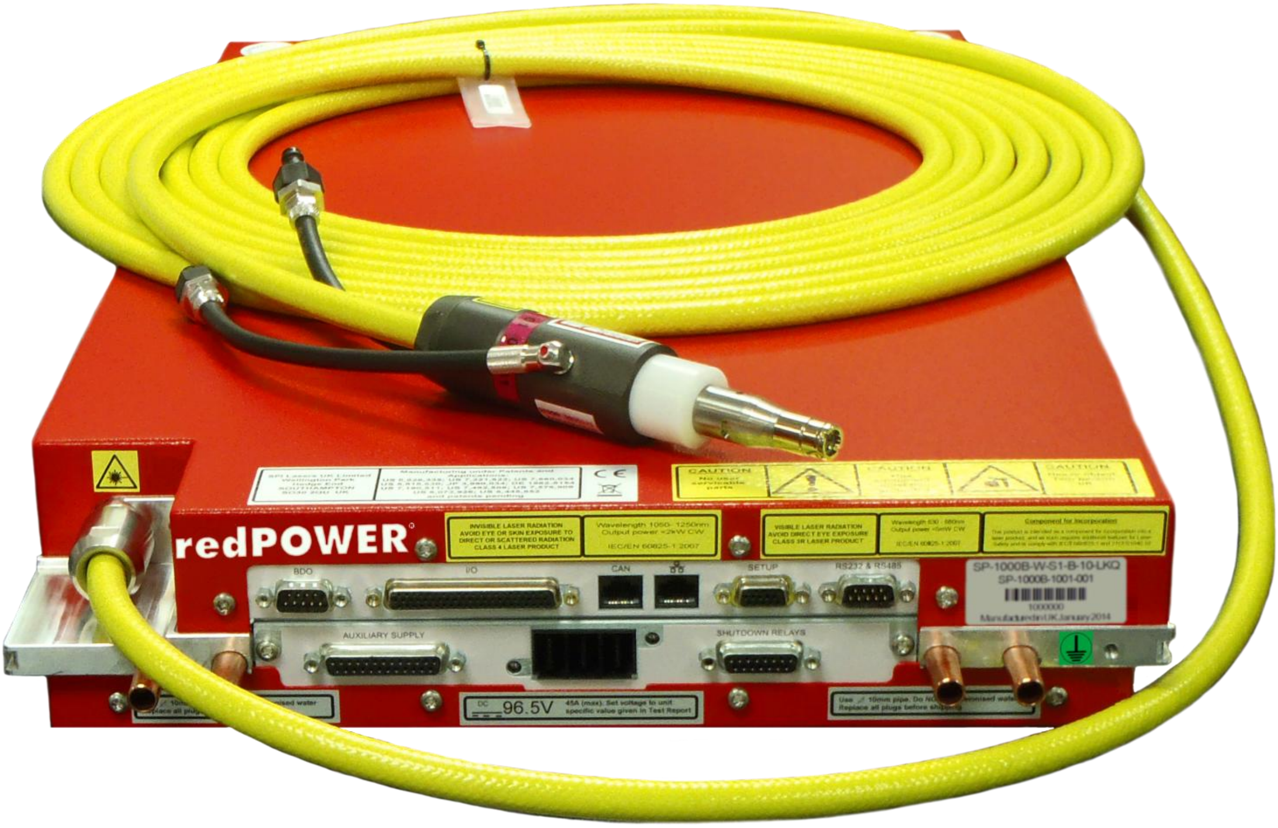
SPI Lasers UK Limited

500W-1kW K1 OEM Fibre Laser

Digital Interface Manual



Change History

Revision	Date	Originator	Description of Change	Section
A	01 August 2013	A Harker	First issue	-
B	18 March 2014	A Harker	Changes to reflect revised shipping configuration.	2.3
C	14 May 2014	A Harker	Terminology updated CAN bus added	-
D	21 December 2015	A Harker	RS-232 and RS-485 set up clarified	Table 4 Section 2.4
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I. Definition of Symbols and Terms

II. Warnings

CAUTION: If the OEM Fibre Laser described in this User Manual is operated in a manner not specified by SPI, the protection provided by the equipment may be impaired.

CAUTION: Modifications to the Product or the use of controls or adjustments or performance of procedures other than those specified herein:

- may be unsafe
- will invalidate the warranty
- may result in patent infringement

Laser Integrators are not authorized to modify the specification of the Product.

III. Laser Safety – Hazard Information

CAUTION: The OEM Fibre Laser controlled through the digital interfaces described in this Manual carries a Class 4 Laser rating and emits invisible laser radiation up to approximately 1kW CW in the region of 1050-1250nm that is invisible to the human eye.

The maximum output power in the event of a single fault condition can be up to 2kW. Additionally, the Product contains embedded laser devices that emit invisible radiation in the region of 900-1000nm. Under no circumstances should the OEM Fibre Laser casing be opened unless by SPI approved service personnel.

AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION.

Contact with direct or scattered laser radiation can cause damage to the eyes, burn human tissue and start fires.

CAUTION: The visible pilot laser controlled through the digital interfaces described in this User Manual carries a Class 3R laser rating and emits visible laser radiation in the range 630 – 680nm.

The visible pilot laser may emit powers of up to 5mW under a single fault condition.

AVOID DIRECT EYE EXPOSURE.

Ensure that users are fully aware of all safety implications identified in the Safety Section of this Manual before attempting to install, operate or maintain the unit.

IV. Table of Contents

V. Laser Safety – Hazard Information

Ensure that operators are fully aware of all safety implications identified in the Safety section of the Product Manual SM-S00399 before attempting to install or operate the laser.

V.I. Laser Safety under Ethernet Control

	CAUTION: It is possible for multiple users to connect to and control an OEM Fibre Laser simultaneously via the Ethernet port. The OEM Fibre Laser will respond to each command in the order in which it is received and does not differentiate between commands sent from different sources. Care should be taken especially when controlling the laser remotely across a network as another user could be working with the laser. It is the Integrators responsibility to ensure that any remote connectivity to the OEM Fibre Laser cannot inadvertently allow power to be emitted by the OEM fibre laser when it is not safe to do so. We recommend that any user intending to control the OEM Fibre Laser via Ethernet remotely across a network should first check that the laser is installed in an interlocked, Class 1 enclosure.

1 Introduction

This user manual defines the command set for SPI's 500W-1kW K1 OEM Fibre Lasers. It does not provide exhaustive information on the functioning of the OEM Fibre Lasers, for which the 500W-1kW K1 OEM Fibre Laser Product Manual, SM-S00264, should be read in conjunction with this manual.

Section 2 of the manual describes how to establish a connection between the OEM Fibre Laser and the PC using either Ethernet, CAN bus[1], RS-485 or RS-232.

Section 3 describes the three modes in which the OEM Fibre Laser can be run using the digital interface. In mode A the interface can be used to read back values for parameters which are monitored in the OEM Fibre Laser but cannot be used to set any. In mode B the interface can be used to read back values for parameters which are monitored in the OEM Fibre Laser and can set many (depending on access level) but cannot initiate laser emission. Mode C additionally allows laser emission to be initiated over the digital interface.

Section 4 gives the protocol for all the commands.

Section 5 gives the details of the commands themselves. The commands are interface independent.

[1] CAN bus is available from Version 2.0 of the OEM Fibre Laser's firmware.

2 Connecting to the OEM Fibre Laser

Figure 1 Control Connections to OEM Fibre Laser

2.1. Connector Locations

Digital connection can be made using Ethernet, CAN bus, RS-485 or RS-232. The positions on the front panel of the connectors for these interfaces are shown in Figure 2. In order establish a digital connection 24V has to be supplied to the OEM Fibre Laser. (It is not necessary for the pump diode PSU to be connected). To operate the OEM Fibre Laser other connections have to be made as described in the Product Manual. Depending on the mode in which it is desired to operate the OEM Fibre Laser the connection to the Analogue and Logic Interface may not be required.

