The universal driver for LEDs with built-in thermocooler
DLT-37M

Operations manual

Contents

1. Application.

The driver DLT-37M is designed for power supply of all models Mid-IR LEDs with built-in thermocooler.

2. Features.

- The driver DLT-37M provides two modes of operation: Quasi Continuous Wave mode (the mode of *maximum average optical power* from the LED) and pulse mode (the mode of *maximum peak optical power* from the LED).
- Temperature controller that is built in DLT-37 provides selecting and stabilizing of temperature on the LED's chip in wide range. That gives possibility to stabilize and tune wavelength or optical power of the LED.
- The possibility to tune the LED current amplitude, repetition rate and pulse duration, to select the optimal mode of the LED.
- The synchronization capability with a selective amplifier or with some other device.
- Easy and durable in use.

WARNING!
Please, do not use multimeter to control the adjust current!
Please, contact your provider regarding these questions.

3. Service conditions.

Temperature tolerance   -15 °C..+50 °C

Relative air humidity (at temperature + 35°C)   less then 80 %

Atmospheric pressure   86..107 kPa

The driver DLT-37M can be used with the LED(TO-5 pin-package), having the next Pin configuration.

TOP VIEW

BACK SIDE VIEW
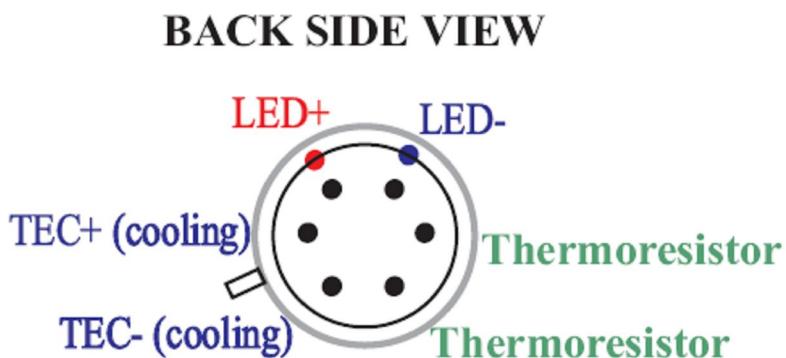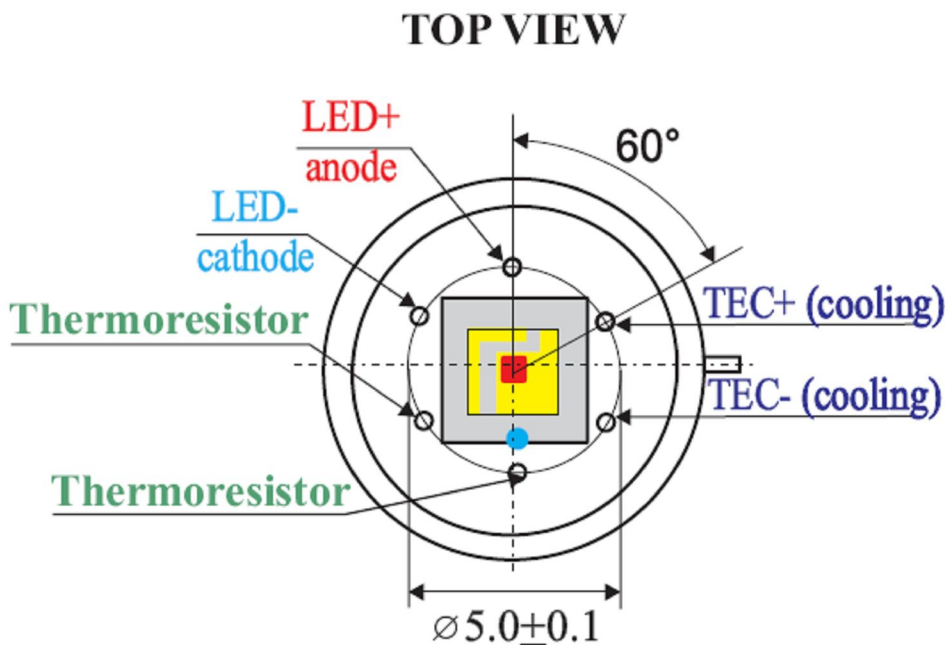
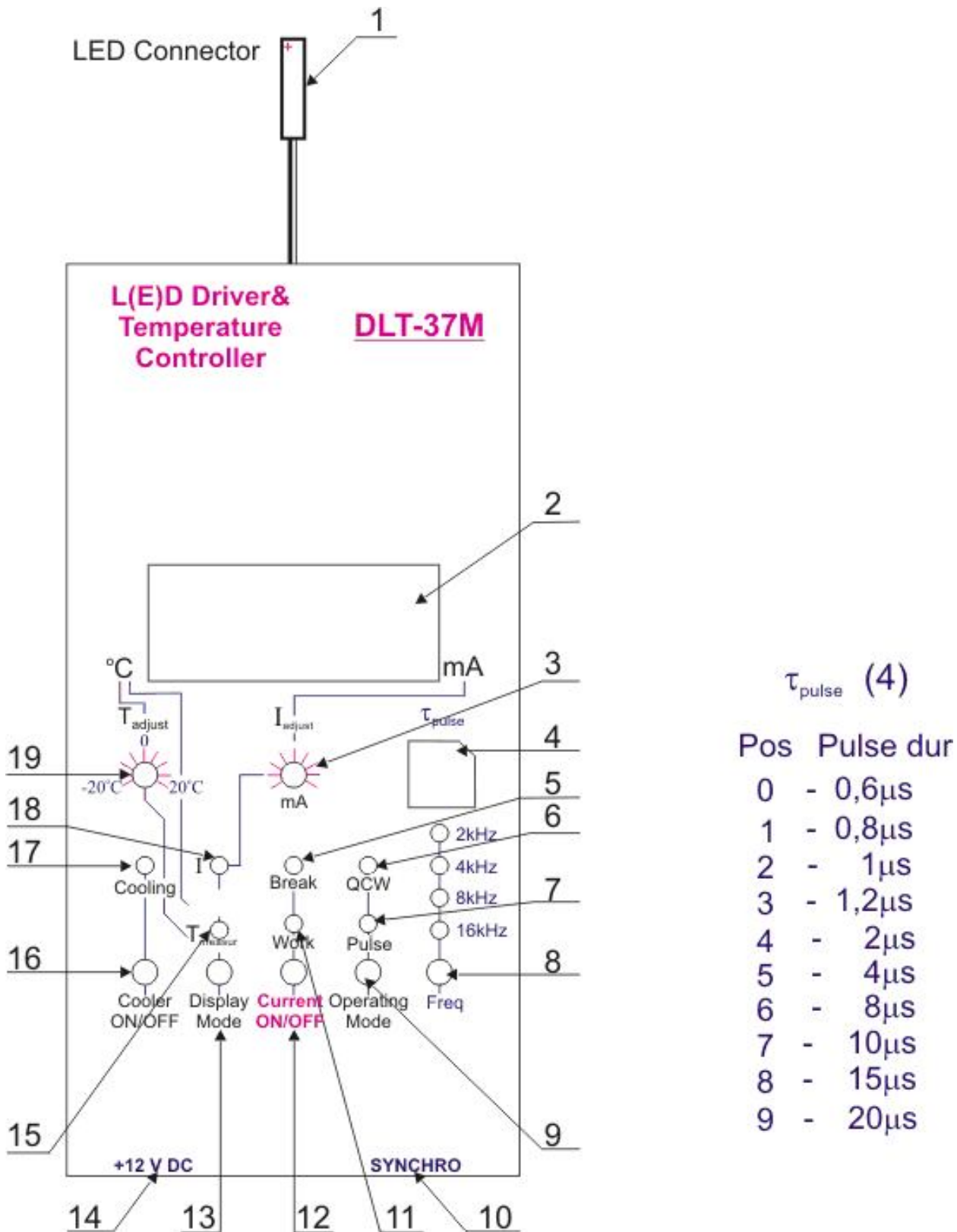## 4. Appearance of the driver and its interface.

