SPI Lasers UK Limited

Customer Command Reference for R4 CW-M Laser

FS-S00031

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Change History

Version	*Description*	*Date*
D	Changed description of error code 9 from framing error to time out.	5/6/13
E	Added section 2 about communicating via Ethernet Add new Setting commands to control RAL behaviour, allow solenoid to be on all the time and OPFA disable.	16/7/13
F	Changed byte in command 0x0C to internal component bits. Allows BDO Thermistor presence to be detected. Added BDO status bits to command 0x04. Added BDO Over temperature to command 0x01	24/10/13

Introduction

This document details the command structures required to write control software for the R4 series on CW-M lasers.

Note that this document covers both the HS and RS series of R4 lasers. Some commands and functions are not applicable for the RS laser.

Specifically these are commands associated with:-

Closed loop operation.

XPR

PSE

Automatic Calibration

Note: For RS Lasers manual calibration is covered in the Maintenance command.

Also note that any references to IPM in this document should be ignored. This feature is not currently available.

1 RS232 Communications

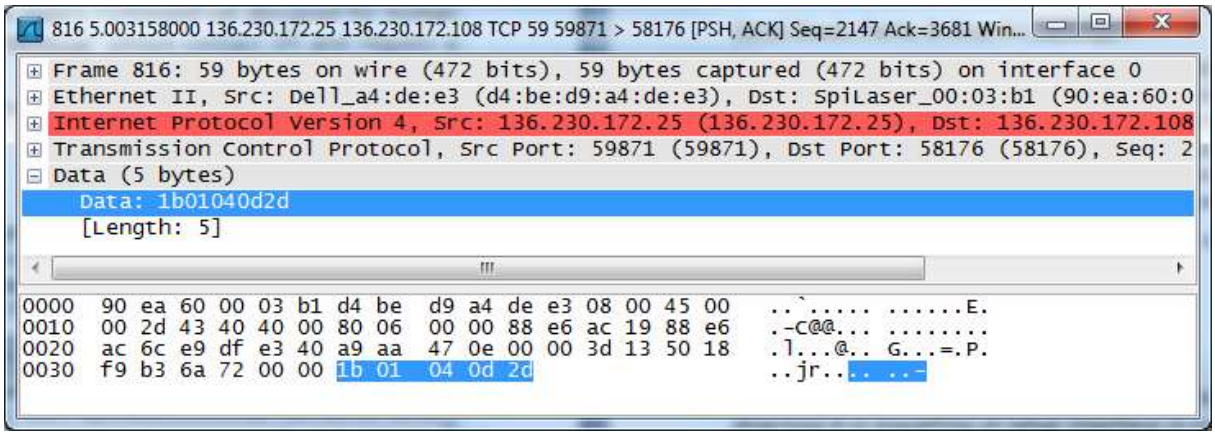
This document covers the Industrial Command Protocols used to control the laser using the RS232 control interface. If the laser is to be operated using the legacy command set designed for human interaction using a terminal programme such as "Hyperterminal" please contact SPI and request a copy of :-

- SM-S00052 Product Manual Addendum – R4 Products Backwards compatibility

2 Ethernet Communications

Ethernet communications may be used with the R4 laser provided that the appropriate interface is fitted. Communication using Ethernet is exactly the same as using RS232. The data described in the following sections forms the payload of the TCP format packet. The IP address of the laser may be established by using the GUI and the RS232 interface. The port number is 58176.

The screen shot shown below was captured via "WireShark" (a free network analyser). The payload is highlighted and has the command 0x01 (Get Status).



3 GUI (Graphical User Interface)

SPI provide a Graphical User Interface CD which incorporates a program and user guide describing the individual functions of the GUI along with screen images. Each screen provides a visual prompt and text. This enables the user to quickly install and control the laser from a suitable PC.

4 Command Protocol

Serial Baud, Parity & Stop Bit Settings

The serial port does not have a specific setting for baud rate. The unit will lock to the baud rate of the first command sent. When first sending a command to the unit it is advisable to use a low baud rate as the maximum speed will be very dependant upon cable characteristics. The baud rate can then be increased until communication failure occurs. The baud rate should be considerably reduced from this failing rate to account for any noise the cable may pick up from the environment. Note that the unit must be powered off and then on to adjust to a baud rate change.

Note that the parity is EVEN and the number of stop bits is ONE.

Interface Data Frame

All data transactions have the following frame structure, no matter what the data is, in what direction it is travelling or what interface is carrying it. The frame structure is:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01 to 0xFF	No of command and data bytes.
3	0x01 to 0xFF	Command value
4	?	Data byte 1
5	?	Data byte 2
6	0x0D	Stop Byte
7	?	CRC byte (Addition of bytes 1 through 6)

Every command sent to the laser will be responded to.

Example Communications Exchange

As an example the following exchange could take place:

Sent to the laser

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes.
3	0x85	Command code (sets some notional level)
4	0x00	LSB of 16 bit value
5	0x65	MSB of 16 bit value (level will be set to this 2 byte value)
6	0x0D	Stop Byte
7	0x15	CRC byte (Addition of bytes 1 through 6)

The laser responds with:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No 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
6	0xAF	CRC byte

Using this format of response 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.

Communications Error Indication

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

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x00	Command value
4	0x00	Response Byte
5	0x0D	Stop byte
6	0x??	CRC byte

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 value:

Value	Function
0x00	Command not supported
0x01	CRC error
0x02	No Start byte
0x03	No Stop byte
0x04	Incorrect No Data Bytes
0x05	Overrun error
0x06	Parity error
0x07	Framing error
0x08	Rx buffer overflow
0x09	Command time out
0x0F	Unknown Error

5 Commands

5.1 Get Status Command – 0x01

Overview

Provides a snapshot of the overall system state. Once executed another command may be required to provide the detail. For example if an alarm is reported then all of the alarms may be read with command 0x04.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x01	Command No
4	0x0D	Stop byte
5	0x2A	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes.
3	0x01	Command value echoed in this response
4	??	Data byte 1
5	??	Data byte 2
6	0x0D	Stop byte
7	??	CRC byte

Data byte 1:

Bit No	Function
0	Emission Status – 1 = Emitting
1	Enable Status – 1 = Enabled
2	Alarm Status – 1 = Alarm present
3	Red Laser status – 1 = Red Laser emitting

4	Bit 1 – Nibble B same as Status bits on user IO port (see section 8.1)
5	Bit 2 – Nibble B
6	Bit 3 – Nibble B
7	Bit 4 – Nibble B

Note that Bits 1 to 3 have the same information as the control panel LEDs.

