

## HPLD-1000

### HIGH POWER CONSTANT CURRENT **LASER DIODE DRIVER**



#### Key Features

- Wide input voltage range up to 48 Vdc
- Output Current up to 25 A
- Compliance voltage up to 40 V
- Efficiency up to 97%
- Low current ripple
- Triggering up to 3 kHz
- Analog modulation up to 30 kHz
- Overcurrent protection
- Reverse current protection
- Crowbar circuit protection
- External interlock function
- CAN interface
- Integrated heatsink
- Compact Size 70 mm × 56 mm × 34mm

# HPLD-1000 CAN Protocol Description

## Introduction

This document describes how data is received and transmitted via CAN addressed systems. This document is based on firmware version PHLD-1000.

## CAN frame format

The device uses CAN 2.0A with 11-bit identifiers. The baud rate is 500 kBit/s.

## Identifiers

Each CAN message has an identifier (ID). A base ID can be set as a parameter (default is 0x001). Also, it has a BROADCAST ID (which is 0x0FA) that can't be modified as a parameter, the user can use BROADCAST ID to change the base ID in cases where the information about base ID is lost. The host ID is always 0x22.

## Message format

Message length is always 8 bytes, unless declared differently in the description. Message byte and bit numbering is zero based.

Table 1. Message format example

CAN format	ID	DLC	B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]	B[7]
Formal description	Base ID	Data size	CMD	Sender ID	0	0	Value byte	Value byte	Value byte	Value byte
Example	0x001	0x08	0x11	0x22	0x00	0x00	0x00	0x00	0x00	0x64

## Response description

Most of the commands has two types. The SET type and GET type. GET type forms from SET type CMD byte plus 0x80.

For example, if SET type CMD=0x10, then same GET type CMD+0x80 = 0x90.

If device received SET command type CMD it will send ACK response with the same CMD byte with empty value bytes.

If device received GET command type CMD+0x80, it will send ANSWER response with the same CMD+0x80 with corresponding value bytes

## Command list

ALL device commands are listed in Table 2.

Table 2. Commands list

CMD	CMD description	Read/Write																																								
0x10	<p><b>ON/OFF laser emitting command</b></p> <p>Value:</p> <ul style="list-style-type: none"> <li>0 – turn laser emitting off</li> <li>1 – turn laser emitting on</li> </ul> <p>Example: Command to turn laser emitting on:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x10</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x01</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x10</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET emitting on/off state:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x90</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x90</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x01</td> </tr> </table> <p>Value = 1;</p>	0x001	0x08	0x10	0x00	0x00	0x00	0x00	0x00	0x00	0x01	0x001	0x08	0x10	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0x90	0x00	0x022	0x08	0x90	0x01	0x00	0x00	0x00	0x00	0x00	0x01	R/W						
0x001	0x08	0x10	0x00	0x00	0x00	0x00	0x00	0x00	0x01																																	
0x001	0x08	0x10	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0x90	0x00																																							
0x022	0x08	0x90	0x01	0x00	0x00	0x00	0x00	0x00	0x01																																	
0x11	<p><b>Laser diode current command</b></p> <p>Current value range 0..25 A</p> <p>Value: integer value bytes multiplied with 100</p> <p>Example: Command to SET current value 12.5A, Value = 12.5 * 100 = 1250 (0x04E2):</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x11</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x04</td><td>0xE2</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x11</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET current value 2A:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x91</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x91</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x14</td> </tr> </table> <p>Value = (0x0014) = 200 / 100 = 2A;</p>	0x001	0x08	0x11	0x00	0x00	0x00	0x00	0x00	0x04	0xE2	0x001	0x08	0x11	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0x91	0x00	0x001	0x08	0x91	0x01	0x00	0x00	0x00	0x00	0x00	0x14	R/W						
0x001	0x08	0x11	0x00	0x00	0x00	0x00	0x00	0x04	0xE2																																	
0x001	0x08	0x11	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0x91	0x00																																							
0x001	0x08	0x91	0x01	0x00	0x00	0x00	0x00	0x00	0x14																																	
0x12	<p><b>Laser diode temperature command</b></p> <p>Value: integer value bytes multiplied with 10</p> <p>Example: Command to GET temperature value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x92</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x92</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0xFC</td> </tr> </table> <p>Value = (0x00FC) = 252 / 100 = 25.2°C;</p>	0x001	0x08	0x92	0x00	0x001	0x08	0x92	0x01	0x00	0x00	0x00	0x00	0x00	0xFC	R																										
0x001	0x08	0x92	0x00																																							
0x001	0x08	0x92	0x01	0x00	0x00	0x00	0x00	0x00	0xFC																																	