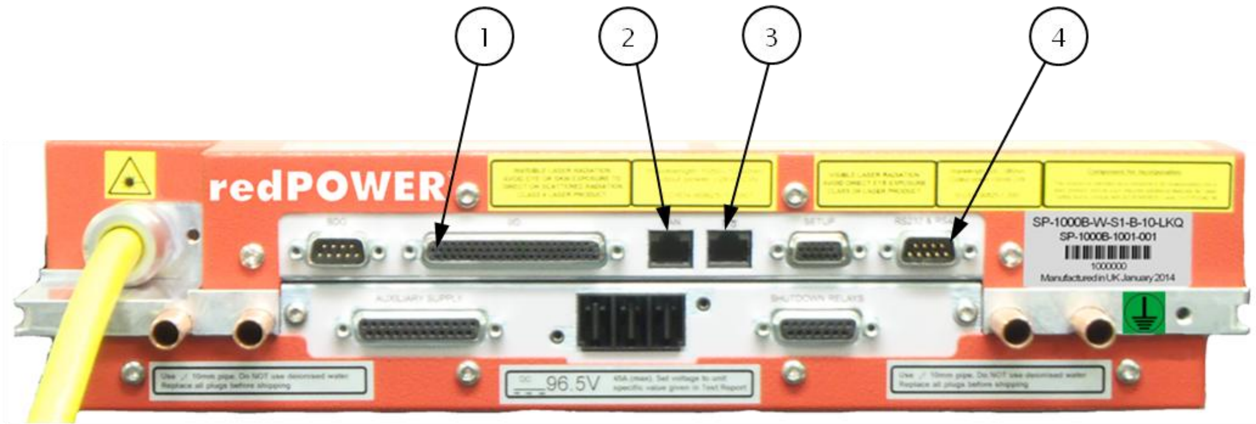

Figure 2 Connector Locations

Table 1 Electrical Interface Connections

№	ID	Function	Connector Description	Reference
1	J18	Analogue and Logic Interface	62-way D-type high density female connector	Section 2.1.1
2	J21	CAN bus	RJ-45 connector	Section 2.1.2
3	SK1	Ethernet	RJ-45 connector	Section 2.1.2
4	J29	RS-232 and RS-485	9-way D-Type male connector	Section 2.1.4

2.1.1. Analogue and Logic Interface Connector

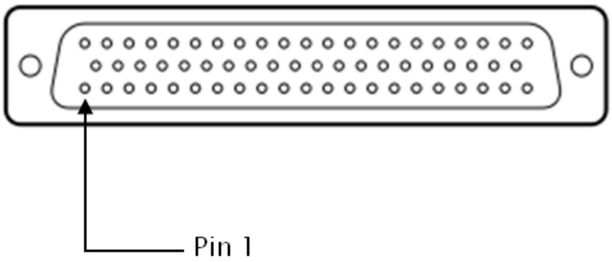

Figure 3 Analogue and Logic Interface Connector

For operation in modes A and B connection should be made to the pins of the 62-way female high density D-type female Analogue and Logic Interface Connector shown in Table 2. The full pinout is given in the Product Manual.

A fully screened, high quality cable should be used. SPI recommends a cable from the L-com series CHD62.

Table 2 Analogue and Logic Interface Connector Pinout

Pin №	Connection Name	Description	I/O	Levels/ Scaling
2	**Power Set**	Analogue input that sets the pump diode current when **Modulate** is High. 10V=100% Rated Power. Over-drive up to 10.5V is possible.	I	0-10V
3	**Simmer Set**	Analogue input that sets the pump diode current when **Modulate** is Low. 2.5V=25% Rated Power. Increasing the voltage up to 10.5V does not increase the pump diode current when **Modulate** is Low.	I	0-2.5V
32	**Enable High**	**Enable High** works with **Enable Low.** When both are asserted they put the OEM Fibre Laser into the Ready state. They do not turn the OEM Fibre Laser on.	I	Active High
33	**Enable Low**	**Enable Low** works with **Enable High**. When both are asserted they put the OEM Fibre Laser into the Ready state. They do not turn the OEM Fibre Laser on.	I	Active Low
35	**Laser ON Request**	Asserting **Laser ON Request** turns the OEM Fibre Laser ON when the OEM Fibre Laser is in the Ready state.	I	Active High
37	**RAL ON Request**	Asserting **RAL ON Request** turns on the pilot laser (RAL)	I	Active High

Pin №	Connection Name	Description	I/O	Levels/ Scaling
39	**Modulate**	When the OEM Fibre Laser is ON, **Modulate** switches the laser power between the levels set by **Power Set** and **Simmer Set**. It is the way of operating the OEM Fibre Laser in the Digital Modulation mode.	I	Active High
49	**Clear Faults**	Asserting **Clear Faults** clears the latched Fault conditions allowing the OEM Fibre Laser to be re-enabled.	I	Active High

2.1.2. CAN bus Connector

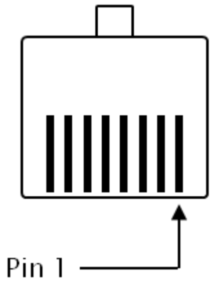

Figure 4 CAN bus connector

The CAN bus has a standard RJ45 connector. The pinout is given in Table 3.

Table 3 CAN bus Connector Pinout

Pin №	Connection Name	Description
1	**CAN_H**	CAN high
2	**CAN_L**	CAN low
3	**Ground**	
4 – 8	–	Not connected

2.1.3. Ethernet Connector

The Ethernet interface has a standard RJ45 connector.

2.1.4. RS-232 and RS-485 Connector

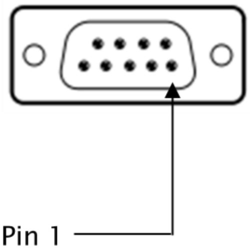

Figure 5 RS-232 and RS-485 Connector

Pin 1 of the RS-232 and RS-485 connector is indicated in Figure 5 and the connections are given in Table 4.

Table 4 RS-232 and RS-485 Control

Pin №	Connection Name	I/O	Description
1	Ground	-	Ground
2	RS-232 Rx	I	RS-232 receive
3	RS-232 Tx	O	RS-232 transmit
4	Not connected	-	-
5	Ground	-	Ground
6	RS-485 Rx +	I	RS-485 receive (differential)
7	RS-485 Rx -	I	
8	RS-485 Tx -	O	RS-485 transmit (differential)
9	RS-485 Tx +	O	

2.2. Establishing a Digital Connection

A graphical user interface (GUI) is provided with the OEM Fibre Laser. It is recommended that this is used when first establishing a digital connection. Refer to the OEM Fibre Laser GUI Manual, SM-S00363

2.3. Making an Ethernet Connection

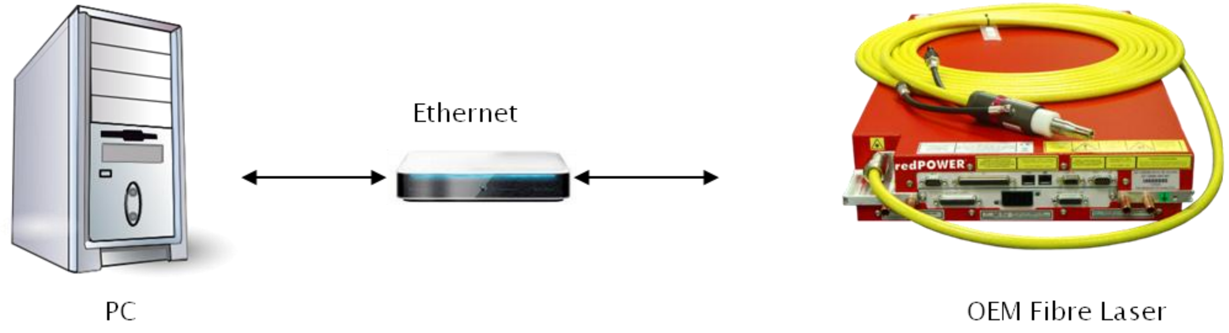

Figure 6 Ethernet Connection Through LAN or Router

The OEM Fibre Laser is shipped configured for dynamic IP addressing (DHCP). With dynamic addressing the OEM Fibre Laser can be connected to any network to receive a valid IP address and establish communication (Figure 6). When the connection is made through a router or LAN a standard Ethernet cable should be used.

