User Manual

LDP-C/CW 120-40 NextGen
LDP-C/CW 80-40 NextGen
LDP-CW 120-40 NextGen
LDP-CW 80-40 NextGen

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Please pay attention to all safety warnings!

	Risk of electrical hazard
	Please pay special attention
	Do not
	Valuable information, remark

Change Notes

Rev 01/2021:
- Initial release

Rev 01/2024:
- restructuring and formatting

Product Family Overview and Parameters

	LDP-C/CW 120-40	LDP-C/CW 80-40
Load Current Range	10 .. 120 A	10 .. 80 A
Compliance Voltage	0 .. 40 V	0 .. 40 V
Max. Output Power	> 4800 W	3200 W
Ripple	< 1 A	< 1 A
Current Overshoot	< 1%	< 1%
Analog Modulation (60 A peak-peak)	< 4 kHz *	< 4 kHz *
Current Setting Time (0 .. 100%)	< 100 µs	< 100 µs
Current Setpoint (external)	0 .. 2.4 V (50 A/V)	0 .. 2.0 V (50 A/V)
LD Current sensing	50 A/V **	50 A/V **
LD Voltage sensing	0.1 V/V **	0.1 V/V **
Inputs	LDP-C BOB, PLB-21, Ethernet	LDP-C BOB, PLB-21, Ethernet
Supply	24 .. 48 V, min. 2 V above LD voltage	24 .. 48 V min. 2 V above LD voltage
Max. Power Dissipation @ 120 A / 12 V out	175 W abs. max.	175 W abs. max.
Dimensions in mm	100 x 180 x 74	100 x 180 x 74
Weight	1510 g	1510 g
Operating Temperature	0 .. +55 °C, non condensing	0 .. +55 °C, non condensing

The table below shows the parameters of the LDP-C that differ from the corresponding LDP-CW units		
Pulse Current Rise Time	< 1 µs fixed	< 1 µs fixed
Pulse Current Rise Time With optional adjustable pulse control *)	1 µs .. 4 µs adjustable	1 µs .. 4 µs adjustable
Pulse Recurring Frequency	Single shot up to typ. 100 kHz, max 200 kHz**	Single shot up to typ. 100 kHz, max 200 kHz**
Arbitrary waveform generator	***)	***)

*) Order code -ADJ, only with new shipments, cannot be integrated into existing systems
**) Depending on load situation
***) Software option, contact PicoLAS for more information

How to use the Manual

Remark: The LDP-C/CW described in this manual are baseplate cooled devices. Improper cooling may cause an internal overtemperature shutdown. The two fans in one side of the unit prevent local thermal hot spots inside the unit. They can not compensate a baseplate cooling. The air inside an enclosure within an OEM application is usually enough to yield enough air flow.

Baseplate cooling: Depending on the final application and operation regime, this unit may stay non-cooled or must be assembled onto a heat sink.

No general rule value can be given. It depends on the (electrical) power used by your diode – and thus the power dissipation (about 5% of this) in the driver.

You may use a passively or an actively air/water cooled device.

Housing: All units are delivered with housing. Changes are possible the units can be delivered without housing upon request.

Before powering on your unit, read this manual thoroughly and make sure your understood everything.

Please pay attention to all safety warnings.

If you have any doubt or suggestion, please do not hesitate to contact us!

How to get started (refer to drawings on next 2 pages)

Step	What to do	Check
1	Unpack your device and place it in front of you as shown on the next page.	
2	Connect a load (for example a Schottky diode or your laser diode) to the output.	⚠ Make sure to use both anode and cathode connectors in parallel.
3	The following connectors refer always to the BOB connector (vertical PWB). ⚠ Set pin 8 (master enable) to high (+ 5 V). In order to do this, you may connect pin 8 to pin 2 (+5 V).	This master enable feature is used for the safety shutdown of the laser.
4	If you do not use your driver as a stand alone module, please connect it to the PLB or PC.	Use the Ethernet or the PLB-21 connector.
5	Set pin 7 (enable/disable driver) to low (0 V)	For start up this input must be low.
6	Connect the input power supply. Make sure that polarity is correct. The supply voltage must be at least 12 V and about 4 V above your diode's compliance voltage. If the red LED (on the upper right of the vertical board – see next side) flashes 4 times, it indicates that the supply voltage is too low.	⚠ Make sure that your power supply does not have any voltage overshoots when switching on or off. Do not exceed the maximum permitted voltage of 48V
7	Set the required current. If you use the plain driver, apply a voltage to pin 10 (input analog). If you use a PLB or a PC, set the current via the corresponding commands.	The conversion scale is 50 A/V. In order to set a current of 25 A apply a voltage of 0.5 V.
8	Set pin 7 (enable driver) to high.	This starts the driver operation.
9	If you use a pulsed trigger mode (default), apply your trigger pulses to input pin 6.	Input impedance is 10 kΩ For pulse parameters see corresponding datasheets.
10	Monitor the output current with an oscilloscope on pin 9 or the compliance voltage on pin 4. Use pin 3 or pin 5 for ground.	Scales: 50 A/V for current (pin 9) 0.1 V/V for voltage (pin 4)
11	Verify that pin 1 is on 0 V.	No internal error, unit works fine.

Connecting and Interfacing

The baseplate is internally not connected to GND to avoid GND loop currents. The chassis / baseplate must be grounded by the user!

The maximum voltage between GND and chassis is 48 V. Exceeding this voltage will damage the driver and / or will cause communication errors.

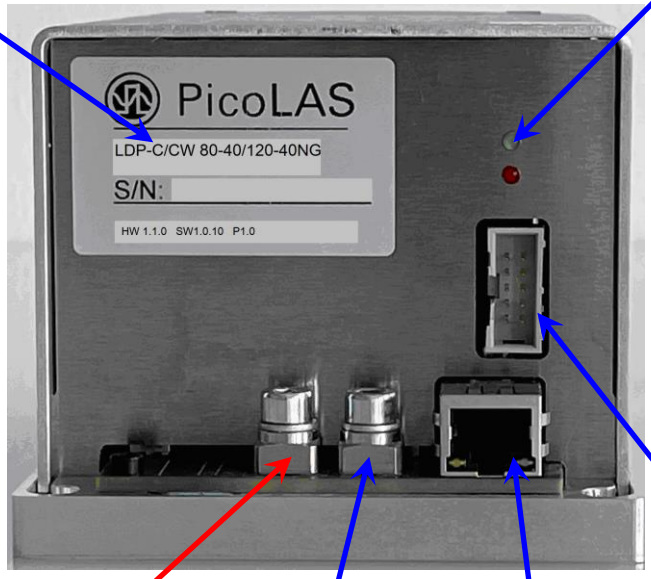
This is not covered by warranty!

Strictly avoid ground loop currents through the controlling interface!

