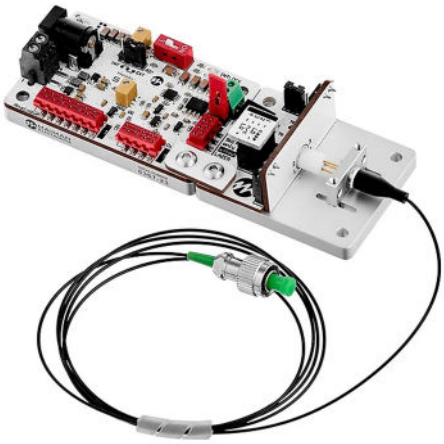


LASER LAB SOURCE
a division of Research Lab Source Inc.

LaserDiodeSource.com | LaserLabSource.com | LaserDiodeControl.com

800.887.5065
contact@LaserLabSource.com

SF8025-TO56B
SF8075-TO56B
SF8150-TO56B
SF8300-TO56B

Laser Diode Driver

Datasheet & User Manual

Before powering on your driver, read this manual thoroughly.
If you have any doubt or suggestion, please do not hesitate to contact us!

Maiman Electronics
e-mail: info@maimanelectronics.com
web site: www.maimanelectronics.com

v1.5.0 – 2024

Table of content

1. Laser diode driver features

- **Constant current mode**
- **Low current ripple ≤ 10uA**
- **Current stability 0.1%**
- **No need to adjust voltage**
- **Soft-start**
- **Adjustable current limit**
- **Reverse current protection**
- **Crowbar circuit protection**
- **Own software**

2. Applications

- **Supplying laser diodes**

3. Controls

- **Potentiometers on the board**
- **External input**
- **Digital control by RS-232/UART/USB[1]/ RS-485**

4. Description

SF8xxx-TO56B laser diode driver is a non isolated low drop out (LDO) regulator with constant current output. Driver produces high stability and low ripple current.

SF8xxx-TO56B can be controlled by analogue or digital signals and switches on the board.

SF8xxx-TO56B is housed in 58 × 37 mm package with aluminum base plate to aid thermal dissipation. Device can be mounted on any thermal conductive surface enough to dissipate driver losses.

5. Package set

- Driver – 1 pcs
- 50 cm ribbon cable with one 6-pin connector – 1 pcs
- 50 cm ribbon cable with one 8-pin connector – 1 pcs
- 50 cm ribbon cable with one 14-pin connector – 1 pcs
- LD pinout type switch board – 3 pcs
- Diode fixing set – 1 pcs
- Datasheet & User Manual – 1 pcs
- USB-UART converter – 1 pcs

6. Overall dimensions and weight

The driver has overall dimensions of 103.4 x 36.8 x 20.9 mm and a weight of 61 g.

[1] Option, USB as external adapter

7. Versions

Device	LDD MAX current, mA
SF8025-TO56B	250
SF8075-TO56B	750
SF8150-TO56B	1500
SF8300-TO56B	3000

8. Absolute maximum ratings

	MIN	MAX	UNIT
Vin+ to Vin-	-0.3	5.5	V
Operating temperature	-40	50	°C
Analogue control pins to GND	-0.3	5.5	V
RS-232 RXD to GND	-25	25	V
RS-232 TXD to GND	-13.2	13.2	V
UART RXD to GND	-0.3	5.5	V
UART TXD to GND	-0.3	5.5	V

Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

9. Recommended operating conditions

	MIN	MAX	UNIT
Input voltage (V_{in})	4.8	5.2	V
Operating temperature	-10	40	°C
Analogue control pins to GND	0	5	V
RS-232 RXD to GND	-12	12	V
RS-232 TXD to GND	-12	12	V
UART RXD to GND	0	5	V
UART TXD to GND	0	5	V

10. Power supply requirements

The driver requires a 5V DC power supply. The power supply must be able to cover the driver output power and losses. The power supply must provide 25W or more and line regulation ± 1%. Recommended power supply: Mean Well RS-35-5.

The driver has two power supply terminals: P1J DC power jack (2 on fig. 9) with 2.1 mm inside contact (power input), 5.5 mm outside contact (GND); and pressure clamp with maximum wire cross-section 0.75 mm2 (3 on fig. 9). These connectors are duplicates; you can use one that is more convenient.

11. Electrical characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OUTPUT LDD					
Output voltage		0.5		4	V
Output current	**SF8025**	0		250	mA
	SF8075	0		750	
	SF8150	0		1500	
	SF8300	0		3000	
Current ripple			10	15	uA
Pulse rate	Set by RS-232 or UART	0.1		100	Hz
Pulse duration	Set by RS-232 or UART	1		5000	ms
Rise time (Soft-start time)	**SF8025**	0.3	0.7	0.9	ms
	SF8075	0.5	0.8	1.0	
	SF8150	0.7	1.0	1.5	
	SF8300	1.0	1.1	1.3	
Fall-time (Stop time)	**SF8025**	1.4	1.5	1.7	ms
	SF8075	0.6	0.7	1.2	
	SF8150	0.4	0.5	0.6	
	SF8300	0.3	0.4	0.4	
Error-triggered fall-time (Stop time)	**SF8025**	1.4	1.5	1.7	ms
	SF8075	0.6	0.8	1.1	
	SF8150	0.4	0.5	0.6	
	SF8300	0.4	0.5	0.6	
CONTROLS					
Enable pins low threshold				1	V
Enable pins high threshold		2.3			V
Interlock pin threshold				1	V
Interlock pin pull-up resistance			10		kΩ
LDD current set pin voltage vs. output current	**SF8025**		100		mA/V
	SF8075		300		
	SF8150		600		
	SF8300		1200		
LDD current set step	Set by RS-232 or UART		0.5		mA
LDD current set accuracy			1		%
LDD current set calibration		-5		+5	%
AUX SUPPLY					
2.5V accuracy			0.2		%
2.5V output current				10	mA
INTERNAL MEASURMENTS					
Internal measurements accuracy			2		%
LDD current monitor pin voltage vs. output current	**SF8025**		100		mA/V
	SF8075		300		
	SF8150		600		
	SF8300		1200		
External sensor temperature	NTC 10k	-10		150	°C
INPUT					
Vin quiescent current		70	100	200	mA
Operating current				7	A

