# ERDI LASER®

160mJ Laser Target Designator
Technical Specification
Model：LR160

POINTS TO NOTE

- Please read the instruction carefully before using the Laser Target Designator.
- Strictly follow the switching process, otherwise the device may be damaged.
- The product belongs to class4 strong laser products, which have irreversible damage to the human body; when working, it is strictly prohibited to look directly at the light outlet or aim at the human body.
- It is strictly prohibited for the operator to leave when working.
- Pay attention to the positive and negative connection, if the connection is reversed, the machine will be burned out.
- Pay attention to the heat dissipation of the shell when working for a long time, and add a radiator and a fan to assist in heat dissipation if necessary.
- Pay attention to keep the surface of the laser transmitting lens clean. If you find dirt, please use cotton wool and anhydrous alcohol to wipe gently. It is strictly prohibited to wipe directly with water.
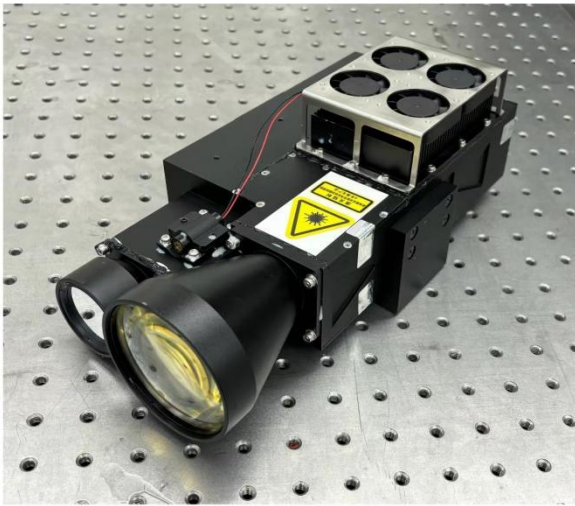
The LR160 laser target designator comprises a laser emission unit, a laser receiving and ranging unit, a laser driving source, and a control and communication unit. Its primary functionalities encompass laser ranging and laser Designator. Additionally, it possesses the capability of photoelectric isolation signal triggering as well as an external trigger function.

INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT
REFERENCE IEC 60825-Edition 1.2

DANGER
INVISIBLE LASER RADIATION - AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
MAX POWER 10W WAVELENGTH 700 - 1070nm
CLASS IV LASER PRODUCT

CAUTION
STATIC SENSITIVE DEVICE
OBSERVE PRECAUTIONS

MAIN INDICATOR PARAMETERS AND TEST RESULTS

Technical indicators		
Working wavelength	1064nm±1nm	
Laser irradiation energy	Both 85mj and 160mj can be switched	
Light delay	304μs±1μs	
Dispersion Angle	≤0.2mrad	
Irradiation frequency	8 ~ 21Hz	
Ranging frequency	10Hz	
Laser pulse width	10ns ~15ns	
Power stability	≤±8%	
Ranging range	0.2m ~ 30km (target size 10 m *10 m *8 m, visibility 30km)	
Ranging error	less than or equal to 5 meters	
Target selection	first/second/end	
Accurate measurement rate	98%	
Start-up time	＜1min（at normal temperature）	
Working time	Ranging mode	continuously working for 5min, rest for 4min, continuous 5 cycles（at low/normal temperature）
		continuously working for 5min, rest for 4min, continuous 2cycles（at high temperature and 85mj output）
		continuously working for 2 min, rest for 4min, continuous 2cycles（at high temperature and 160mj output）
	Irradiation mode	irradiation time 90s, rest 60s, continuous 5 cycles （at low/normal temperature and 85mj output）
		irradiation time 60s, rest 60s, continuous 5 cycles （at low/normal temperature and 160mj output）
		irradiation time 90s, rest 60s, continuous1 cycles （at high temperature and 85mj output）
		irradiation time 60s, rest 60s, continuous 1 cycles （at high temperature and 160mj output）
Full set weight	≤ 3.2kg	
Key performance indicators		
Power supply and power consumption	Power supply range	20V ~ 33V, DC
	Power consumption	peak power is not more than 400W, standby power is not more than 60W (limit temperature)
Reliability	MTBF is not less than 4000h	
Security	Set up a warning device for the laser to work	
	The exit of the laser transmitter is provided with obvious warning signs	
	The equipment is well grounded	
Maintainability	All major functional parts and equipment are set up fault indication and normal working indication	
	The average repair time MTTR is not more than 20min	
Electromagnetic aticompbility requirements	In the system boot operation process, the equipment can be compatible with other equipment in the system, normal work	
Environmental adaptability requirements		
Temperature	Operating temperature	-40℃ ~ +55℃
	Storage temperature	-40℃ ~ +70℃