Data byte 2:

Bit No	**Function**
0	Modulation Input from PLC port - 1 = Modulation Active
1	Modulation Enable from PLC port – 1 = Modulation Enabled Active (pin = low)
2	Loop Control – 1 = Closed Loop
3	PLC port use – 1 = PLC port being used
4	Warning Status - ! = Warning Present
5	Control Source – 1 = External
6	Key switch position – 1 = Closed
7	Spare

Nibble Meanings

Value	**Meaning**
0	Emitting
1	Idle
2	Safety Delay
3	Key Switch Open
4	Key Switch Required
5	Alarm BDO Over Temperature
6	Alarm BDO Damage
7	Alarm Thermistor
8	Alarm Thermal Snap Switch
9	Alarm Memory
10	Alarm PSU Failure
11	Alarm Ground Fault

12	Alarm Fibre Failure
13	Internal Error
14	BDO Over Temperature
15	Unknown

5.2 Get Digital I/O – 0x02

Overview

Returns the value of all digital inputs to and outputs from the system, both internal and external.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x02	Command No
4	0x0D	Stop byte
5	0x2B	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x09	No of command and data bytes.
3	0x02	Command value echoed in this response
4	0x??	Inputs Data byte 1
5	0x??	Inputs Data byte 2
6	0x??	Inputs Data byte 3
7	0x??	Inputs Data byte 4 (Spare Inputs)
8	0x??	Outputs Data byte 1
9	0x??	Outputs Data byte 2
10	0x??	Outputs Data byte 3
11	0x??	Status Data byte 1
12	0x0D	Stop byte
13	0x??	CRC byte (Addition of bytes 1 through 12)

Inputs Data byte 1:

Bit No	Function
0	Key Switch (High = Switch Closed)
1	Safety Relay Switch Open (High = Relay Closed)

2	PLC Port - Red Laser Requested (High = Laser Requested)
3	PLC Port - Loop Type Request (High = Open Loop)
4	PLC Port - Use Port (High = Use PLC, Low = Use Computer)
5	PLC Port - Modulation Signal (High = Modulation On)
6	PLC Port – Averaging Input
7	PLC Port - Clear Alarm 1 (High = Clear Alarms)

Inputs Data byte 2:

Bit No	**Function**
0	PLC Port - Clear Alarm 2 (High = Clear Alarms)
1	PLC Port/BNC - Modulation Enable (High = Enabled)
2	BDO Fault (High = Fault Exists)
3	BDO Fault - Open Circuit (High = Open Circuit)
4	BDO Fault – Short Circuit (High = Short Circuit)
5	Thermal Snap Switch 1 (High = Over Temperature)
6	Thermal Snap Switch 2 (High = Over Temperature)
7	Pump Enable (High = Pump Enabled)

Inputs Data byte 3:

Bit No	**Function**
0	Diode Pump Modulation (High = Pumps On)
1	Safety Relay Shutdown Signal Feedback (High = Relay Shutting Down)
2	Output Fibre Emitting (High = Emitting)
3	Seed Fibre Emitting (High = Emitting)
4	Ground Fault (High = Fault Present)
5	USB D+ Status
6	USB D- Status
7	PLC XPR Request

Inputs Data byte 4:

Bit	**Function**

No	
0	Fan 1 Sensor Status
1	Fan 2 Sensor Status
2	Fan 3 Sensor Status
3	Fan 4 Sensor Status
4	Fan 5 Sensor Status
5	Fan 6 Sensor Status
6	Fan 7 Sensor Status
7	Fan 8 Sensor Status

Outputs Data byte 1:

Bit No	Function
0	Internal Pump Modulation Drive (High = Emitting)
1	PLC – Red Laser Status (High = Red Laser Emitting)
2	Not Used
3	Water Valve (High = Valve Energised)
4	PWM Enable (High = Internal Modulation Circuit On)
5	Thermistor Address 0 (000 = Channel 0 – 111 = Channel 7)
6	Thermistor Address 1
7	Thermistor Address 2

Outputs Data byte 2:

Bit No	Function
0	Pump Rise Time (High = Slow Rise Time)
1	PLC Status 0
2	PLC Status 1
3	PLC Status 2
4	PLC Status 3
5	Safety Relay Shutdown (High = Request Relay Open) – Software Generated
6	Safety Relay Reset Pulse (High = Request Relay Close)
7	BDO Test (High = BDO being tested)

Outputs Data byte 3:

Bit No	Function
0	PLC Warning (High = Warning Exists)
1	PLC Spare Output
2	PLC/LED Alarm (High = Alarm On)
3	PLC/LED Emit (High = Emitting)
4	Spare
5	PLC/LED Enable (High = Enabled = Safety Relay Closed)
6	Pump Error Clear (High = Clearing Error)
7	Internal/External Power Request Multiplex (High = ????)

Status Data byte 1:

Bit No	Function
0	Version 2 of backplane PCB
1	Power relay is closed (only if backplane PCB is version 2)
2	OSM Temperature compensation
3	OSM Tap compensation
4	Spare
5	Spare
6	Spare
7	Spare

5.3 Get Analog Input – 0x03

Overview

Returns the value of a single, user specified, analogue input.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x03	Command No

4	0x??	Analogue Input required
5	0x0D	Stop byte
6	0x??	CRC byte

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x05	No of command and data bytes.
3	0x03	Command value echoed in this response
4	0x??	Analogue Input required
5	0x??	Resolution (0=1, 1=0.1, 2=0.01, 3=0.001 etc)
6	0x??	LSB of the reading
7	0x??	MSB of the reading
8	0x0D	Stop byte
9	0x??	CRC byte

Byte No 4 is the analogue channel being read. Byte No 5 is the resolution of the ADC in bits (currently either 10 or 12). Bytes 6 & 7 may be combined to reconstruct the reading.

Byte 4 – Requested Analogue Channel

Value	Function
0x00	External Requested Power Set Point (% of 13.2) volts
0x01	Internal Requested Power Set Point (% of 13.2) volts
0x02	Pump diode drive voltage (Milli volts)
0x03	Electrical Sub Module Heat Sink Temperature (0.1 degrees)
0x04	Power Supply Unit Temperature
0x05	Ambient Temperature
0x06	Optical Sub Module Temperature
0x07	Optical Monitor Temperature
0x08	24v supply (Milli volts)
0x09	BDO detect level (counts where max = 1024)
0x0A	Fan speed in %
0x0B	Fan PWM value
0x0C	BDO Temperature (Firmware Ver 65 or greater)

Note!

The thermistor channels will return 0xFFFF if the channel is out of range. This could either be because the temperature being measured is below 10.5 degrees or if the thermistor has failed.