CMD	CMD description	Read/Write																																								
0x13	<p><b>Coefficient I command</b></p> <p>Value: integer value multiplied with 10000</p> <p>Example: Command to SET coefficient I, Value = 1000,0000*10000 = 10000000 (0x989680):</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x13</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x98</td><td>0x96</td><td>0x80</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x13</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET coefficient I value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x93</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x93</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x98</td><td>0x96</td><td>0x80</td> </tr> </table> <p>Value = (0x00989680) = 10000000 / 10000 = 1000;</p>	0x001	0x08	0x13	0x00	0x00	0x00	0x00	0x98	0x96	0x80	0x022	0x08	0x13	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0x93	0x00	0x022	0x08	0x93	0x01	0x00	0x00	0x00	0x98	0x96	0x80	R/W						
0x001	0x08	0x13	0x00	0x00	0x00	0x00	0x98	0x96	0x80																																	
0x022	0x08	0x13	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0x93	0x00																																							
0x022	0x08	0x93	0x01	0x00	0x00	0x00	0x98	0x96	0x80																																	
0x18	<p><b>Coefficient P command</b></p> <p>Value: integer value multiplied with 10000</p> <p>Example: Command to SET coefficient P, Value = 10000,0000 * 10000 = 100000000 (0x05F5E100):</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x18</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x05</td><td>0xF5</td><td>0xE1</td><td>0x00</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x18</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET coefficient P value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x98</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x98</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x05</td><td>0xF5</td><td>0xE1</td><td>0x00</td> </tr> </table> <p>Value = (0x05F5E100) = 100000000 / 10000 = 10000;</p>	0x001	0x08	0x18	0x00	0x00	0x00	0x05	0xF5	0xE1	0x00	0x022	0x08	0x18	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0x98	0x00	0x022	0x08	0x98	0x01	0x00	0x00	0x05	0xF5	0xE1	0x00	R/W						
0x001	0x08	0x18	0x00	0x00	0x00	0x05	0xF5	0xE1	0x00																																	
0x022	0x08	0x18	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0x98	0x00																																							
0x022	0x08	0x98	0x01	0x00	0x00	0x05	0xF5	0xE1	0x00																																	
0x19	<p><b>Coefficient D command</b></p> <p>Value: integer value multiplied with 10000</p> <p>Example: Command to SET coefficient D, Value = 2000,0000*10000 = 20000000 (0x0131 2D00):</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x19</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x01</td><td>0x31</td><td>0x2D</td><td>0x00</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x19</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET coefficient D value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x99</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x99</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x01</td><td>0x31</td><td>0x2D</td><td>0x00</td> </tr> </table> <p>Value = (0x0131 2D00) = 20000000 / 10000 = 2000;</p>	0x001	0x08	0x19	0x00	0x00	0x00	0x01	0x31	0x2D	0x00	0x022	0x08	0x19	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0x99	0x00	0x022	0x08	0x99	0x01	0x00	0x00	0x01	0x31	0x2D	0x00	R/W						
0x001	0x08	0x19	0x00	0x00	0x00	0x01	0x31	0x2D	0x00																																	
0x022	0x08	0x19	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0x99	0x00																																							
0x022	0x08	0x99	0x01	0x00	0x00	0x01	0x31	0x2D	0x00																																	

