编号

密级

阶段标记

页数 19

名称 **武汉锐科光纤激光器**

串口通讯协议英文版

会签

单位	武汉锐科-第二事业部
编写	蔡一鸣
校对	熊裕峰
审核	施建宏
标审	李其军
批准	王建明

武汉锐科光纤激光技术股份有限公司

内部资料
注意保存

Wuhan Raycus Fiber Laser
Serial Communication Protocol

——V1.1

Catalogue

1. Communication Parameter

1.1 Baud Rate 9600

Except for special requirement.

1.2 Data Format

Data bits 8
Parity bit NA
Stop bit 1

2. Frame Format

2.1 Protocol Consideration

Communication all use ASCII codes, \r (Hexadecimal 0D) represents terminator.
All of the following descriptions are the hexadecimal of the ASCII after it converte to a byte.
Illustrates:
Suppose the data link is transmitting:
46 45 46 45 46 45 36 38 46 46 46 46 33 34 30 30 30 30 30 30 33 30 30 45 35 35 0D
The corresponding ASCII is displayed as:
FEFEFE68FFFF34000000300E55\r
The device will transform the original data.
(46 45 46 45 46 45 36 38 46 46 46 46 33 34 30 30 30 30 30 30 33 30 30 45 35 35 0D)
Into hexadecimal:
FE FE FE 68 FF FF 34 00 00 00 30 0E 55

2.2 Frame Format

Parameter	Length	Code	Range	
Initial flag	4 byte	FE FE FE 68		
Address	2 byte	High byte in front, low byte in the back.	00-FFFF	
Command words	1 byte		00-FF	
Alternate parameters	1 byte			
Data length	2 byte	High byte in front, low byte in the back.	00-FFFF	
Data	N byte			nullable
Check code	2 byte	High byte in front, low byte in the back.		CRC16 audit
Data tail	1 byte	0x55		

2.3 Illustrates:

Address: 0x0123
Command words: 0x31
Data length: 0x0008
Data: 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
Sending format:
FE FE FE 68 01 23 31 00 00 08 11 22 33 44 55 66 77 88 6B EA 55

2.4 Check Code

The 16 bits Check Code is the CRC16 of the calculated address, command words, alternate parameters, data length and data field.

3. Communication Protocol of the Host Computer Software and Single-Chip Program

Protocol follows the specification of serial communication protocol.
Refer to Appendix I.

3.1 Command Word

3.1.1 Inquiries state parameter of laser device.

Ps: Those commands are usually used for GPRS communication field to read parameters or status of the laser device when the parameters of the laser device parameters are unclear.

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x30	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data	0byte		
Check code	2byte		High byte in front, low byte in the back.
Data tail	1byte	0x55	

Laser device return

Parameter	Length	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command	1byte	0xB0	00-FF

words			
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data 0	4		Read the first ID of the parameter (High byte in front, low byte in the back.）
Data 1	4		Read the first code of the Parameter（High byte in front, low byte in the back.）
Data 2	4		Read the second ID of the parameter（High byte in front, low byte in the back.）
Data 3	4		Read the second code of the parameter （High byte in front, low byte in the back.）
Data n-1	4		Read the Nth ID of the parameter
Data n	4		Read the Nth code of the parameter
Checkout	2		CRC
Data tail	1	0x55	Stop characters

Laser device return parameters include but not limited to the following ID: 0x06200090,0x06200091,0x06200092,0x06200093,0x06200094,0x06200095,0x06200096,0x06200097,0x0420000f,0x04200080,0x0420F000,0x0420F800,0x0420F801,0x06200082,0x06200083,0x06200084,0x06200085,0x00200086

3.1.2 Read Parameter

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x31	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data 0	4		Intend to read the first ID of the parameter（High byte in front, low byte in the back.）
Data 1	4		Intend to read the second ID of the parameter（High byte in front, low byte in the back.）
	4		
	4		
Data N	4		Intend to read the Nth ID of the parameter
Check code	2byte		High byte in front, low byte in the back.