5.4 Get Alarms & Warnings – 0x04

Overview

Returns the status of all alarms.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x04	Command No
4	0x0D	Stop byte
5	0x2D	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x05	No of command and data bytes.
3	0x04	Command value echoed in this response
4	0x??	Data byte 1
5	0x??	Data byte 2
6	0x??	Data byte 3
7	0x??	Data byte 4
8	0x0D	Stop byte
9	0x??	CRC byte

Data byte 1:

Bit No	Function (Pass code level)
0	1= Alarm present
1	1 = Warning present
2	1 = 24v supply fail Alarm
3	Spare
4	Spare
5	1 = Thermal Snap switch OSM Alarm (Supervisor)

6	1 = Thermal Snap Switch ESM Alarm (Supervisor)
7	1 = Fibre Fail Alarm (See command 0x19)

Data byte 2:

Bit No	**Function**
0	1 = Electrical Sub Module Heat Sink Temperature Alarm (Supervisor)
1	1 = Power Supply Unit Temperature Alarm (Supervisor)
2	1 = Ambient Temperature Alarm (Supervisor)
3	1 = Optical Sub Module Temperature Alarm (Supervisor)
4	1 = Optical Monitor Temperature Alarm (Supervisor)
5	Spare
6	1 = BDO Temperature Alarm (Supervisor) (Firmware Ver 65 or greater)
7	Spare

Data byte 3:

Bit No	**Function**
0	1 = Electrical Sub Module Heat Sink Temperature Warning
1	1 = Power Supply Unit Temperature Warning
2	1 = Ambient Temperature Warning
3	1 = Optical Sub Module Temperature Warning
4	1 = Optical Monitor Temperature Warning
5	1 = Calibration Required Warning
6	1 = BDO Temperature Warning (Firmware Ver 65 or greater)
7	Spare

Data byte 4:

Bit No	**Function**
0	1 = BDO damage Alarm (Service Engineer – cct closed = pinched BDO cable)
1	1 = BDO thermal/damage Alarm (Supervisor – cct open = thermal switch open or severed cable)

2	1 = Thermistor Over range Warning
3	1 = Internal Error Alarm (Service Engineer)
4	1 = Memory Failure Alarm (Supervisor)
5	1 = Ground Fault Alarm (Service Engineer)
6	1 = Cooling Warning (Fan has failed)
7	1 = Calibration Failed Warning

Alarm Notes

An alarm can only be reset when the cause of the alarm has been cleared. All alarms are latched. For example if a thermal snap switch has opened due to excessive temperature then the unit must be allowed to cool until the snap switch has closed. Only then can the alarm be cleared. All alarms are stored in the log. Note a Power Fail Alarm can only be cleared by using command 0x19.

Warning Notes

Unlike alarms warnings do not need to be actively cleared, they will clear themselves when the warning condition is removed. For example if a fan fails to rotate a waning will be issued but when a new fan is fitted the warning is cleared when the fan rotation is detected. If a calibration is attempted and failed then a “calibration failed” warning will be set. This will remain set until a calibration is successfully completed.

Calibration Required Warning

This warning is present if the following conditions are seen:

a. Maximum optical pump power is reached.
b. The actual power is 5% less than the required power in closed loop.
c. The actual power is 10 less than the required power in open loop.

The condition may be brought about by 2 conditions:

a. The laser requires a calibration.
b. Operation is in average mode using inappropriate modulation.

For example if the laser is set to provide 50% average output power and is provided with a modulation signal of only 10%. The maximum possible average power is only 10% given the modulation signal. The laser attempts to provide the 50% power selected and drives the pump power to a maximum. The laser condition then fulfils the conditions a + b and a calibration required warning appears.

5.5 Reset Alarms – 0x05

Overview

Resets the alarms. Some alarms are regarded as so serious that the customer cannot reset them. These serious alarms can only be cleared by an SPI service engineer. Note that the alarms can also be reset from the analogue interface, provided that the PLC interface is enabled. This command has the same effect as activating the alarm reset pin on the analogue interface. The calibration warning can only be cleared by successfully using the calibration routine.

Laser Receives:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x05	Command No
4	0x0D	Stop byte
5	0x2E	CRC byte

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x05	Command value echoed in this response
4	0x??	Response byte
5	0x0D	Stop byte
6	0x??	CRC byte

The response can take the following values:

Response Byte Meanings

Value	**Function**
0x00	All alarms successfully cleared
0x01	Not used
0x02	Alarm condition has not been rectified
0x03	Access level inadequate

5.6 Calibrate – 0x06

Overview

In order that the laser will provide exactly the rated power for a command input of 100% the laser needs to be calibrated. This is needed because some components of the laser will age and become less efficient over time. The calibration procedure makes an internal adjustment to ensure that the maximum output power is available. The user must ensure that enabling signals are provided to the unit and that a beam dump is placed in front of the BDO. Should the calibration routine fail because adjustment has run out in either direction then the calibration warning will be asserted. This warning can only be cleared by running the calibration routine successfully.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x06	Command No
4	0x0D	Stop byte
5	0x2F	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes.
3	0x06	Command value echoed in this response
4	0x??	Adjustment value
5	0x??	Response byte
6	0x0D	Stop byte
7	0x??	CRC byte

Response Byte Values

Value	Function
0x00	Calibration carried out successfully
0x01	Access level insufficient
0x02	Enabling signals are not available
0x03	Calibration failed - modulation signal removed

0x04	Calibration failed – timed out
0x05	Calibration failed – internal communication
0x06	Calibration failed – high end stop reached
0x07	Calibration failed – low end stop reached
0x08	Calibration failed – Output Failure
0x09	Command not supported

5.7 Set Current Mode – 0x07

Overview

Sets the mode the laser should operate in. However if the PLC interface has been selected via its select pin, then this command may not be used. The PLC interface must be deselected via the PLC interface selection pin. Additionally the control mode may not be changed unless the key switch is open.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x07	Command No
4	0x??	Required Mode
5	0x0D	Stop byte
6	0x??	CRC byte

Required Mode byte :

Bit No	Function
0	1 = Closed Loop, 0 = Open Loop
1	1 = Use Average power measurement, 0 = use pulse power measurement
2	1 = External Requested Power Level, 0 = Internal Requested Power Level
3	1 = Use 100 samples, 0 = Use 150 samples for pulse measurement
4	Not used
5	Not used
6	Not used
7	Not used

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes.

3	0x07	Command value echoed in this response
4	0x??	Mode Byte
5	0x??	Response byte
6	0x0D	Stop byte
7	0x??	CRC byte (Addition of bytes 1 through 6)

Mode Byte Value returned has the same bit values as defined for transmission above.

Response Values

Value	**Function**
0x00	Mode Accepted
0x01	Access level insufficient
0x02	PLC Port selected
0x03	Key Switch Closed

5.8 Set Access Level – 0x09

Overview

Sets the access level by entering a pass code. Different access levels will allow the user access to various commands. The access levels are hierarchical so if the user has entered the highest level pass code then they will have access to all commands. The access level is time limited and varies depending upon the access level. The times are as follows:

Supervisor = 1 minute

SPI Service = 10 minutes

SPI Manufacturing = 2 hours

The time out mechanism is a balance between usability and protection. Thus if a customer supervisor sets his access level and leaves the laser unit without resetting it the access code will not then be available to the operator.