12. Typical Performance Characteristics

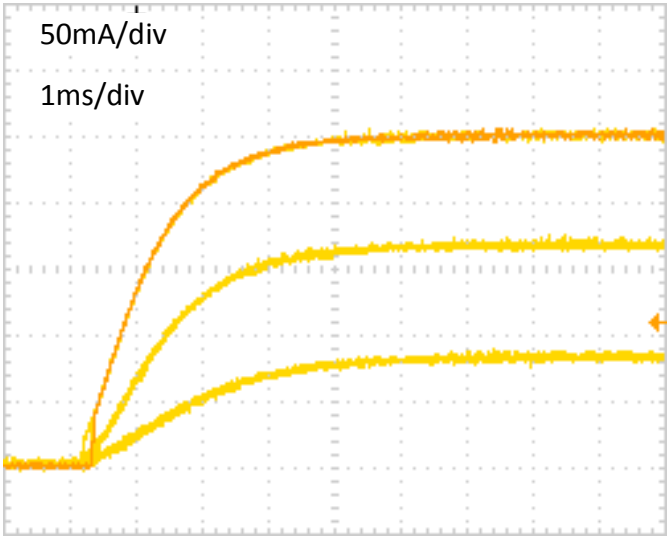


Fig. 1 – Typical start up sequence SF8025

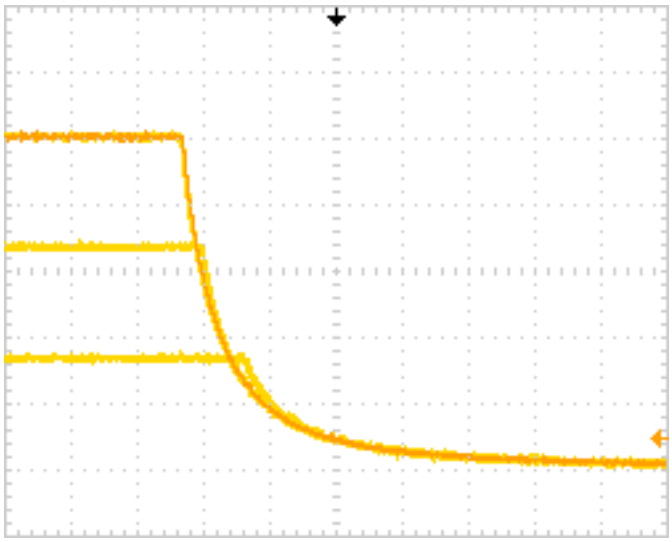


Fig. 2 – Typical stop sequence SF8025

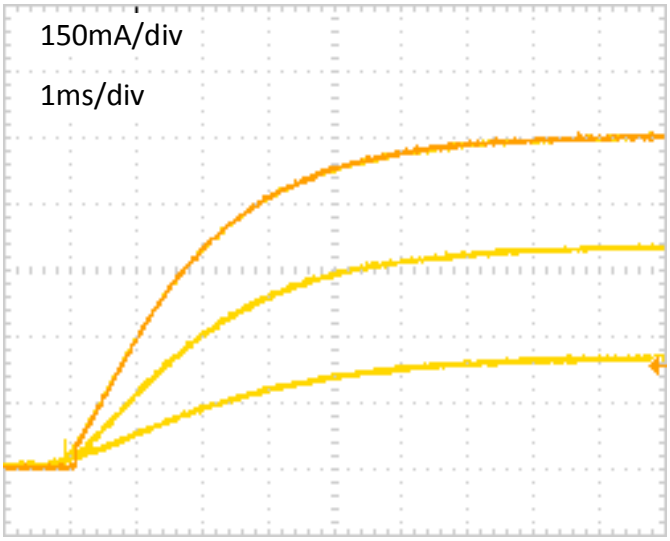


Fig. 3 – Typical start up sequence SF8075

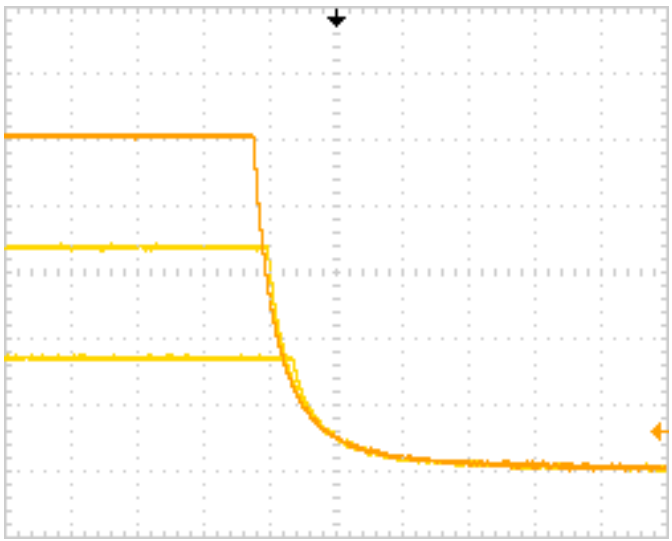


Fig. 4 – Typical stop sequence SF8075

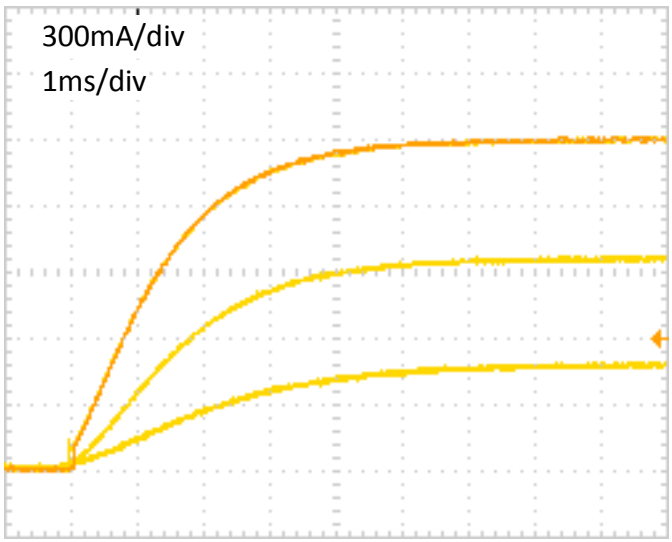


Fig. 5 – Typical start up sequence SF8150

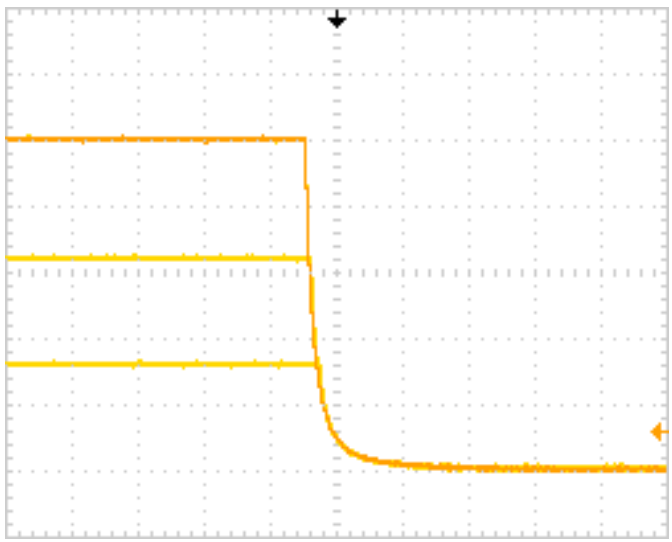


Fig. 6 – Typical stop sequence SF8150

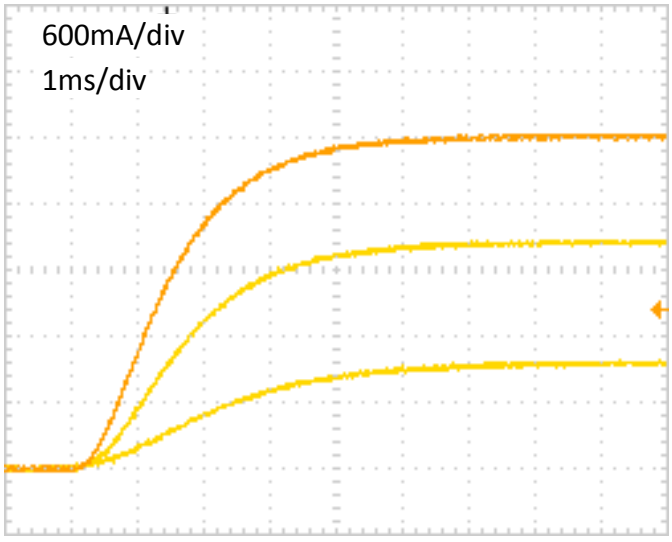


