starts blinking and the output current is set to a minimum (*ca*. 3.75mA) or maximum (*ca*. 21.75mA) value. The exact behaviour may be defined during configuration.

The configuration program, T1500.exe, runs under Windows. The newest version is always available for download on our website www.cciba.eu.

CCIBA Sp. j. J. Wnuk
54-616 Wroclaw, Tarnopolska 10, Poland, www.cciba.eu
KRS 0000296549 REGON 006037493 VAT PL8940049874

Block scheme



During resistance measurements current flow is forced through the sensor and connecting wires. The signal on terminals **2** and **3** resulting from a voltage drop across RTD, or thermocouple voltage, is filtered and converted to digital value. So is the excitation current and voltage drop on connecting wires for 3-wire resistance measurement. Processor reads cold-junction temperature if needed and performs the necessary calculations to send their result as a PWM signal to the output side through a pair of optocouplers. The PWM signal is filtered and converted to output current limited internally to *ca*. 25 mA. Both input and output are protected against overvoltage and bias reversal. An internal DC to DC converter supplies the input part of the transmitter.

The measurement channel parameters are estimated during factory calibration and saved in non-volatile memory. Configuration parameters, along with user corrections to zero and gain, configuration date and a symbol ascribed to the transmitter by the user are saved in the same manner.

Signal conditioning

Signal coming from sensor undergoes a complex filtration. There are several filters applied which cleanse the signal from various noise components. First, the signal passes a low-pass filter eliminating high-frequency noise. Very effective digital power net frequency filter is applied next. The processor follows the residual noise left and removes any momentary signal jumps. Final filtration, being actually a smart averaging, takes place after initial calculations and is described by two parameters accessible for the user: integration time constant, and filtration range. The latter is expressed as percentage of the input temperature range and serves to determine the level of signal change between the consecutive measurements above which a new average is started. It may sound complicated but is easy in application, especially so, that the PC code may estimate both parameters by itself. The user may correct them at a later time, having some experience about the object's behaviour. There is also a 'spurious signal' filter present, and the user may switch it on defining the level above which it should start working. This parameter is also expressed as percentage of the input temperature range and should not be lower than 10 times the filtration range parameter.

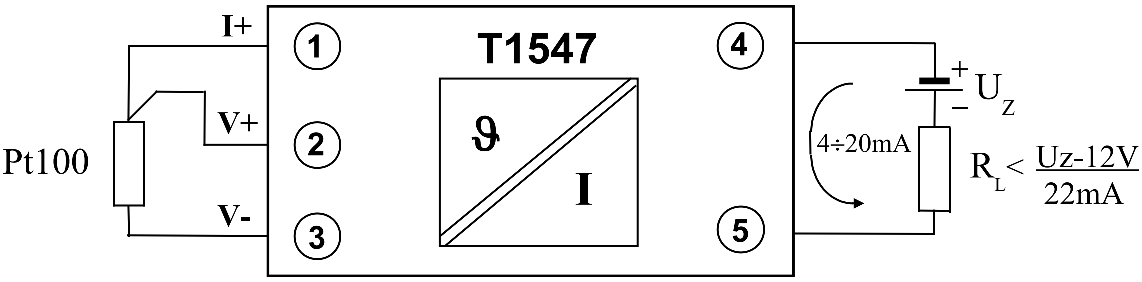
The measured value is being corrected according to calibration constants, and the sensor's temperature is finally calculated. The sensor's nonlinearity correction performed inside the transmitter keeps the estimated temperature error at minimum. User-defined zero and gain corrections are then applied and the resulting value is compared to the temperature range giving the value of output current.

For thermocouples, input terminals temperature is also measured to allow for cold junction compensation (CJC). This temperature is being used at the last stage of calculations, which, unlike in analog transmitters, takes care of nonlinearity in ambient temperatures range. The T1547 may also operate with external CJC or be used for temperature difference measurement.

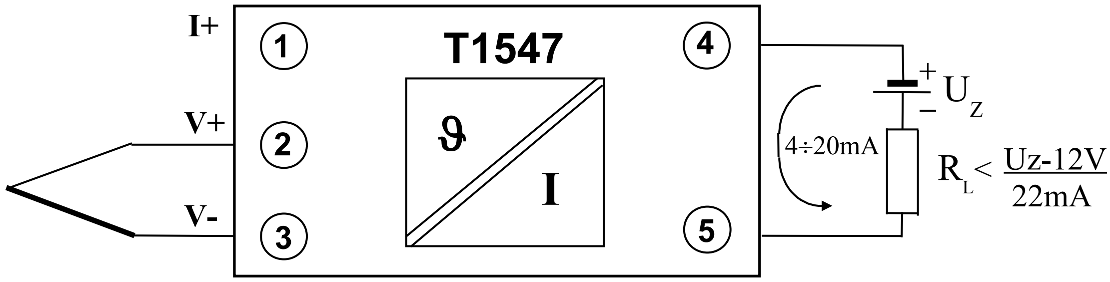
Connections

As mentioned above, the temperature sensor may be of RTD type. Resistive sensors may be connected with 2 or 3 wires. For the former, terminals **1** and **2** have to be shorted.

Permitted load resistance, R_L, is limited by supply voltage value, U_Z, minimal voltage drop on transmitter's output and maximum output current – as described by the inequality below.



For operation with thermocouple or a voltage source, one exploits terminals **2** and **3** taking care of correct polarization:



If external cold junction compensation is to be used, one should set the external CJC temperature during configuration. Naturally, measuring difference of temperatures with thermocouple doesn't require compensation.

Technical data

Transmitter's enclosure, 6.2mm in width and made of self-extinguishing material, may be mounted on standard 35mm 'top-hat' rails.

Input: temperature sensor - range depends on sensor type:

RTD:

Pt100,200,500,1000/1.385	-100÷850 °C*
Pt100,200,500,1000/1.392	-100÷850 °C*
(* for Pt1000 maximal sensor temperature is limited to 400 °C)	
Ni100,200,500,1000/1.617	-60÷180 °C
Cu100,200,500,1000/1.426	-50÷180 °C
measurement range	0÷2500Ω
sensor excitation current	ca. 250 µA
wires influence (3-wire connection)	< 0.001 %/Ω
maximum wires resistance	50 Ω

thermocouple:

	B	200÷1820 °C
	C	0÷2300 °C
	E	-100÷1000 °C
	J	-100÷1200 °C
	K	-150÷1370 °C
	N	0÷1300 °C
	T	-100÷400 °C
	R	0÷1700 °C
	S	0÷1700 °C
measurement range		±1V

Output:	current	4÷20 mA
	voltage drop	12÷36V

Accuracy class:	0.1
Test isolation voltage:	2 kV

Other technical parameters:

single measurement duration	<180 ms (6 updates/s)
maximum nonlinearity	0.03 %
output current resolution	0.006% (1 μA)
output noise level	< 10 μA
temperature coefficient	< 100ppm/°C
warm-up time	5 min
operating temperature range	-10÷50 °C
storage temperature range	-40÷80 °C
relative humidity	30÷75 %
ambient pressure	1000±200 hPa
external magnetic field	0÷400 A/m
working position	irrelevant
external dimensions	6.2×80×80 mm^3
housing protection type	IP 20

Absolute maximum ratings:

input voltage	30V
output current (internally limited)	25 mA
voltage applied to output terminals	100 V

CE