CMD	CMD description	Read/Write																																								
0x24	<p><b>Laser emitting mode</b></p> <p>Value: integer value where:</p> <ul style="list-style-type: none"> <li>· 0x00: Internal CW mode</li> <li>· 0x01: External TTL mode</li> <li>· 0x02: External ANALOG modulation mode</li> </ul> <p>Example: Command to SET external ANALOG modulation mode:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x24</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x02</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x24</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET internal CW mode value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xA4</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0xA4</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Value = (0x00) = Internal CW mode;</p>	0x001	0x08	0x24	0x00	0x00	0x00	0x00	0x00	0x00	0x02	0x001	0x08	0x24	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0xA4	0x00	0x022	0x08	0xA4	0x01	0x00	0x00	0x00	0x00	0x00	0x00	R/W						
0x001	0x08	0x24	0x00	0x00	0x00	0x00	0x00	0x00	0x02																																	
0x001	0x08	0x24	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0xA4	0x00																																							
0x022	0x08	0xA4	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x25	<p><b>Laser diode maximum current command</b></p> <p>Value: integer value bytes multiplied with 100</p> <p>Example: Command to SET maximum current value 25A, Value = 25 * 100 = 2500 (0x09C4):</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x25</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x09</td><td>0xC4</td> </tr> </table> <p>Response ACK:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0x25</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Command to GET maximum current value 25A:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xA5</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x022</td><td>0x08</td><td>0xA5</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x09</td><td>0xC4</td> </tr> </table> <p>Value = (0x09C4) = 2500 / 100 = 25A;</p>	0x001	0x08	0x25	0x00	0x00	0x00	0x00	0x00	0x09	0xC4	0x022	0x08	0x25	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x001	0x08	0xA5	0x00	0x022	0x08	0xA5	0x01	0x00	0x00	0x00	0x00	0x09	0xC4	R/W						
0x001	0x08	0x25	0x00	0x00	0x00	0x00	0x00	0x09	0xC4																																	
0x022	0x08	0x25	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x001	0x08	0xA5	0x00																																							
0x022	0x08	0xA5	0x01	0x00	0x00	0x00	0x00	0x09	0xC4																																	
0x30	<p><b>Laser alarm flags command</b></p> <p>Value: integer value with 8 bit mask where:</p> <ul style="list-style-type: none"> <li>· Bit0 - flag_Rebooted</li> <li>· Bit1 - flag_ALARM_INTERLOCK</li> <li>· Bit2 - flag_Overtemp</li> <li>· Bit3 - flag_OverCurrent</li> <li>· Bit4 - flag_UnderVoltage_IN</li> <li>· Bit5 - flag_OverVoltage_IN</li> <li>· Bit6 - flag_UnderVoltage_OUT</li> <li>· Bit7 - flag_OVER_Current_IND</li> </ul> <p>Example: Command to GET alarm flags value:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xB0</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xB0</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x02</td> </tr> </table> <p>Value Bit1 = 1 = flag_ALARM_INTERLOCK;</p>	0x001	0x08	0xB0	0x00	0x001	0x08	0xB0	0x01	0x00	0x00	0x00	0x00	0x00	0x02	R																										
0x001	0x08	0xB0	0x00																																							
0x001	0x08	0xB0	0x01	0x00	0x00	0x00	0x00	0x00	0x02																																	

CMD	CMD description	Read/Write																																								
0x33	<p><b>Save parameters command</b></p> <p>Example: Command to save parameters in FLASH memory:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x33</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0x33</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table>	0x001	0x08	0x33	0x00	0x001	0x08	0x33	0x01	0x00	0x00	0x00	0x00	0x00	0x00	W																										
0x001	0x08	0x33	0x00																																							
0x001	0x08	0x33	0x01	0x00	0x00	0x00	0x00	0x00	0x00																																	
0x50	<p><b>Device type command</b></p> <p>Value: HPLD-1000 device type = 0x12</p> <p>Example: Command to GET device type:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xD0</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x001</td><td>0x08</td><td>0xD0</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x12</td> </tr> </table> <p>Value = (0x12) = HPLD-1000;</p>	0x001	0x08	0xD0	0x00	0x001	0x08	0xD0	0x01	0x00	0x00	0x00	0x00	0x00	0x12	R																										
0x001	0x08	0xD0	0x00																																							
0x001	0x08	0xD0	0x01	0x00	0x00	0x00	0x00	0x00	0x12																																	
0x51	<p><b>CAN identifier command</b></p> <p>Value: base ID</p> <p>Example: Command to SET base ID using BROADCAST ID, Value base ID = 0x01</p> <table border="1"> <tr> <td>0x0FA</td><td>0x08</td><td>0x51</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x0FA</td><td>0x08</td><td>0x51</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x01</td> </tr> </table> <p>Command to GET base ID using BROADCAST ID:</p> <table border="1"> <tr> <td>0x0FA</td><td>0x08</td><td>0xD1</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td> </tr> </table> <p>Response ANSWER:</p> <table border="1"> <tr> <td>0x0FA</td><td>0x08</td><td>0xD1</td><td>0x01</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x01</td> </tr> </table> <p>Base ID = 0x01</p>	0x0FA	0x08	0x51	0x00	0x0FA	0x08	0x51	0x01	0x00	0x00	0x00	0x00	0x00	0x01	0x0FA	0x08	0xD1	0x00	0x0FA	0x08	0xD1	0x01	0x00	0x00	0x00	0x00	0x00	0x01	R/W												
0x0FA	0x08	0x51	0x00																																							
0x0FA	0x08	0x51	0x01	0x00	0x00	0x00	0x00	0x00	0x01																																	
0x0FA	0x08	0xD1	0x00																																							
0x0FA	0x08	0xD1	0x01	0x00	0x00	0x00	0x00	0x00	0x01																																	