Serial sticker with:
product type
hardware version (HW)
software version (SW)

Front view

Indicator LEDs



Positive power supply input

GND (supply return)

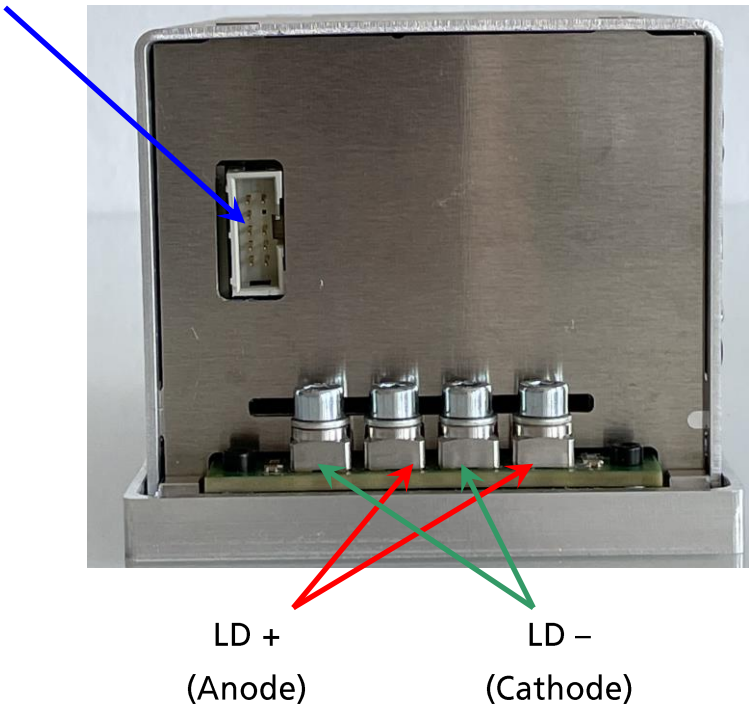
Ethernet interface

Analog interface (connect e.g. BOB here)

Rear view

Digital interface for PLB-21

(RS-232)



LD anode and cathode must be floated and must have no contact to GND!

The drawing shows all connections which are available to the user.

LDP-C BOB Connector	See section “Interface Specifications” for detailed information. (Breakout board connector.)
PLB	Connector for PLB-21 interface device (protected against polarity reversal).
Vin	Supply voltage must be about 4 V above laser diode compliance voltage but at least +12 V. Do not exceed the limits listed in the datasheets. (24 V and 48 V respectively).
GND	Supply ground
LD+	Positive laser diode output (anode). It is highly recommended to use both connectors parallel, especially for high currents.
LD-	Negative laser diode output (cathode). Do not connect to ground. It is highly recommended to use both connectors parallel, especially for high currents.
Ethernet	Ethernet connector for linking the driver to a network.

For a more convenient use of the driver (e.g. in laboratory use) we recommend the optional available product accessories LDP-C BOB or the PLB-21.
Please see LDP-C BOB and PLB-21 manual for further details.

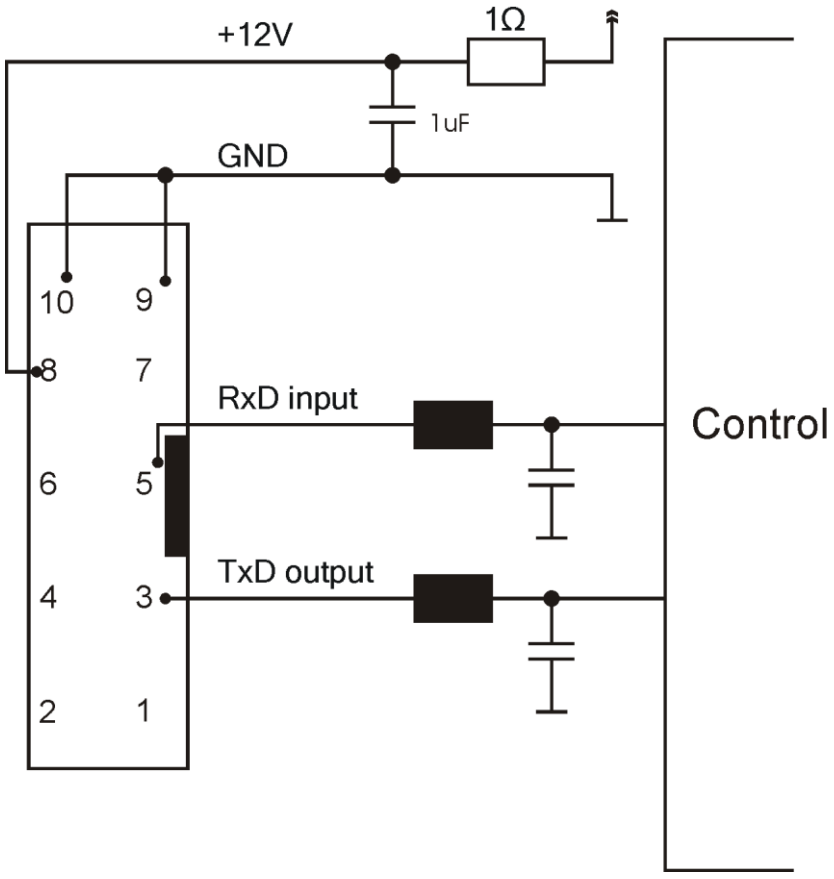
Interface Specifications

The following figure shows the input and output signals of the external analogue BOB connector. This connector can be found on the perpendicular circuit board on the right side as shown on the previous page.

The BOB (Breakout board) is recommended for easy testing of the driver. It will be replaced in the application by your machine interface. The PLB-21 is a human interface device that allows for full control of all relevant device parameters.

PLB-21 Interface

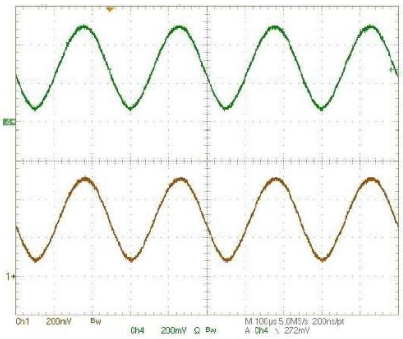
The PLB-21 interface is a standard RS-232 interface connection. It can be used to connect either the PLB-21 or a PC to the driver. If a PC or an USB-Serial converter is used it is recommended to **not** connect pin 8 (+12V) as it may cause these converters to malfunction.



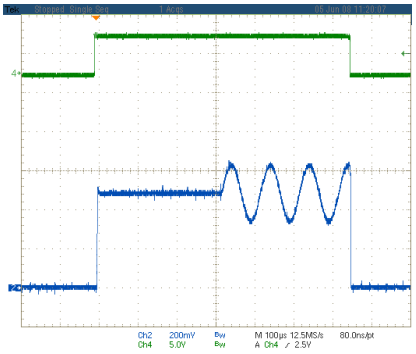
Bob Interface

Isetpoint (Pin 10)

This input signal is used to provide an analog setpoint value (amplitude modulation). In order to use the analog setpoint, it must be configured in the PC via USB or the PLB-21. Please apply a voltage corresponding to the desired current settings. The scaling is 50 A/V. For analog modulation the best results are obtained when modulating between 50 and 100% of the maximum values.



Analog modulation for LDP-CW series



Analog modulation for LDP-C series

Idiode (Pin 9)

This signal is used as an output signal of the internal current shunt. It provides near real time measurement of the output current. Connect your scope and take into account the following scaling: 50 A/V

Udiode (Pin 4)

This signal is used to determine the compliance voltage of the connected load. It provides near real time measurement. Connect your scope and use the following scaling: 0.1 V/V

Master Enable (MEN) (Pin 8)

The Master Enable provides a safety interlock that disables the driver when pulled low.
This signal must be pulled high by the user for the driver to start up. If the signal is low when the driver is powered on, it will not work properly.
It is recommended that the user also disables the ENABLE after disabling MEN. Otherwise there will be a current overshoot on the connected load.
When no safety interlock is needed this signal can be connected to pin 2 of the BOB connector.