If connection is made directly from a PC to the OEM Fibre Laser a crossover cable should be used (Figure 7). (A crossover cable is included in the standard accessories kit, PT-K00146, supplied with the OEM Fibre Laser.)

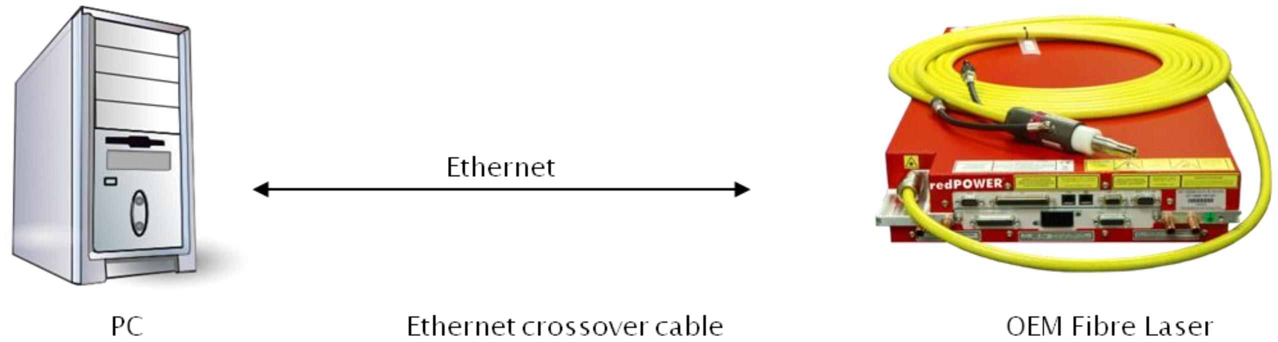

Figure 7 Direct Ethernet Connection

If required a static IP address can be selected once a connection has been established. Note that changing the addressing from dynamic to static will also require the PC addressing mode to be changed to re-establish communication.

An accessory kit containing an Ethernet hub, which can use DHCP, and a USB to RS-232 adaptor, which is configured to suit the OEM Fibre Laser, is available from SPI: order code PT-K00177.

2.4. Making an RS-232 Connection

Before making an RS-232 connection the PC should be setup with the parameters given in Table 5.

Table 5 Recommended RS-232 and RS-485 settings

Parameter	Value
Bits per second	38400

Parameter	Value
Data bits	8
Parity	None
Stop bits	1
Flow control	None

To establish serial communications the COM port must be set. Using the GUI, open the Comms window by clicking the Comms tab and follow the instructions given in the GUI manual.

2.5. Making an RS-485 Connection

Before making an RS-232 connection the PC should be setup with the parameters given in Table 5.

To establish serial communications the COM port must be set and unit number known. The default unit number is 1. Using the GUI, open the Comms window by clicking the Comms tab and follow the instructions given in the GUI manual.

2.6. Making a CAN bus Connection

CAN bus is available from Version 2.0 of the OEM Fibre Laser's firmware.

The CAN bus controller should be connected to the OEM Fibre Laser according to the wiring diagram in Figure 4. The OEM Fire Laser has the default CAN identifier 0x401. The CAN identifier can be changed using the GUI: open the Comms window by clicking the Comms tab and follow the instructions given in the GUI manual.

3 Modes of Controlling the Laser

The OEM Fibre Laser can be controlled without a digital interface by using analogue and logic signals on the Analogue and Logic Interface. These give full set point control and status monitoring. This mode of operation is described in the 500W-1kW K1 OEM Fibre Laser Product Manual, document number SM-S00264.

The digital interface gives three additional modes of operation – A, B and C – which retain the functions available by using analogue and logic signals and add more monitoring and control. (These modes are separate from the three modes of operation of the OEM Fibre Laser: continuous wave (CW), analogue modulation and digital modulation.)

Mode A gives additional monitoring and is easy to add to an existing installation which uses the analogue and logic interface. In this mode the parameters available on the Analogue and Logic Interface can be read back from the OEM Fibre Laser but none can be set. OEM Fibre Lasers are supplied set to Mode A.

In mode B the power and all other all parameters can be set and read back from the OEM Fibre Laser but the laser cannot be enabled. This is to ensure that laser emission cannot be commanded remotely. To obtain laser emission appropriate logic levels must be applied to the pins of the Analogue and Logic Interface connector as given in Table 2 and described further in the Operating

Instructions section of the Product Manual. As inputs are made directly to the OEM Fibre Laser, it can be operated in continuous wave (CW), analogue modulation and digital modulation modes.

In mode C the power and all other all parameters can be set and read back from the OEM Fibre Laser and laser emission can be commanded. Ensure that sufficient laser safety measures are in place before selecting this mode. In this mode the OEM Fibre Laser can only be operated CW. It is not necessary to connect to the Analogue and Logic Interface, but the analogue output signals on it are still available, however the digital input lines are disabled.

In all modes the OEM fibre laser faults can be cleared using the digital interface following some fault shutdown events. Note that some faults cannot be cleared using the digital interface, as clearing the fault and restarting the OEM Fibre Laser after it has shut down may result in damage, or further damage, to the OEM Fibre Laser. If these faults occur contact SPI.

The mode setting is non-volatile, so the laser powers up in the mode it was in when it was turned off.

4 Command Protocol

4.1. Ethernet, RS-232 and RS-485

4.1.1. Interface Data Frame

For Ethernet, RS-232 and RS-485 all data transactions have the frame structure is given in Figure 8, no matter what the data is or in what direction it is travelling.

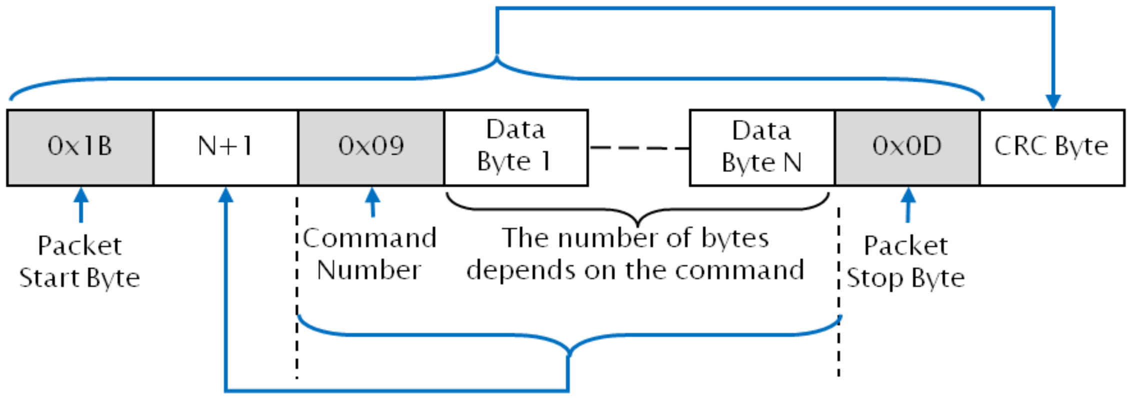

Figure 8 Data Frame

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01 to 0xFF	Number of command and data bytes (N+1).
3	0x01 to 0xFF	Command number
4	0x??	Data byte 1

Byte No	Value	Function
5	0x??	Data byte 2
...	...	...
N+3	0x??	Data byte N
N+4	0x0D	Stop byte (not CAN bus)
N+5	0x??	CRC byte (Addition of bytes 1 through N+4) (not CAN bus)

Every command sent to the laser will be responded to, except Reset System – 0x08.

