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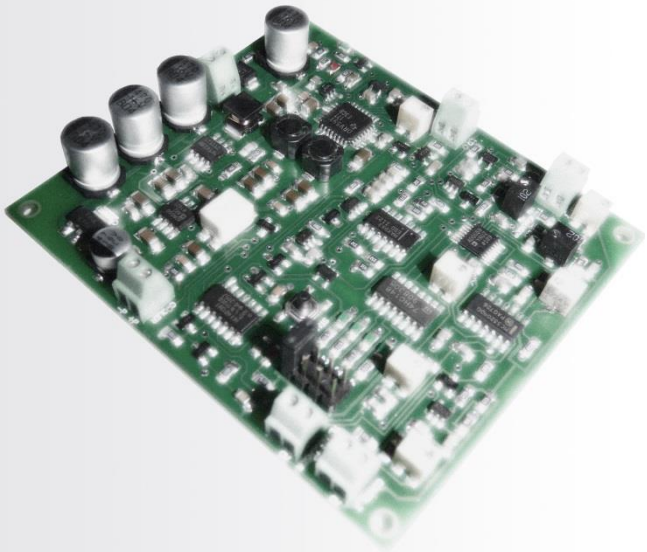
LED Microsensor NT

TCM
THERMOCONTROLLER
INSTRUCTION MANUAL



rev. 150515

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Application

Thermocontroller is designed for control and adjustment of temperature of LMSNT LED and photodiode models with built-in thermoelectric modules (thermocoolers).

Compatibility table

One-element LED models		PD models	
LmsXXLED	✘	LmsXXPD-XX	✘
LmsXXLED-R	✘	LmsXXPD-XX-R	✘
LmsXXLED-RW	✘	LmsXXPD-XX-RW	✘
LmsXXLED-TEM	✓	LmsXXPD-XX-R-PA	✘
LmsXXLED-TEM-R	✓	LmsXXPD-XX-RW-PA	✘
Standard multielement LED models		LmsXXPD-XX-TEM	✓
LmsXXLED-4M	✘	LmsXXPD-XX-TEM-R	✓
LmsXXLED-4M-R	✘	LmsXXPD-XX-TEM-PA	✓
LmsXXLED-4M-RW	✘	LmsXXPD-XX-TEM-R-PA	✓
LmsXXLED-4M-TEM	✓		
LmsXXLED-4M-TEM-R	✓		
Lms18-..-23LED-6M	✘		
Lms18-..-23LED-6M-TEM	✘		

Note! Please contact us to specify compatibility of custom multielement LED and PD models

Modes & Features

- TCM thermocontroller provides **two modes of temperature adjustment and two modes of temperature control:**

		temperature adjustment* way	
		via potentiometer	**via external device**
temperature control way**	**via LED/PD thermistor**	4th mode	2nd mode
	via D-51 temp. control block***	3rd mode (for LEDs only)	1st mode (for LEDs only)

- Possibility of **temperature values output** (as a voltage signal) to a signal observing device.

* *Temperature adjustment is a procedure performed by a user in order to change the target temperature of an LED/PD chip.*

** *Temperature control is an automated procedure performed by TCM board in order to stabilise the temperature of an LED/PD chip on the needed level.*

*** *Temperature control with a temperature control block of **D-51 LED driver** can be done only after the calibration procedure and is applicable for one exact LED. For more info about temperature control principle of D-51 LED driver please refer to the Appendix*

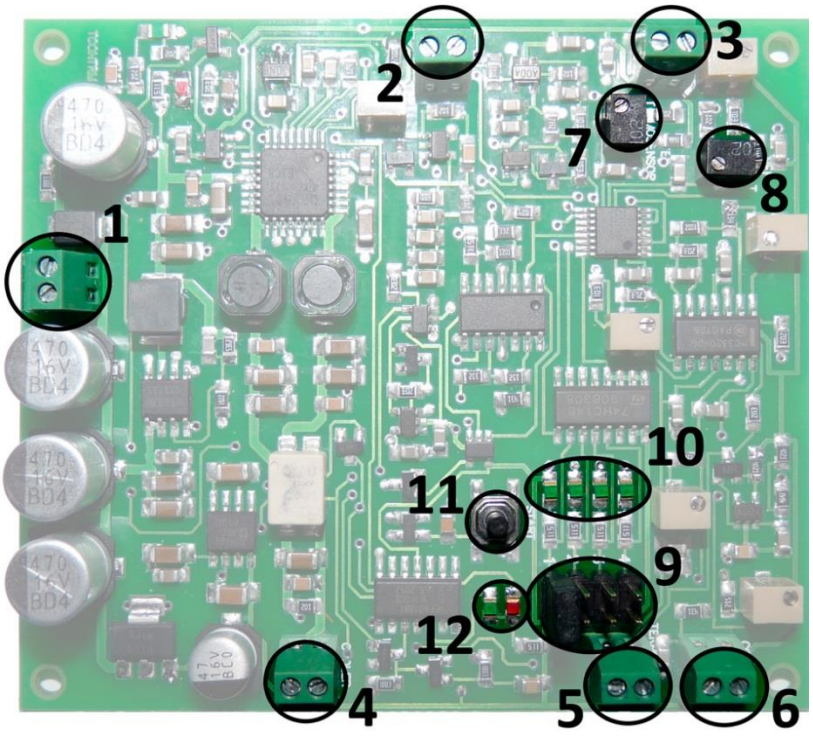
Operation conditions

Indoor operation only. Ingress Protection Rating IP00.

Important Note

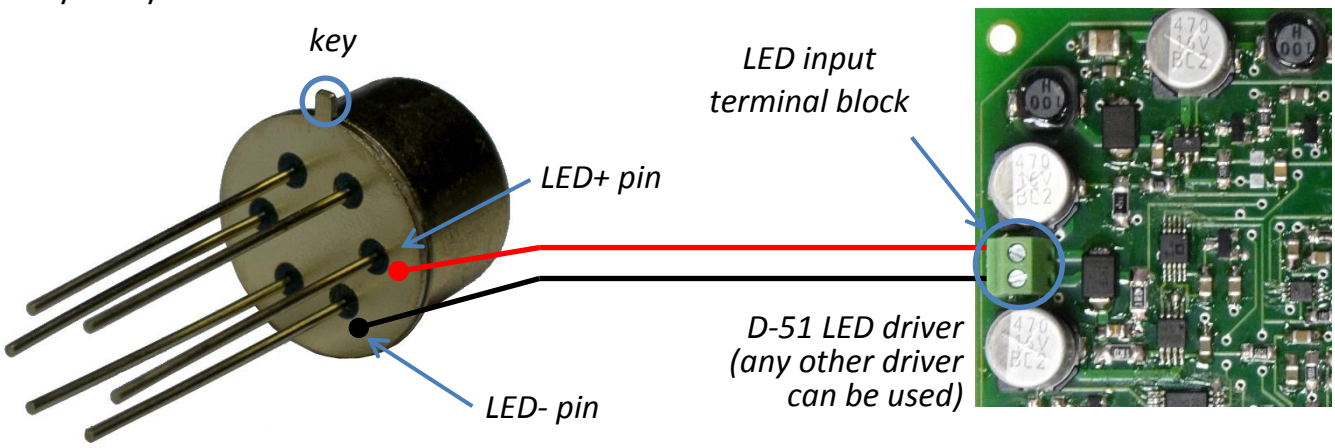
Making adjustments of TCM except ones described in the given manual is customer's responsibility.