A special access level may be entered which is ****. This has no effect on the unit but it will allow the user to see what the current access level is. This is implemented because if the user enters a bad pass code the unit will prevent this command being executed until a 5 second time out has passed. The time out implemented to prevent the user bombarding the unit with a series of pass codes until a correct code is found. An additional special code is added which will allow the user to set the access level to "operator". This code is ####.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x05	No of command and data bytes.
3	0x09	Command No
4	0x??	Pass Code Byte 1
5	0x??	Pass Code Byte 2
6	0x??	Pass Code Byte 3
7	0x??	Pass Code Byte 4
8	0x0D	Stop byte
9	0x??	CRC byte

Note that the pass code must be an alphanumeric value between but including the following ASII decimal values: 48>57, 65>90,97>122.

Laser Transmits:

Byte	Value	Function

No		
1	0x1B	Start byte
2	0x03	No of command and data bytes.
3	0x09	Command value echoed in this response
4	0x??	Current Access Level
5	0x??	Response byte
6	0x0D	Stop byte
7	0x??	CRC byte

Current Access Level

Value	Function
0x00	Customer Operator
0x01	Customer Supervisor
0x02	SPI Service Engineer
0x03	SPI Manufacturing

Response Values

Value	Function
0x00	Pass code Accepted
0x01	Pass code Not Accepted
0x02	Command disabled – wait for time out

This command has a repeat delay of 5 seconds. That is if the command is repeated within 5 seconds the response “Command Disabled” is given. The user must wait 5 seconds before repeating the command.

5.9 Set Required Power Level – 0x0A

Overview

Sets the required internal power level in percent. This command may only be executed if the PLC interface is NOT selected. If the PLC interface is selected then the power level must be set on this interface by means of a voltage level.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte

2	0x03	No of command and data bytes.
3	0x0A	Command No
4	0x??	Power Level LSB
5	0x??	Power Level MSB
6	0x0D	Stop byte
7	0x??	CRC byte

The power level is expressed in tenths of a percent and is binary format. For example a value of 36.9 percent byte 4 would be set to 0x71 and byte 5 to 0x01.

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x0A	Command value echoed in this response
4	0x??	Response byte
5	0x0D	Stop byte
6	0x??	CRC byte

Response Values

Value	**Function**
0x00	Power Level Accepted
0x01	Power Lower than Minimum level
0x02	Power Higher than Maximum level
0x03	Command rejected due to PLC interface being selected
0x04	Access level insufficient
0x05	Command rejected due to external source being selected

5.10 Get Output Power Level – 0x0B

Overview

Returns the current requested power level in percentage of rated power and the mode.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x0B	Command No
4	0x0D	Stop byte
5	0x34	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x0B	Command value echoed in this response
4	0x??	Response byte
5	0x??	Power Level LSB
6	0x??	Power Level MSB
7	0x0D	Stop byte
8	0x??	CRC byte

Response byte:

Bit No	Function
0	Loop Type – 1 = Closed Loop, 0 = Open Loop
1	Measurement Type – 1 = Average, 0 = Pulse
2	Source – 1 = External, 0 = Internal
3	Pulse Measurement Sample Width – 1 = 100uS, 0 = 150uS
4	Internal Pulse Generation – 1 = On, 0 = Off
5	XPR Mode – 1 = XPR mode is On, 0 = Off

6	PSE Mode – 1 = PSE level is NOT 0, 0 = PSE level = 0 = off
7	Spare

The Power Level returned is in tenths of a percent so a byte 5 value of 0x14 and a byte 6 value of 0x02 gives a value of 53.2 percent or 106.4 watts for a 200 watt laser.

5.11 Get Model & Version – 0x0C

Overview

Returns the model information and internal software versions. The return values are all ASCII characters.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x0C	Command No
4	0x0D	Stop byte
5	0x35	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x70	No of command and data bytes.
3	0x0C	Command value echoed in this response
4	0x??	Model Type Character 1
5	0x??	Model Type Character 2
..	0x??	Model Type Character ….
101	0x??	Model Type Character 98
102	0x??	Internal component bits (see table below)
103	0x??	Capability Character (see table below)
104	0x??	Software Version NXP LSB
105	0x??	Software Version NXP

106	0x??	Software Version NXP MSB
107	0x??	Software Version AD LSB
108	0x??	Software Version AD
109	0x??	Software Version AD MSB
110	0x??	Maximum Power Watts LSB
111	0x??	Maximum Power Watts MSB
112	0x??	No Spools
113	0x??	Air or Water Cooled (A=Air & W=Water)
114	0x??	Variant
115	0x0D	Stop byte
116	0x??	CRC byte

Internal component bits Meanings:

Bit No	**Function**
0	1 = Air Cooled, 0 = Water cooled
1	1 = Single Spool, 0 = Dual Spool
2	1 = BDO Thermistor Fitted
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused

Capability byte:

Value	**Meaning**
"F"	Full capability unit
"R"	Reduced capability (no closed loop etc)

5.12 Maintenance – 0x0E

Overview

Multiple option, general purpose command.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes.
3	0x0E	Command No
4	0x??	Parameter 1
5	0x??	Parameter 2
6	0x0D	Stop byte
7	0x??	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x0E	Command value echoed in this response
4	0x??	Echo of Parameter 1
5	0x??	Echo of Parameter 2
6	0x??	Response Byte
7	0x0D	Stop byte
8	0x??	CRC byte

Parameter 1 Value = 0x00 = Drain Water Cooled System

This command unconditionally opens the water cooling valve to allow the system to be drained. The unit must be power cycled to return to normal cooling operation. Parameter 2 has no effect with this value of Parameter 1.

Response Value

Value	Function
0x00	Valve has been opened
0x01	Access level insufficient
0x02	System is air cooled

Parameter 1 Value = 0x01 = Disable fibre fail alarm

This command prevents a fibre fail alarm being triggered for a period of 2 minutes. Parameter 2 has no effect with this value of Parameter 1.

Response Value

Value	Function
0x00	Fibre alarm disabled
0x01	Access level insufficient

Parameter 1 Value = 0x02 = Get EEPROM read status

This command allows the user to determine what components have been read from the EEPROM memory.