4.1.2. Example Communications Exchange

As an example the following exchange could take place:

To set value 25865 (decimal), 0110010100000000 (binary), 6500 (Hex)

Laser receives

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x85	Command code (fictitious command which sets a parameter)
4	0x00	LSB of 16 bit value
5	0x65	MSB of 16 bit value (parameter will be set to this 2 byte value)
6	0x0D	Stop byte (not CAN bus)
7	0x15	CRC byte (addition of bytes 1 through 6) (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x85	Command value echoed in this response
4	0x00	Data byte 1 – could indicate that the command was successful
5	0x0D	Stop byte (not CAN bus)
6	0xAF	CRC byte (not CAN bus)

Using this command protocol ensures that a response received from the laser cannot be misinterpreted due to command / response synchronisation as the command requesting the response is included in the response.

4.1.3. Communications Error Indication

Should an error in communication occur then this response will be sent by the laser:

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x00	Command value
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Note that the command value is 0, which is an invalid command value and is only ever used to indicate a communications error. The response byte can take the following values:

Response byte values:

Value	Function
0x00	Command not supported
0x01	CRC error
0x02	No Start byte (not CAN bus)
0x03	No Stop byte (not CAN bus)
0x04	Incorrect number of data bytes
0x05	Overrun error
0x06	Parity error
0x07	Framing error
0x08	Rx buffer overflow
0x09	Unspecified framing error
0x0A	Command timeout

4.1.4. Data Format Settings

The RS-232 interface simply transmits and receives the command protocol as described above.

The Ethernet interface employs the use of TCP packets. The port number is 58178. The payload of the TCP packet is the command as described above.

The RS-485 interface is very similar to the RS-232 except that an additional byte is used to define the laser address. This is built up in the following way:

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x??	RS-485 address
3	0x02	No of command and data bytes.
4	0x01	Command number
5	0x0D	Stop byte (not CAN bus)
6	0x2B	CRC byte (not CAN bus)

Note the addition of byte number 2. This is inserted into the command protocol previously described. The additional byte is not included in the calculation of the CRC byte. The response from the laser uses the same format.

4.2. CAN Bus

4.2.1. CAN Protocol

The standard CAN communications protocol with an 11-bit identifier, as defined in ISO-11898:2003 is used. The frame structure is shown in Figure 9 and the meanings of the bit fields are given in Table 6.

SOF	11 bit Identifier	RTR	IDE	r0	DLC	0…8 Data bytes	CRC	ACK	EOF	IFS

Figure 9 CAN Data Frame

Table 6 The meanings of CAN bit fields

Bit field Name	Length (bits)	Meaning
SOF	1	The single dominant start of frame (SOF) bit marks the start of a message, and is used to synchronize the nodes on a bus after being idle
Identifier	11	The Standard CAN 11-bit identifier establishes the priority of the message. The lower the binary value is, the higher its priority is
RTR	1	The single remote transmission request (RTR) bit is dominant when information is required from another node. All nodes receive the request, but the identifier determines the specified node. The responding data is also received by all nodes and used by any node interested. In this way, all data being used in a system is uniform
IDE	1	A dominant single identifier extension (IDE) bit means that a standard CAN identifier with no extension is being transmitted

Bit field Name	Length (bits)	Meaning
r0	1	Reserved bit (for possible use by future standard amendment)
DLC	4	The 4-bit data length code (DLC) contains the number of bytes of data being transmitted
Data	0 to 64	Up to 64 bits, 8 bytes, of application data may be transmitted
CRC	16	The 16-bit (15 bits plus delimiter) cyclic redundancy check (CRC) contains the checksum (number of bits transmitted) of the preceding application data for error detection
ACK	2	Every node receiving an accurate message overwrites this recessive bit in the original message with a dominate bit, indicating an error-free message has been sent. Should a receiving node detect an error and leave this bit recessive, it discards the message and the sending node repeats the message after re-arbitration. In this way, each node acknowledges (ACK) the integrity of its data. ACK is 2 bits, one is the acknowledgment bit and the second is a delimiter
EOF	7	This end-of-frame (EOF), 7-bit field marks the end of a CAN frame (message) and disables bit-stuffing, indicating a stuffing error when dominant. When 5 bits of the same logic level occur in succession during normal operation, a bit of the opposite logic level is stuffed into the data
IFS	7	This 7-bit inter-frame space (IFS) contains the time required by the controller to move a correctly received frame to its proper position in a message buffer area

4.2.2. CAN Data Field Utilization

Note that the CAN Data Frame includes SOF, EOF and CRC bit fields. Therefore the start byte, stop byte and CRC byte are not included in the 8 data bytes of the CAN data frame.

As the OEM Fibre Lasers in a CAN network do not have to communicate with each other, the CAN bus can be configured as a network between a master and multiple slaves as shown Figure 10.

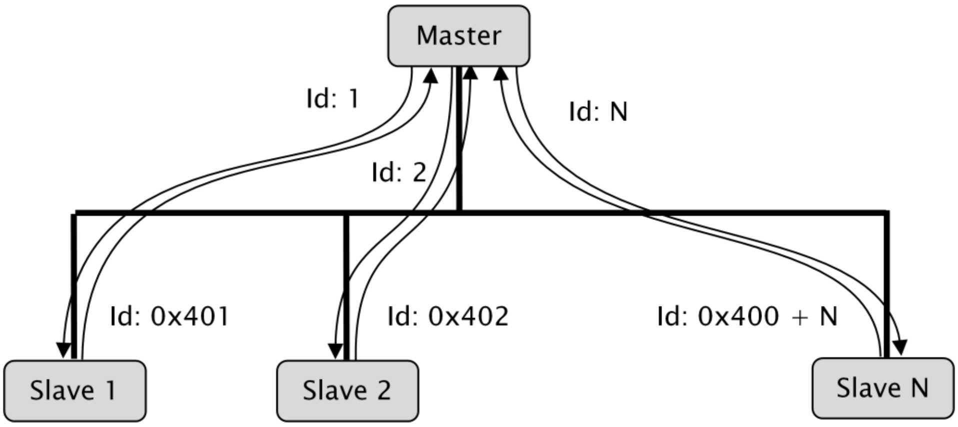

Figure 10 CAN network with master and slaves

In this configuration, the master is the host CAN node and is, for example, connected to a host PC through a CAN-USB adaptor. Slave nodes 1...N are the OEM Fibre Lasers. The numerical value of N can be up to 1023, but there may a lower limits to the number of CAN nodes on the same CAN bus-line.

To make full use of the CAN identifier field, the master is assigned multiple CAN identifiers, 0...0x3FF. Correspondingly, the CAN identifiers of the OEM Fibre Lasers are assigned 0x400...0x7FF. The master has smaller CAN identifier values and always has higher priority over the OEM Fibre Lasers.

When the master node talks to the i^{th} node, it uses CAN identifier i. Only the i^{th} node responds with CAN identifier 0x400+i. In other words, the i^{th} node only receives the transfers from CAN identifier i and responds to it with CAN identifier 0x400+i.