Fig.1.Appearance of the driver and its interface.

1. The jack for the LED connection.

2. The display for the LED temperature and LED current indication.

3. The LED current adjust.

4. The multiposition switch for adjusting the pulse duration.

5. The red LED indicator of failure of LED current.

6. The green LED indicator of quasi continuous wave mode.

7. The green LED indicator of pulse mode.

8. The button of frequency selection.

9. The button of mode selection.

10. The jack for synchronization cable.

11. The LED current indicator.

12. The start/stop button of LED power supply.

13. The button of display mode selection.

14. The jack for the cable of AC/DC adapter.

15. The LED indicator of the LED temperature indication mode.

16. The start/stop button of LED cooling.

17. The LED indicator of the LED cooling mode.

18. The LED indicator of the LED current indication mode.

19. The LED temperature adjuster.

5. Mode description.

Driver provides two modes of operation: Quasi Continuous Wave (quasi steady-state) mode and Pulse mode.

5.1. Quasi continuous wave mode – the oscillating mode of symmetrical unipolar meander (fig.2.). Such mode provides maximum average optical power from the LED. Led current in this mode can be changed in the range from 20 to 250 mA using the current adjuster (3). Using the button 8 one of four frequencies (512 Hz, 2 kHz, 8 kHz and 16 kHz) can be selected. The pulse duration will be respectively equal 250 μs, 100 μs, 62 μs и 31 μs.
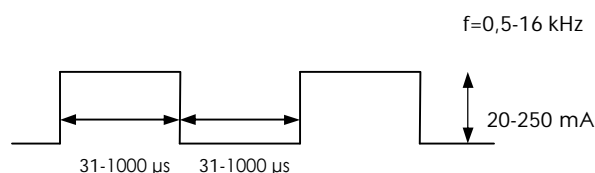

f=0,5-16 kHz

20-250 mA

31-1000 μs   31-1000 μs

Fig.2. Current-time relation in case of continuous wave mode.

5.2. Pulse mode – the oscillating mode of pulse sequence (fig.3). Such mode provides maximum peak optical power from the LED. Similarly to the quasi continuous wave mode, by adjusting the regulator 3 the LED current can be changed, but in the wider range: from 0,1 to 2,0 A. Using the button 8 one of four frequencies (512 Hz, 2 kHz, 8 kHz and 16 kHz) can be selected. Pulse duration can be also selected in the range from 0.6 to 20 μs.
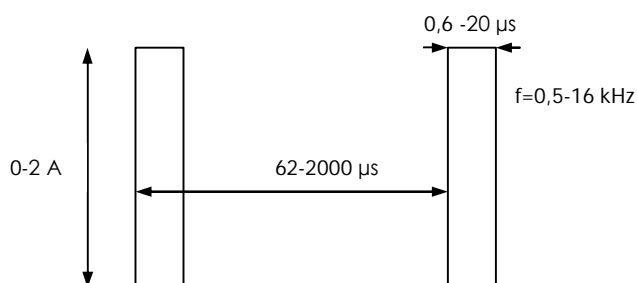

0,6 -20 μs

f=0,5-16 kHz

0-2 A   62-2000 μs

Fig.2. Current-time relation in case of pulse mode.

Note! Please, don't use the combination of frequency and pulse duration that gives a duty cycle more than 10 percents (table 1).

Note! We recommend to use the pulse current amount to 2 A only at pulse duration less than 1 µs. Otherwise used LED can be broken.

		Frequency			
		512 Hz	2 kHz	8 kHz	16 kHz
Pulse duration, µs	0,6				
	0,8				
	1				
	1,2				
	2				
	4				
	8				
	10				
	15				
	20				

Table 1. Permissible and **impermissible** combinations of frequency and pulse duration in pulse mode.