Fig. 7 – Typical start up sequence SF8300

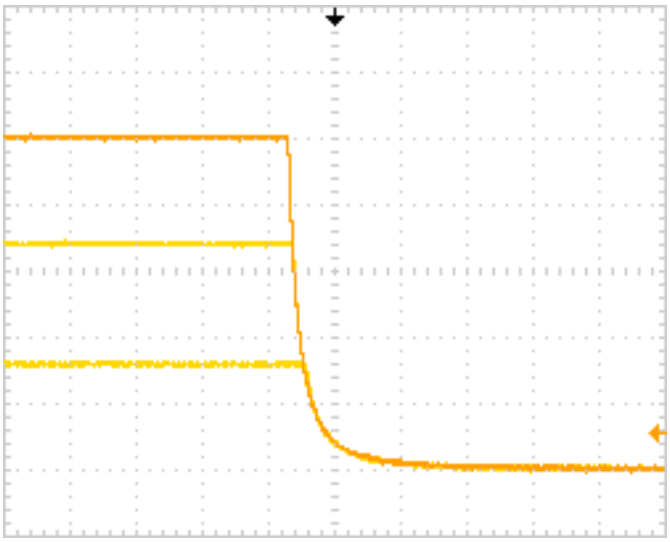
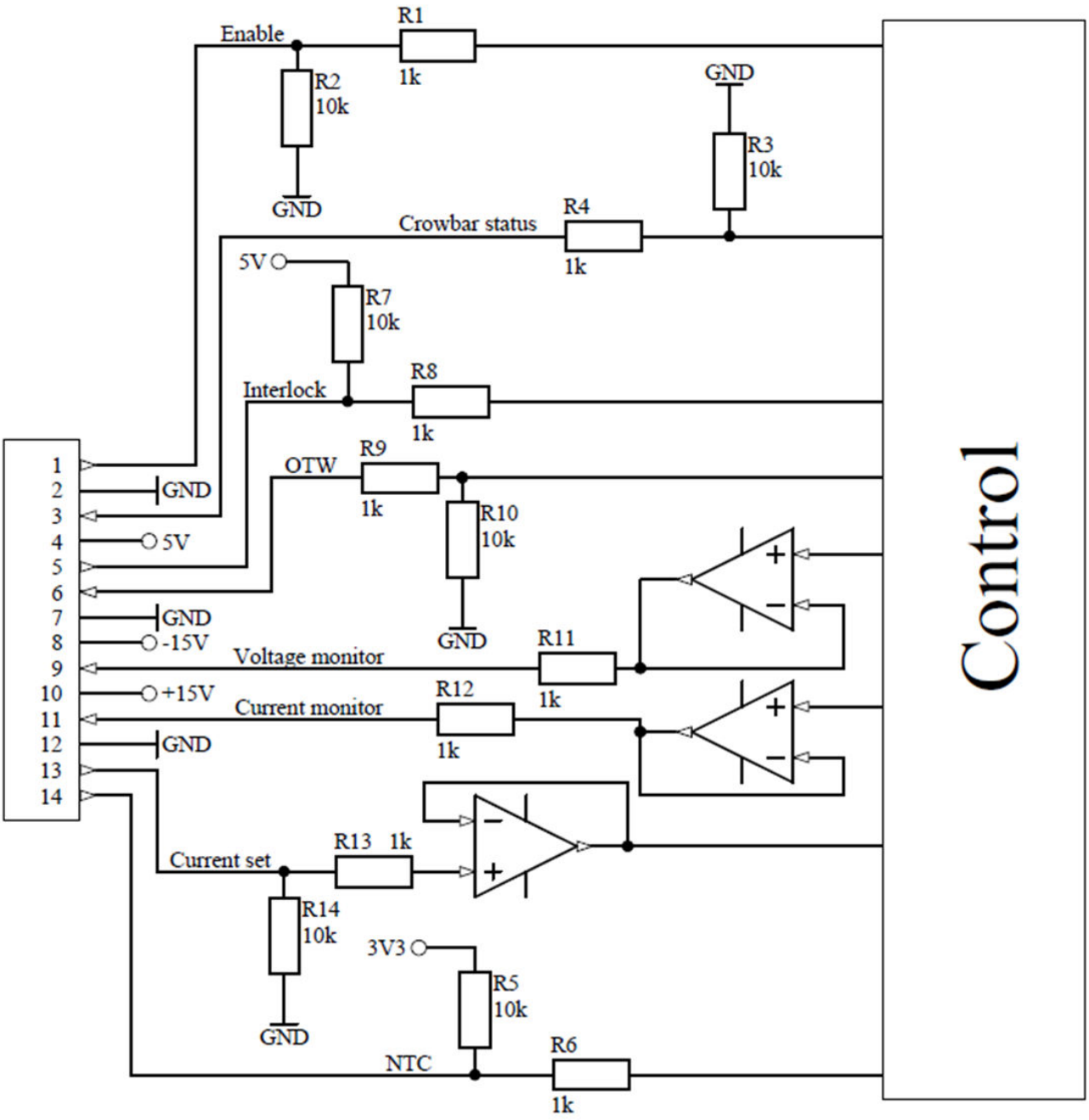


Fig. 8 – Typical stop sequence SF8300

13. Functional scheme

Analogue interface



14. Pin and terminal functions

Please, note polarity!

Never ground any lead of the output, this may cause permanent damage to the laser diode and the driver!

Never use any grounded probes (e.g. from the oscilloscope) at the output!

Control pins are not isolated!

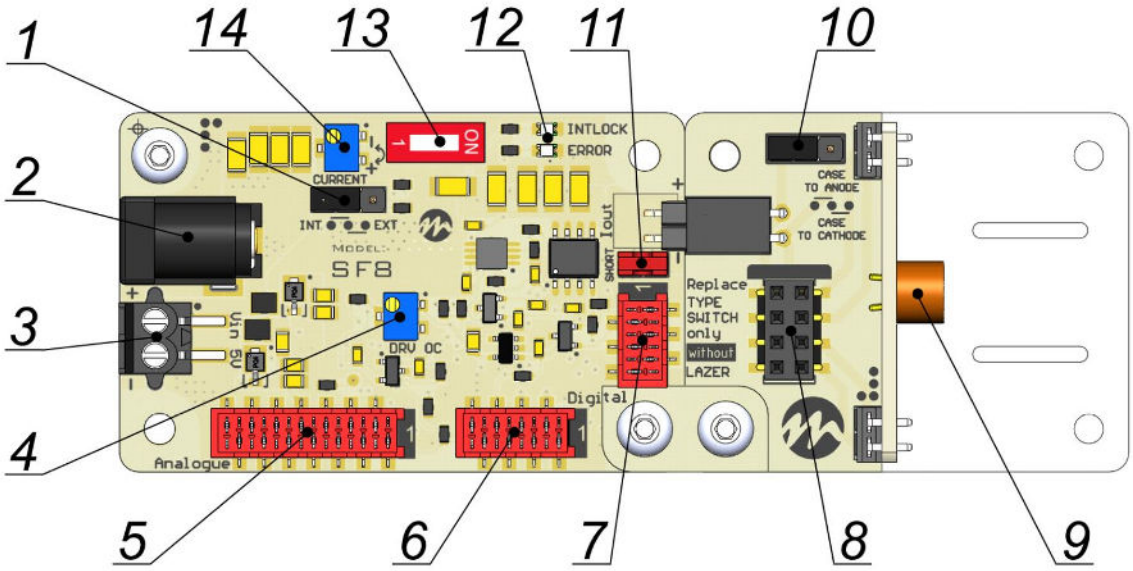
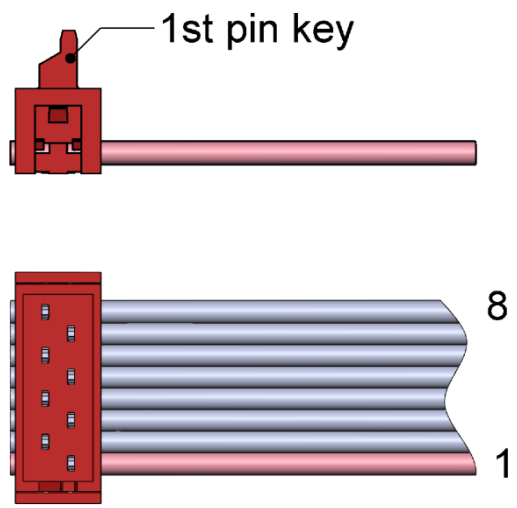