Because the slave CAN identifier, 0x400+i, is unique, the master node knows that data on the CAN bus is from the slave node which it initiated communication with, and that the data bits, representing the required information or responses of the OEM Fibre Laser, are from the i^{th} OEM Fibre Laser. In this way, neither source address nor destination address needs to be included in the CAN data field, as is needed with RS-485, and so all the data bytes can be used for data.

4.2.3. Assignment of CAN data field

The CAN data field is organised as follows.

Byte No	Value	Function
1	0x??	Frame number starting from 0.
2	0x??	Number or remaining number of command and data bytes of this command.
3	0x??	Command number
4	0x??	Data byte
5	0x??	Data byte
6	0x??	Data byte

Byte No	Value	Function
7	0x??	Data byte
8	0x??	Data byte

The 1st byte is the frame number of a command. For commands with multiple frames, the frame numbers are used to assemble the command from the received frames at the receiving node.

The 2nd byte is the total number or remaining number of command number bytes and data bytes and command parameter bytes of the command. If it is less than or equal to 6, it means that the current frame is the last frame of the command.

For the first frame, frame 0, the 3rd byte is the command number. If the command has more than 1 frame, the 3rd byte of frame 1 upwards is a command parameter or data.

Bytes 4-8 are command parameters or data.

As an example, for Get Status (0x01) command, the OEM Fibre Laser receives the following data field.

Byte No	Value	Function
1	0x00	Frame number 0
2	0x01	Command length is 1
3	0x01	Get laser status
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-

The laser transmits the following 3 frames in response.

Byte No	Value	Function
First Frame		
1	0x00	Frame 0
2	0x0F	Number of bytes is 15.
3	0x01	Command value echoed in this response
4	0x??	Status byte 1
5	0x??	Status byte 2
6	0x??	Status byte 3

Byte No	Value	Function
7	0x??	Status byte 4
8	0x??	Status byte 5
Second Frame		
1	0x01	Frame 1
2	0x09	Remaining number of data bytes is 9.
3	0x??	Status byte 6
4	0x??	Status byte 7
5	0x??	Status byte 8
6	0x??	Status byte 9
7	0x??	Status byte 10
8	0x??	Status byte 11
Third Frame		
1	0x02	Frame 2
2	0x03	Remaining number of data bytes is 3.
3	0x??	Status byte 12
4	0x??	Status byte 13
5	0x??	Status byte 14
6	-	-
7	-	-
8	-	-

4.2.4. Changing the CAN identifier

The CAN identifier is read and set using the commands Get Settings – 0x0C and Set Settings – 0x0D which are described in Sections 5.12 and 5.13. For convenience the specific syntaxes are given below

4.2.4.1. Get CAN identifier

This command gets the CAN identifier from the OEM Fibre Laser.

Laser receives:

Byte No	Value	Function
1	0x00	Frame number

Byte No	Value	Function
2	0x08	Number of command and data bytes
3	0x0C	Command number
4	0x03	This byte is 3 to get the CAN identifier
5	0x00	This byte is always 0
6	0x00	This byte is always 0
7		
8		

Laser transmits:

Byte No	Value	Function
1	0x00	Frame number
2	0x09	Number of command and data bytes
3	0x0C	Command number
4	0x??	Response byte
5	0x03	Subcommand Number
6	0x??	Parameter 1
7	0x??	Parameter 2
8	0x??	Parameter 3
9	0x??	Parameter 4
10	0x??	Parameter 5
11	0x??	Parameter 6
12	0x0D	Stop byte
13	0x??	CRC byte

Response byte values

Value	Function
0x00	RS-485 unit number
0x01	ADC expansion channel
0x02	Seed DAC adjust value
0x03	Amp DAC adjust value

Value	Function
0x04	Mode stripper amplification (0=1, 1=10, 2=100, 3=1000)
0x05	Amp photodiode amplification (0=1, 1=10, 2=100, 3=1000)
0x06	Seed fault disable (0 = not disabled, 1 = disabled)
0x07	TBD
0x08	TBD
0x09	TBD
0x0A	TBD
0x0B	TBD
0x0C	TBD
0x0D	TBD
0x0E	TBD
0x0F	TBD
0x10	TBD
0x11	TBD

4.2.4.2. Set CAN identifier

This command sets the CAN identifier of the OEM Fibre Laser.

Laser receives:

Byte No	Value	Function
1	0x00	Frame number
2	0x08	Number of command and data bytes
3	0x0D	Command number
4	0x03	Subcommand number to set the CAN identifier
5	0x??	Parameter 1
6	0x??	Parameter 2
7	0x??	Parameter 3
8	0x??	Parameter 4
9	0x??	Parameter 5
10	0x??	Parameter 6

Byte No	Value	Function
11		
12		

Laser transmits:

Byte No	Value	Function
1	0x00	Frame number
2	0x03	Number of command and data bytes
3	0x0D	Command number
4	0x??	Response byte
5	0x03	Subcommand number
6		
7		

Response byte values:

Value	Function
0x00	Function executed successfully
0x01	Access level inadequate
0x02	Subcommand not supported
0x03	Parameter out of range
0x04	I2C Error

5 Commands

5.1. Get Status – 0x01

This command is designed to be short and so with a fast transmission speed. The state of the laser can easily be determined via this command alone. Further, more detailed, information is provided in other commands.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes

Byte No	Value	Function
3	0x01	Command number
4	0x0D	Stop byte (not CAN bus)
5	0x2B	CRC byte

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x0F	Number of command and data bytes
3	0x01	Command value echoed in this response
4	0x??	Status byte 1
5	0x??	Status byte 2
...		...
16	0x??	Status byte 13
17	0x??	Status byte 14
18	0x0D	Stop byte (not CAN bus)
19	0x??	CRC byte

Status byte 1:

Bit No	Meaning
1	OEM board EEPROM read error.
2	OEM board EEPROM write error
3	Driver board EEPROM read error
4	Driver board EEPROM write error
5	I2C output setup error
6	Port A or port B I2C read failure
7	Port C or port D I2C read failure
8	TBD

Status byte 2:

Bit No	Meaning	
1	Internal mode bit 0	A = 000
2	Internal mode bit 1	B = 001
3	Internal mode bit 2	C = 010
4	0 = not enabled, 1 = enabled (only valid in mode C)	
5	Access level bit 0	
6	Access level bit 1	
7	RAL (0 = RAL off, 1 = RAL on)	
8	Fault (0 = No fault, 1 = Fault present)	

Status byte 3: LSB of requested power (only valid in modes B & C)

Status byte 4: MSB of requested power (only valid in modes B & C)

Status byte 5: LSB of requested simmer (only valid in modes B & C)

Status byte 6: MSB of requested simmer (only valid in modes B & C)

Status byte 7:

Bit No	Meaning
1	RAL On Requested
2	TBD
3	TBD
4	TBD
5	TBD
6	TBD
7	TBD
8	TBD

Status byte 8: LSB of actual power output in % (937 = 93.7%)

Status byte 9: MSB of actual power

5.2. Get Ethernet Settings – 0x02

This command returns the current settings for the Ethernet interface

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01	Number of command and data bytes
3	0x02	Command number
4	0x0D	Stop byte (not CAN bus)
5	0x2C	CRC byte

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x12	Number of command and data bytes
3	0x02	Command value echoed in this response
4	0x??	Current IP address MSB
5	0x??	Current IP address
6	0x??	Current IP address
7	0x??	Current IP address LSB
8	0x??	Static IP address MSB
9	0x??	Static IP address
10	0x??	Static IP address
11	0x??	Static IP address LSB
12	0x??	Mask MSB
13	0x??	Mask
14	0x??	Mask
15	0x??	Mask LSB
16	0x??	Gateway address MSB
17	0x??	Gateway address
18	0x??	Gateway address
19	0x??	Gateway address LSB
20	0x??	0 = Static IP, 1 = DHCP
21	0x0D	Stop byte (not CAN bus)