Data tail	1byte	0x55	

Laser device return

Parameter	byte	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0xB1	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data 0	4		Read the first ID of the parameter （High byte in front, low byte in the back.）
Data 1	4		Read the first code of the parameter （High byte in front, low byte in the back.）
Data 2	4		Read the second ID of the parameter（High byte in front, low byte in the back.）
Data 3	4		Read the second code of the parameter （High byte in front, low byte in the back.）
Data n-1	4		Read the Nth ID of the parameter
Data n	4		Read the Nth code of the parameter
Checkout	2		CRC
Data tail	1	0x55	Stop characters

3.1.2.1 Parameter Definition Table

The parameters of read and set value are in 8byte。 The specifically definition as follow table:

BYTE0	BYTE1		BYTE2	BYTE3	BYTE4	BYTE4	BYTE5	BYTE7
0x02	0x00		0x00	0x04	0x12	0x34	0x56	0x78
Data type	High four bits	Low four bits	Data ID		Data object contains data value object. High address in front, low address in the back.			
0x00	Device type	Unit number	0x0004		0x00000080			
	02	0x01						
An8-byte unsigned	Parameter of	The first unit	Monitoring and amplifying		0x80			

integer	continuous medium power laser device		coefficient of light protection	

Data type corresponding table

Data type	Illustration
0x00	An8-byte unsigned integer
0x01	An8-byte signed integer
0x02	An16-byte unsigned integer
0x03	An16-byte signed integer
0x04	An32-byte unsigned integer
0x05	An32-byte signed integer
0x06	32 bit single precision floating point type
0x07	32 bit variable quantity
0x80	Successfully read or set.
0x81	Wrong data type
0x82	Overrun
0x83	Unknown parameter

Read Illustrates

Upper computer sending down

BYTE0	BYTE1	BYTE2	BYTE3
Arbitrarily		0x0002	

Slave computer return

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x04		0x0002		0x12345678			

Or unknown parameter

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x83		0x0002		0x00000000			

Setting Illustrates

Upper computer sending down

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE4	BYTE5	BYTE7
0x04		0x0002		0x12345678			

Slave computer return

Setting successfully

BYTE0		BYTE1	BYTE2	BYTE3
0x80			0x0002	

Or overrun

BYTE0	BYTE1	BYTE2	BYTE3
0x82		0x0002	

Device type

Device type number	Illustration
0	Common physical parameters
1	Pulsed laser device parameters
2	Continuous medium power laser device parameters
3	QCW
4	Aging theory test
Others	Backup

3.1.2.2 ID Number Distribution Rules

ID number rang	Illustration	Illustrates
0x0000-0x3FFF	Readable and writable parameters	Laser device configuration parameter. For example, high temperature alarm of temperature value.
0x4000-0x7FFF	Only readable Parameter	Current temperature of laser device
Others	Backup	
0xF000	Length of readable and writable parameters in Variable zone n (n represents number of INT)	
0xF001-0xF7FF	Readable and writable parameters variable zone	Enabling or prohibiting protection functions.
0xF800	Only read the length n of variable zone (n represents number of INT)	
0xF801-0xFFFF	Only read variable zone	Alarm bit

Ps: Still temporary use the previous non-conforming parts. The new defined ID number must follow the rules from now on.

3.1.2.3 Device type 02 Continuous Laser Device ID Number Corresponding Table

ID number（16byte）	Illustration	Data	Illustrates
0x0000	Laser device power		An32-byte unsigned integer
0x0001	Maximum power percentage		An8-byte unsigned integer
0x0002	Upper limit of temperature		Float type
0x0003	Lower limit of		Float type

	temperature			
0x0004	GPRS Transmission time interval		An32-byte unsigned integer	
0x0081	Current status	An32-byte unsigned integer	BIT0	Front panel LASER status
			BIT1	Front panel REM button status
			BIT2	Stand by button 3
			BIT3	Stand by button 4
			BIT4	Alarm light
			BIT5	Stand by application
			BIT6	Relay output status
			BIT7	Output
			BIT8	Laser ON
			BIT9	Stand by application
			BIT10	Stand by application
			BIT11	AD/232 mode selection
			BIT12	INTER LOCK
			BIT13	Q9 signal
			BIT14	Stand by application
			BIT15	Stand by application
			BIT16	Stand by application
			BIT20	
			BIT21	
			BIT22	
			BIT23	
			BIT24	
			BIT25	
			BIT26	
			BIT27	
			BIT28	
			BIT29	
			BIT30	
			BIT31	
0x0082	System power supply voltage	Single precision floating point		
0x0083	Single chip microprocessor temperature	Single precision floating point		
0x0084	External power setting	Single		