Fig. 9 – Controls

№	Description
1	Current control selector. Close 2-3 to use analog control connector (EXT), 1-2 to use potentiometer (INT).
2	P1J DC power jack for connecting the 5V power supply (see paragraph 10).
3	Pressure clamp for connecting the 5V power supply (see paragraph 10). Please, note polarity!
4	Current limit adjustment potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise - reduces. Adjustment from zero to maximum occurs in 12 turns.
5	Analogue control connector
6	UART, RS-232 digital control connector
7	RS-485 digital control connector
8	LD pinout type switch board connector
9	LD connector
10	LD case connect selector
11	ESD protection LD short. Remove when the laser module is set up!
12	Laser diode driver overcurrent protection (red) and interlock (yellow) indicators. Lights red when the protection is activated. To reset, the device must be restarted. Lights yellow when the driver is in the locked state (see paragraph 18.1).
13	One-position switch that enables laser diode driver. Switch is duplicated on the analog control connector.
14	Output current of laser diode driver adjustment potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise - reduces. Adjustment from zero to maximum occurs in 12 turns.

UART, RS-232 digital control connector

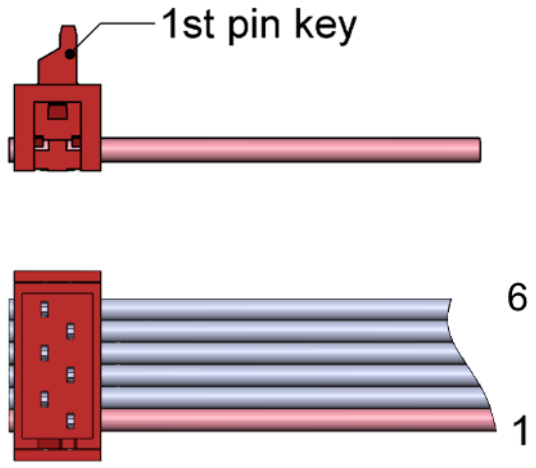
Wurth WR-MM 690157000872 or TE Connectivity 215083-8



Pin	Description
1	UART RXD
2	RS-232 RXD
3	UART TXD
4	RS-232 TXD
5	Connected to Vin+
6	Interlock (duplicates pin 15 of analogue control connector)
7	Crowbar status (duplicates pin 5 of analogue control connector)
8	GND (connected to Vin- terminal)

RS-485 digital control connector

Wurth WR-MM 690157000472 or TE Connectivity 215083-4



Pin	Description
1	RS-485 A
2	RS-485 B
3	GND
4	Do not connect
5	Do not connect
6	GND

Analogue control connector

Wurth WR-MM 6901 5700 20 72 or TE Connectivity 2-215083-0

PIN	I/O	Name	Description
1	I	Laser Driver Enable	HIGH = operates, LOW = stop. Internally pulled down.
2		**GND**	
3	O	Laser Driver Overcurrent	HIGH = fault, LOW = normal operation.
4		+5V	Connected to Vin+.
5	I	Interlock	Open = locked; Low = operates. Internally pulled up.
6	O	Over-temperature warning	High = t° > 60°C; Low = t° < 58°C. Internally pulled down.
7		**GND**	
8		-15V	Auxiliary -15V power supply. Up to 20mA output current capability.
9	O	Voltage monitor	0-2V = 0-4V at the output.
10		+15V	Auxiliary +15V power supply. Up to 20mA output current capability.
11	O	Driver Current Monitor	0-2.5V = 0-MAX current at the output.
12		**GND**	
13	I	Laser Current Set	0-2.5V = 0-MAX current at the output.
14		NTC Interlock	Connect NTC thermistor 10k between this pin and GND.

15. Analogue control description

15.1. Laser Driver Enable

The "Enable" contact is logic inputs.

Apply high level to *«Laser Driver Enable»* pin to initiate soft-start sequence of laser diode driver. Apply low level to *«Laser Driver Enable»* pin to stop the driver.

The enable features are duplicated with on-off switch located on the board (13 in Fig. 9).

15.2. Laser Driver Overcurrent

The *«Laser Driver Overcurrent»* contact is logic output.

The *«Laser Driver Overcurrent»* pin is intended for monitoring the status of the protection circuits. When the current protection is activated, the laser driver stops, the output terminals are shunted, the LED on the board lights up red. The high logic level in the contact indicates the presence of shunting of the output terminals. The current generator cannot be restarted after the protection has tripped. To reset the protection, restart the driver.

15.3. Laser Current Set

The *«Laser Current Set»* pin is an analog input.

The *«Laser Current Set»* is intended for setting the driver output current amplitude. Apply voltage to the *«Laser Current Set»* with respect to GND to control the output current. Signal resolution depends on driver model, maximum amplitude of the signal is 2.5V.

The *«Laser Current Set»* pin can be used for analogue modulation by applying sign, square or ramp signal with the DC component. Please, control the output current while using this feature. In this case, the value of the DC component determines the average current in the load, and the amplitude of the signal determines the modulation amplitude. It is necessary to ensure that the current for analog modulation does not exceed the current protection threshold. Analogue modulation amplitude depends on frequency.

ATTENTION! If you use arbitrary/function generator or lab PS for current set, make sure it is in High Z mode, please, control the current set and current monitor pin voltages while getting started. When you using a generator with an output "50 Ohms", the value on the screen of the device can be less than the actually set 2 times. Be careful, monitor the voltage on the contact *«Laser Current Set»* with an oscilloscope.

15.4. Driver current monitor

The output current of the driver can be monitored by current monitor.

15.5. NTC Interlock (External thermistor connection)

This allows to measure the temperature of a laser diode or other devices. The measurement result is readable by the digital interface. You can set upper and lower limits of the temperature using the digital interface (with command or software). If the temperature goes beyond the limits, the driver operation is blocked. When the temperature returns to the specified range, the driver operation resumes. After setting, limits will be saved in device memory and will work when used both digital and analogue control.

16. Current setting variants

Parameter can be set in three ways: using potentiometer, analog control connector or digital commands.

Signal source	Digital state	Board jumper state
Potentiometer	External (default at power up)	INT
Analog control connector	External (default at power up)	EXT
Digital	Internal	INT or EXT

17. How to get started

Unpack the device. The new device is configured with the following values:

Parameter	**Value**
Laser diode driver current set (potentiometer CURRENT)	0mA
Laser diode driver current control (switch CURRENT)	INT
Laser diode driver current protection threshold (potentiometer DRV OC)	2/5 of max current
Laser diode case connection (switch position)	CASE TO ANODE

Connect the LD pinout type switch board (see paragraph 17.1).

For the first time we recommended to connect a dummy load. You can use any diodes that are suitable for the current you want to operate. Dummy load should be connected as load to the corresponding pins of the LD connector.

Connect the controls (analogue and/or digital).

Connect the power supply (note polarity).

17.1. LD pinout type switch

It is possible to connect to the device laser diodes with different pinouts. Each pinout requires its own special board that connects to the LD pinout type switch board connector (8 in fig. 9).