THERMOCONTROLLER LAYOUT

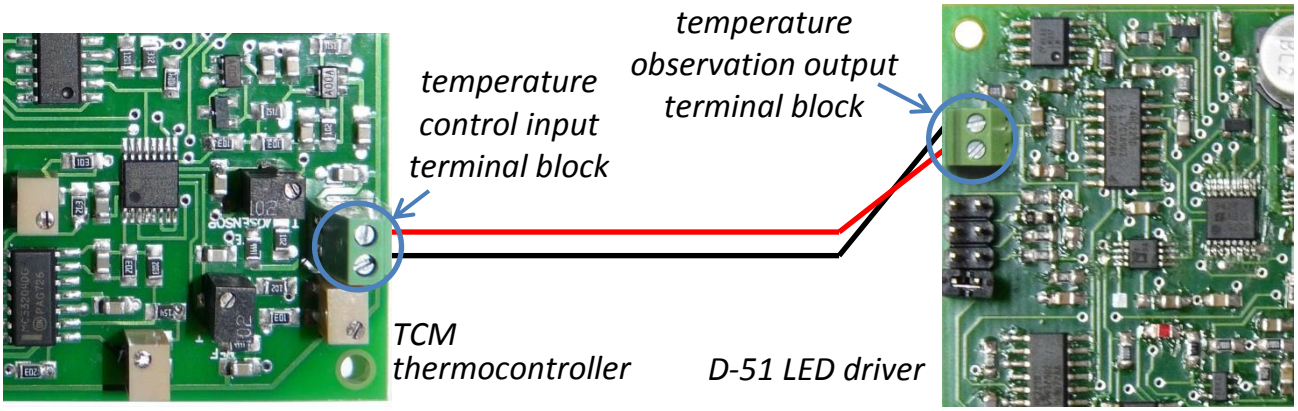


1. Power input terminal block.
2. Temperature voltage adjustment input terminal block.
3. D51 temperature observation input terminal block.
4. Thermocooler power output terminal block.
5. Thermistor input terminal block.
6. Thermistor temperature signal output terminal block.
7. Thermistor temperature adjustment potentiometer.
8. D51 temperature adjustment potentiometer.
9. Mode switching jumper.
10. LED indicator of selected mode.
11. Thermocontroller start/stop button.
12. Green/red thermocontroller LED indicator.

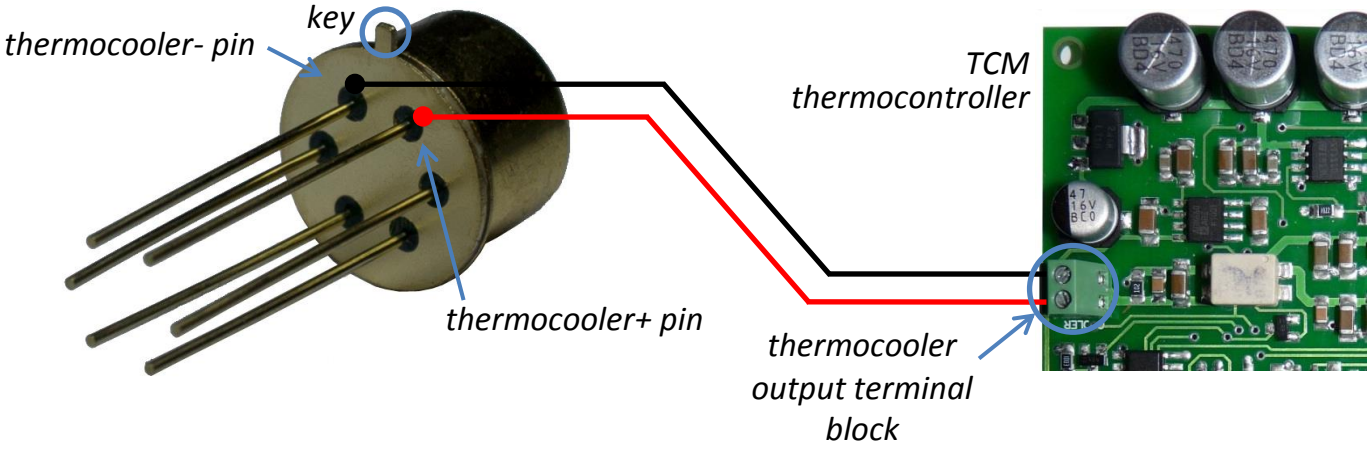
1. Connect the driving pins of an LED to the LED connection terminal block of D-41/D-51/mini LED driver.



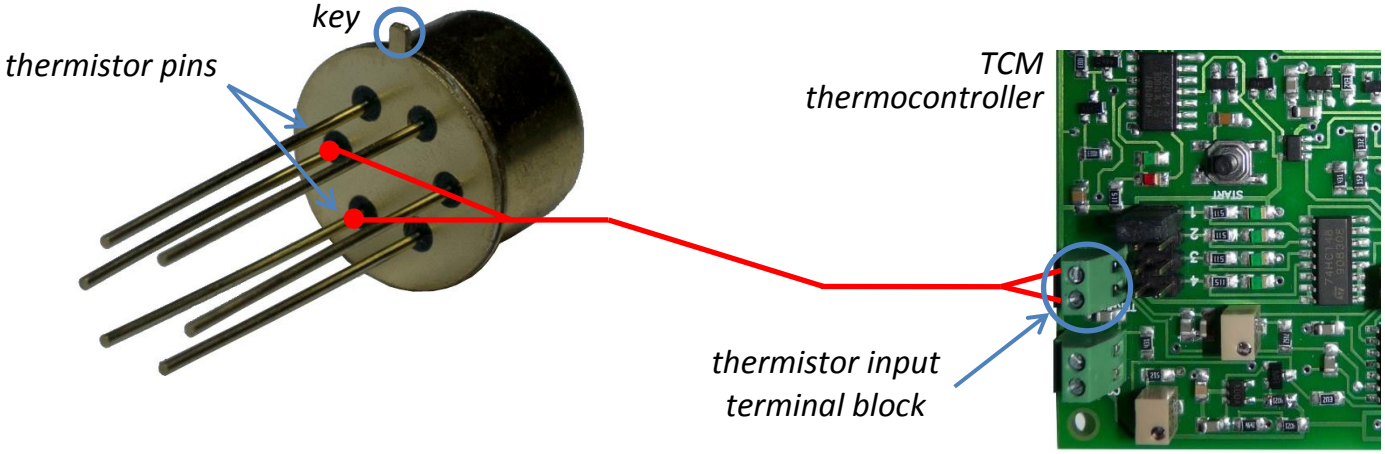
2. **(Optional)** If you use D-51 LED driver and want to use D-51-based mode of TCM operation, connect the temperature observation voltage output terminal block of D-51 driver with temperature observation input terminal block (3) of TCM.



