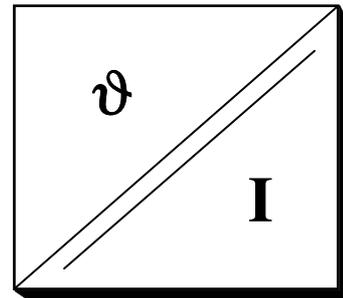


PROGRAMMABLE TRANSMITTER T1249

- sensor's temperature / 4÷20 mA
- accuracy class: 0.05
- input-output isolation of 3kV
- supplied from output current loop
- rail-mounted enclosure



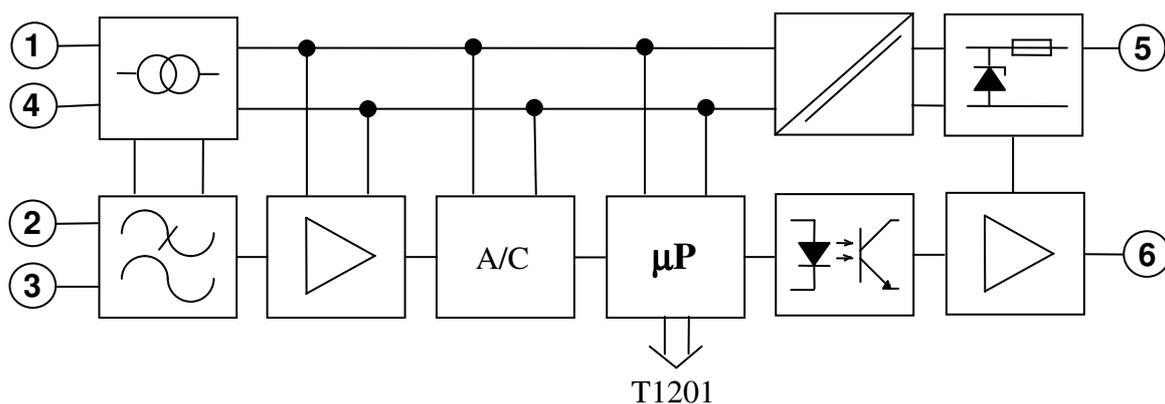
The temperature transmitter is fully programmable - both sensor type (RTD or thermocouple) and temperature range may be redefined at any time. User-friendly configuration software runs under Windows (95 or later). All that is needed is an interface cable (T1201) connected between PC's RS232 serial port and three-pin 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 $\pm 2\%$) to a specific sensor. Output current may be set independently from input for testing purposes. Nine standard thermocouple types are implemented. Non-standard sensor may be defined with a temperature *versus* signal table prepared under any text editor. Linearization and internal CJC are provided and may be switched on and off.

The transmitter provides galvanic isolation between temperature sensor and output current loop. Factory test isolation voltage equals 3kV. The conversion accuracy class of 0.05 is guaranteed.

The output part of the transmitter is supplied from output current loop forcing current flow proportional to the input signal. Thus, the T1249 may be used together with contemporary controllers equipped with two-wire inputs able to supply over 15V 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.

The block scheme of T1249 is shown below. Current source supplies RTD sensor. The signal on terminals 2 and 3 resulting from a voltage drop across RTD, or thermocouple voltage, is filtered and converted to a digital value. Processor performs the necessary calculations and sends the result as a PWM signal to the output side through a pair of optocouplers. The PWM signal is filtered and converted to the 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.



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 non symmetric 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. An additional option, not shown in the block scheme, is an infrared transmitter built into the transmitter allowing to use a PDA (Pocket PC) to check the state of the transmitter in place of operation without the need of any electrical connections.

The enclosure, 12.5mm in width and made of self extinguishing material, may be mounted on standard 35mm 'top-hat' rails.

Operation

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 an 'intelligent' 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 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 within the configuration program.

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 uses a 200 segments approximation keeping 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 T1249 may also operate with external CJC or be used for temperature difference measurement.

Configuration

The configuration program, called 'Programator', runs under Windows. The newest version is always available for download as 'www.cciba.eu/dlnd/programator.zip'.

Our programmers put every effort to make the code user-friendly, but some short remarks seem to be in place.

The program does not need any special installation. It may be run from a diskette or any hard-disk folder. A serial port number (COM) should be chosen before a communication with the transmitter may be started. This may be done by clicking on the icon with picture of a computer. As a default, COM2 is used, but the program saves basic settings and last used port will be remembered and used next time the program is run.