Byte No	Value	Function
22	0x??	CRC byte

5.3. Set Ethernet Settings – 0x03

This command allows the settings for the Ethernet interface to be modified. Note that after these settings are changed a system reboot will be required to implement then. This can be achieved with command 0x08.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x0E	Number of command and data bytes
3	0x03	Command value
4	0x??	Static IP address MSB
5	0x??	Static IP address
6	0x??	Static IP address
7	0x??	Static IP address LSB
8	0x??	Mask MSB
9	0x??	Mask
10	0x??	Mask
11	0x??	Mask LSB
12	0x??	Gateway address MSB
13	0x??	Gateway address
14	0x??	Gateway address
15	0x??	Gateway address LSB
16	0x??	Address Type – 0 = Static IP, 1 = DHCP
17	0x0D	Stop byte (not CAN bus)
18	0x??	CRC byte

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)

Byte No	Value	Function
2	0x02	Number of command and data bytes
3	0x03	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Meaning
0x00	Values changed, no error
0x01	Value of address type should either be 0 or 1.
0x02	Access level must be supervisor or greater
0x03	TBD
0x04	TBD
0x05	TBD

5.4. Get Digital IO – 0x04

Returns the state of the digital input and output lines.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01	Number of command and data bytes
3	0x01	Command number
4	0x0D	Stop byte (not CAN bus)
5	0x2D	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x15	Number of command and data bytes
3	0x04	Command value echoed in this response

Byte No	Value	Function
4	0x??	Inputs data byte 1
5	0x??	Inputs data byte 2
...	0x??	Inputs data byte ....
13	0x??	Inputs data byte 10
14	0x??	Outputs data byte 11
...	0x??	Outputs data byte ....
23	0x??	Outputs data byte 20
24	0x0D	Stop byte (not CAN bus)
25	0x??	CRC byte (not CAN bus)

Inputs data byte 1:

Bit	Meaning
0	RAL is on
1	Optical fault present
2	Hardware fault present
3	OEM fault present
4	Laser On status
5	Laser safety enabled
6	Laser active status
7	BDO fault present

Data byte 2:

Bit	Meaning
0	Shutdown relay A status
1	Shutdown relay B status
2	Laser is active
3	Pump diode supply on
4	Back reflection
5	Driver fault present
6	Safe on status

Bit	Meaning
7	Laser ready status

Data byte 3:

Bit	Meaning
0	Amplifier active status
1	Seed active status
2	Fault multiplexer interrupt
3	ADC data converting
4	Unused
5	Unused
6	Unused
7	Unused

Data byte 4:

Bit	Meaning
0	Back Reflection Fault
1	Output Fault
2	Ground Fault
3	Scattered Light Fault 2
4	Scattered Light Fault 1
5	BDO Fault 1
6	BDO Fault 2
7	Cold Plate Temp Fault

Data byte 5:

Bit	Meaning
0	LT_OVER_T
1	LT_OSD_FB
2	LT_MS_OVER_T
3	LT_OSD_WL

Bit	Meaning
4	Unused
5	Unused
6	Unused
7	Unused

Data byte 6:

Bit	Meaning
0	Pump PSU Fault (1 = fault present)
1	Unbalanced driver fault
2	Over power fault
3	Driver condensation fault
4	OEM condensation fault
5	Unused
6	Unused
7	Unused

Data byte 7: Unused

Data byte 8: Unused

Data byte 9: Unused

Data byte 10: Unused

Data byte 11:

Bit	Meaning
0	OEM digipot enabled
1	Driver digipot enabled
2	OEM EEPROM enabled
3	RS-485 transmit enabled
4	SPI DAC enabled
5	Clear faults is asserted
6	Forced fault

Bit	Meaning
7	Laser is on

Data byte 12:

Bit	Meaning
0	Amplifier turned on
1	Seed turned on
2	RAL turned on
3	Mode B or C selected
4	SPI ADC reset active
5	SPI ADC power down active
6	SPI ADC conversion started
7	SPI ADC chip select active

Data byte 13:

Bit	Meaning
0	SPARE_ON
1	TEST_I
2	FORCE_FAULT
3	MODE_EPOT
4	PS_I2C_ON
5	DELAY_OFF
6	LPF_ON driver imbalance
7	RAL_ON

Data byte 14:

Bit	Meaning
0	FAULT_DIS
1	SPARE6
2	GND_LEAK_DIS
3	+100V_ON

Bit	Meaning
4	P1_SAFE_DIS
5	P2_SAFE_DIS
6	P3_SAFE_DIS
7	P4_SAFE_DIS

Data byte 15:

Bit	Meaning
0	AS_S0
1	AS_S1
2	AS_S2
3	AS_EXA
4	AS_EXB
5	AS_EXC
6	AS_EXG1
7	AS_EXG2

Data byte 16:

Bit	Meaning
0	AMP1_A0
1	AMP1_A1
2	AMP2_A0
3	AMP2_A1
4	SEED_ACTIVE
5	SPARE2
6	SPARE3
7	SPARE4

Data byte 17:

Bit	Meaning
0	SPARE5

Bit	Meaning
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused

Data byte 18

Bit	Meaning
0	Mode B or C selected
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused

Data byte 19: Unused

Data byte 20:

Bit	Meaning
0	Unused
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Test output (when active prevents interface scanning)

5.5. Get Analogue Value – 0x05

This command allows internal analogue values to be read from the laser.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x05	Command number
4	0x??	Analogue channel to be read
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x06	Number of command and data bytes
3	0x05	Command value echoed in this response
4	0x??	Analogue channel requested
5	0x??	Response byte
6	0x??	Unit Type
7	0x??	LSB of the reading
8	0x??	MSB of the reading
9	0x0D	Stop byte (not CAN bus)
10	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Meaning
0x00	Channel read OK
0x01	Unknown channel number

Analogue channel numbers:

Value	Function	Units
0x00	Heat sink temperature 1	0.1 Centigrade
0x01	Heat sink temperature 2	0.1 Centigrade
0x02	BDO voltage	Millivolts
0x03	Velocity	Millivolts
0x04	I0	Milliamps
0x05	I1	Milliamps
0x06	I2	Milliamps
0x07	I3	Milliamps
0x08	V0	Millivolts
0x09	V1	Millivolts
0x0A	V2	Millivolts
0x0B	V3	Millivolts
0x0C	Mux	See table below
0x0D	Output power monitor	Millivolts
0x0E	Seed power monitor	Millivolts
0x0F	RAL power	Milliwatts
0x10	Driver PCB temp	0.1 Centigrade
0x11	Mode stripper 1	0.1 Centigrade
0x12	Mode stripper 2	0.1 Centigrade
0x13	Mode stripper 3	0.1 Centigrade

Unit type:

Value	Meaning
0x00	Millivolts
0x01	Milliamps
0x02	0.1 degrees Centigrade
0x03	Milliwatts

Unit type mux channel selection (use Set Setting command).