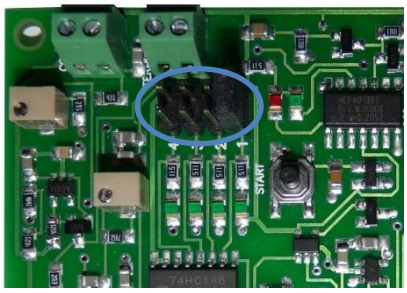
3. Connect thermocooler pins of an LED with thermocooler output terminal block (4).



4. Connect thermistor pins of an LED with thermistor input terminal block (5).



5. Choose one of four modes of TCM thermocontroller using mode selection jumper.

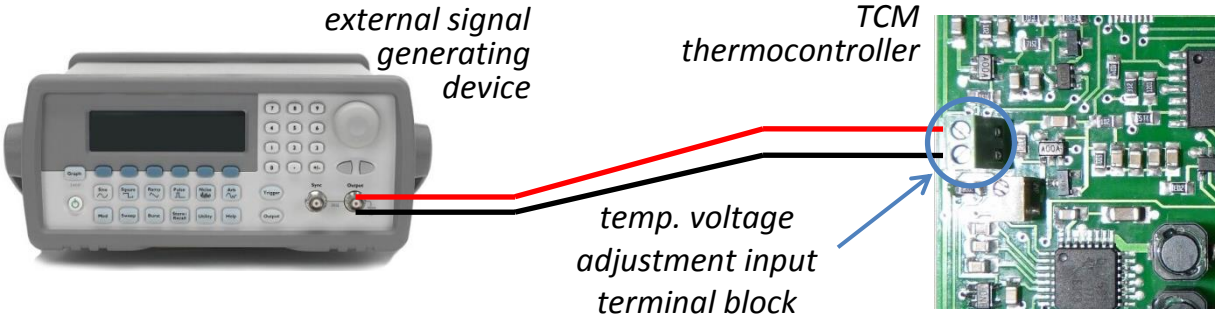


(1) D-51-based mode; external T adjustment
(2) Thermistor-based mode; external T adjustment
} go to step 6.

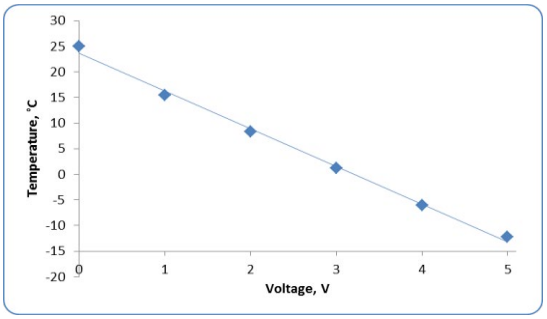
(3) D-51-based mode; potentiometer T adjustment
(4) Thermistor-based mode; potentiometer T adjustment
} go to step 7.

Note! You may choose 1st and 3rd mode only when using D-51 LED driver.

6. **(For external T adjustment only – 1st and 2nd modes).** Connect an external signal generating device with the temperature voltage adjustment input terminal block of TCM.

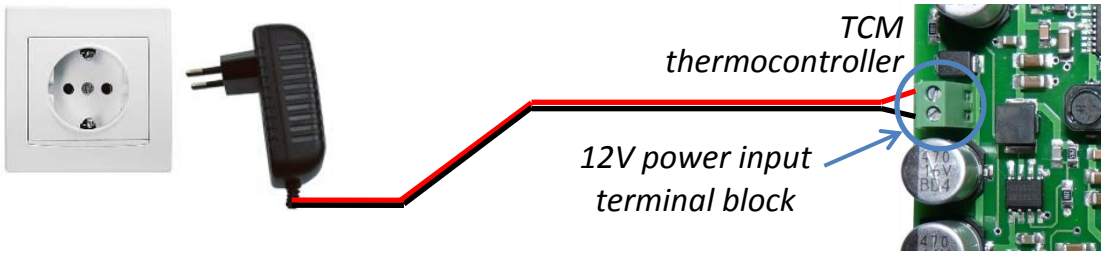


Set the needed temperature using the following diagram (ΔV/ΔT=0.1V/°C):

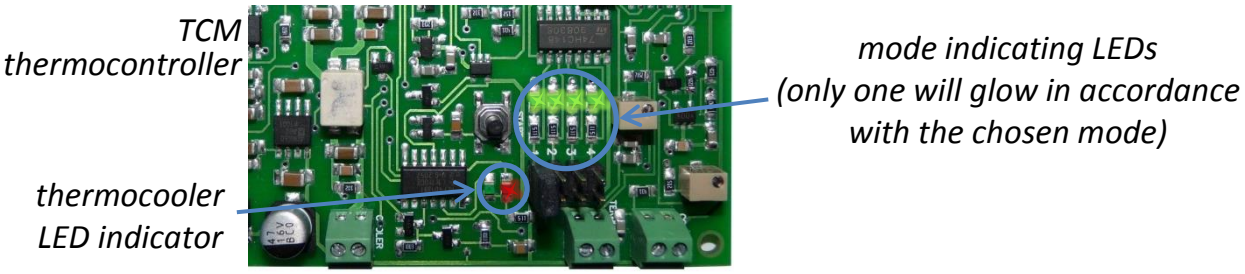


Note! The temperature values are approximate and may vary slightly (±1°C) due to the ambient conditions, but the linear dependence stays put anyway.