Parameter 2 Value

Bit	Meaning
0x00	Basic EEPROM Read of Gain and Offset
0x01	Additional Read of Photo Diode compensation
0x02	Additional Read of (not yet implemented)

Response Value

The response is a single byte of which the following bits have meaning

Bit	Meaning
0x00	EEPROM Read correctly.
0x01	EEPROM Not Read correctly
0x02	Access level insufficient
0x03	Parameter not recognised

Parameter 1 Value = 0x03 = Set UART baud rate

This command allows the user to set a specific baud rate. The unit is shipped with the baud rate set to auto. The user then need only to set the baud rate once as the rate is stored in non volatile memory. Note that the new baud rate will not be used until the unit is power off and then on.

Parameter 2 Value

Bit	Meaning
0x00	Auto baud rate (set on reception of first command byte)

0x01	2400
0x02	4800
0x03	9600
0x04	19200
0x05	38400
0x06	57600
0x07	115200

Response Value

The response is a single byte of which the following bits have meaning

Byte	**Meaning**
0x00	Baud rate set correctly
0x01	Baud rate parameter not recognised
0x02	Access level insufficient

Parameter 1 Value = 0x04 = Set CANOpen ID

This command is only available if the firmware is built to include the CANOpen firmware. Additionally the CAN interface must be fitted. The user must have supervisor status to use this command

Parameter 2 Value is the ID requested which must have a value between 1 and 127 inclusive.

Response Value

The response is a single byte of which the following bits have meaning

Byte	**Meaning**
0x00	ID set correctly
0x01	ID value illegal
0x02	CANOpen firmware not built
0x03	CAN Interface not fitted
0x04	Access level insufficient

Parameter 1 Value = 0x05 = Get CANOpen ID

This command retrieves the current CANOpen ID value. The user must have supervisor status to use this command

Parameter 2 Value is not required.

Response Value

The response is a single byte of which the following bits have meaning

Byte	Meaning
0x00	Access level insufficient
0x01 – 0x7F	Valid ID value
0x80	ID value illegal
0x81	CANOpen firmware not built
0x82	CAN Interface not fitted

Parameter 1 Value = 0x06 = Set calibration setting

The calibration setting varies the amount of optical power output when a particular power level is specified. For example a 100w laser will output 100w when 100% is commanded. However over time the laser will degrade until perhaps only 95% can be output. At this point a warning may be raised depending upon the features of the laser and the mode used. On a Full Specification laser the user may run a calibration routine. On a Reduced Specification laser the user may adjust the power output using this command. The laser should be set at full power and the beam directed at a power meter. The required value is then adjusted until the power meter displays 100% power. The user must have supervisor status to use this command

Parameter 2 Value is the required setting which must have a value between 0 and 255 inclusive.

Response Value

The response is a single byte of which the following bits have meaning

Byte	Meaning
0x00	Value written correctly
0x01	Value not written – Error
0x02	Access level insufficient

Parameter 1 Value = 0x07 = Get calibration setting

The value set with the 0x06 parameter or using the calibration function (command 0x06) may be read using this command.

Parameter 2 Value is not required and is ignored.

Response Value

The response is a single byte which is the value of the calibration setting

4.13 Internal Pulse Generation – 0x0F

Overview

Allows the user to modulate the incoming modulation signal. This allows the user to generate accurate pulse widths so avoiding the use of an external pulse generator. The pulses will be generated upon the rising edge of the modulation signal or by receipt of command 0x1B. If the modulation signal is removed then the unit will cease emitting light. Once the required number of pulses have been emitted the unit will cease to emit light. The programmed number of pulses will be emitted once the modulation signal is either removed and restored or when a trigger command is received. This mode will not be active upon power on. The user must enable this mode each time the unit is powered on. The minimum pulse width is 2 µs and the resolution 0.1µs. This allows for a maximum pulse width and period of over 1.67 seconds.

*Note that this is a feature that must be turned on by use of a pass code (see command 0x1E). Please contact SPI for the code for your laser. You may have to upgrade your firmware in order to use this feature.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x0B	No of command and data bytes.
3	0x0F	Command No
4	0x??	Pulse width LSB (0.1 µs)
5	0x??	Pulse width
6	0x??	Pulse width MSB
7	0x??	Cycle time LSB (0.1 µs)
8	0x??	Cycle time
9	0x??	Cycle time MSB
10	0x??	Number of cycles LSB
11	0x??	Number of cycles
12	0x??	Number of cycles MSB
13	0x??	Mode

14	0x0D	Stop byte
15	0x??	CRC byte

Mode Byte

Value	Meaning
0x00	Pulse Generation = OFF
0x01	Pulse Generation = ON
0x02	Ignore sent parameters. Allows for read only, can only be sent.

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x0F	No of command and data bytes.
3	0x0F	Command value echoed in this response
4	0x??	Pulse width LSB (µs)
5	0x??	Pulse width
6	0x??	Pulse width MSB
7	0x??	Cycle time LSB (µs)
8	0x??	Cycle time
9	0x??	Cycle time MSB (µs)
10	0x??	Number of cycles LSB
11	0x??	Number of cycles
12	0x??	Number of cycles MSB
13	0x??	Mode
14	0x??	Response Byte
15	0x0D	Stop byte
16	0x??	CRC byte

Response Values

Value	Function
0x00	Command Accepted
0x01	Cannot turn mode on or off if in idle or emit modes

0x02	Not used
0x03	Period less than pulse width
0x04	Period less than minimum of 10 (µs)
0x05	Pulse width less than minimum of 2 (µs)
0x06	Access level insufficient

5.13 Red Targeting Laser Control – 0x10

Overview

Turns the red targeting laser on or off. Note that the targeting laser is eye safe and may be turned on at any time. The targeting laser is turned on briefly at power on along with the targeting laser status LED on the front panel. Once on the targeting laser will turn off after 10 minutes.

Laser Receives:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x10	Command No
4	0x??	0 = Target Laser Off. Any other value = Target Laser ON.
5	0x0D	Stop byte
6	0x??	CRC byte

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x10	Command value echoed in this response
4	0x??	Response Value
5	0x0D	Stop byte
6	0x??	CRC byte

Response Byte Meanings

Value	**Function**
0x00	Command executed correctly
0x01	PLC port is being used
0x02	Inappropriate control state

5.14 Read Log – 0x13

Overview

Returns a specific log entry. The laser use history is logged and stored by the controller. This allows any alarms to be logged which may help service engineering to solve customer problems. Each entry carries a comprehensive data in a 16 byte record.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x03	No of command and data bytes
3	0x13	Command No
4	0x??	Entry to be read LSB
5	0x??	Entry to be read MSB
6	0x0D	Stop byte
7	0x??	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x13	No of command and data bytes.
3	0x13	Command value echoed in this response
4	0x??	Laser Emit Time LSB (Seconds)
5	0x??	Laser Emit Time
6	0x??	Laser Emit Time
7	0x??	Laser Emit Time MSB
8	0x??	Laser On Time LSB (Seconds)
9	0x??	Laser On Time
10	0x??	Laser On Time
11	0x??	Laser On Time MSB
12	0x??	Entry Type
13	0x??	State of laser at point of alarm (see table below)
14	0x??	Analogue Value LSB