Enable (Pin 7)

The ENABLE signal enables / disables the driver during normal operation. The ENABLE signal must be pulled low by the user in order for the driver to start up. If the signal is high when the driver is powered on it will not work properly. After the user applies the ENABLE signal, the internal current regulator ramps the current flow to the configured setpoint in a configured amount of time (soft start).

Pulse (Pin 6)

This signal is only used by the LDP-C. It provides fast access to the output stage and can be used to pulse the output current. Its actual usage depends on the configured trigger mode. Please see section “Trigger Modes” for more details.

Pulser OK (Pin 1)

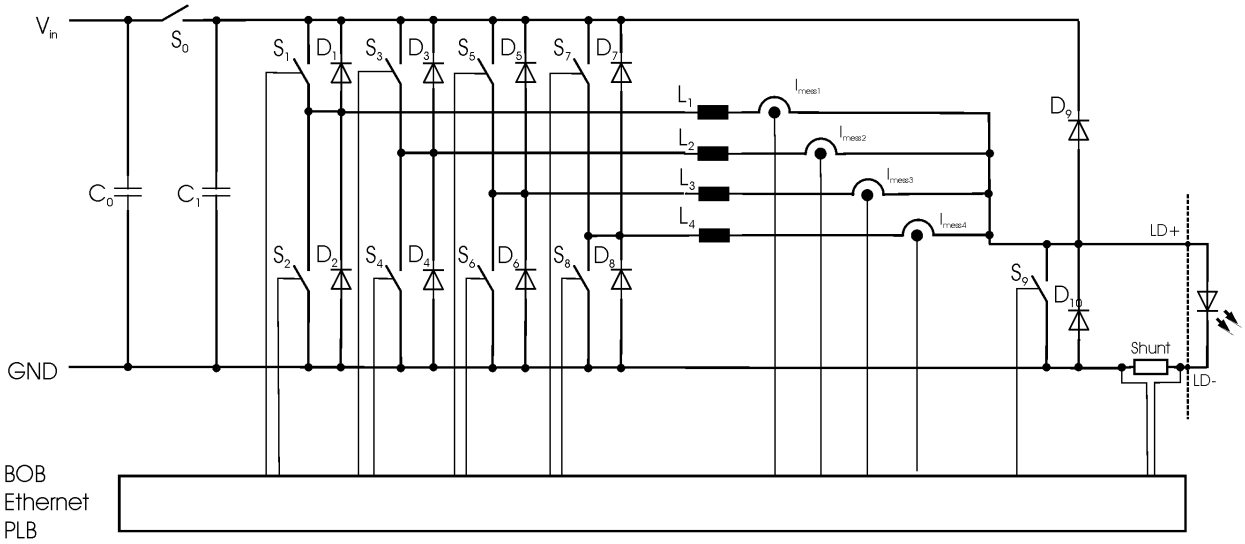
This signal informs the user about any error condition. It is pulled low by the driver when no internal error is detected (remark: The word “pulser” here refers to the “driver” itself).

Functional Description

The driver operates with four parallel buck converters (S1, S2, D1, D2, L1; S3, S4, D3, D4, L2; S5, S6, D5, D6, L3; S7, S8, D7, D8, L4). Every single converter has an independent control loop with a current sensor (Imeas1, Imeas2, Imeas3 and Imeas4). The setpoint current that is defined by the user is evenly spread over all four converters. The current through the laser diode is measured directly at the output pins with the help of a shunt resistor.

Inductor current (additional current of all three phases), laser diode current and compliance voltage are pre-processed and then fed into to the external BOB connector. An enable input as well as a status output is available.

Several security features protect the laser diode and driver from damage. D10 protects the laser diode from reverse currents, S9 could short the output pins and the bypass diode D9 protects the driver in case of a load failure. To protect the laser diode during start-up of the driver, S0 remains opened until the supply voltage has reached a stable level. In case of a failure, the control unit disables the driver. A soft start mechanism slowly rises the current after an over temperature shutdown or at start-up.



Operation principle of the LDP-C/CW driver family

Element	Function
S0	Security switch
C1, S1, S2, S3, S4, S5, S6, S7, S8, D1, D2, D3, D4, D5, D6,D7 L1, L2, L3, L4	Buck converter
C0	Input buffer capacitor
S9	Shunt MosFETs short output
D9, D10	Laser diode and driver protection diodes
Shunt	LD current monitor

Dos and Don’ts

Never ground any output connector. This may result in an incorrect current regulation!
Never use any grounded probes at the output.

Do not connect your oscilloscope to the output!

This will immediately destroy the driver and the probe!

For measuring current and voltage you connect the scope to pin 9 or pin 4 respectively.

Do not shorten the output. This will not do any harm to the laser driver but will result in an incorrect current measurement.

Keep connecting cables between power supply and driver as well as the connection between driver and laser diode as short as possible.

Mount the driver on an appropriate heat sink!

Please be aware that there might be hot surfaces, be careful not to touch them!

Never connect the oscilloscope to the output connectors!!!

(Please note: the picture above shows another but similar PicoLAS driver)

Test Load

A common method to test the driver is to connect a regular silicon rectifier diode to the driver output. Attention has to be paid to the junction capacitance of the diode. Only fast recovery diodes (or similar) have as low a parasitic capacitance as laser diodes have. To achieve reasonable test results, the parasitic elements of the test diode and the connection must be very similar to a laser diode. Regular silicon rectifier diodes have a junction capacitance of several microfarads and are not a suitable test load! The use of these diodes will result in incorrect current measurement at the pulse edges!