7. Connect the 12V stabilised DC power supply with the power input terminal block (1).



The green indicating LED of the chosen mode will turn on; the thermocontroller LED indicator will turn red.

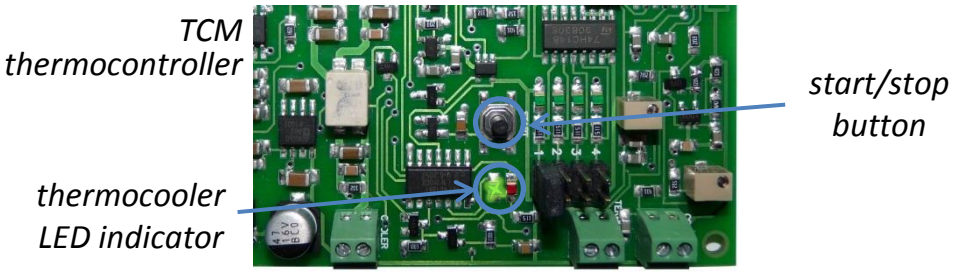


8. Make all the connections of other boards (driver, synchronous detector etc.) following the appropriate instructions manuals. Before turning them on check the required connections and modes:

Driver:
- LED connection
- Synchronisation with sync. detector
- Pulse duration, frequency, current selection
- External connections (if necessary)

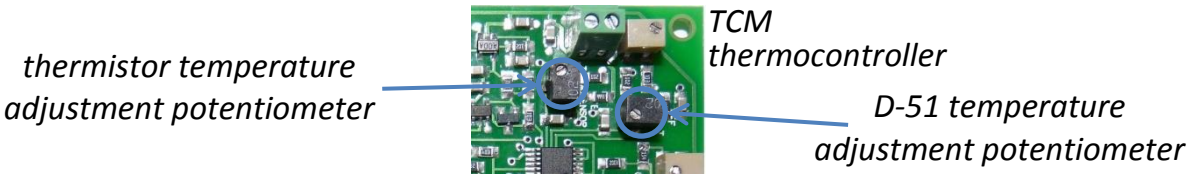
Synchronous detector:
- Photodiode input connection
- Preamplifier power output connection
- Synchronisation with driver
- Averaging time and signal gain selection
- External signal observing device connection

9. Turn on the thermocooling using thermocontroller start/stop button, the thermocontroller LED indicator will turn green.

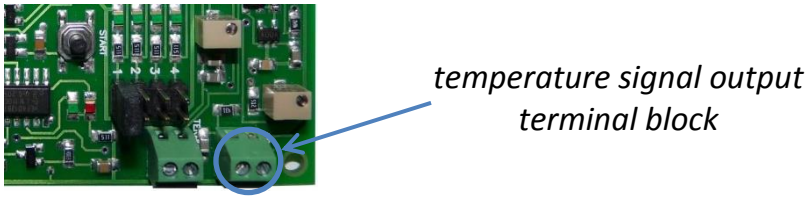


10. TCM thermocontroller controls the LED temperature in different ways depending on the chosen mode. To adjust the temperature of the thermocooler, use:

- **for 1st and 2nd modes** - external signal generating device (see the adjustment parameters in the step 6)
- **for 3rd mode** – D51 temperature adjustment potentiometer.
- **for 4th mode** – thermistor temperature adjustment potentiometer.



11. To observe the actual temperature of TEC connect a signal observing device to the temperature signal output terminal block (6).

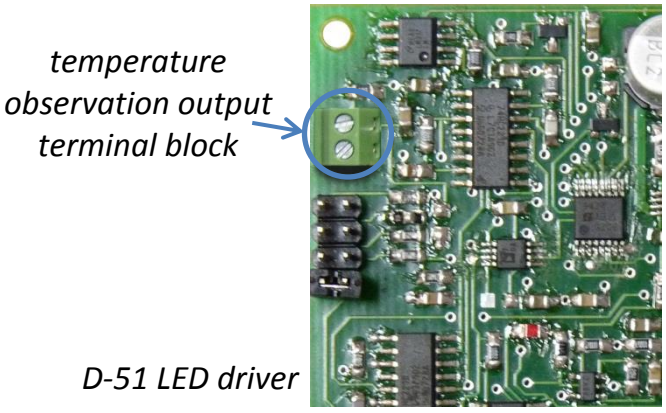


The relation of the temperature and output voltage is linear and corresponds to the following table (ΔV/ΔT=10 mV/°C):

voltage, mV	-150	0	+250
temperature, °C	-15	0	+25

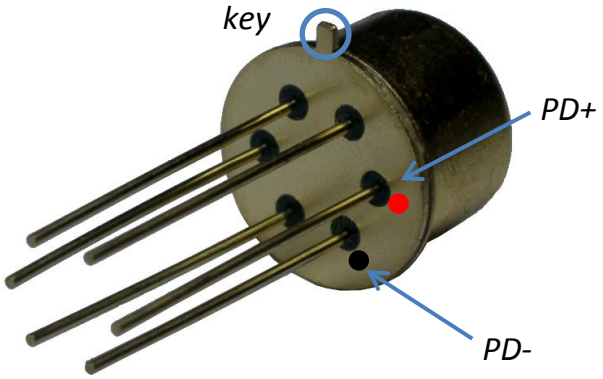
Note! The relation between T and V beyond this interval becomes non-linear.

12. For D-51-based modes (1st and 3rd modes) it is possible to observe the intrinsic p-n junction temperature connecting a signal observing device to the temperature observation output terminal block of D-51 LED driver. To know more about temperature observation feature please refer to the Appendix 1 on the p. 16.