	voltage	precision floating point		
0x0085	Abnormal information	An32-byte unsigned integer	BIT0	CPLD status： 0x51 ： 1Power monitor abnormal 0x52 ： 2Power monitor abnormal 0x53 ： 3Power monitor abnormal 0x54 ： 4Power monitor abnormal 0x55 ： 5Power monitor abnormal 0x56 ： 6Power monitor abnormal 0x11：1Power abnormal 0x12：2Power abnormal 0x13：3Power abnormal 0x14：4Power abnormal 0x15：5Power abnormal 0x16：6Power abnormal 0x17：7Power abnormal 0x21 ： 1Laser emitting abnormal 0x22 ： 2Laser emitting abnormal 0x23 ： 3Laser emitting abnormal 0x24 ： 4Laser emitting abnormal 0x25 ： 5Laser emitting abnormal 0x26 ： 6Laser emitting abnormal 0x27 ： 7Laser emitting abnormal 0x40：InterLock abnormal 0x60：Current driving plate abnormal
			BIT1	
			BIT2	
			BIT3	
			BIT4	
			BIT5	
			BIT6	
			BIT7	
			BIT8	
			BIT9	
			BIT10	
			BIT11	
			BIT12	
			BIT13	
			BIT14	
			BIT15	

			BIT16 BIT17 BIT18 BIT19 BIT20 BIT21 BIT22 BIT23 BIT24 BIT25 BIT26 BIT27 BIT28 BIT29 BIT30 BIT31	MCU abnormal: 0x 01:MCU voltage abnormal 0x02: Authorized time out 0x03:Press the power on botton 0x06:interlockabnormal 0x07:ACDC mode1 abnormal 0x08: ACDC mode2 abnormal 0x09: Current driving plate abnormal 0x0a: Internal temperature humidity abnormality 0xmn04 ： Monitor plane temperature m and n high abnormal， for example： 0x2104:monitor plane 2 temperature 1temperature（m 0~5，n 0~3） 0xmn05 ： Monitor plane temperature m and n low abnormal， for example： 0x2104:monitor plane 2 temperature 1temperature（m 0~5，n 0~3）
0x0086	Current laser power percent	An8-byte unsigned integer		
0x009b	Get single module fault information	bit	unsigned int Temp1Alarm :1 ; unsigned int Temp2Alarm :1 ; unsigned int Temp3Alarm :1 ; unsigned int Temp4Alarm :1 ; unsigned int JKBLaserAlarm :1 ; unsigned int JKBPowerAlarm :1 ; unsigned int DYBPowerAlarm :1 ; unsigned int Byte1rev1 :1 ; unsigned int Byte2rev1 :1 ; unsigned int Byte2rev2 :1 ; unsigned int Byte2rev3 :1 ; unsigned int Byte2rev4 :1 ;	

			unsigned int Byte2rev5 :1 ;
			unsigned int Byte2rev6 :1 ;
			unsigned int Byte2rev7 :1 ;
			unsigned int Byte2rev8 :1 ;
			
			// system Faut
			unsigned int InterLock :1; //Iterlock
			unsigned int CurrentERRAlarm :1;
			unsigned int LasetON :1;
			unsigned int MCUVol :1;
			unsigned int WaterInterLock :1; // Water flow failure
			unsigned int MCUTemp :1;
			unsigned int SysTemVolHightAlarm :1;
			unsigned int SysTemVolLowAlarm :1;
			
			//byte4
			unsigned int Byte4rev1 :1;
			unsigned int Byte4rev2 :1;
			unsigned int Byte4rev3 :1;
			unsigned int Byte4rev4 :1;
			unsigned int Byte4rev5 :1;
			unsigned int Byte4rev6 :1;
			unsigned int Byte4rev7 :1;
			unsigned int Byte4rev8 :1;

0x009c	Laser device cumulative power up time	Long type	
0x009d	Laser device cumulative laser emitting time	Long type	
0x009e	Laser device cumulative power up and laser emitting time		
0x009f	Laser device cumulative laser emitting time	int	Bit0 Current driving plate 1-2 Bit1 Current driving plate 3-4 Bit2 Current driving plate 5-6 Bit3 Interlock
0x00f0	MCU software version		32Unsigned integer

0x00f1	Protocol version		32Unsigned integer
0x00f2	Hardware master board PCB version		32Unsigned integer
0x00f3	Master board CPLD software version		32Unsigned integer
0x00f4	CPLD broad PCB version		32Unsigned integer
0x00f5	CPLD board software version		32Unsigned integer
0x00f6	Electric / optical module number		32Unsigned integer
0x00f7	Software version 1.5		

3.1.3 Read System Parameter Setting

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x32	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Laser device return

Parameter	Length	Data	Illustration
Initial flag	2byte	AA 55	
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Address	1byte	0xFF	00-FF
Alternate parameters	1byte	0x00	00-FF
Command words	1byte	0Xb2	00-FF
Checkout	2		High byte in front, low byte in the back.
Data tail	1	0x55	Stop characters

3.1.4 Setting Internal Power Frequency and Duty Cycle

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x60	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Laser device return

Parameter	Length	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0xE0	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Checkout	2		High byte in front, low byte in the back.
Data tail	1	0x55	Stop characters

3.1.5 Read Limited Locking Time

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x35	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Laser device return

Parameter	Length	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.