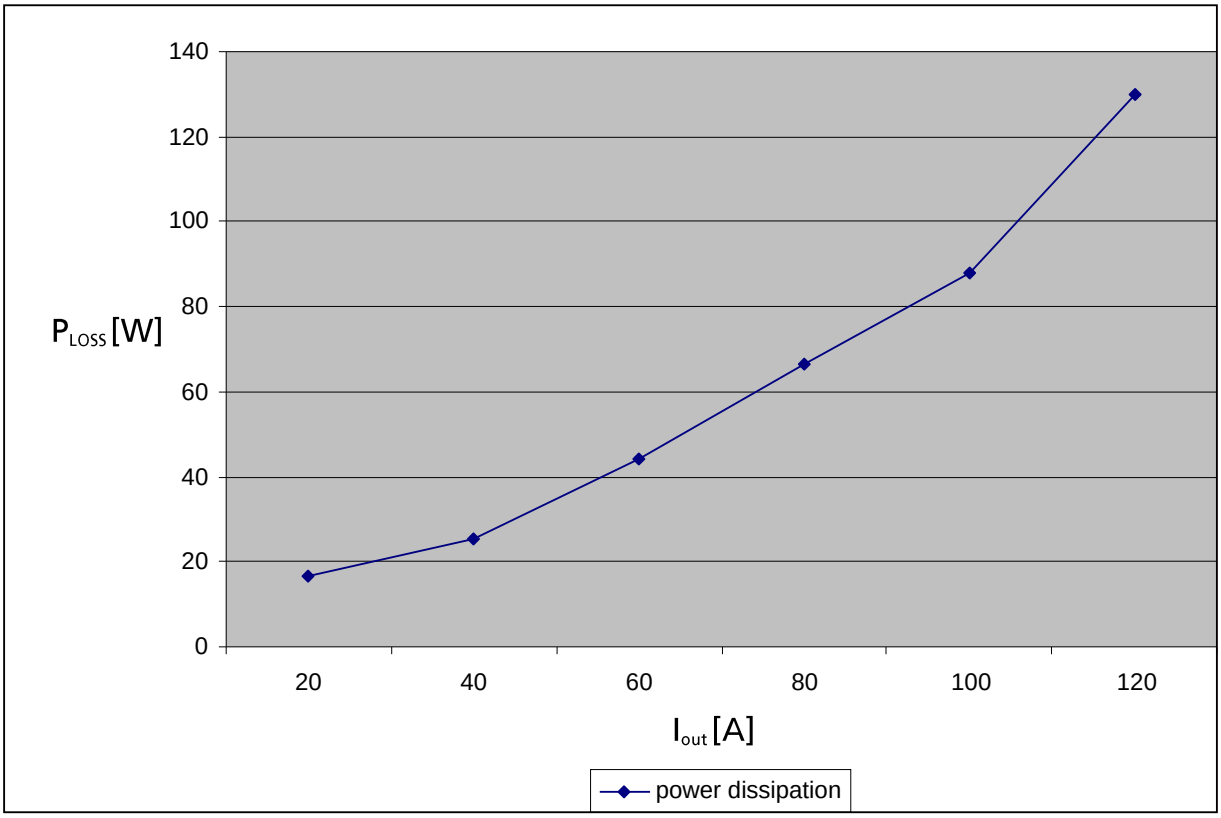
Power Supply

To obtain a good pulsing performance with the driver, it requires an appropriate power supply unit (PSU). The PSU has to supply not only the power that is delivered to the laser diode but also the power to compensate for the losses in the driver itself. Please take into account that the laser diode power varies strongly when the output current is modulated. Although the driver is equipped with a large input capacitance of 12 mF to buffer these power peaks, the power supply has to deliver the required power fast enough to avoid input voltage drops. For excessive modulation of the output current, the PSU output impedance as well as the line impedance between PSU and diode driver has to be as low as possible.

When the input voltage drops below 20.0 V the driver shuts down automatically. To remove this condition the enable line has to be toggled (switched off and on again).

Cooling

The driver produces up to 220 W of losses. Thus, the baseplate has to be mounted on a heat sink to ensure proper operation and prevent an overtemperature shutdown. If working with high currents above 90 A, it is recommended to cool the power inductors as well.
This can be achieved easily by placing the diode driver with its heat sink in the air flow of a fan.



Power dissipation as a function of output current

Overtemperature Shutdown

To protect the laser diode and the driver the unit automatically disables itself if its temperature rises above the configured shutdown temperature.
This condition is latched and the diode driver will not start working until temperature drops five degrees below the shutdown temperature and the ENABLE pin is toggled. During the overtemperature shutdown, the PULSER_OK output (pin 1 of the BOB connector) is pulled low.

Soft Start

The driver implements a soft start mechanism, which is activated every time the output is enabled via the ENABLE pin or the L_ON bit in the LSTAT register. This mechanism ramps up the current output from zero the setpoint.

LED Blink Codes

The driver has two status LEDs located above the BOB connector. The green LED indicates the readiness and the red LED an error condition of the driver. The following table shows the meaning of the different blink codes:

Nr.	Green LED	Red LED	Meaning	Solution
1	on	off	Normal operation	--
2	blink 1x	off	Stand by	--
3	blink 2x	off	Master enable not given	--
4	off	off	Driver has no power supply	Switch power on
5	off	on	**When self test has been completed:** Power self test failed	Contact your distributor
6	off	on	**When driver was on before:** Overtemperature shutdown	Set ENABLE low and wait until the driver cooled down
7	off	blink 1x	Temperature warning	

Trigger Modes

LDP-CW

The LDP-CW series has no different trigger modes. The PULSE input signal is not used. The output stage as well as the current regulator is controlled by the ENABLE signal and the L_ON bit in the LSTAT register.
Every time the output is enabled the driver performs a soft start and ramps up the output current. Please see sections “Soft Start” and “Timing Diagram” for more details.

LDP-C

The LDP-C series can be configured by the user for internal, external or cw trigger.

CW

When the cw mode is configured the LDP-C/CW behaves like the LDP-CW series. See above for more details.

EXTERNAL

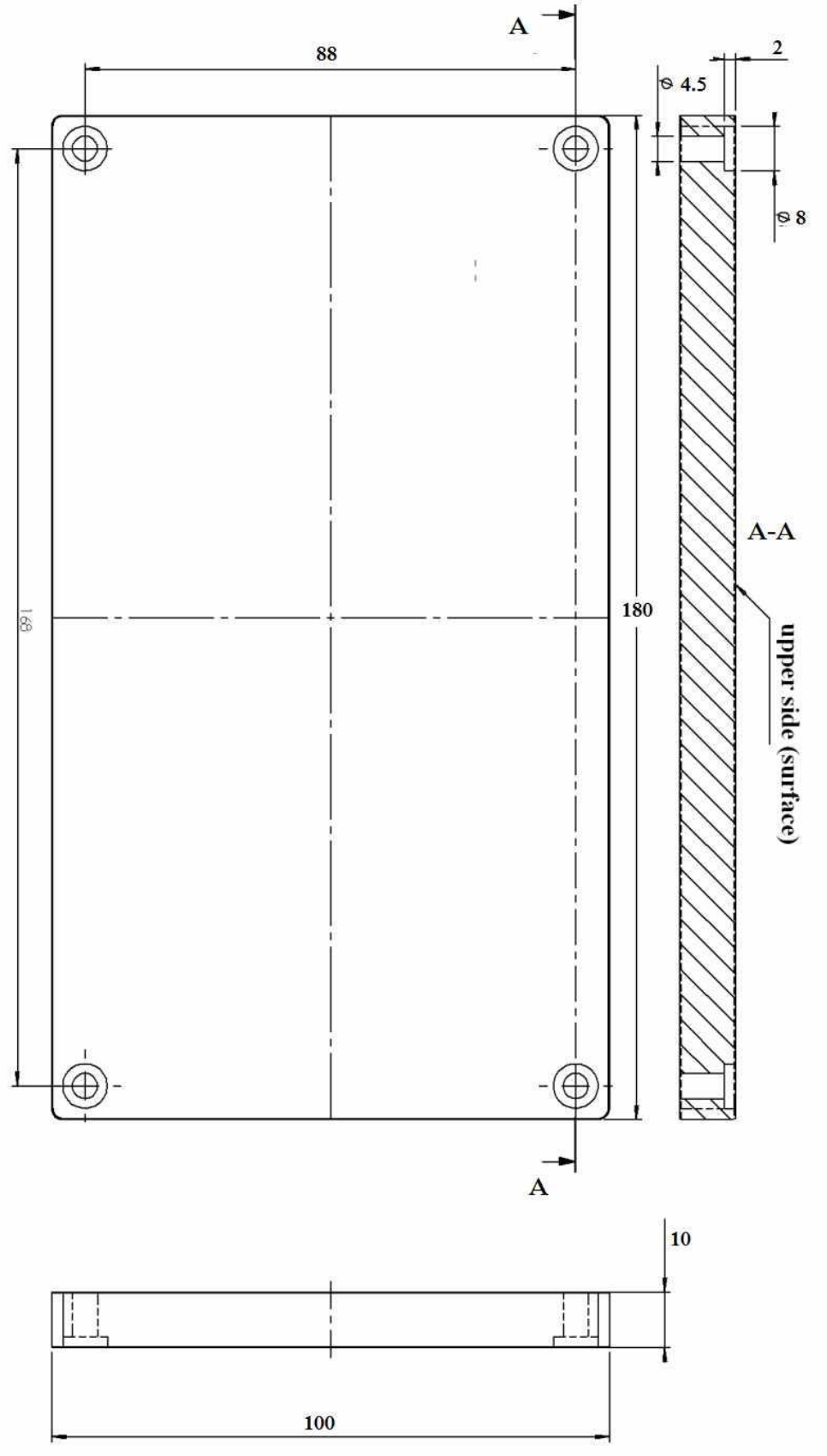
The output stage is controlled by the PULSE signal. Like the cw mode, the current regulator is controlled by the ENABLE signal and L_ON bit, but the output stage is controlled separately. Hence, the user can enable the internal current flow, but wait for the soft start to be finished before enabling the output stage. This will lead to a very low rise time compared to the soft start. The actual rise time can be configured using the digital control.
Please see sections “Soft Start” and “Timing Diagram” for more details.