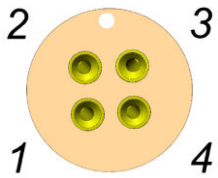
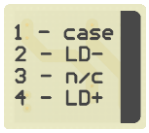
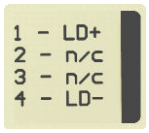
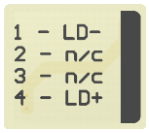


Fig. 10 – LD connector pinout

There are three pinout options:

№	Switch board type	Pinout
1		1-st pin connected to the LD case; 2-nd pin connected to the LD cathode; 3-rd pin not connected; 4-th pin connected to LD anode.
2		1-st pin connected to the LD anode; 2-nd pin not connected; 3-rd pin not connected; 4-th pin connected to the LD cathode.
3		1-st pin connected to the LD cathode; 2-nd pin not connected; 3-rd pin not connected; 4-th pin connected to LD anode.

17.2. Interlock

The driver has interlock. This is pin 5 of the analog control connector. If you left this pin open the driver is in the locked state. This pin must be connected to any GND pin for normal operation.

The driver can only be turned on with shorted Interlock.

You can also connect something like an emergency button to this pin.

By default at power up the driver is in the "allow interlock" state. Via USB you can set the driver to the "deny interlock" state. At this case the driver will ignore interlock state and can operate with opened pin 5.

17.3. NTC Interlock

The driver can only be turned on with installed LD. When driver is turned on without the installed LD, the operation and measure values will be incorrect!

17.4. Change the current protection threshold of the driver

The current protection threshold level sets with DRV OC potentiometer. The set level can be seen in the software or requested by a digital command. Set the current protection threshold to the required level before turn on the laser diode current.

If it is necessary, the current protection threshold can be changed using analog controls. Make sure that the jumper DRIVER SHORT is installed. CURRENT control selector must be in the INT position to use the CURRENT potentiometer.

Connect the measuring instrument to the «Driver Current Monitor» pin.

If it is necessary to increase the limitation level, turn the potentiometer DRV OC clockwise for a few turns.

Turn on the driver. Set the current equal to the desired current protection threshold with the potentiometer CURRENT. Then slowly turn the potentiometer DRV OC counterclockwise until the protection is activated. Restart the driver to reset an error. Make sure that the protection is triggered at the correct current level.

You can also set the current level by analogue or digital signals.

Set current to zero, turn off the driver.

17.5. How to control by digital signals

Use the 8 pin digital control connector to use UART, RS-232. Use the 6 pin digital control connector to use RS-485. The USB-UART converter can be used (optional) to connect the device to computer.

See paragraphs 20-21.

17.6. How to control by analogue signals

CURRENT control selector must be in the EXT position.

Use the analogue control connector.

If you connect pins 1 to pin 4 (5V) before power up the device, the driver will turn on.

See paragraph 15.

17.7. How to control by board switches

CURRENT control selector must be in the INT position.

Use one-position switch to start/stop laser diode driver. If you set onboard switch to ON before power up the device, the driver will turn on.

Turn CURRENT potentiometer (1 in Fig. 9) clockwise to increases the value of driver output current amplitude, counterclockwise – to reduce.

18. Cooling

The board does not require active cooling. Aluminum mount is designed to remove heat.

19. Internal protections

The device provides several security features to ensure the safety of the laser module.

The jumper shunts the outputs of driver, to protect the laser diode from static discharges while installing.

Before connecting the laser diode, make sure there is a jumper! Remove the jumper before turning on the driver.

Reverse diode protects the laser diode from reverse current and reverse voltage.

In case of an over-current condition, the control logic disables the driver and the output shorts with 2 mOhm shunt. Setting the current protection threshold is described in paragraph 18. The current protection threshold must be less than the laser module absolute maximum ratings.

20. Software

We offer own software to control driver. You can find it on maimanelectronics.com in the downloads section of the product page. Or contact us at info@maimanelectronics.com.

21. Digital control description

. When the input voltage applied, the TEC is always in "analogue parameters set, external enable and allowing interlock" state. Any other state should be set any time after powering the TEC if needed.

21.1. UART, RS-232 protocol description

Default serial port settings:

Baud rate	Data bits	Stop bits	Parity	Flow control
115200	8	1	none	none

Data exchange between the device and the PC is only initiated by the PC. **All commands are sent in plain text format. All commands in text-plain mode should be in ASCII.** All commands are sent with prefix. Number of command follows the prefix without any symbols. If there is the value after the command they separates with "space" symbol. The command ends with "carriage return" symbol.

The format of the command to set the value (P-type):

Number of byte	Value	Comment
1	P (50h)	Set prefix
2-5	Number of the parameter	Hex-number of the parameter. For example, 0100h
6	‘space’ symbol (20h)	
7-10	New value of the parameter	Hex-value of the parameter. For example, 0000h
11	‘return carriage’ symbol<CR> (0Dh)	End of the command

The device does not respond to P-type commands by default (see section "the protocol extension").

You can request the value of parameter by the J-type command. The device will return a value of requested parameter.

The format of the command to get the value (J-type):

Number of byte	Value	Comment
1	J (4Ah)	Request prefix
2-5	Number of the parameter	Hex-number of the parameter. For example, 0100h
6	‘return carriage’ symbol<CR> (0Dh)	End of the command

The format of the response:

Number of byte	Value	Comment
1	K (4Bh)	Response prefix
2-5	Number of the parameter	Hex-number of the requested parameter
6	‘space’ symbol (20h)	
7-10	Returned value of the parameter	Hex-value of the parameter
11	‘return carriage’ symbol<CR> (0Dh)	End of the command

If the device could not recognize a command, it returns an error message with error code.

The format and codes of errors

Error (returned command)	Reasons (one or few)
E0000	1) Internal buffer of device is overflowed. 2) Cannot find <CR> (0x0D) or\and <LF> (0x0A). 3) Format of command is invalid.
E0001	1) Unknown command (it does not P- or J-type command). 2) The device failed to correctly interpret a command.
E0002	The CRC of received command (see section “Digital control description (extended)”).
K0000 0000	Request or set the parameter that does not exist.

21.2. MODBUS protocol description

Default serial port settings:

Baud rate	Data bits	Stop bits	Parity	Flow control
115200	8	1	none	none

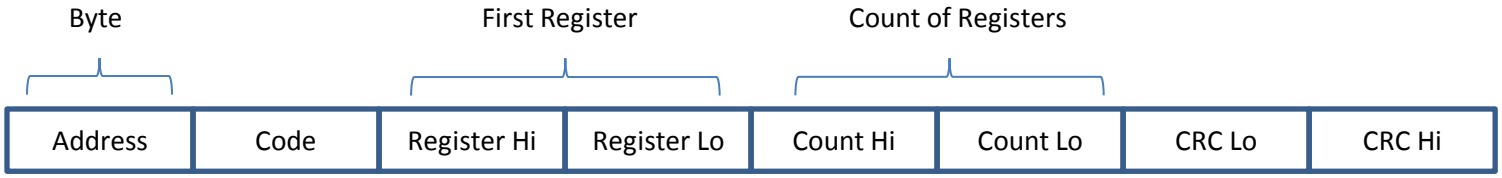
The driver has RS485 interface and can operate via MODBUS protocol. Data exchange between the source and the computer is carried out only at the initiative of the computer. To control the device, the MODBUS RTU protocol is used via the RS-485 communication line, with a maximum number of devices in the network equal to 32. The following commands are supported by the driver:

- 03h - multiple reading of memory registers
- 06h – single write to memory register
- 10h - multiple write to memory registers