15	0x??	Analogue Value MSB
16	0x??	Sensor Status Word LSB
17	0x??	Sensor Status Word
18	0x??	Sensor Status Word
19	0x??	Sensor Status Word MSB
20	0x??	Num Log Entries LSB
21	0x??	Num Log Entries MSB
22	0x??	Response byte
23	0x0D	Stop byte
24	0x??	CRC byte

Response Byte Meanings

Value	**Meaning**
0x00	Record retrieved correctly
0x01	No records available
0x02	Requested record does not exist

Sensor Status breakdown

Value	**Meaning**
0x00000001	Modulation Input into the laser
0x00000002	Modulation Enabled Input into the laser
0x00000004	Set point is external analogue
0x00000008	Loop type is closed
0x00000010	RAL status (1 = on).
0x00000020	State of Clear Alarm 1 input
0x00000040	State of Clear Alarm 2 input
0x00000080	Average or Pulse mode
0x00000100	XPR status
0x00000200	PSE Status
0x00000400	Not used
0x00000800	Alarm already present
0x00001000	Key switch closed

0x00002000	Safety Relay open
0x00004000	BDO Open circuit
0x00008000	BDO Closed circuit
0x00010000	Snap 1 over temperature
0x00020000	Snap 2 over temperature
0x00040000	Fibre not detected
0x00080000	Pump modulation on
0x00100000	Output fibre on
0x00200000	Seed fibre on
0x00400000	Cooling is on
0x00800000	IPM running
0x01000000	External set point selected
0x02000000	Unused
0x04000000	Unused
0x08000000	Unused
0x10000000	Unused
0x20000000	Unused
0x40000000	Unused
0x80000000	Unused

Entry Type Byte Meanings

Value	Function	Analogue Value
0x00	24v supply fail	24v measurement
0x01	BDO short circuit	
0x02	BDO open circuit	
0x03	BDO over temperature	BDO Temp in 0.1 degrees
0x04	Thermal Snap switch 1	
0x05	Thermal Snap Switch 2	
0x06	Electrical Sub Module Heat Sink Temperature	Temperature in 0.1 degrees
0x07	Power Supply Unit Temperature	Temperature in 0.1 degrees
0x08	Ambient Temperature	Temperature in 0.1 degrees
0x09	Optical Sub Module Temperature	Temperature in 0.1 degrees
0x0A	Optical Monitor Temperature	Temperature in 0.1 degrees
0x0B	Not Used	
0x0C	Not Used	
0x0D	Not Used	
0x0E	Memory	See Memory Alarm Meanings table below
0x0F	Fibre power fail	
0x10	Ground Fault	
0x11	Calibration	Calibration value (0 to 255)
0x12	Cooling	
0x13	Internal Alarm	See Internal Alarm Value Meanings
0x14		
0x15		

Memory Alarm Meanings

Value	Function
0x00	No Memory error (receiving this may indicate an internal error)
0x01	Flash Clear Error
0x02	EEPROM Checksum failed
0x03	EEPROM Read failed
0x04	FRAM Checksum failed
0x05	FRAM Read failed
0x06	FRAM Value failed

Internal Alarm Value Meanings (each bit represents an alarm)

Value	Function
0x01	SPI interface between the two microprocessors
0x02	Diode control failure (output detected when not commanded0
0x04	Feature failure (feature selected but no hardware detected)
0x08	Firmware has failed
0x10	Interlock circuit has failed

Internal Alarm Value Meanings (each bit represents an alarm)

Value	Function
0x01	SPI interface between the two microprocessors
0x02	Diode control failure (output detected when not commanded0
0x04	Feature failure (feature selected but no hardware detected)
0x08	Firmware has failed
0x10	Interlock circuit has failed

5.15 Get On Times – 0x15

Overview

Gets the total unit on time and the total emission time. The unit on time is the length of time the laser unit has been powered up regardless of whether it has been emitting. The emission time is measured to the nearest microsecond by analysing the modulation input including any internal modulation that may take place. Each value is a binary representation in seconds.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x15	Command No
4	0x0D	Stop byte
5	0x3E	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x09	No of command and data bytes.
3	0x15	Command value echoed in this response
4	0x??	Unit On Time Value 1 (MSB)
5	0x??	Unit On Time Value 2
6	0x??	Unit On Time Value 3
7	0x??	Unit On Time Value 4 (LSB)
8	0x??	Emission Time Value 1 (MSB)
9	0x??	Emission Time Value 2
10	0x??	Emission Time Value 3)
11	0x??	Emission Time Value 4 (LSB)
12	0x0D	Stop byte
13	0x??	CRC byte

5.16 Get Output Power and Pulse width – 0x16

Overview

Gets the modulation signal pulse times and peak power. The results are in µs and tenths of a watt.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x16	Command No
4	0x0D	Stop byte
5	0x3F	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x07	No of command and data bytes.
3	0x16	Command No
4	0x??	Modulation On Time LSB (µs)
5	0x??	Modulation On Time
6	0x??	Modulation On Time
7	0x??	Modulation On Time MSB (µs)
8	0x??	Power LSB (0.1 %)
9	0x??	Power MSB
10	0x0D	Stop byte
11	0x??	CRC byte

5.17 Get Settings-0x17

Overview

Retrieves an internal numeric setting such as the temperature which will cause a warning or alarm.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x17	Command No
4	0x??	Parameter Number (see command 0x18)

5	0x0D	Stop byte
6	0x??	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x07	No of command and data bytes.
3	0x17	Command No
4	0x??	Parameter Requested
5	0x??	Parameter Value LSB
6	0x??	Parameter Value
7	0x??	Parameter Value
8	0x??	Parameter Value MSB
9	0x??	Response byte
10	0x0D	Stop byte
11	0x??	CRC byte

Response Byte Meanings

Value	Function
0x00	Function Executed successfully
0x01	Access level inadequate
0x02	Parameter out of range
0x03	Feature not enabled
0x04	Parameter could not be read

5.18 Set Settings-0x18

Overview

Sets an internal numeric setting such as the temperature which will cause a warning or alarm. All settings must have SPI service engineer access level or greater with the exception of the interpreter and safety delay which has customer supervisor access level. Note that if the interpreter is turned on then communications using the commands in this section will cease. Commands must be sent using the old style VT100 command set described in this document (see section 11).