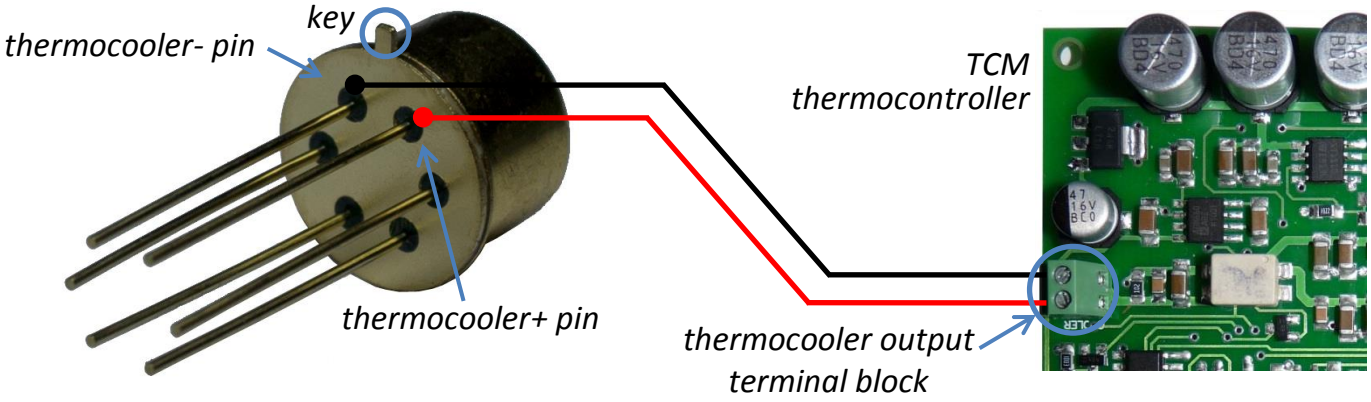


Connection of photodiode models with TEM: LmsXXPD-XX-TEM и LmsXXPD-XX-TEM-R

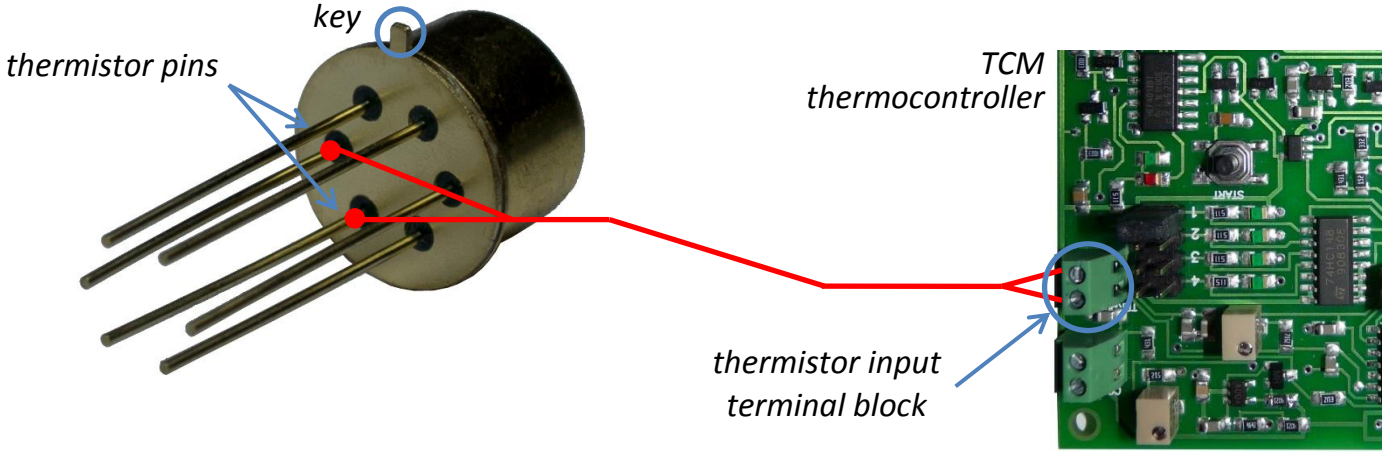
1. Connect the photodiode contacts to a preamplifier/amplifier.



2. Connect thermocooler pins of the PD with thermocooler output terminal block (4).



3. Connect thermistor pins of the PD with thermistor input terminal block (5).



Note!

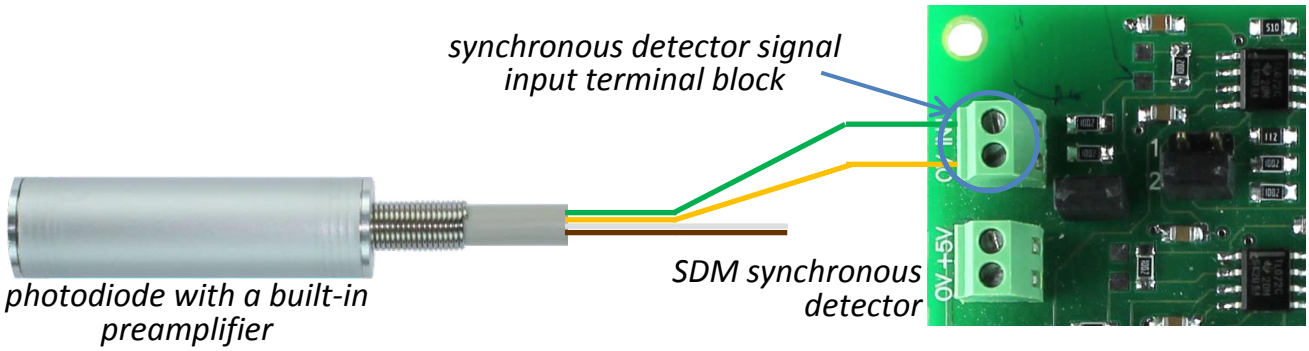
- Check all the connections before turning on the photodiode.
- Do not connect the photodiode to the multimeter.
- If you use a standalone version of the preamplifier (PAb board), make sure that the connection between the photodiode and the preamplifier is proper, safe and securely screened before taking next steps.

Please proceed from **step 6**.

Connection of photodiode models with TEM and built-in preamplifiers: LmsXXPD-XX-TEM-PA и LmsXXPD-XX-TEM-R-PA

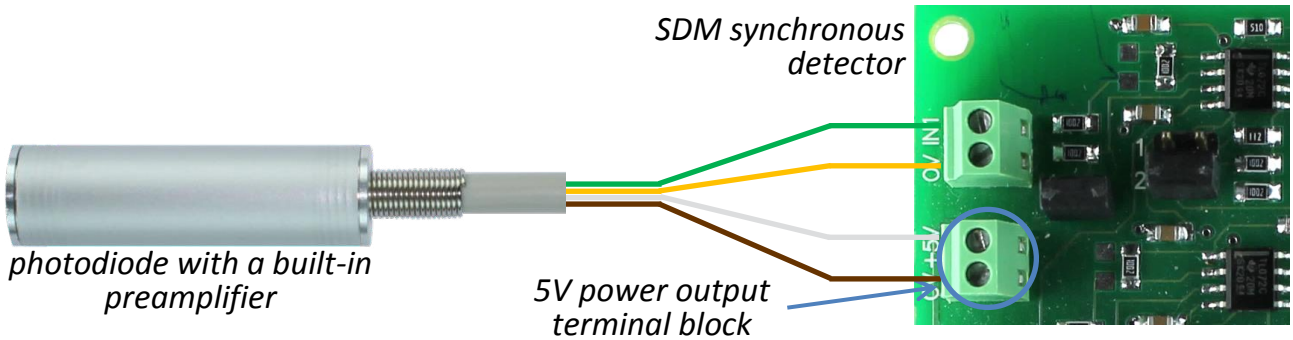
4. Connect the photodiode to the SDM synchronous detector (if available).