Humid heat	Relative humidity	95% ± 3%	
	Temperature	+25°C±2°C	
	Storage time	72h	
Vibration	Vibration spectrum shape (grms=6.06)	20Hz to 80Hz	+3dB/oct
		80Hz to 350Hz	G2/0.04 Hz
		350Hz to 2000Hz	-3dB/oct
	Vibration direction and time	vibrate in one direction for at least 10min	
	Control point	should be selected in the fixture or shaking table surface near the maximum stiffness of the product, large equipment can use multi-point average control	
	Monitoring point	the monitoring point should be selected in the key part of the product under test, so that the root mean square acceleration response does not exceed the maximum allowable design (grms=6.06)	
	Installation requirements	The specimen is rigidly connected to the shaking table, and the product with shock absorber should remove the shock absorber for test	
	Performance check	Power-on test during vibration, all performance indicators should meet the technical requirements specified in the design document.In case of failure, it is allowed to repair.When the acceptance test is carried out after repair, the spectrum value should be reduced to 0.01g2/Hz, grms=3.03, and the specimen should be vibrated in the direction most afraid of vibration for 10min	
Temperature cycle	Temperature range	Power-on test	-35±3°C ~ +52±2°C
	Rate of temperature change	Temperature rise	10°C/min
		Cooling	10°C/min
	Cycle times	10 times, should ensure that the last 2 cycles without fault, if the fault occurs in the last 2 cycles, after repair, need to make up 2 trouble-free cycles	
	Cycle time	One cycle time is 4h, one cycle includes temperature rise → temperature stay → cooling → temperature stay → temperature rise	
	High and low temperature residence time	the residence time depends on the heat capacity of the specimen. Based on the principle of product thermal or cold permeability, the	

		internal temperature of the specimen is maintained for 5min after reaching stability
	The requirements of the product under test	general temperature cycle test with the whole machine, should be as far as possible to open the cover
	Check and repair	power test equipment, in each temperature cycle, after the test to confirm that the equipment is fault, can carry out the next temperature cycle
Drenching requirements	Drenching is carried out with the whole equipment	
Sports car	Sports cars go with the whole device		
	If the product does not do road transport test, you can use the simulation transport table for indoor transport simulation test, that is, sinusoidal cyclic vibration test for product identification		
	The requirements of the simulated transport table test are as follows		
	Test conditions	Frequency	5Hz ~ 200Hz
		Amplitude	5Hz ~ 7Hz
		Amplitude 12mm ~ 8mm	
		7Hz ~ 200Hz equal acceleration 1.5g	
		Vibration test condition allowable deviation is the same as broadband random vibration test	
	Direction	vertical axle direction and side;Orientation: vertical and lateral to the axle	
	Cycle time	log-scan 5Hz ~ 200Hz ~ 5Hz, 12min per cycle;When the resonant frequency of the specimen is measured below 5Hz, the test frequency can be extended to 2Hz, 2Hz ~ 200Hz ~ 2Hz scanning, scanning time should be 15min.The vibration time in each direction is 90min	
	After transportation test, check whether there is damage and structural loosening phenomenon, carry out technical index inspection, should meet the design requirements		