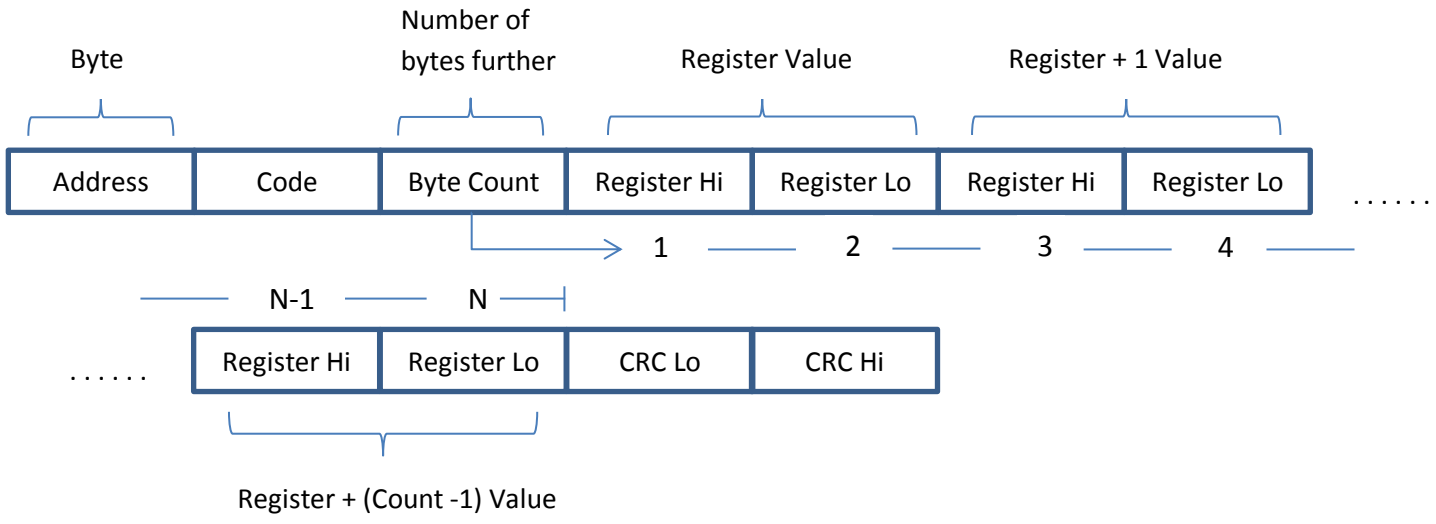
All registers are 16 bits wide. Commands for multiple write/read work only with registers located in a row, if there is no such register when writing/reading, and then the driver will send an error. The read command works as follows: the driver sends the address of the first register, for example 0001h, and the number of requested registers, for example 0008h, thus, the response will receive register values from 1 to 8. With a write, the address of the first register, the number and the values themselves are also transmitted.

Commands format:

Multiple read query (Code = 0x03):

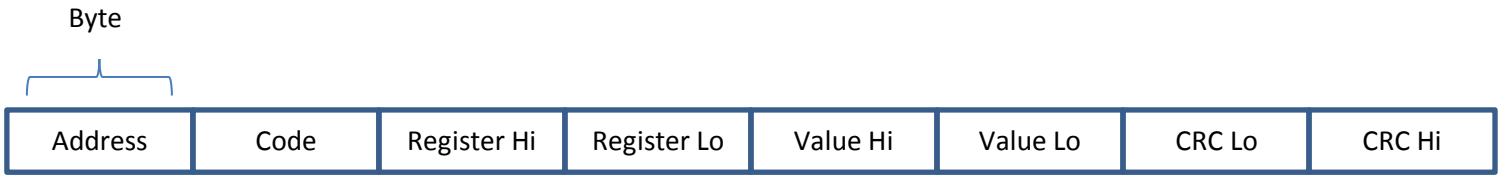


Multiple read answer (Code = 0x03):

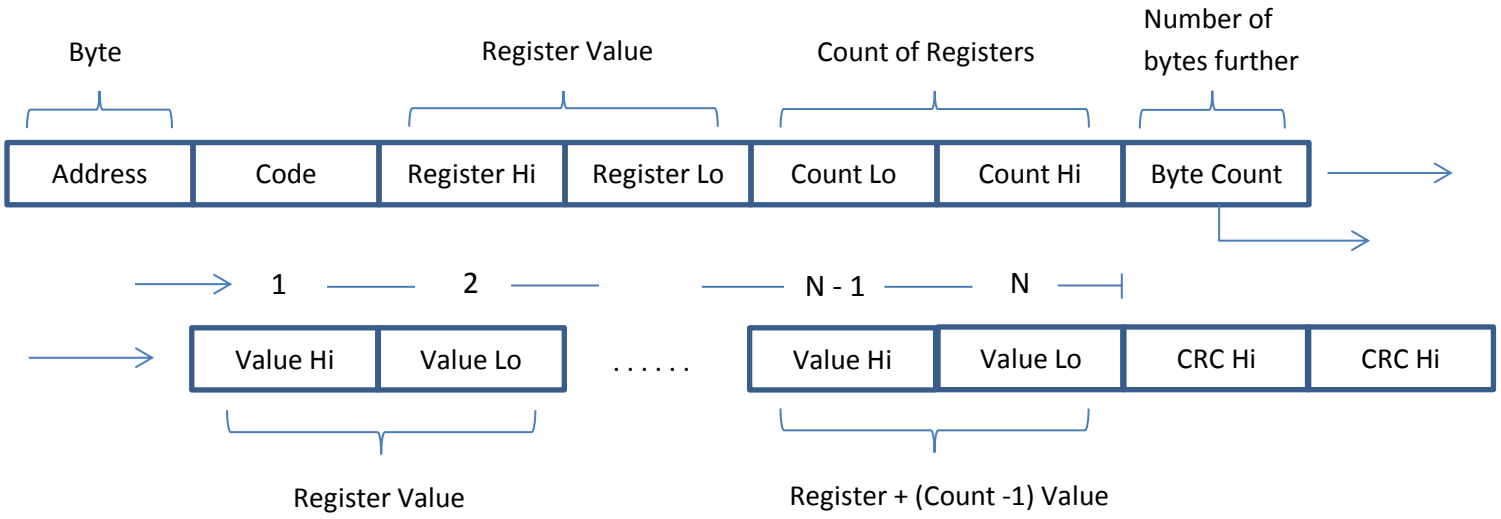


Single write query (Code = 0x06):

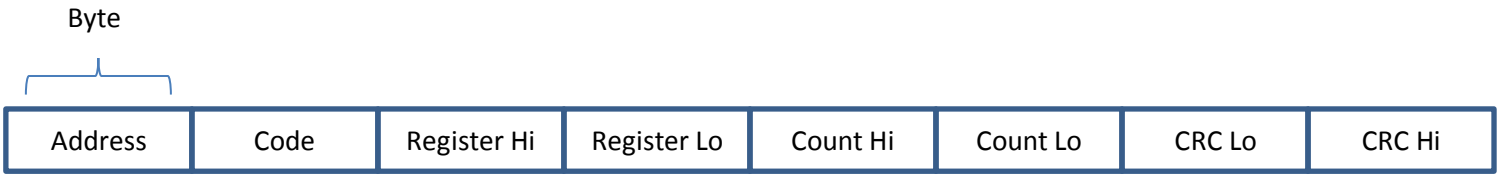
Single write answer (Code = 0x06):



Multiple write query (Code = 0x10):



Multiple write answer (Code = 0x10):



21.3. Available parameters and its description

Action			R/W	HEX-number of parameters	
				UART, RS-232	RS-485
Frequency (0.1 Hz)	Value		R/W	0100	0006
	Minimum		R	0101	0020
	Maximum		R	0102	0021
Duration (0.1 ms)	Value		R/W	0200	0007
	Minimum		R	0201	0022
	Maximum		R	0202	0023
Current (0.1 mA)	Value		R/W	0300	0008
	Minimum		R	0301	0024
	Maximum		R/W	0302	0025
	Maximum limit		R	0306	0029
	Measured value		R	0307	0040
	Current protection threshold		R	0308	002A
Current set calibration (0.01%)[2]	Value		R/W	030E	0088
Voltage (0.1 V)	Measured value		R	0407	0041
State of the device	Start (Enable)	0008h	W	0700	0004
	Stop (Disable)	0010h			
	Internal current set	0020h			
	External current set	0040h			
	External Enable	0200h			
	Internal Enable	0400h			
	Allow Interlock	1000h			
	Deny Interlock	2000h			

[2] Default – 100.00% (2710h), calibration range is from 95.00% (251Ch) to 105.00% (2904h).