6. Operating instruction.

1. Please take a LED with a cooler (termocooler). Carefully combine its many-colored wires with pins of connector "LED" (1) tightly till fixation (fig.4).

Note! Marked with the red point pin of connector "LED" must be connected with the appropriate red wire of the LED (fig.4). In the case of wrong junction the LED can be damaged.
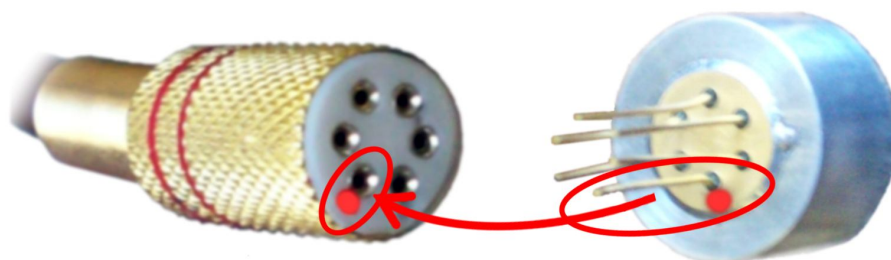

Fig.4. Observance of polarity during the connection between the LED and the LED connector (1).

2. If necessary with the help of cable for synchronization connect the signal detector with the driver DLT-37M (jack "SYNCRO" (10)).
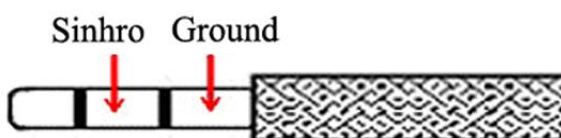

Fig.5. The polarity of jackplug of cable for synchronization.

3. Insert the jackplug of cable of AC/DC adapter into connector "+12V DC" (14).
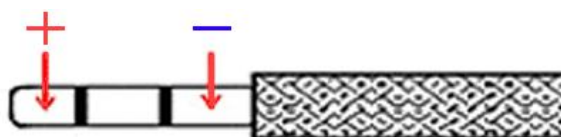

Fig.6. The polarity of jackplug of power cable.

4. Using the button "Operation mode" (13) select the operating mode of the driver: QCW or pulse. The appropriate green LED indicator "Pulse" (7) or "QCW" (6) will be turned on.
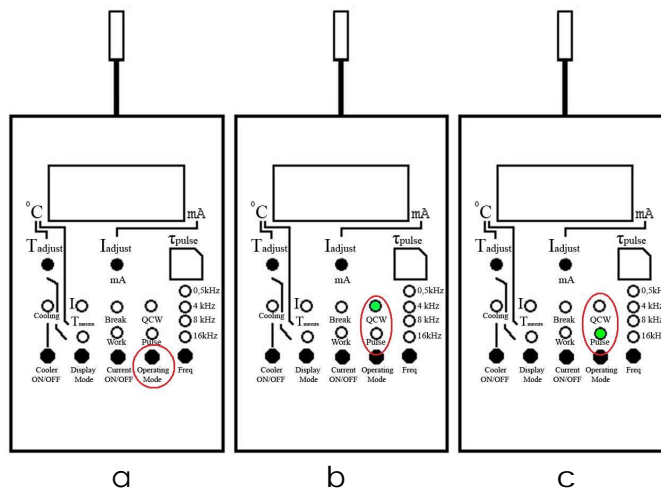
Fig.7. a – the button of mode selection,
b – QCW mode, c – pulse mode.

5. Using the button "Display mode" (13) select the LED current indication mode. The green LED indicator "$T_{measure}$" (15) will be turned on. On the LC display you will see (2) the real (measured) temperature of the LED's chip.

6. Set the adjuster "T_{adjust}" (19) to the extreme left position which corresponds to the maximum value of LED temperature.