INTERNAL

The output stage is controlled by an internal pulse generator which can be enabled / disabled using the L_ON bit in the LSTAT register. The PULS input is not used. The values for pulse width and repetition rate can be configured via the PLB-21.
Please see sections “Soft Start” and “Timing Diagram” for more details.

Mechanical Dimensions

All dimensions in mm
Over all height: 69.0 mm

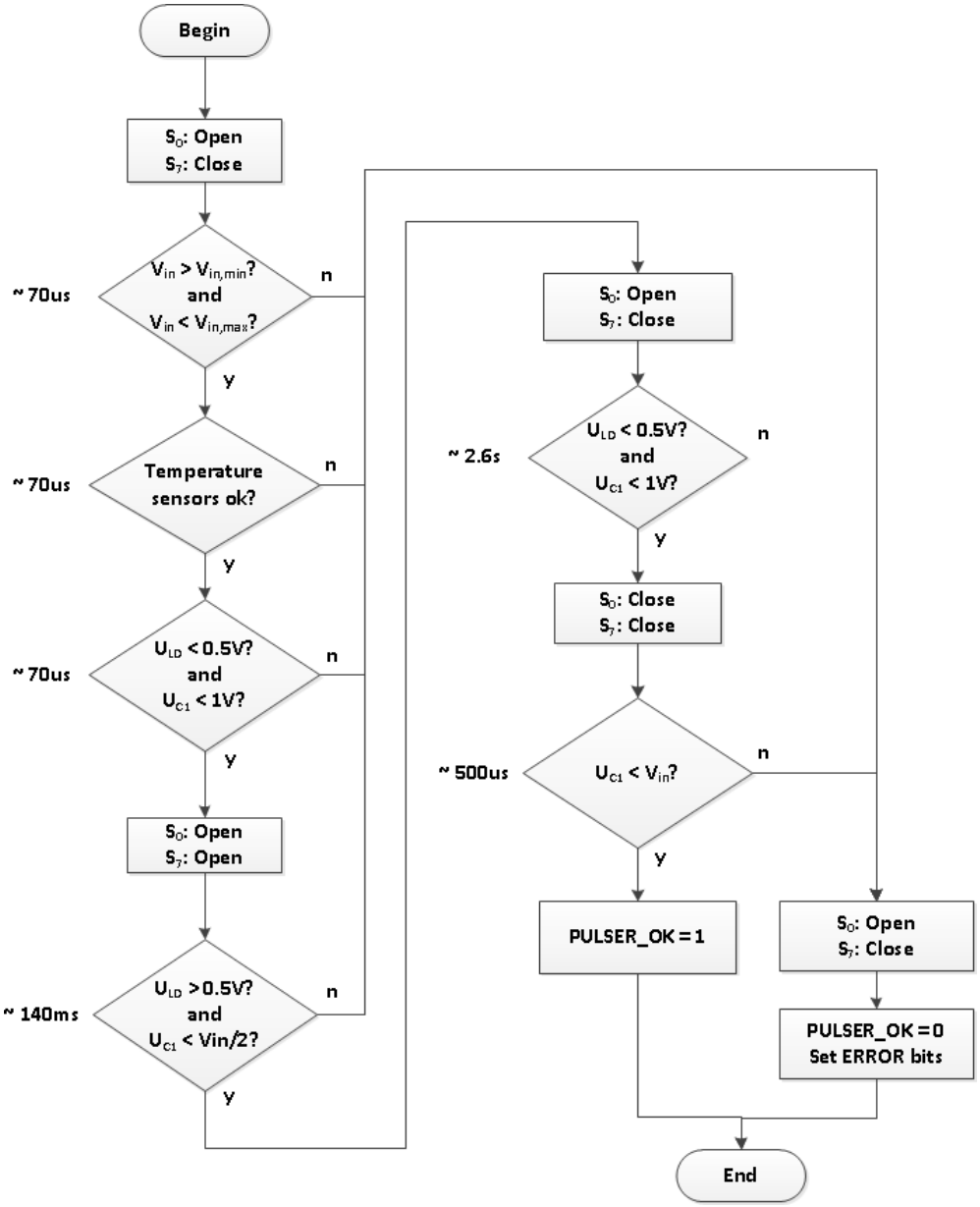


Power on Self Test

Each time the driver is powered on, it performs a test of its internal safety features.

The MEN pin (pin 8, Master Enable) has to be HIGH, while the ENABLE pin (pin 7) has to be LOW for the self test to work properly.

Changing either of the signals during the self test will result in a failure. The driver cannot be enabled until a self test has been performed successfully. The PULSER_OK signal will be pulled high when the test has been successful. ("PULSER" here stands for "diode driver)
The test will take less than 5 seconds, but can take up to 15 seconds due to internal time outs if any failure is detected. The following diagram shows the individual tests and the approximate time it will take:



Controlling the Driver using a PLB-21

To control the driver with a PLB-21 it must be connected via the enclosed cable. The PLB-21 will not work if the USB and the PLB-21 are connected at the same time.
When the PLB-21 is connected the first time to the driver the user is asked to download a new driver. This must be confirmed with “yes” for working the PLB-21 properly.

Menu Structure

The following diagram shows the structure of the PLB-21 menu which affects the driver. All entries are described in detail. All other menu entries are described in the PLB-21 manual. For detailed instructions see the PLB-21 manual.

Menu root

- Pulseparameter
  - Width
  - Reprate
  - Cur(int/ext)
- Trigger
  - Mode
  - Edge
- Config
  - Enable
  - Ex. Enable
  - Cur setpoint
- Defaults
  - Def. pwron
  - Load defaults
  - Save defaults
- Temperature
  - Dev. Off
  - Temp 1
  - Temp 2
  - Temp 3
- Measurement
  - Uin
  - Udiode
  - IDiode

Pulse Parameters

In this menu the setpoint current and the simmer current can be modified. See the datasheet of the specific device for detailed information.