Command words	1byte	0xb5	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data 0-11	12byte		12 byte serial number of single chip microcomputer
Data 12	1byte		The lower eighth bits of the 12 byte simulation of single chip microcomputer
Checkout	2		High byte in front, low byte in the back.
Data tail	1	0x55	Stop characters

3.1.6 Open Optical Shutter

Laser device return

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x61	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Parameter	Length	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Data length	2byte	00-FFFF	High byte in front, low byte in the back.
Address	1byte	0xFF	00-FF
Alternate parameters	1byte	0x00	00-FF
Command words	1byte	0XE1	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Checkout	2		Cumulative sum ，High byte in front, low byte in

			the back.
Data tail	2	0x55	Stop characters

3.1.7 Shutter down the optical shutter

Parameter	byte	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x62	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Laser device return

Parameter	byte	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Data length	2byte	00-FFFF	High byte in front, low byte in the back.
Address	1byte	0xFF	00-FF
Alternate parameters	1byte	0x00	00-FF
Command words	1byte	0XE2	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Checkout	2		Cumulative sum ，High byte in front, low byte in the back.
Data tail	2	0x55	Stop characters

3.1.8 Read Error Recording

Parameter	Length	Code	Illustration
Initial flag	4byte	FE FE FE 68	
Address	2byte	0000-FFFF	High byte in front, low byte in the back.
Command words	1byte	0x71	00-FF
Alternate parameters	1byte	0x00	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.

Data 0	4byte		Rereading the beginning error recording
Data 1	4byte		Rereading the end error recording
Check code		2byte	High byte in front, low byte in the back.
Data tail		0x55	

Laser device return

Parameter	Length	Data	Illustration
Initial flag	4byte	FE FE FE 68	
Data length	2byte	00-FFFF	High byte in front, low byte in the back.
Address	1byte	0xFF	00-FF
Alternate parameters	1byte	0x00	00-FF
Command words	1byte	0XF1	00-FF
Data length	2byte	0000-FFFF	High byte in front, low byte in the back.
Data 0	4byte		The total number of error recording
Data 1			Current data number
Data 2			error recording1
Data 3			
Data 4			
Data N			error recording N
Checkout	2		Cumulative sum ，High byte in front, low byte in the back.
Data tail	2	0x55	Stop characters

Crror Record

参数	bit	数据	意义
Number	1bit		
CPLD 故障	2bit		CPLD status： 0x51：1Power monitor abnormal 0x52：2Power monitor abnormal 0x53：3Power monitor abnormal 0x54：4Power monitor abnormal 0x55：5Power monitor abnormal 0x56：6Power monitor abnormal 0x11：1Power abnormal 0x12：2Power abnormal 0x13：3Power abnormal 0x14：4Power abnormal 0x15：5Power abnormal 0x16：6Power abnormal 0x17：7Power abnormal

			0x21：1Laser emitting abnormal 0x22：2Laser emitting abnormal 0x23：3Laser emitting abnormal 0x24：4Laser emitting abnormal 0x25：5Laser emitting abnormal 0x26：6Laser emitting abnormal 0x27：7Laser emitting abnormal 0x40：InterLock abnormal 0x60：Current driving plate abnormal
Cpu abnoemal	2bit		MCU abnormal: 0x 01:MCU voltage abnormal 0x02: Authorized time out 0x03:Press the power on botton 0x06:interlockabnormal 0x07:ACDC mode1 abnormal 0x08: ACDC mode2 abnormal 0x09: Current driving plate abnormal 0x0a: Internal temperature humidity abnormality 0xmn04： Monitor plane temperature m and n high abnormal， for example： 0x2104:monitor plane 2 temperature 1temperature（m 0~5，n 0~3） 0xmn05：Monitor plane temperature m and n low abnormal，for example：0x2104:monitor plane 2 temperature 1temperature（m 0~5， n 0~3）
year	1bit		year
month	1bit		month
day	1bit		day
hour	1bit		hour
minute	1bit		minute