7. Switch on the LED cooling by depresses the button "Cooler ON/OFF". The green LED indicator "Cooling" (17) will be turned on. After that, slowly rotate the adjuster "T_{adjust}" (19) clockwise until the real temperature of the LED's chip will be correspond to the requisite value of it.
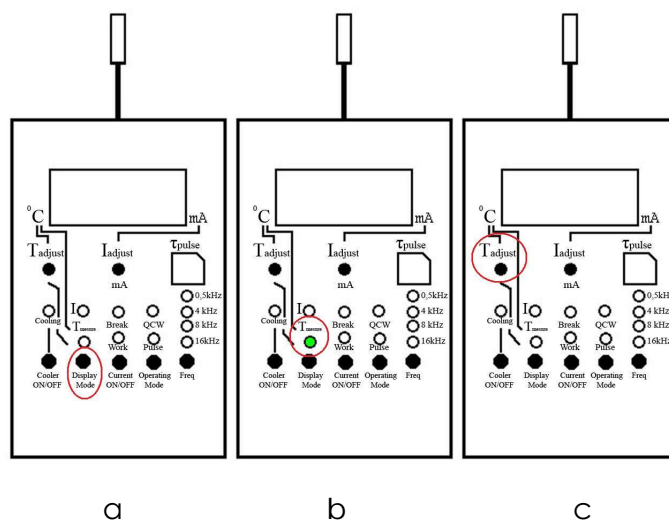

Fig.8. a – the button of display mode selection,
b – the mode of current LED temperature indication,
c – the LED temperature adjuster.

8. Set the adjuster "I_{adjust}" (3) to the extreme left position which corresponding the minimum value of LED current. Using the button "Display mode" (13) select the LED current display mode. The green LED indicator "I" (18) will be turned on. On the LC display (2) you will see the measured current of the LED (approximately zero).
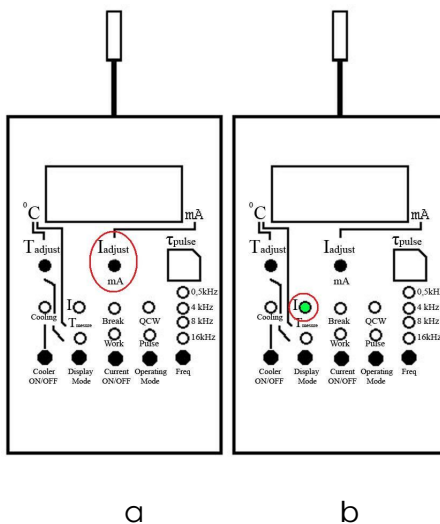

Fig.9. a - the LED current adjuster, b – the mode of LED current indication.

9. Using the button "Freq" (8) select one of four values of frequency. In the case of working in the pulse mode select the requisite value of pulse duration by adjusting the switch "τ_{pulse}" (4) and using the table in fig.1 (page 5).
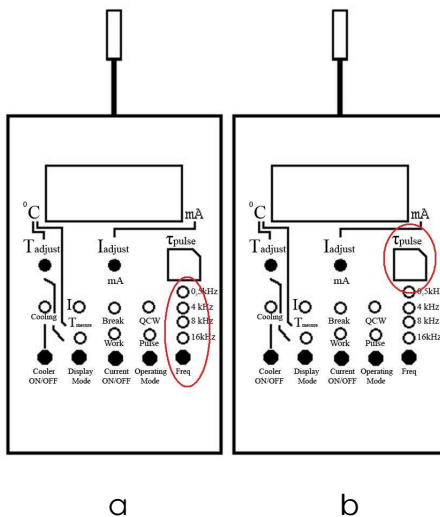

Fig.10. a – the button of frequency selection and the indicators of selected frequency, b – the multiposition switch for adjusting the pulse duration.

10. Switch on the LED current by depress the button "Current ON/OFF" (12). The green LED indicator "Work" (11) will be turned on. In the event that the red LED indicator "Break" (5) go on working that will be mean the failure of LED current (That is the LED is damaged).