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x06	No of command and data bytes.
3	0x18	Command No
4	0x??	Parameter Number
5	0x??	Parameter Value LSB
6	0x??	Parameter Value
7	0x??	Parameter Value
8	0x??	Parameter Value MSB
9	0x0D	Stop byte
10	0x??	CRC byte

Parameter Number

Value	Function
0x00	Supply Voltage Alarm Limit (240 = 24v)
0x01	Not used
0x02	Electrical Sub Module Heat Sink Temperature Alarm Limit (600 = 60.0 centigrade)
0x03	Power Supply Unit Temperature Alarm Limit (600 = 60.0 centigrade)
0x04	Ambient Temperature Alarm Limit (100 = 10.0 centigrade)
0x05	Optical Sub Module Temperature Alarm Limit (600 = 60.0 centigrade
0x06	Optical Monitor Temperature Alarm Limit (600 = 60.0 centigrade
0x07	Not used.
0x08	Electrical Sub Module Heat Sink Temperature Warning Limit (550 = 55.0 centigrade)
0x09	Power Supply Unit Temperature Warning Limit (550 = 55.0 centigrade)
0x0A	Ambient Temperature Warning Limit (150 = 15.0 centigrade)
0x0B	Optical Sub Module Temperature Warning Limit (550 = 55.0 centigrade)
0x0C	Optical Monitor Temperature Warning Limit (550 = 55.0 centigrade)
0x0D	Internal Power Setting (500 = 50% of rated power)

0x0E	Safety delay
0x0F	Unit On Time
0x10	Unit Emit Time
0x11	Interpreter (old character based commands) (0 = off)
0x12	Set all values to default (no value need be defined)
0x13	Set Alarm (see table below) using only for internal SPI purposes
0x14	Trigger watchdog (only for internal SPI purposes)
0x15	Set Ethernet Static IP address
0x16	Set Ethernet Static IP mask
0x17	Set Ethernet mode
0x18	Set RAL time out (in minutes where 0 = infinity & max = 250)
0x19	Set Ethernet Static IP Gateway
0x1A	Set Ethernet MAC Address
0x1B	Get current Ethernet IP address (read only)
0x1C	Start flash loader (flash new interface firmware via Enet)
0x1D	Get firmware type and version (read only)
0x1E	RAL behaviour
0x1F	Solenoid behaviour
0x20	Output Power Fail Alarm Control (0 = Off)

Note that the parameter value must be expressed as an unsigned long integer. This means that the value 9 must be entered as:

MSB = 0x00,

0x00,

0x00,

LSB = 0x09. If this is not adhered to the command my not be executed correctly.

An IP address entry of 136.230.172.129 would be:

MSB = 0x88,

0xE6,

0xAC,

LSB = 0x81.

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x18	Command No
4	0x??	Response byte
5	0x0D	Stop byte
6	0x??	CRC byte

Response Byte Meanings

Value	Function
0x00	Function Executed successfully
0x01	Access level inadequate
0x02	Parameter out of range
0x03	Requested value is too large
0x04	Requested value is too small
0x05	Feature not enabled
0x06	Parameter could not be written

Alarm Setting Values

Value	Function
0x00	Clear all alarms unconditionally
0x01	Supply voltage alarm
0x02	BDO Short Circuit
0x03	BDO Open Circuit
0x04	Spare
0x05	Snap Switch 1
0x06	Snap Switch 2
0x07	Thermistor 1
0x08	Thermistor 2
0x09	Thermistor 3
0x0A	Thermistor 4

0x0B	Thermistor 5
0x0C	Thermistor 6
0x0D	Thermistor 7
0x0E	Thermistor 8
0x0F	Memory
0x10	Output Fibre Fail
0x11	Ground Fault
0x12	Internal
0x13	Clear all warnings unconditionally
0x14	Set calibration warning

RAL behaviour bits (command 0x1E)

This command controls the RAL depending upon the state of the laser. The bits sent in this command are described in the table below. The state and action table is as follows:

Action	PRIORITY	EMIT	IDLE	SAFETY	OTHER
Allow ON					X
Auto ON	Lowest				
Auto OFF	Highest				

By ticking the box above the behaviour of the RAL is defined. The states of the laser are shown along with the desired action. By placing an X in the “Allow ON” row the RAL may be turned ON using the RAL command. The RAL may always be turned off using the command. The “Auto” option defines what the RAL does when the state is entered. So for example if the following table is constructed:

Action	PRIORITY	EMIT	IDLE	SAFETY	OTHER
Allow ON		X	X		X
Auto ON	Lowest	X			
Auto OFF	Highest		X		

The RAL will behave in the following way. When the laser is in the “Other” state (Key Open, Alarm etc) the RAL may be turned on via the RAL command. When the key switch is closed and the Safety Delay state is entered the RAL may not be on and if on will be extinguished. If the RAL on command is sent in this state the response will be “Inappropriate control state”. When the Safety Delay ends and the laser enters the IDLE state the RAL will illuminate. When the modulation signal is applied and the laser enters the EMIT state the RAL is then extinguished. However in both the EMIT and IDLE modes the RAL may be controlled using the RAL command. Note that the RAL time out still applies at all times.

It is possible to set bits which have actions which clash. When the command is sent the firmware in the laser will clear in appropriate bits. These may be read back using the Get Setting command. If either the "Auto On" or "Auto Off" bits are set then the "Allow On" must also be set. If the "Allow On" bit is not set then the other bits will be cleared. The "Auto Off" has priority over the "Auto On". If both are set then the "Auto On" bit is cleared.

The bits are allocated as shown:

Byte No	Bit No	Bit meaning
5	0x01	Emit – Allow On
5	0x02	Idle – Allow On
5	0x04	Safety – Allow On
5	0x08	Other – Allow On
5	0x10	Emit – Auto On
5	0x20	Idle – Auto On
5	0x40	Safety – Auto On
5	0x80	Other – Auto On
6	0x01	Emit – Auto Off
6	0x02	Idle – Auto Off
6	0x04	Safety – Auto Off
6	0x08	Other – Auto Off

5.19 Clear Output Power Alarm – 0x19

Overview

Attempts to reset a fibre alarm. This type of alarm occurs when either the signal or output fibres is not in the same state as it's partner after a set period of time. For example if the signal fibre is on but the output fibre is not, or vice versa, then an alarm is triggered. Once a fibre alarm has been triggered the only way to clear it is to use this command. This command may be used by the supervisor once. However should the alarm not be cleared then only an SPI service engineer or above can run this command a second time. Additionally the user must provide all signals required for the laser to operate and should ensure that the BDO is pointing at a beam dump.

The command will apply power to the laser for a short period at low power to ensure normal operation. At the end of the command the original power setting is restored and the unit will require a key cycle to operate normally.