4.1. Connect the preamplifier output with signal input of the SDM synchronous detector.



Green cord – to the signal input “+”; Yellow cord – to the signal input “0”

4.2. Connect the 5V power output of the synchronous detector with the preamplifier power input.

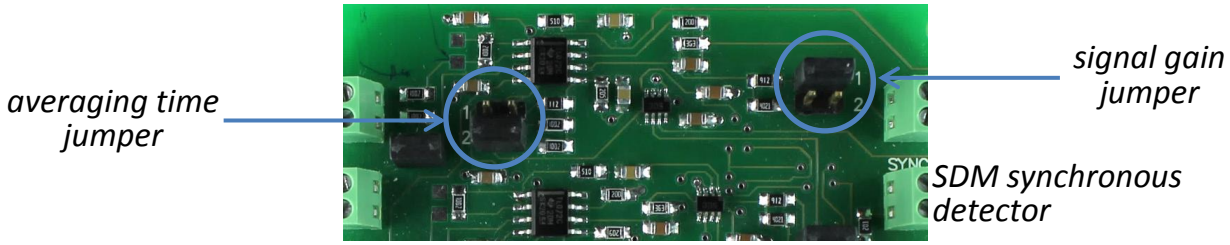


White cord – to the power output “+”; Brown cord – to the power output “0”

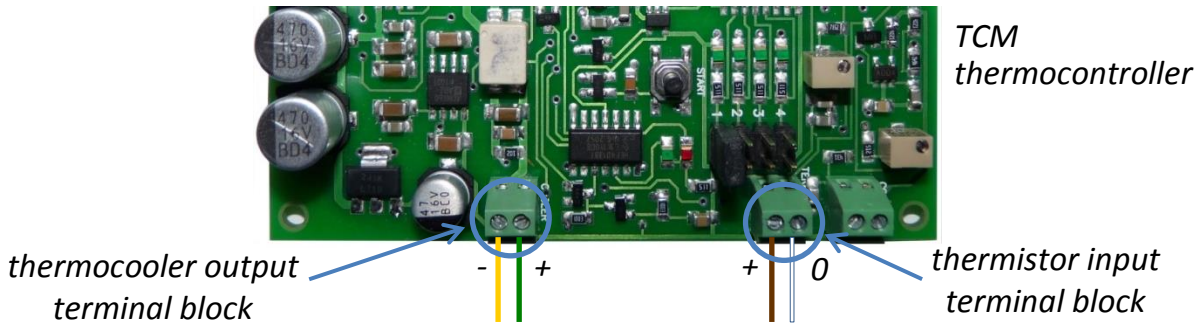
Note!

- Check all the connections before turning on the photodiode.
- Do not connect the photodiode to the multimeter.
- Pay your attention to the colours of the cords; actual colours may differ from ones pointed in the present manual, follow the instructions pointed in the technical data provided with the order.

4.3. Choose the needed averaging time and signal amplification with the help of the appropriate jumpers of the SDM synchronous detector.

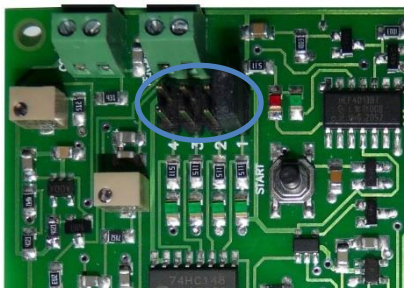


5. Connect the photodiode's thermocooler output cable cords to the TCM board in the following way:



6. Choose one of two thermistor-based modes of TCM thermocontroller using mode selection jumper (9).

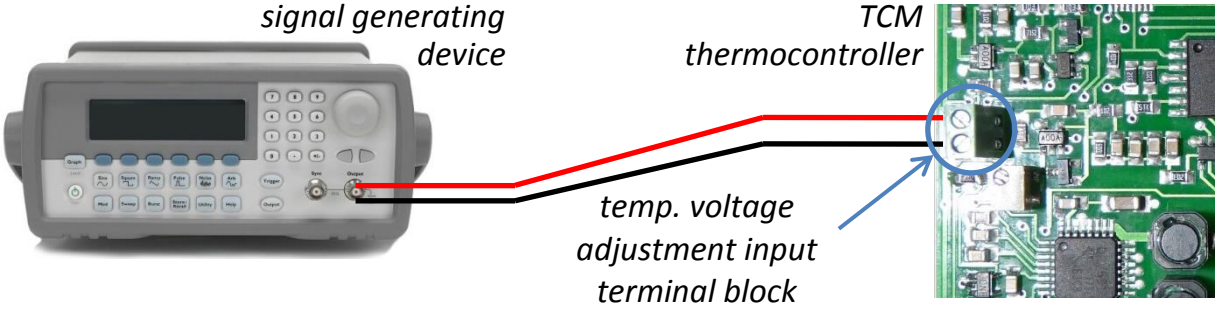
(D-51-based modes – 1st and 3rd – are **not available** for photodiodes).



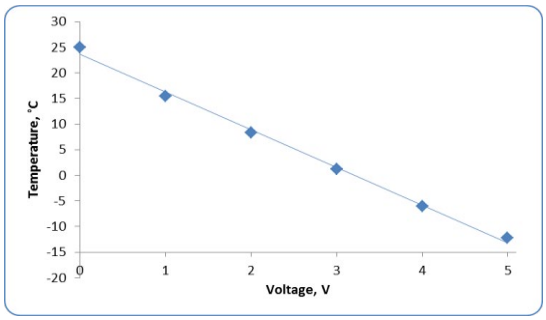
(2) Thermistor-based mode; external T adjustment – go to step 6

(4) Thermistor-based mode; potentiometer T adjustment – go to step 7

7. **(For external T adjustment only – 2nd mode).** Connect an external signal generating device with the temperature voltage adjustment input terminal block of TCM (2).