Value	Function	Units
0x00	OSD_FB1 fibre burn	Millivolts
0x01	OSD_FB2	Millivolts
0x02	OSD_SC1scattered light	Millivolts
0x03	OSD_SC2	Millivolts
0x04	OSD_POF1pdof	Millivolts
0x05	OSD_POF2	Millivolts
0x06	OSD_POF3	Millivolts
0x07	OSD_POF4	Millivolts
0x08	OSD_SM	Millivolts
0x09	OSD_OM	Millivolts
0x0A	OSD_MS	Millivolts
0x0B	OSD_MFA	Millivolts
0x0C	OSD_WL1	Millivolts
0x0D	OSD_WL2	Millivolts
0x0E	LT_FAULT_HW Hardware fault	Millivolts
0x0F	LT_FAULT_OP output fault	Millivolts
0x10	OSD_FB1_TH Fibre burn threshold	Millivolts
0x11	OSD_FB2_TH	Millivolts
0x12	OSD_SC1_TH scatter 1	Millivolts
0x13	OSD_SC2_TH	Millivolts
0x14	OSD_MS_WARN_TH mode stripper warning temperature	Millivolts
0x15	OSD_MFA_TH	Millivolts
0x16	OSD_WL1_TH	Millivolts
0x17	OSD_WL2_TH	Millivolts
0x18	HUMID_DRV humidity driver	Millivolts
0x19	HUMID_OEM	Millivolts
0x1A	HUMID_T_OEM OEM temperature	Millivolts
0x1B	OP_SEED_ACTIVE	Millivolts

Value	Function	Units
0x1C	OP_AMP_ACTIVE	Millivolts
0x1D	0V	Millivolts
0x1E	BDO_VOLTS	Millivolts
0x1F	DAC_MODE	Millivolts
0x20	EXT_WD	Millivolts
0x21	0V	Millivolts
0x22	OEM_WD	Millivolts
0x23	DB_WD	Millivolts
0x24	B_PX_FET_P FET power	Millivolts
0x25	B_PX_DIODE+_V	Millivolts
0x26	0V	Millivolts
0x27	0V	Millivolts
0x28	LT_FAULT_OEM	Millivolts
0x29	LT_FAULT_DB	Millivolts
0x2A	FAULT_RESET	Millivolts
0x2B	LT_OVER_T	Millivolts
0x2C	5V	Millivolts
0x2D	LT_+100V_FAULT LT-latched	Millivolts
0x2E	LT_OVER_P	Millivolts
0x2F	LT_UNBALLANCED	Millivolts
0x30	LT_GLEAK_DB	Millivolts
0x31	LT_CONDENSATION_DB	Millivolts
0x32	LT_CONDENSATION_OEM	Millivolts
0x33	DELAY_DIS	Millivolts
0x34	LPF_ON	Millivolts
0x35	MODULATE	Millivolts
0x36	MS1_T	Millivolts
0x37	MS2_T	Millivolts
0x38	MS3_T	Millivolts

Value	Function	Units
0x39	SAFE_FAST_ACTIVE	Millivolts
0x3A	GND_LEAK_DIS_DB	Millivolts
0x3B	PX_ON	Millivolts
0x3C	P1_SAFE_EN	Millivolts
0x3D	P2_SAFE_EN	Millivolts
0x3E	P3_SAFE_EN	Millivolts
0x3F	P4_SAFE_EN	Millivolts

5.6. Command – 0x06

This command is unused.

5.7. Command – 0x07

This command is unused.

5.8. Reset System – 0x08

This command resets the processor. It is usually used to initialise the Ethernet interface after address or mode changes.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01	Number of command and data bytes
3	0x08	Command number
4	0x0D	Stop byte (not CAN bus)
5	0x31	CRC byte (not CAN bus)

Laser transmits:

There is no response to this command as the processor will have been reset.

5.9. Command – 0x09

This command is not for use by the laser integrator.

5.10. Command – 0x0A

This command is not for use by the laser integrator.

5.11. Command – 0x0B

This command is not for use by the laser integrator.

5.12. Get Settings – 0x0C

This command gets various settings from the laser.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x04	Number of command and data bytes
3	0x0C	Command number
4	0x??	Subcommand number
5	0x00	This byte is always 0
6	0x00	This byte is always 0
7	0x0D	Stop byte (not CAN bus)
8	0x??	CRC byte (not CAN bus)

Subcommand numbers:

Number	Function
0	RS-485_UNIT_NO
1	ADC_EXPANSION_CHANNEL
2	DAC_ADJUST
3	CAN_NODE_NO
4	MODE_STRIP_AMPLIFICATION
5	AMP_PDIODE_AMPLIFICATION
6	SEED_ERROR_DISABLE

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x09	Number of command and data bytes
3	0x0C	Command number
4	0x??	Response byte

Byte No	Value	Function
5	0x??	Subcommand Number
6	0x??	Parameter 1
7	0x??	Parameter 2
8	0x??	Parameter 3
9	0x??	Parameter 4
10	0x??	Parameter 5
11	0x??	Parameter 6
12	0x0D	Stop byte (not CAN bus)
13	0x??	CRC byte (not CAN bus)

Response byte values

Value	Function
0x00	RS-485 unit number
0x01	ADC expansion channel
0x02	Seed DAC adjust value
0x03	Amp DAC adjust value
0x04	Mode stripper amplification (0=1, 1=10, 2=100, 3=1000)
0x05	Amp photodiode amplification (0=1, 1=10, 2=100, 3=1000)
0x06	Seed fault disable (0 = not disabled, 1 = disabled)
0x07	TBD
0x08	TBD
0x09	TBD
0x0A	TBD
0x0B	TBD
0x0C	TBD
0x0D	TBD
0x0E	TBD
0x0F	TBD
0x10	TBD
0x11	TBD

Note that the values Parameter1, Parameter 2, must be expressed as unsigned long integers. This means that, for example, the value 9 must be entered as 0x00, 0x00, 0x00, 0x09. If this is not adhered to the command may not be executed correctly.

5.13. Set Settings – 0x0D

This command sets various settings of the laser. Some of these settings may be changed only by qualified service personnel.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x08	Number of command and data bytes
3	0x0D	Command number
4	0x??	Subcommand Number
5	0x??	Parameter 1
6	0x??	Parameter 2
7	0x??	Parameter 3
8	0x??	Parameter 4
9	0x??	Parameter 5
10	0x??	Parameter 6
11	0x0D	Stop byte (not CAN bus)
12	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x0D	Command number
4	0x??	Response byte
5	0x??	Subcommand Number
6	0x0D	Stop byte (not CAN bus)
7	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Function executed successfully
0x01	Access level inadequate
0x02	Subcommand not supported
0x03	Parameter out of range
0x04	I2C Error

5.14. Set Access Level – 0x0E

Two levels of access are available to the user: Operator and Supervisor. A passcode is necessary to allow the supervisor access to a wider range of monitoring and control functions. The passcode is given on the test report for each laser.

In the example below the passcode is assumed to be 12Ab. The pass code will change if the firmware is changed.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x08	Number of command and data bytes
3	0x0E	Command number
4	0x31	Passcode character 1 – "1" (Note, example only!)
5	0x32	Passcode character 2 – "2"
6	0x41	Passcode character 3 – "A"
7	0x62	Passcode character 4 – "b"
8	0x0D	Stop byte (not CAN bus)
9	0x21	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x0E	Command number
4	0x??	Response byte

Byte No	Value	Function
5	0x??	Current Access Level
6	0x0D	Stop byte (not CAN bus)
7	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Function Executed successfully
0x01	Bad passcode
0x02	Subcommand not supported
0x03	Parameter out of range
0x04	Feature not enabled

Current access level byte meaning

Value	Function
0x00	Operator
0x01	Supervisor

5.15. Command – 0x0F

This command is not for use by the laser integrator.

5.16. Command – 0x10

This command is not for use by the laser integrator.

5.17. Command – 0x11

This command is not for use by the laser integrator.