After that, slowly rotate clockwise the adjuster "I$_{adjust}$" (3) until the measured real current of the LED will be correspond to the requisite value of it.
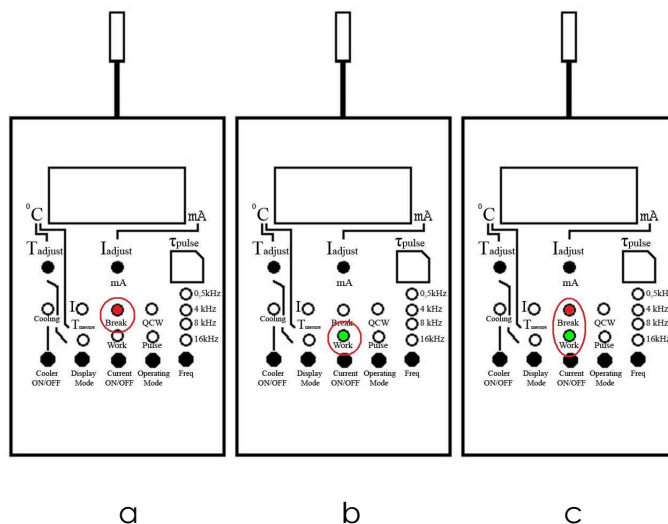

Fig.11. a – the LED current is off, b – the Led current is on,
c – the LED current is on, but the LED circuit is broken .

11. Please, ascertain that the running LED current complies with the LED specification.

7. Technical characteristics.

Input voltage	+12 V, stabilized
Voltage tolerance	-5..+5 %
Power consumption	Less then 4 W
Adjustment temperature range	-10 °C..+25 °C
Board dimensions	145?70?30 mm
Weight	200 g

	QCW mode	Pulsed mode
Pulse duration	31 – 1000 μs	0,6 – 20 μs
Repetition rate (Frequency)	0,5 – 16 kHz	0,5 – 16 kHz
Output current amplitude	20 – 250 mA	0,1- 2,0 A

8. Block diagram

The driver block diagramme (pulse power supply) DLT-37M is presented in fig.12.

The pulse power supply of light-emitting diodes functionally consists of generator G, single-shot multivibrator M, multiplexer MX1, voltage-to-current converterv U/I, multiplexer MX2, analog-to-digital converter ADC, liquid crystal display LCD, the pulse power supply converter of Peltier element DRVP, the pulse power supply converter DC/DC.

The generator G forms the pulse sequence with variable repetition rate. The repetition rate can be changed with the help of the button "Frequency". It's indicated by light-emitting diodes "2 kHz", "4 kHz", "8 kHz", "16kHz". The waiting multivibrator M and the multiplexer MX1 receive the voltage impulses in the form of a meander from the generator G .

The single-shot multivibrator M generates voltage impulses with the adjustable fixed duration synchronously with rise-up portion of input voltage impulses. Switching of duration of impulses is carried out by means of the switch SW1 in the range from 0,6 to 20 µc.

The multiplexer MX1 by means of the button "Operating mode" switch the clock pulses on the input of voltage-to-current converter U/I. In addition, clock pulses come to the jack "Synchro" for synchronisation with the external photoreception amplifier.

The IR-light-emitting diode LED recive a pulse current from U/I converter. Start-up of circuit U/I is carried out by means of the button "Curent ON/OFF". The green light-emitting diode "Work" lights up in that case . If the circuit of the LED is broken the light-emitting diode "Break" lights up. Adjustment of the amplitude of the LED pulse current is implemented by means of a potentiometer "I_{adjust}".

The circuit executed on DRVP, A2, A3 is used for stabilisation and adjustment of LED temperature. Stabilisation and temperature adjustment is carried out by means of Pelte element P. The temperature sensor is based on the thermoresistor RT. After amplification by A2 the signal from the temperature sensor supplies on the first input of the error amplifier A3. The reference voltage from potentiometer "T_{adjust}" supplies on the second input of A2. The converter DRVP generates the voltage on the Peltier element which changes the temperature of the LED and supports its at the level set by the potentiometer "T_{adjust}". The DRVP begin working after pressing the button "Cooler ON / OFF". Then cooling is working the light-emitting diode "Cooling" is shining . Integrated temperature controller allows to maintain the temperature of LED in the range from -10 ° C to +25 ° C.