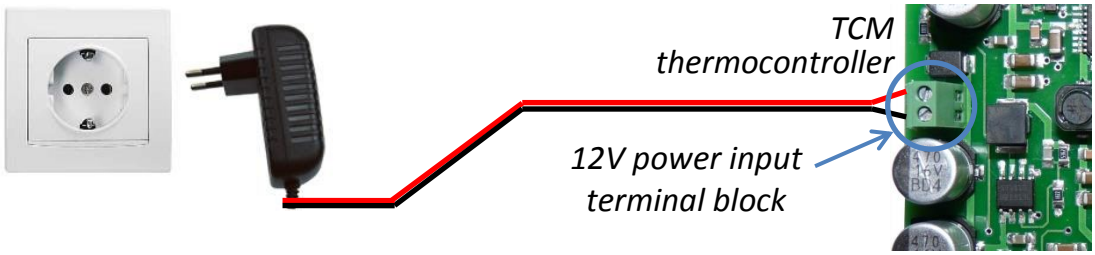


Set the needed temperature using the following diagram (ΔV/ΔT=0.1V/°C):

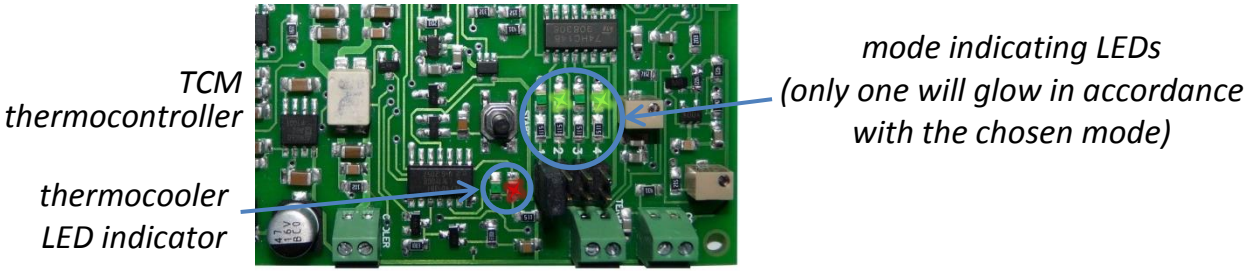


Note! The temperature values are approximate and may vary slightly (±1°C) due to the ambient conditions, but the linear dependence stays put anyway.

8. Connect the 12V stabilised DC power supply with the power input terminal block.



The green indicating LED of the chosen mode will turn on; the thermocontroller LED indicator will turn red.



9. Make all the connections of other boards (driver, synchronous detector etc.) following the appropriate instructions manuals. Before turning them on check the required connections and modes:

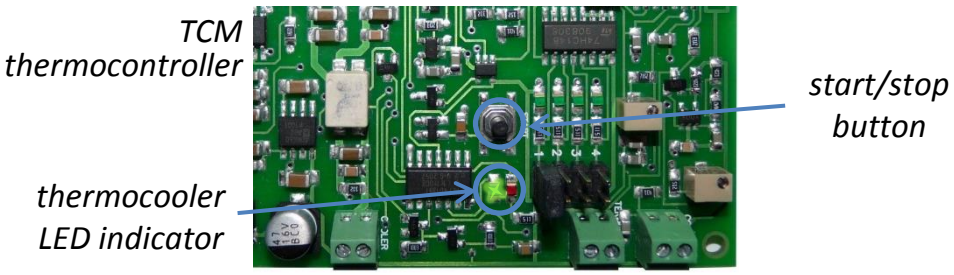
Driver:

- LED connection
- Synchronisation with sync. detector
- Pulse duration, frequency, current selection
- External connections (if necessary)

Synchronous detector:

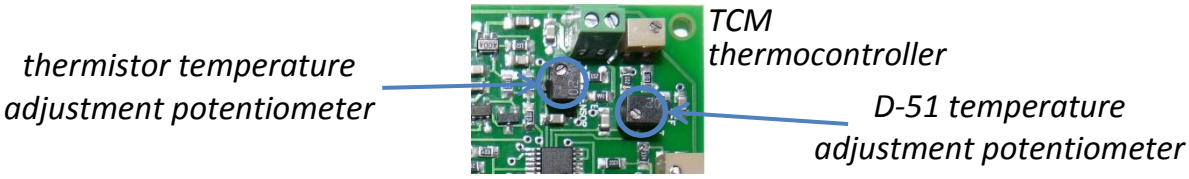
- Photodiode input connection
- Preamplifier power output connection
- Synchronisation with driver
- Averaging time and signal gain selection
- External signal observing device connection

10. Turn on the thermocooling using thermocontroller start/stop button, the thermocontroller LED indicator will turn green.

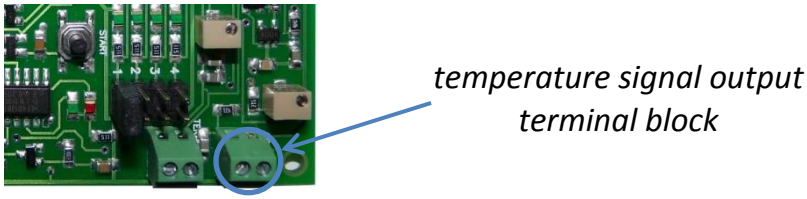


11. TCM thermocontroller controls the LED temperature in different ways depending on the chosen mode. To adjust the temperature of the thermocooler, use:

- **for 2nd mode** - external signal generating device (see the adjustment parameters in the step 7)
- **for 4th mode –** thermistor temperature adjustment potentiometer (7).