5.18. Retrieve Fault Status – 0x12

Minimum Access Levels:

Erase faults = Supervisor

Retrieve fault = Operator

This command either retrieves the status of an fault or erases all faults. Note that command 0x17 Reset Hardware Faults should be used to reset the OEM Fibre Laser.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x04	Number of command and data bytes
3	0x12	Command Number
4	0x??	Action (See notes below)
5	0x??	Fault LSB
6	0x??	Fault MSB
7	0x0D	Stop byte (not CAN bus)
8	0x??	CRC byte (not CAN bus)

Action byte and meaning:

Value	Function
0x00	Read fault specified
0x01	Clear faults

Notes:

The fault requested can range from 1 to 1024 inclusive. However there may be no faults stored at all. In order to find out how many faults have been stored the user should read fault 0 as a special case. Then the “Number of faults stored” value returned is valid but the fault data is not and will be set to 0. The response byte will return “Fault retrieved OK “. If the fault requested is nonzero and this fault is not stored then the response is “Fault requested is not stored “, even if there are no faults stored. The “Number of faults stored” value is always correct. If the fault requested is greater than 1024 the response will be “Fault requested too big”.

In order to ensure that the faults are not cleared by accident the fault word must be set to 0xDEAD and the action to 0x01. Otherwise the response “Number to be retrieved not set for erase” will be returned.

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x86	Number of command and data bytes
3	0x12	Command number
4	0x??	Response byte
5	0x??	Number of faults stored LSB

Byte No	Value	Function
6	0x??	Number of faults stored MSB
7	0x??	Fault read LSB
8	0x??	Fault read MSB
9	0x??	Fault data 0
10	0x??	Fault data 1
	...	...
135	0x??	Fault data 126
136	0x??	Fault data 127
137	0x0D	Stop byte (not CAN bus)
136	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Fault retrieved OK
0x01	Fault requested does not exist
0x02	Insufficient access level
0x03	Number to be retrieved not set for erase
0x04	Fault requested too big
0x05	Unsupported action requested

5.19. Command – 0x13

This command is not for use by the laser integrator.

5.20. Get Version Information – 0x14

Minimum Access Levels: Supervisor

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01	Number of command and data bytes
3	0x14	Command number
4	0x??	Required Info Number

Byte No	Value	Function
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x2C	Number of command and data bytes
3	0x14	Command number
4	0x??	Response byte
5	0x??	Required info number
6	0x??	Required info ASCII character 1
7	0x??	Required info ASCII character 2
...	0x??	...
45	0x??	Required info ASCII character 39
46	0x??	Required info ASCII character 40
47	0x0D	Stop byte (not CAN bus)
48	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Value read OK
0x01	Required info number not supported
0x02	Driver EEPROM not available

Required info number values

Value	Function
0x00	Laser serial number (see note 1 below)
0x01	Laser model number (40 ASCII characters)
0x02	Firmware version – (see note 2 below)
0x03	OEM PCB serial number (see note 1 below)

Value	Function
0x04	OEM PCB build date (see note 3 below) (3 numbers read day, month, year)
0x05	OEM PCB repair date (see note 3 below)
0x06	Driver PCB serial number (see note 1 below)
0x07	Driver PCB build date (see note 3 below)
0x08	Driver PCB repair date (see note 3 below)

Note 1

Serial numbers are numeric ASCII characters so all values must be not less than 0x30 and not greater than 0x39.

Note 2

Firmware version is four numbers. For example:

byte 6 = 0x01, byte 7 = 0x02, byte 8 = 0x03, byte 9 = 0x04

This gives a version number to be displayed thus: 1.2.3.4

Note 3

Date is given as a number which is the number of days expired since December 30, 1899. So for example:

byte 6 = 0x3B, byte 7 = 0xA1. Where byte 6 is the LSB and byte 7 the MSB. This yields a value of 41275 and represents 1st Jan 2013.

5.21. Command – 0x15

This command is not for use by the laser integrator.

5.22. Set Mode – 0x16

Sets the required mode (A, B or C)

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x2E	Number of command and data bytes
3	0x16	Command number
4	0x??	Requested mode. A=1, B=2, C=3
4	0x0D	Stop byte (not CAN bus)
5	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x16	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Mode changed successfully.
0x01	Mode number not supported

5.23. Reset Hardware Faults – 0x17

Attempts to clear the hardware faults

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x01	Number of command and data bytes
3	0x17	Command number
4	0x0D	Stop byte (not CAN bus)
5	0x40	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x17	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)

Byte No	Value	Function
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Fault clear being attempted (this takes some time).
0x01	TBD

5.24. Command – 0x18

This command is not for use by the laser integrator.

5.25. Command – 0x19

This command is not for use by the laser integrator.

5.26. Set Power – 0x1A

Sets the required power (modes B or C)

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x1A	Command number
4	0x??	Requested power LSB
5	0x??	Requested power MSB
6	0x0D	Stop byte (not CAN bus)
7	0x??	CRC byte (not CAN bus)

Requested simmer is in the form of % with a resolution of 0.1%. For example 76.3% would be 763.

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x1A	Command number
4	0x??	Response byte

Byte No	Value	Function
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Power level changed OK
0x01	Not allowed in this mode

5.27. Enable Laser – 0x1B

Enables the laser (mode C only)

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x1B	Command number
4	0x??	0=Disable, 1=Enable
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x1B	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Laser enabled OK

Value	Function
0x01	Not allowed in this mode

5.28. Set Simmer – 0x1C

Sets the required simmer (modes B or C)

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x1C	Command number
4	0x??	Requested simmer LSB
5	0x??	Requested simmer MSB
6	0x0D	Stop byte (not CAN bus)
7	0x??	CRC byte (not CAN bus)

Requested simmer is in the form of % with a resolution of 0.1%. For example 76.3% would be 763.

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x1C	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Simmer level changed OK
0x01	Not allowed in this mode
0x02	I2C Error

5.29. Set RAL (Red Alignment Laser) – 0x1D

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x03	Number of command and data bytes
3	0x1D	Command number
4	0x??	0 = RAL off, 1 = RAL on
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes
3	0x1D	Command number
4	0x??	Response byte
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	RAL changed OK
0x01	Not allowed in this mode

5.30. Get Clock – 0x1E

Gets one of the two clocks in the system. There is a real time clock (RTC) and an elapsed clock. The devices fitted are an Microchip MCP79400 (RTC) and a Maxim DS1682 (Event Counter). The length of the response to this command will vary depending upon the read type requested.

Laser receives:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x02	Number of command and data bytes

Byte No	Value	Function
3	0x1E	Command number
4	0x??	Read type
5	0x0D	Stop byte (not CAN bus)
6	0x??	CRC byte (not CAN bus)

Read type:

Value	Function
0x00	Read Full RTC data
0x01	Read full event counter data
0x02	Read RTC time
0x03	Read event counter elapsed time & count

Laser transmits:

Byte No	Value	Function
1	0x1B	Start byte (not CAN bus)
2	0x??	Number of command and data bytes
3	0x1D	Command number
4	0x??	Response byte
5	0x??	Read type
6	0x??	Byte 1
7	0x??	Byte 2
...		...
N+6	0x??	Byte N
N+7	0x0D	Stop byte (not CAN bus)
N+8	0x??	CRC byte (not CAN bus)

Response byte values:

Value	Function
0x00	Data read OK
0x01	I2C error

Value	Function
0x02	Read type not supported

The format of the data is as follows:

Read types 0 & 1

Byte	Meaning	
0x00	Device data address 0	Refer to MCP79400 and DS1682 data sheets for device memory maps
…	…	
0x1F	Device data address 31	

Read type 2 – RTC Time

Byte	Meaning
0x00	Seconds
0x01	Minutes
0x02	Hours (24 hour format)
0x03	Day (1 = Monday, 7 = Sunday)
0x04	Date (day of month)
0x05	Month (1 = January)
0x06	Year

Read type 3 – Event Counter Time & Count

Byte	Meaning
0x00	Elapsed time LSB (seconds)
0x01	Elapsed time
0x02	Elapsed time
0x03	Elapsed time MSB
0x04	Event count LSB
0x05	Event count
0x06	Event count MSB

5.31. Command – 0x1F

This command is not for use by the laser integrator.

6 Contact Information

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