Width

This value defines the width of the pulses generated by the internal pulse generator if the internal trigger is used. It is measured in steps of 0.1 us.

Reprate

This value defines the repetition rate of the pulses generated by the internal pulse generator if the internal trigger is used. It is measured in steps of 1 Hz.

Cur (int/ext)

This value defines the setpoint current. It can be switched between internal (int) and external (ext) setpoint in the config menu.
When using the internal setpoint, the value can be modified by the user.
When using the external setpoint, the shown value is the measured value supplied at pin 10 of the BOB connector. The display is updated every few seconds, so it is not accurate when using analog modulation.

Trigger

The LDP-C series supports various trigger modes. These are selected in this submenu.

Trigger

Possible values are “internal”, “external” and “CW”. Please note that any change disables the output.

Edge

This value defines the edge of the trigger signal on which the driver reacts. This is not used in the current Firmware version.

Config

The LDP-C series has some additional safety features which can be user enabled. This is done within this submenu.

Enable

When the driver is configured for external enable, this shows the state of the enable pin of the BOB connector. When internal enable is used, this can be used to enable/disable the driver.

Enable ext.

This value determines weather the driver uses the enable input pin of the BOB connector (yes) or the value of the enable field (see above).

Cur setpoint

The determines wether the analog input pin of the BOB connector of the internal value is used for current setpoint.

Defaults

The driver can load a default setting each time it powers up or the user commands it to do so. This is done within this submenu.

Def. pwron
When enabled, the driver loads the saved settings each time it powers up.

Load
When activated via turning the Jog-dial or the ENTER key all internal registers are changed to the previously saved values. The output stage has to be re-enabled via the L_ON bit or the FIRE Key afterwards.
Save
When activated via turning the Jog-dial or the ENTER key all internal registers are stored into an internal EEPROM for later usage.

Temperature

The LDP-C /-CW is equipped with several temperature sensors. In this submenu, the actual and shutdown temperatures can be read and modified. All values are in °C.

Dev. Off
This shows the user defined shutdown temperature. If the LDP-C /-CW reaches this temperature during operation, the output will be disabled and an error message is displayed. It can be modified within
40 .. 80 °C.

Temp 1…3
This shows the actual temperatures measured by the sensors of the LDP-C /-CW.

Measurement

This submenu holds some runtime measurement information.

Uin
This shows the measured value of the supply voltage.

Udiode
This shows the measured value of the compliance voltage of the connected load. The output must be enabled for a correct result. Please note that this is not a real time measurement. If the setpoint is modulated, the display may show incorrect values.
In that case use the signal of the analog current monitor at pin 9 on the BOB connector with appropriate measurement equipment.

Idiode
This shows the measured value of the current flow through the connected load.

If an Error Occurs

If an error occurs during operation the pulse output is switched off, the "pulser_ok_ext" signal on the BOB connector is pulled low and a message is displayed on the PLB-21. If no other action is described on the display, a toggle (switch on and off) of the ENABLE pin resets the error condition and re-enables the driver.

Controlling the Driver via PC

Introduction

Since the PLB-21 connector houses a standard RS-232 interface it can also be used to connect the driver to a PC. This can be done by connecting a USB-Serial converter cable using the PLB-21 cable. However, since the PLB-21 receives its poser through the same connector, it is recommended to cut the +12 V line when using the cable to connect to a USB-Serial converter. Please note, that the PLB-21 will no longer operate when connected with a modified cable. Details regarding the pin out of the PLB-21 connector can be found ion the chapter "Interface specification".

In addition to the PLB-21, the driver also has an Ethernet interface to interface directly with a computer / laptop / network. This interface allows communications with the driver over a network using a TCP (telnet client) or UDP connection. See below for more details.

Available protocols

The driver supports two protocols, a text interface for direct interaction between the operator and the driver and a binary protocol for machine-machine interfaces. Both protocol sets have the same functionality and are available on both interfaces.

Please note, that when using telnet on the Ethernet interface, only the text protocol is supported. See below for more details

Description of the RS232 Interface

The PLB-21 connector implements a standard RS-232 interface with the following connection settings:

Baud rate	115200
Data bits	8
Stop bits	1
Parity	even

Description of the Ethernet Interface

In the current hardware revision (1.0) the Ethernet interface is considered experimental and should not be used in a productive environment.

The Ethernet interface supports direct connection to a 10/100/1000 Mbit Ethernet switch. It is by default configured to use DHCP to obtain an IP address, but can be configured to static mode with the serial interface.

It can be accessed by either using a telnet client like putty or by sending UDP packets to port 23. Be aware that the telnet/TCP interface does not use a full TCP stack. Packet retransmissions as well as multiple connections are not supported. If the driver detects a new TCP connection, the current one is terminated.

The UDP connections work like the RS-232 interface and can be used by text or binary protocol.

The telnet interface supports only the text protocol.

The Serial Text Interface

The following section describes the structure and commands of the text interface.

Structure

Every command that is sent to the driver must be completed with a CR (Enter). It consists of a command word followed by a parameter. If the command was successfully executed a “0” is sent, otherwise a “1”. If there is an error pending, the response will be “10”, otherwise “11”. If the command requires an answer parameter, this parameter is sent before the confirmation is given.

Example:

The user would like to read out the actual setpoint current:

User input: gcur<Enter>

Output of the LDP-CW: 12.2<CR><LF>

0<CR><LF>

Example 2:

The user would like to set a new setpoint current:

User input: scur 25.7<Enter>

Output of the LDP-CW: 25.7<CR><LF>

0<CR><LF>

Input is done in ASCII code and is case sensitive. Every terminal can be used that supports this standard.

Commands for the LDP-C / CW

The following table contains a command reference for the LDP-C/CW series.

Command	Parameter	Answer	Description
gserial	--	serial number	Returns the device serial number
ps	--	current settings	Prints out an overview of all settings
loaddef	--	--	Loads previously saved settings
savedef	--	--	Saves the current settings as defaults
ghwver	--	hardware version	Prints out the hardware version
gswver	--	software version	Prints out the software version
scur	Current in A	Current in A	Sets the pulse current to the indicated value. A dot is used as decimal point. No more then on decimal place is used! (12.22 is the same as 12.2)
gcur	--	Current in A	Outputs the present output current
gcurmin	--	Current in A	Outputs the minimum output current
gcurmax	--	Current in A	Outputs the maximum output current
scurlimit	Current in A	Current in A	Sets the maximum pulse current to the indicated value. This value determines the maximum aviable current for the scur command. A dot is used as decimal point. No more then on decimal place is used! (12.22 is the same as 12.2)
gcurlimit	--	Current in A	Outputs the present current limit
gcurlimitmin	--	Current in A	Outputs the minimum current limit
gcurlimitmax	--	Current in A	Outputs the maximum current limit
curext	--	0/1	Switches to external current setpoint
curint	--	0/1	Switches to internal current setpoint
swidth	pulse width in µs	pulse width in µs	Sets the pulse width to the indicated value. A dot is used as decimal point. No more then one decimal place is used!
gwidth	--	pulse width in µs	Outputs the present pulse width
gwidthmin	--	pulse width in µs	Outputs the minimum pulse width