Laser Receives:

Byte	Value	Function

No		
1	0x1B	Start byte
2	0x01	No of command and data bytes.
3	0x19	Command No
4	0x0D	Stop byte
5	0x42	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x19	Command value echoed in this response
4	0x??	Response byte
5	0x0D	Stop byte
6	0x??	CRC byte

Response Byte Meanings

Value	Function
0x00	Alarm cleared
0x01	Access level inadequate
0x02	PLC port is being used
0x03	Key Switch open
0x04	Interlock open
0x05	Modulation or modulation enable signal not present
0x06	Internal error
0x07	Output fibre failed
0x08	Signal fibre failed
0x09	No Alarm to be cleared
0x0A	No Output Signal from either fibre
0x0B	Modulation signal not CW
0x0C	Hardware shut down power

5.20 Set Pump Driver PSE Level – 0x1C

Overview

This command sets the bias level for the pump diodes. This command is provided to allow the user to just start to turn on the laser. In this state the laser will reach full power in the shortest possible time. The bias setting may be set between 0 and 1000, where 1000 is the maximum. The user must ensure that the correct bias level is set, if the bias level is too high then the work piece may be marked. The automatic level routine allows the unit to set the optimum bias level so that output is just detected. This routine can only be run if the unit is already in idle mode. If during this routine the state changes from idle the bias level will be set to zero.

Laser Receives:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x1C	Command No
4	0x??	Action Byte
5	0x??	Bias setting LSB
6	0x??	Bias setting MSB
7	0x0D	Stop byte
8	0x??	CRC byte

Action Byte:

Value	**Meaning**
0	Set bias Value
1	Get bias value (input value is ignored)
2	Run automatic set level function

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x1C	Command No
4	0x??	Response byte

5	0x??	Bias setting LSB
6	0x??	Bias setting MSB
7	0x0D	Stop byte
8	0x??	CRC byte

Response Byte Meaning

Value	**Function**
0x00	Current bias level read correctly
0x01	Action Byte not recognised
0x02	Bias level manual setting is greater than maximum - ignored
0x03	Bias level manually set OK
0x04	Bias level automatically set OK
0x05	Bias level automatic setting failed out of range
0x06	Bias level hardware not present
0x07	Unit not in IDLE mode
0x08	Bias level automatic setting timed out

5.21 Set XPR Mode – 0x1D

Overview

This command allows the user to enable or disable the eXtended Pulse Range mode. This improves the optical pulse response (see manual).

Laser Receives:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x1D	Command No
4	0x??	Action Byte
5	0x0D	Stop byte
6	0x??	CRC byte

Action Byte:

Value	Meaning
0	Disable XPR mode
1	Enable XPR mode

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x1D	Command No
4	0x??	Response byte
5	0x0D	Stop byte
6	0x??	CRC byte

Response Byte Meaning

Value	Function
0x00	XPR Mode Disabled
0x01	XPR Mode Enabled
0x02	PLC port enabled
0x03	XPR hardware not present
0x04	Action Byte not recognised

5.22 Enable Feature – 0x1E

Overview

This command allows the user to enable various features on the laser. A feature may or may not require additional hardware to function correctly. To enable a feature the user will be provided with a pass code by SPI. Note that after sending this command the command will be disabled for one minute if the command fails due to an incorrect code being sent. If the user sends three incorrect pass code the command is disabled until the laser is power cycled. Once the feature has been enabled the laser stores this information when the power is turned off. If a feature is enabled and the hardware is subsequently removed an internal alarm will be generated. In this case the feature should be disabled. Note that when disabling a feature the same pass code must be supplied. The current features enabled or disabled can be extracted without the need for a pass code. The value of

the feature byte should be set to zero. The value of the enable or disable is ignored as well as the pass code. Additionally there is no time constraint.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x05	No of command and data bytes.
3	0x1E	Command No
4	0x??	Feature
5	0x??	0=disable, 1=enable
6	0x??	Pass code byte LSB (hexadecimal)
7	0x??	Pass code byte MSB
8	0x0D	Stop byte
9	0x??	CRC byte

Feature Byte:

Value	Meaning
0	Read Flags only
1	XPR
2	PSE
3	CAN Bus
4	Internal Pulse Generation
5	Ethernet

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x1E	Command No
4	0x??	Response byte LSB
5	0x??	Feature Flags LSB
6	0x??	Feature Flags MSB

7	0x0D	Stop byte
8	0x??	CRC byte

Response Byte Meaning

Value	**Function**
0x00	Command executed OK
0x01	Access level inadequate
0x02	Bad pass code
0x03	Hardware not fitted
0x04	Command timed out wait
0x05	Command disabled power off
0x06	Unknown feature

Feature Flag Values

Value	**Function**
0x0000	No features are enabled
0x0001	XPR (eXtended Pulse Range)
0x0002	PSE (Pulse Stability Equalisation)
0x0004	CAN Bus
0x0008	Internal Pulse Generation
0x0010	Ethernet

5.23 Get string description- 0x1F

Overview

This command allows the user to retrieve a string of characters. Initially implemented to obtain a description of the firmware.

Laser Receives:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0x02	No of command and data bytes.
3	0x1F	Command No
4	0x??	String type
5	0x0D	Stop byte
6	0x??	CRC byte

String type Byte:

Value	**Meaning**
0	Firmware description
1	Spare

Laser Transmits:

Byte No	**Value**	**Function**
1	0x1B	Start byte
2	0xDC	No of command and data bytes.
3	0x1F	Command No
4	0x??	String type
5	0x??	Number of character used in command
6	0x??	String character index 0
7	0x??	String character index 1
8	0x??	String character index …..n
??	0x??	String character index ??
??	0x0D	Stop byte

	0x??	CRC byte

5.24 User Clear All Alarms – 0x20

Overview

This command allows the user to clear all alarms. To successfully execute the command the user must enter a pass code which will be provided by the manufacturer. To use this command enter any pass code. The command will fail but the attempt count will be returned. Send the serial number of the laser, the version of the NXP firmware and the attempt number to the manufacturer. The manufacturer will supply the pass code. Run the command again using the pass code supplied to correctly execute the command. When correctly executed the attempt number will be indexed by one. Once the attempt number reaches 255 it will roll back to 0. The user must then request another code to clear the alarms. The command cannot be retried within 10 seconds.

Laser Receives:

Byte No	Value	Function
1	0x1B	Start byte
2	0x06	No of command and data bytes.
3	0x20	Command No
4	0x??	Unused at present (any character is valid)
5	0x??	Pass code byte LSB (hexadecimal)
6	0x??	Pass code byte MSB
7	0x0D	Stop byte
8	0x??	CRC byte

Laser Transmits:

Byte No	Value	Function
1	0x1B	Start byte
2	0x04	No of command and data bytes.
3	0x20	Command No
4	0x??	Attempt count
5	0x??	Response byte
6	0x0D	Stop byte
7	0x??	CRC byte

Response byte meaning:

Value	Meaning
0	Command executed correctly
1	Pass code incorrect
2	Command repeated too soon (10 second hold off)