State of the device	Deny ext. NTC Interlock	4000h	W	0700	0004
	Allow ext. NTC Interlock	8000h			
State of the device (bit mask)	0 bit	1 – Device is powered on (always = 1)	R	0700	0004
	1st bit	0 – Stopped; 1 – Started			
	2nd bit	Current set: 0 – External; 1 – Internal			
	4th bit	Enable: 0 – External; 1 – Internal			
	6th bit	External NTC Interlock: 0 – Allowed; 1 – Denied			
	7th bit	Interlock: 0 – Allowed; 1 – Denied			
Serial number	Return the hex-value of the serial number		R	0701	0003
MODBUS address[3]	Return the hex-value of the MODBUS address		R/W	0720	1000
Lock status (bit mask)[4]	1st bit	Interlock	R	0800	0005
	3rd bit	LD over current			
	4th bit	LD overheat			
	5th bit	External NTC Interlock			
Save parameters				0900	0009
Reset parameters				0901	000A
External NTC sensor temperature (0.1°C)	Lower limit		R/W	0A05	0026
	Upper limit		R/W	0A06	0027
	Measured value		R	0AE4	0042
	$B_{25/100}$ (1 = 1 K)		R/W	0B0E	008A
PCB temperature (0.1°C)	Measured value		R	0AF4	0043

[3] Default – 0064h.

[4] If temperature of the device reaches the over temperature warning threshold the overheat flag will be set. If the device is in over temperature protection state, then it will be set overheat and over current flags together.

Examples (UART, RS-232)

1) For the current value parameter, 0300:

To request value, send the following command:

"J0300" in text or "4a 30 33 30 30 0d" in hex.

Answer will be:

"4b 30 33 30 30 20 30 42 42 38 0d" in hex, "K0300 0BB8" in text, 0BB8h > 3000 in dec > 300.0 mA.

To set new value, 400 mA (0FA0 in hex) for example, send the following command:

"P0300 0FA0" in text or "50 30 33 30 30 20 30 46 41 30 0d" in hex.

2) For the state of the driver, 0700:

To request value, send the following command:

"J0700" in text or "4a 30 37 30 30 0d" in hex.

Answer will be:

"4b 30 37 30 30 20 30 30 44 35 0d" in hex, "K0700 00D5" in text, 00D5h > 11010101 in bin > Device is powered on, stopped, internal current set, internal enable, denied external NTC Interlock, denied Interlock.

To set new state, for example, allow Interlock, send the following command:

"P0700 1000" in text, "50 30 37 30 30 20 31 30 30 30 0d" in hex.

3) Errors:

If a command with the wrong parameter number was sent, answer will be "K0000 0000" ("4b 30 30 30 30 20 30 30 30 30 0d").

If a command with the wrong format was sent, answer will be an error "E0001" ("45 30 30 30 31 0d").

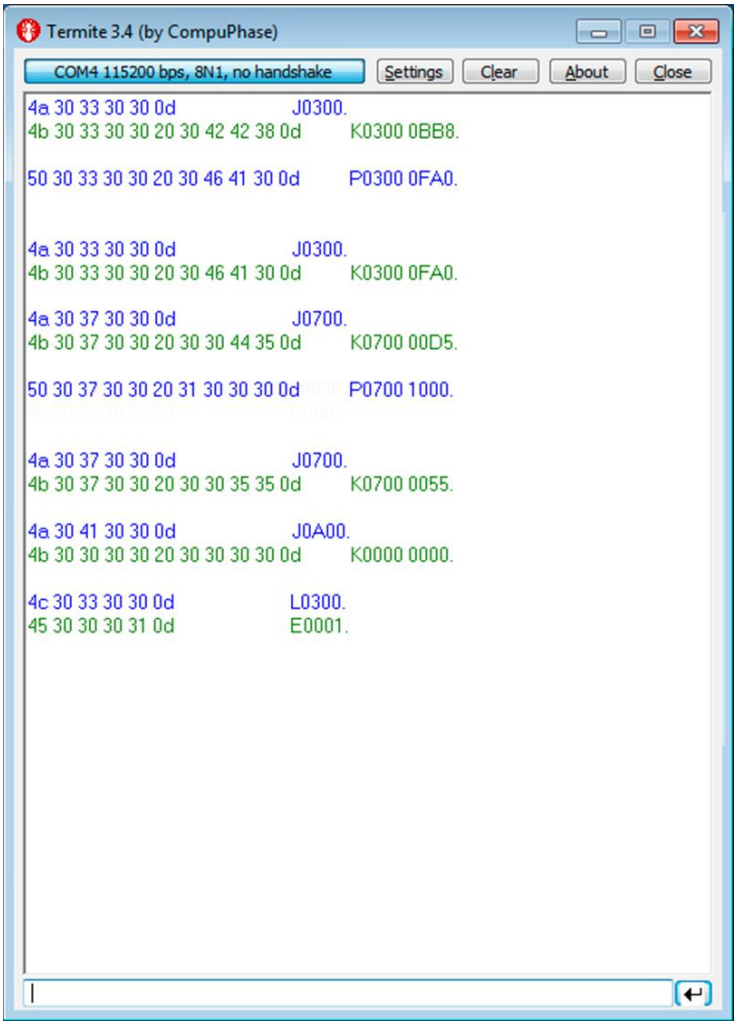


Fig. 10 – Screenshot from the Termite terminal with commands and answers

The maximum duration depends on the set value of the frequency. When you change frequency, a new value of the maximum duration is compute automatically. The duration of pulse cannot be less than 2 ms and more than period of frequency minus 2 ms. For low frequencies the duration cannot be more than 5000 ms.

Set the zero frequency to switch the device into CW mode or set not zero frequency value to switch the device into QCW (long pulses) mode. If you try to set a value more or less than limits, then the value will be rounded to limit. Any attempts to set a new state of the device, except “start”, forcibly switch the device to the state “stop”. Some states of the device are mutually exclusive, for example, if you set “Ext. Enable”, then you will not be able to set the state “start”. If you send “start” and “stop” commands to each other, the device will save all parameters in the internal memory. The saving process lasts about 300 ms. In this time the device does not respond to any actions. The device is able to save the next parameters in the internal memory:

- Frequency with limits;
- Duration with limits;
- Current with limits and calibration;
- Temperature limits and $B_{25/100}$;

Settings of the RS protocol extension (see section «Digital control description (extended)»).

22. Digital control description (extended)

WARNING! *Extended protocol recommend for advanced users only. In addition, it might be use for integration of the device with other devices.*

The description of the UART protocol extension command

Action			**R\W**	**HEX-number of parameters**	
				UART, RS-232	**RS-485**
Information about the extended protocol	0 bit	1 – the device supports this option	R	0704	0080
	1st bit	Checksum (1 – on, 0 – off)			
	2nd bit	Return a new value for P-type commands (1 – on, 0 – off)			
	3-5 bits	Baud - rate 0 – 2400 1 – 9600 2 – 10417 3 – 19200 4 – 57600 5 – 115200 (default) 6 – 230400			
	6th bit	Data exchange mode (1 – binary, 0 –text-plain)			
Configuring of the extended protocol	On checksum (CS)	0002h[6]	W	0704	0080
	Off checksum	0004h[6]			
	Return a new value for P-type commands	0008h[6]			
	Do not return answer for P-type commands	0010h[5]			
	Set new baud-rate(baud)[6]	0100h – 2400 0120h – 9600 0140h – 10417 0160h – 19200 0180h – 57600 01A0h – 115200 01C0h – 230400			
	Binary mode on[7]	0200h			
	Text-plain mode on	0400h			

[5] In binary mode the specified commands are ignored by the device.
[6] Here are binary numbers.
[7] For more information, see section “binary mode”.