Command	Parameter	Answer	Description
gwidthmax	--	pulse width in µs	Outputs the maximum pulse width
sreprate	repetition rate in Hz	repetition rate in Hz	Sets the repetition rate to the indicated value
greprate	--	repetition rate in Hz	Outputs the present repetition rate
grepratemin	--	repetition rate in Hz	Outputs the min. repetition rate
grepratemax	--	repetition rate in Hz	Outputs the max. repetition rate
strgmode	0 .. 2	0 .. 2	Sets the trigger mode to the indicated value: 0: external trigger input 1: internal trigger 2: cw mode
gtrgmode	--	0 .. 2	Outputs the current trigger mode
gtempoff	--	--	Outputs the shutdown temperature
gtempmax	--	--	Outputs the shutdown temperature
gtemphys	--	--	Outputs the temperature hysterere, at which the driver can be re-enabled after shutdown
gtempwrn	--	--	Outputs the warning temperature at which the driver will show a warning
gtemp	--	--	Outputs the actual temperature
enautoload	--	--	Enables the automatic loading of default values on power-on
disautoload	--	--	Disables the automatic loading of default values on power-on
on	--	--	Enables the current output. Internally ANDed with the enable signal
off	--	--	Disables the current output. Internally ANDed with the enable signal
glstat	--	--	Outputs the content of the LSTAT register.
slstat	32 bit number	32 bit number	Sets the LSTAT register to the given value. Outputs the new value.

Command	Parameter	Answer	Description
gerror	--	32 bit number	Outputs the content of the ERROR register.
gerrtxt	--	Text	Outputs a text describing any pending error.
gvcc	--	Supply voltage in V	Outputs the actual measured supply voltage
gudiode	--	Output voltage in V	Outputs the actual measured output voltage
gidiode	--	Output current in A	Outputs the actual measured output current
enable_ext	--	0 or 1	Switches the driver to external enable
enable_int	--	0 or 1	Switches the driver to internal enable
enable	--	0 or 1	Enables the driver. Only used when enable_ext = 1
disable	--	0 or 1	Disables the driver. Only used when enable_ext = 1
enabledhcp	--	0 or 1	Enables the DHCP protocol to obtain an IP address
eisabledhcp	--	0 or 1	Disbles the DHCP protocol
gip	--	Ip address	Outputs the current IP address
sip	Ip address	Ip address	Sets the IP address to the given value. Only useable when enabledhcp=0
gnetmask	--	Ip address	Outputs the current netmask
snetmask	Ip address	Ip address	Sets the net mask to the given value. Only useable when enabledhcp=0
ggateway	--	Ip address	Outputs the current gateway
sgateway	Ip address	Ip address	Sets the gateway to the given value. Only useable when enabledhcp=0

The PicoLAS Protocol

The following section describes the structure and possible commands of the PicoLAS protocol.

Structure

Each transmission consists of 12 bytes – called a frame as follows – which must be sent consecutively. Otherwise, the system times out and the transmission must start again from the beginning.
A frame has a fixed structure. The first two bytes describe the command, the following eight bytes the parameters, followed by one reserved byte and one checksum byte. The checksum is calculated out of the first 11 bytes which are linked by a bitwise XOR.

A frame therefore has the following structure:

Byte	Meaning
1	Bit 8-15 of the command
2	Bit 0-7 of the command
3	Bit 56-63 of the parameter
4	Bit 48-55 of the parameter
5	Bit 40-47 of the parameter
6	Bit 32-39 of the parameter
7	Bit 24-31 of the parameter
8	Bit 16-23 of the parameter
9	Bit 8-15 of the parameter
10	Bit 0-7 of the parameter
11	Reserved, always 0x00
12	Checksum

A properly received frame must be acknowledged by the recipient with an answer, which is also a frame. If the acknowledgement does not occur the command has not been processed and the sending procedure should be repeated.

If the recipient recognizes the command as valid, but not the parameters, it will answer with an ILGLPARAM (0xFF12) as command. In the case that the recipient receives an invalid command it will answer with UNCOM (0xFF13).

If a faulty checksum is recognized the answer is RXERROR (0xFF10). If this error occurs often the connection should be checked.

General Commands

The following list contains an overview of the general commands which are supported by every product from PicoLAS which makes use of this protocol. The explanation of the individual commands is given further below.

Command Name	Sent Frame		Answer Frame	
	Command	Parameter	Command	Parameter
PING	0xFE01	0	0xFF01	0
IDENT	0xFE02	0	0xFF02	ID
GETHARDVER	0xFE06	0	0xFF06	Version
GETSOFTVER	0xFE07	0	0xFF07	Version
GETSERIAL	0xFE08	0 .. 20	0xFF08	Refer to description
GETIDSTRING	0xFE09	0 .. 20	0xFF09	Refer to description

PING

This command is used to determine the presence of a connected driver and to initialize its interface. It does not change any registers. The command parameter is always 0, the answer parameter too.

IDENT

This command is used to determine the device ID of an attached recipient. It has no effect on the condition of the recipient. The parameter is always 0. The answer contains the ID.

GETHARDVER

Instructs the driver to send back the version number of its hardware. The parameter is always 0. The answer contains the hardware version number. The format of the answer is: 0x000000<major><minor><revision>. In other words: one byte for each of the three elements of the version number.
As example, version 1.2.3 has the parameter 0x000000010203.

GETSOFTVER

Instructs the driver to send back the version number of its firmware. The parameter is always 0.
The answer contains the software version of the recipient. The format of the answer is: 0x000000<major><minor><revision>. In other words: one byte for each of the three elements of the version number.
As example, version 2.3.4 has the parameter 0x000000020304.

GETSERIAL

Instructs the driver to send back its serial number. If 0 is sent as parameter, the answer contains the number of (ASCII) digits of the serial number. Otherwise the respective position of the serial number is sent in ASCII format.

GETIDSTRING
Instructs the driver to send back its name. If 0 is sent as parameter, the answer contains the number of digits of the string. Otherwise the respective position of the serial number is sent in ASCII format.

Commands for the Driver

The following table contains a list of the commands which the driver supports in addition to the generally applicable commands. An explanation of the individual commands and its parameters follows afterwards.

The commands are internally organised in the following groups:

Temperature

The driver is equipped with tree temperature sensors, which will monitor the base plate. If any reaches the value of GETTEMPOFF, the driver is disabled.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
GETTEMP	0x0100	0	0x8100	Temp in 0.1°C
GETTEMP1	0x0101	0	0x8100	Temp in 0.1°C
GETTEMP2	0x0102	0	0x8100	Temp in 0.1°C
GETTEMP3	0x0103	0	0x8100	Temp in 0.1°C
GETEMPOFF	0x0104	0	0x8100	Temp in 0.1°C
GETTEMPHYS	0x0105	0	0x8100	Temp in 0.1°C

LSTAT

The Laser Status Register contains all internal settings for the driver. The exact meaning of each bit is explained in the chapter “Description of the LSTAT register”.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
GETLSTAT	0x0200	0	0x8200	32 bit number
SETLSTAT	0x0201	32 bit number	0x8200	32 bit number

ERROR

The Error Register contains information of any pending error. The exact meaning of each bit is explained in the chapter “Description of the ERROR register”.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
GETERROR	0x0300	0	0x8200	32 bit number
CLEARERROR	0x0301	0	0x8200	0

Current

The current commands controls any aspect of the current settings. The CURLIMIT registers defines the borders of the GETCURMIN/GETCURMAX commands.