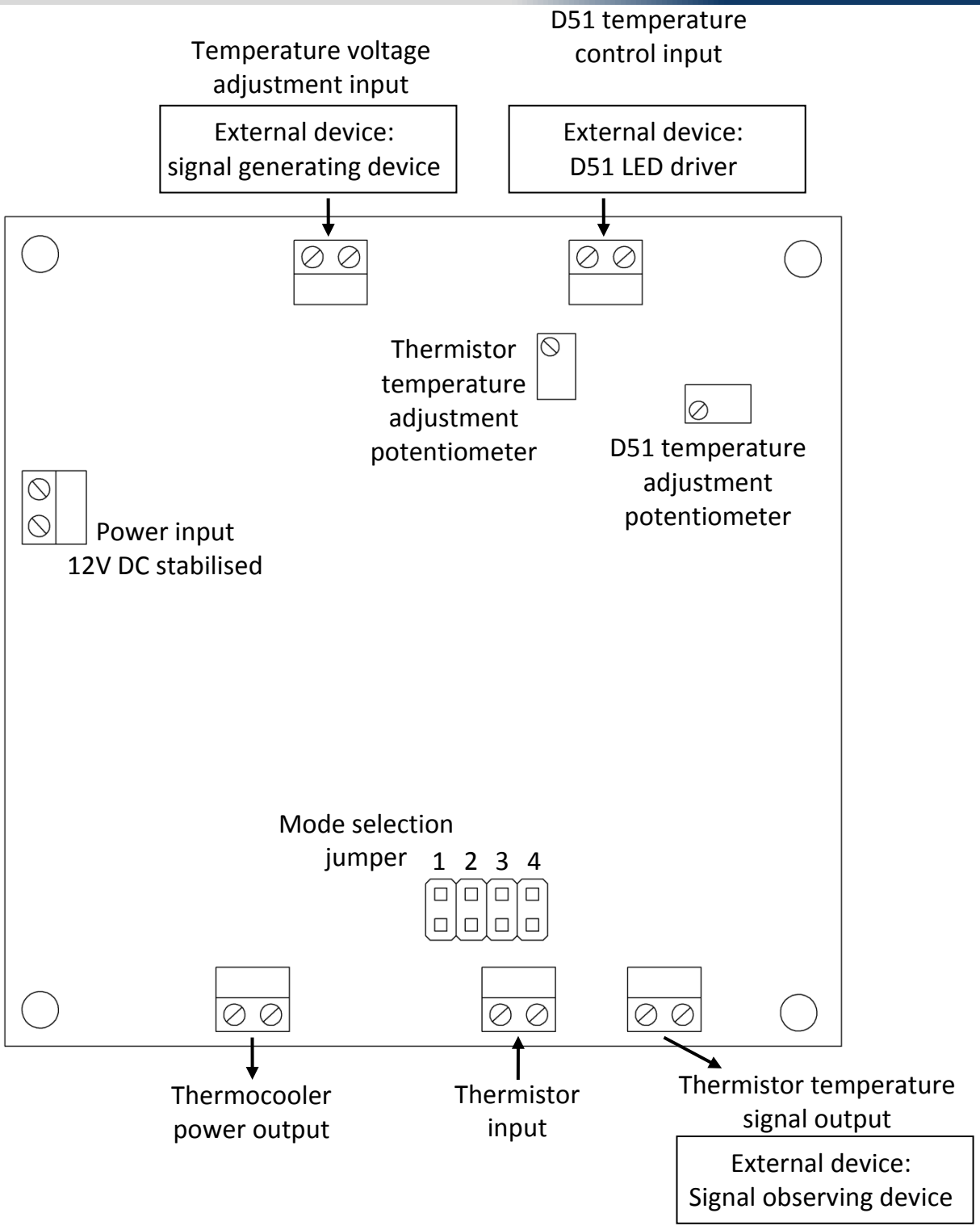
12. To observe the actual temperature of TEC connect a signal observing device to the temperature signal output terminal block.



The relation of the temperature and output voltage is linear and corresponds to the following table (ΔV/ΔT=10 mV/°C):

voltage, mV	-150	0	+250
temperature, °C	-15	0	+25

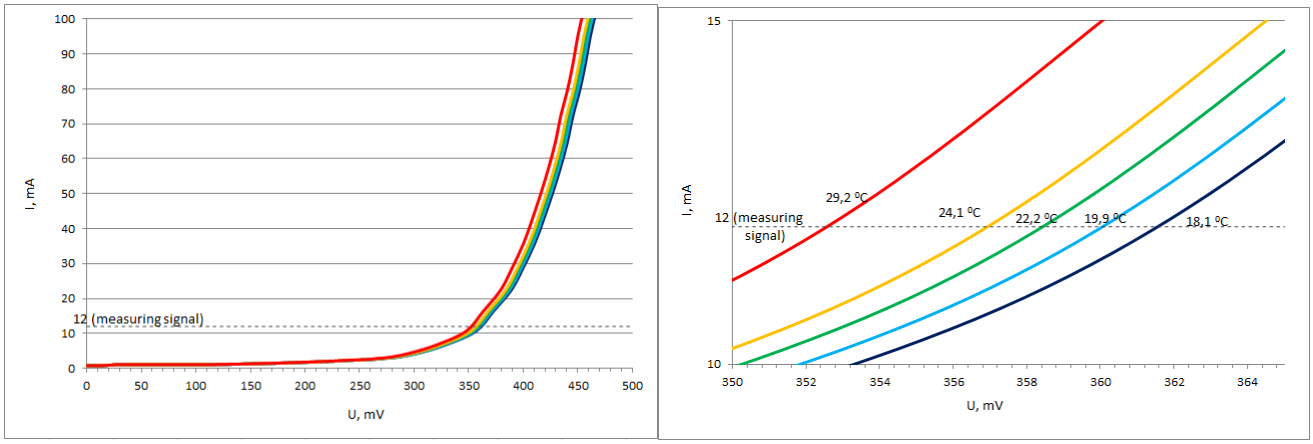
Note! The relation between T and V beyond this interval becomes non-linear.



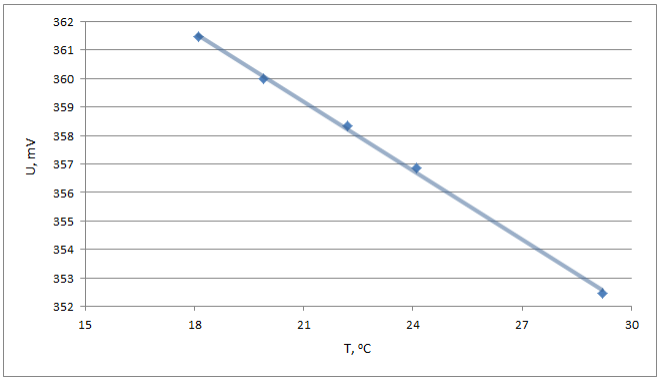
TCM connections

Power input voltage	+12 V, stabilized
Voltage tolerance	-5..+5 %
Input current	max. 0.3 A
Board dimensions	80×70×15 mm
Temperature adjustment input voltage	0..5 V
Thermistor output voltage	-0.15 V..+0.25 V

Temperature control is possibility to define LED p-n junction temperature and observe temperature changing using current-voltage dependence. Driver generates low current signals with amplitude 12 mA and duration 500 ns for plugged LED. These signals are placed between driving signals and don't affect LED temperature. Special block of D-51 driver registers the pulse voltage value and converts it into constant voltage. Since there is a univocal dependence of voltage on intrinsic LED temperature it becomes possible to judge temperature changing by observing voltage changing.



Family of current-voltage characteristics at different temperatures.



Voltage-temperature dependence at 12mA measuring signal.
Straight-line relationship is clearly seen.

Every LED has a unique current-voltage characteristic, that's why relation between output voltage and temperature will be different depending on measured LED. Therefore, for measuring exact p-n junction temperature, the calibration for every LED is needed. For calibration we recommend measuring voltage values at 2 temperatures (for example, room temperature and some other) and use linear approximation (U(T)=kT+b).