The description of the MODBUS protocol extension command

Action			R\W	HEX-number of parameters	
				UART, RS-232	RS-485
Information about the extended protocol	3-5 bits	Baud - rate 0 – 2400 1 – 9600 2 – 10417 3 – 19200 4 – 57600 5 – 115200 (default) 6 – 230400	R	0705	0081
Configuring of the extended protocol	Set new baud-rate(baud)[8]	0100h – 2400 0120h – 9600 0140h – 10417 0160h – 19200 0180h – 57600 01A0h – 115200 01C0h – 230400	W	0705	0081

[8] Here are binary numbers.

Text-plain mode (UART, RS-232)

All commands in text-plain mode should be in ASCII.

WARNING! *If you enable the checksum it will change format of commands. After <CR> symbol you will be write 2 bytes of checksum and last byte will be <LF> (0Ah – "new line" symbol). Checksum is computed for all bytes of command before checksum bytes (including<CR> symbol).*

All answers of the device will also contain a checksum, including K-type and E-type answers. Checksum is computed by CRC-CCITT-8 algorithm. This is the main difference between the format of commands for the extended protocol and standard protocol.

The format of commands for enabled checksum

Number of byte	Value	Comment
1	P,J,K,E	Type of command
2-5	Number of parameter	Hex-number of value
6	'space' symbol (20h)	*(does not use for J and E-type commands)*
7-10	New value of the parameter	Hex-value of parameter *(does not use for J and E-type commands)*
11	'return carriage' symbol<CR> (0Dh)	End of value
12-13	Checksum	CRC checksum of the first 11 bytes *(for J and E-type commands checksum is computed for the first 6 bytes)*, including <CR> symbol.
14	'new line' symbol<LF> (0Ah)	End of command

Possible problems

1. The device waiting for symbol <LF>. If <LF> symbol does not received and buffer is overflowed, then all symbols after overload will be processed as a new command. The device returns an error. In this case, it is recommended to send the <LF> symbol. The device will generate an error and clear the buffer for the next command.
2. All symbols after the <LF> symbol will be processed as a new command.

Binary mode (UART, RS-232)

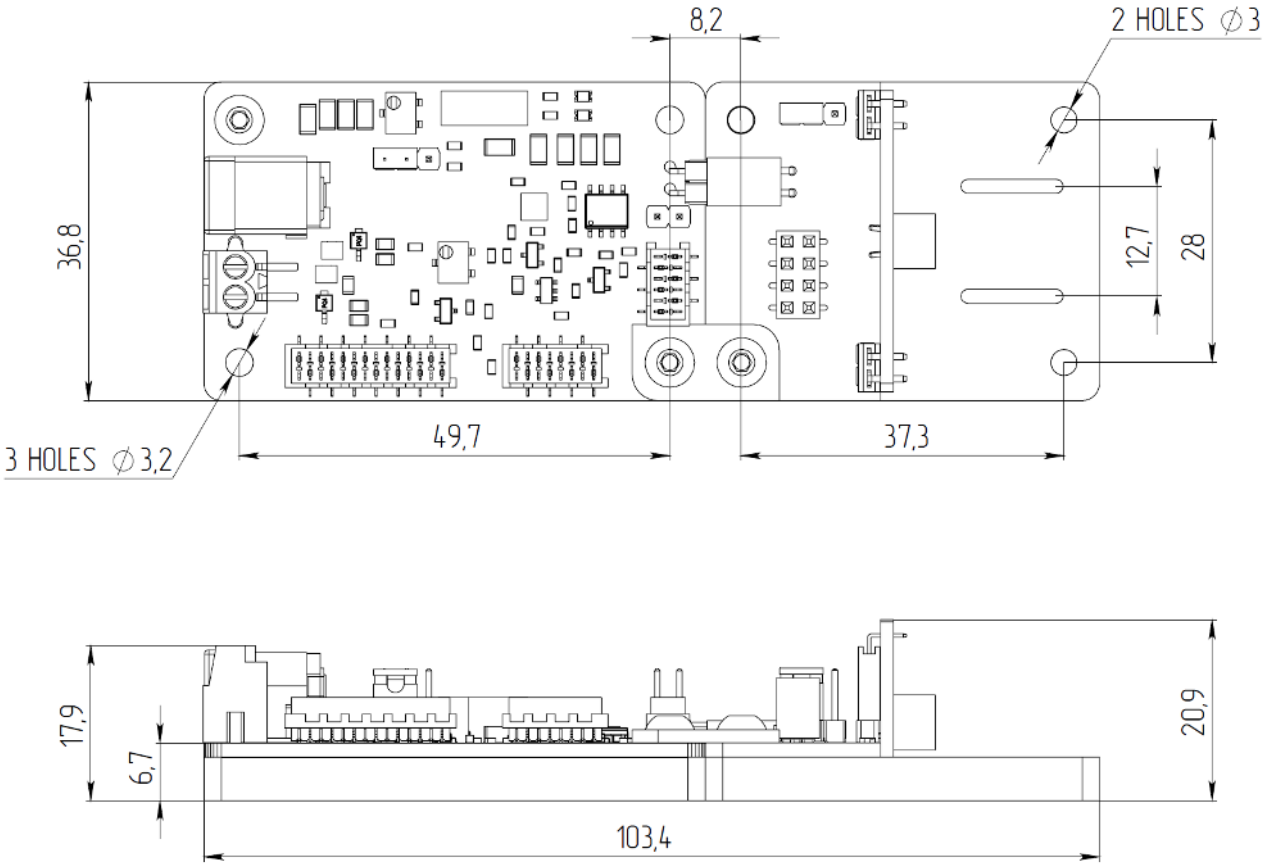
The binary mode has a significant difference. In this mode, data are exchanged in binary form. Length of any type of command is 8 bytes! In this mode, next options are always enable and you cannot disable it: return a new value of parameter for P-type commands and checksum. The format of binary mode commands is represented in table 8.

The format of binary mode commands

Number of byte	Value	Comment
1	Type of command	50h (P - ascii) – Set a new value of parameter 4Ah (J - ascii) – Get a value of parameter 4Bh (K - ascii) – Answer of the device 45h (E - ascii) – Error
2-3	Number of parameter	Hex-number of parameter
4-5	Value of parameter	Hex-value of parameter. This value is **STRICTLY REQUIRED** in the binary mode. If this value does not make sense, it will be returned as 0000 (K or E-type commands) or you should set it field to any value (for P or J-type commands).
6	'return carriage' symbol <CR> (0Dh)	End of value
7	Checksum	CRC checksum of the first 11 bytes *(for J and E-type commands checksum is computed for the first 6 bytes)*, including <CR> symbol.
8	'new line' symbol <LF> (0Ah)	End of command

23. Mechanical dimensions

All dimensions are in millimeters. You can download the 3D-model of the driver on maimanelectronics.com in the downloads section of the product page.



24. Warranty

In compliance with the provisions of Conditions limited warranty the Buyer has the right to guarantee during the one year period. The warranty period comes into effect from the shipping date.

The warranty only concerns products that are applied according requirements and for the applications specified in the manual for the product. If you want to use the products for other applications, contact us by e-mail: info@maimanelectronics.com. This warranty does not apply to damage due to incorrect use, abnormal use, or use in violation of product manual.

See the full warranty conditions on www.maimanelectronics.com/warranty.