The GETCUREXT command reads the value of the analogue set point pin of the BOB connector

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
SETCUR	0x0500	Current in 0.1A	0x8500	Current in 0.1A
GETCUR	0x0501	0	0x8500	Current in 0.1A
GETCURMIN	0x0502	0	0x8500	Current in 0.1A
GETCURMAX	0x0503	0	0x8500	Current in 0.1A
SETCURLIMIT	0x0504	Current in 0.1A	0x8500	Current in 0.1A
GETCURLIMIT	0x0505	0	0x8500	Current in 0.1A
GETCURLIMITMIN	0x0506	0	0x8500	Current in 0.1A
GETCURLIMITMAX	0x0507	0	0x8500	Current in 0.1A
GETCUREXT	0x0508	0	0x8500	Current in 0.1A

ADC

The driver monitors several internal signals. They can be accessed with the following commands.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
GETADCUDIODE	0x0600	0	0x8600	Voltage in 0.1V
GETADCIDIODE	0x0601	0	0x8600	Current in 0.1A
GETVCC	0x0603	0	0x8600	Voltage in 0.1V
GETVINSAFE	0x0604	0	0x8600	Voltage in 0.1V

Defaults

The driver has an internal register set, which can overwrite all settings to previously saved values.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
LOADDEFAULT	0x0700	0	0x8700	0
SAVESEVAULT	0x0701	0	0x8700	0

Pulse control

The pulse commands control any aspect of the internal trigger generator. They are only used when using the internal trigger mode.

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
SETWIDTH	0x0900	Width in us	0x8900	Width in us
GETWIDTH	0x0901	0	0x8900	Width in us
GETWIDTHMIN	0x0902	0	0x8900	Width in us
GETWIDTHMAX	0x0903	0	0x8900	Width in us
SETREPRATE	0x0904	Reprate in Hz	0x8900	Reprate in Hz
GETREPRATE	0x0905	0	0x8900	Reprate in Hz
GETREPRATEMIN	0x0906	0	0x8900	Reprate in Hz
GETREPRATEMAX	0x0907	0	0x8900	Reprate in Hz

LAN

The Lan Status Register contains all settings regarding the Ethernet interface. The exact meaning of each bit is explained in the chapter “Description of the LANSTAT register”.

The IP / Netmask / Gateway commands expect the data the following format:

192.168.1.1 = 0x00000101A8C0

Command	Sent Frame		Received Frame	
	Command	Parameter	Command	Parameter
GETLANSTAT	0x0A00	0	0x8A00	32 bit number
SETLANSTAT	0x0A01	32 bit number	0x8A00	32 bit number
GETIP	0x0A02	0	0x8A00	32 bit number
SETIP	0x0A03	32 bit number	0x8A00	32 bit number
GETNETMASK	0x0A04	0	0x8A00	32 bit number
SETNETMASK	0x0A05	32 bit number	0x8A00	32 bit number
GETGATEWAY	0x0A06	0	0x8A00	32 bit number
SETGATEWAY	0x0A07	32 bit number	0x8A00	32 bit number

Register Description

Description of the LSTAT Register

The following list contains a description of the individual LSTAT bits. These can be read with GETLSTAT and written with SETLSTAT. With SETLSTAT a complete 32 bit word must always be written. Thus, to change individual bits, first of all the register must be read out with GETLSTAT, then the desired bits are changed and then passed back with SETLSTAT.

Bit	Name	Read/Write	Meaning
0	L_ON	Read/Write	Switch on/off the pulse output. **Note** that this bit is automatically set high each time the driver is powered on.
1-2	TRG_MODE	Read/Write	Trigger mode: 0 : external pulse input 1 : internal pulse generator 2 : cw mode
3	TRG_EDGE	Read/Write	Currently not used
4	ISOLL_EXT	Read/Write	When “1” the external setpoint current is used
5	INIT_COMPLETE	Read	The power-on test is performed successfully
6	PULSER_OK	Read	Indicates that the driver is in no error condition
7	ENABLE_IN	Read/Write	When ENABLE_EXT = 1: Indicates that the external enable is given When ENABLE_EXT = 0: Enables of disables the driver
8	DEF_PWRON	Read/Write	When “1” the driver will load the default values at each power-up.
9	Reserved	Read	Reserved
10	ENABLE_EXT	Read/Write	1: The external enable input of the BOB interface is used to enable the driver 0: The ENABLE_IN bit is used
11	Reserved	Read/Write	Reserved
12	MASTER_ENABLE_IN	Read	Indicates the state of the MEN input pin
13	ENABLED	Read	Indicates if the driver is enabled of not

Bit	Name	Read/Write	Meaning
14	ENABLE_LOCK	Read	Indicates that the driver is locked in the disable state. Set Enable to 0 to release the lock
15	MEF_IN	Read	Indicates that a falling edge on the Master Enable has been detected. Set Enable to 0 to clear.
16-18	IOFF_CAL	Read	Internal use
19-23	POST_STATE	Read	Internal use
24-27	CAL_STATE	Read	Internal use
28	IS_CA	Read	Internal use
29-31	reserved	Read	Reserved

Description of the ERROR Register

The following list contains a description of the individual bits of the ERROR register. A "1" as a bit leads to a deactivation of the drivers output. Bit 11 is excluded of this directive as it is just a warning.

Bit	Name	Read/Write	Meaning
0	CRC_DEVDRV	Read	Indicates a CRC error in the PLB-Driver. It does not affect the driver, but might disable the PLB-21 usage.
1	CRC_DEFAULT	Read	Indicates a CRC error in the stored default values. The values should be re-saved
2	CRC_CONFIG	Read	Indicates a CRC error in the configuration. The driver must be repaired
3	CRC_PARAM	Read	Reserved
4	CRC_CAL	Read	Indicates a CRC error in the calibration. The driver must be repaired
5	VCC_LOW	Read	Indicates that the Supply voltage is too low
6	VCC_HIGH	Read	Indicates that the Supply voltage is too high
7	VCC_UVLO	Read	Indicates that the Supply voltage has dropped during operation. Check the current limitation of the power supply.
8	FAILED_DEFAULT	Read	The default values could not be loaded during power-on.
9	TEMP_OVERSTEPPED	Read	The operation temperature has exceeded 80°C
10	TEMP_HYSTERESE	Read	The driver needs to cool down
11	TEMP_WARNING	Read	The drivers operation temperature reaches critical levels
12	ENABLE_POWERON	Read	Enable was given during power-on
13	ENABLE_ENCHANGE	Read	Enable was given while switching between internal / external
14	PWM_MAX	Read	The current regulator was unable to generate the desired output current

Bit	Name	Read/Write	Meaning
15	IOFFSET _FAIL	Read	Indicates an internal error
16	POST_FAILED	Read	Indicates that the power on self test has failed
17	TEMP_SENSOR_1	Read	Indicates a malfunction of an internal NTC
18	TEMP_SENSOR_2	Read	Indicates a malfunction of an internal NTC
19	TEMP_SENSOR_3	Read	Indicates a malfunction of an internal NTC
20	CB_ALWAYS_OPEN	Read	Used in combination with POST_FAILED
21	CB_ALWAYS_CLOSE	Read	Used in combination with POST_FAILED
22	HST_ALWAYS_OPEN	Read	Used in combination with POST_FAILED
23	HST_ALWAYS_CLOSE	Read	Used in combination with POST_FAILED
24-31	Reserved	Read	Reserved

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