Voltage proportional to the current amplitude through the LED amplifier A1 feed to the first input of multiplexer MX2. The other input of MX2 is supplied with the voltage proportional to the LED temperature. Voltage from the output of MX2 feed to the analog-digital converter ADC and then to liquid-crystal indicator

LCD DISPLAY. The display mode can be selected with the help of button "Display mode"

The DC / DC circuit is a pulse voltage converter from + 12 V in + 5 V, -5 V for power supply of all the elements of the DLT-37M. The input voltage of DC / DC converter supplies from "+12 VDC" jack.
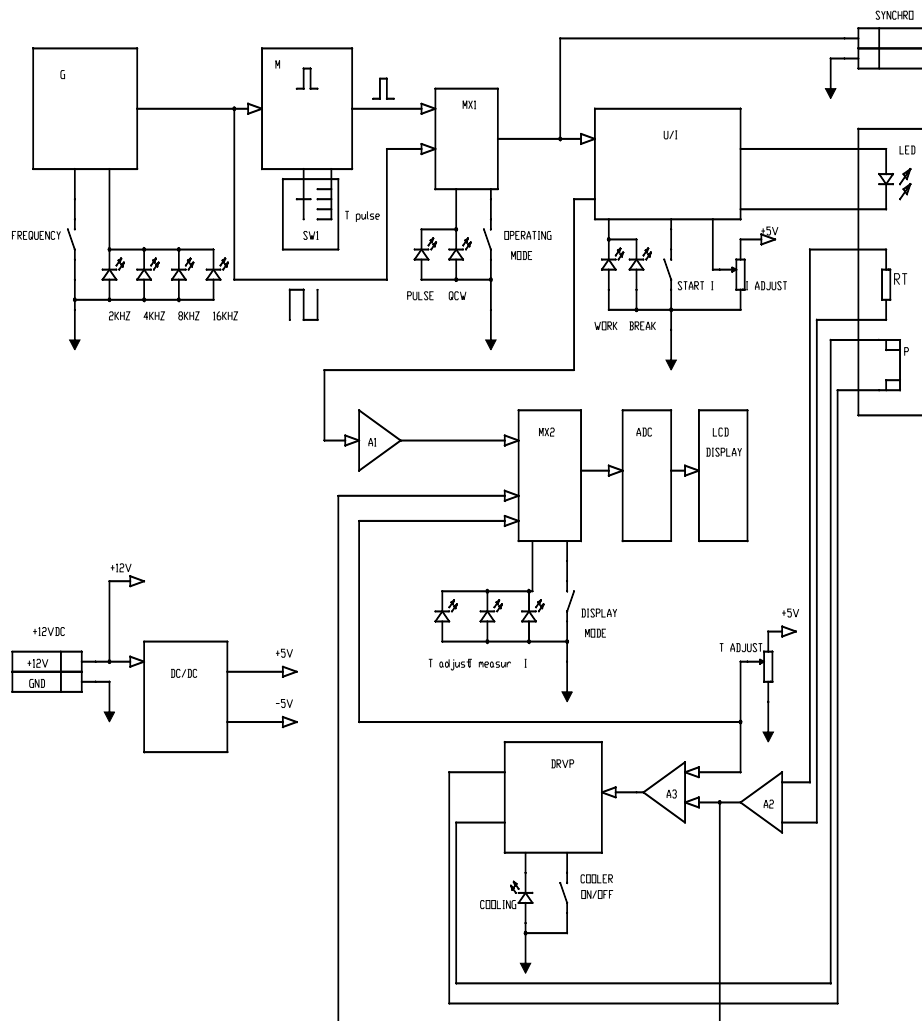

Fig.12. The Block diagram of DLT-37M.