The program starts communication whenever a transmitter is connected (through the T1201 adapter). For standard operations it is enough to use only the icons placed in the toolbar. A short description appears whenever the cursor rests on an icon for more than half a second. The same applies to all fields and buttons, which are applicable at the moment.

It is a good practice to read the settings from the connected transmitter first, before any changes are applied. An icon with open book serves to this purpose. Clicking on the icon with a pen and a piece of paper will cause downloading of configuration settings to the transmitter (provided that the configuration is complete). Preparation of configuration file is also possible without any transmitter connected.

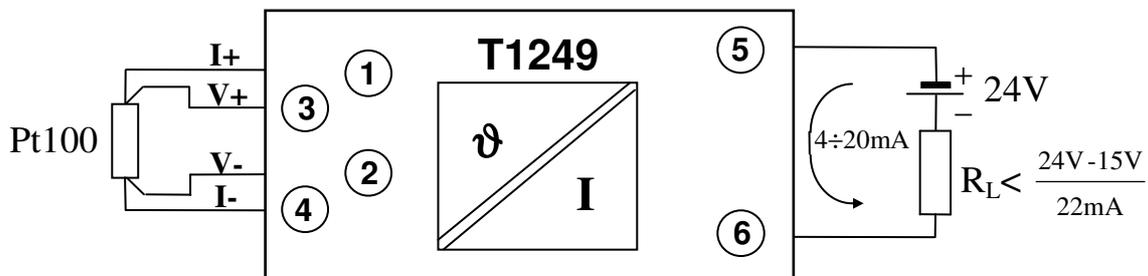
Naturally, the user may save (in a file) or print the settings of any transmitter for future reference.

To correct the zero and gain one has to know a password. The initial password is 'ciba' and may be changed from menu (Options/General) to any other combination of letters and numbers.

As mentioned before, for non-standard sensors, a user-defined text table may be used. The configuration program applies elaborate mathematical methods to approximate the supplied characteristics, which allows to limit the user input to just few points for smooth curves.

Connections

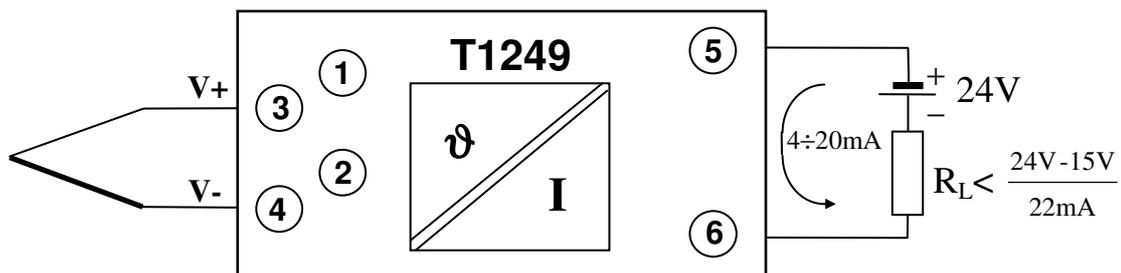
As mentioned above, the temperature sensor may be of RTD type. Supported are: Pt100, Ni100, and Cu100. Resistive sensors may be connected in three ways – with 2, 3, or 4 wires.



The 4-wire connection is shown above.

For 3-wire connection one just skips the terminal No 2, and if a 2-wire connection is to be used, terminals 1 and 3 should be shorted.

For operation with thermocouple or voltage source, one exploits terminals 3 and 4 taking care of correct polarization:



Technical data

Input: temperature sensor - range depends on sensor type:

resistive sensors:	0÷400Ω
Pt100/1.385	-100÷850 °C
Pt100/1.392	-100÷850 °C
Ni100/1.617	-60÷180 °C
Cu100/1.426	-50÷180 °C
excitation current	ca. 300 μA
wires influence (3-wire connection)	< 0.001 %/Ω
maximum wires resistance	50 Ω
thermocouple:	-5÷70mV
B	200÷1820 °C
C	0÷2300 °C
E	-100÷1000 °C
J	-100÷1200 °C
K	-100÷1370 °C
N	0÷1300 °C
T	-100÷400 °C
R	0÷1700 °C
S	0÷1700 °C
input current	10 nA

Output: current 4÷20 mA
voltage drop 15÷36V

Accuracy class: 0.05

Test isolation voltage: 3 kV

Other technical parameters:

single measurement duration	<180 ms (6 updates/s)
maximum nonlinearity	0.02 %
output current resolution	0.006% (1 μA)
output noise level	< 10 μA
temperature coefficient	50ppm/°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	12.5×99×114mm 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

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