⧽ STRUCTURAL DIMENSIONS
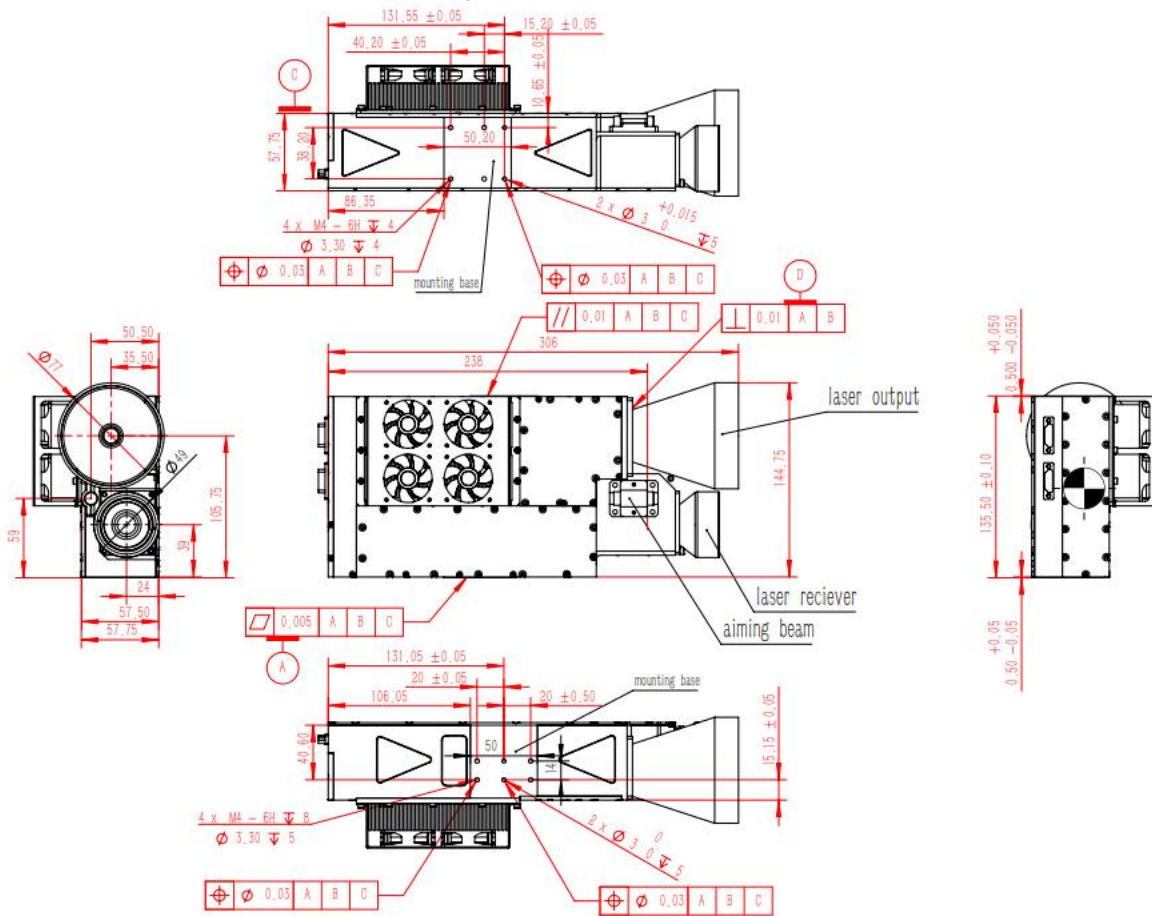
Product Dimensions: ≤306X145X94mm

TECHNICAL PARAMETERS

1. The electrical connection mode is connector J30J-21ZKP and J30J-04ZK, and the cable is defined as follows:

Table 1 J30J-21ZKP interface definition

PIN	Identification	Instructions	Direction of signal	Others
		J30J-21ZKP		
1	TX+	RS422 sending end +	Output	RS422 communication interface
2	TX-	RS422 sending end -	Output	
3	RX+	RS422 receiving end +	Input	
4	RX-	RS422 receiving end -	Input	
5	GND	RS422 reference ground	GND	
6	EN+	Power supply enable end		24V power supply enable switch
7	EN-	Power supply enable end		
8-13		Not used		
14	A	External trigger differential signal + (A)	Input	A, B are the A and B ends of differential chip (RS422
15	B	External trigger differential signal - (B)	Input	

		differential)
16-21		Not used		

Table 2 J30J-04ZK wiring definition

J30J-04ZK				
PIN	Identification	Instructions	Direction of signal	Others
A、B	24V	power supply	Input	Red.
C、D	GND	power reference point	GND	Black.

2. Power interface: +24VDC±10%;

3. External trigger level: RS422 differential level;

4. Cooling mode: cooling fan on the top of the shell;
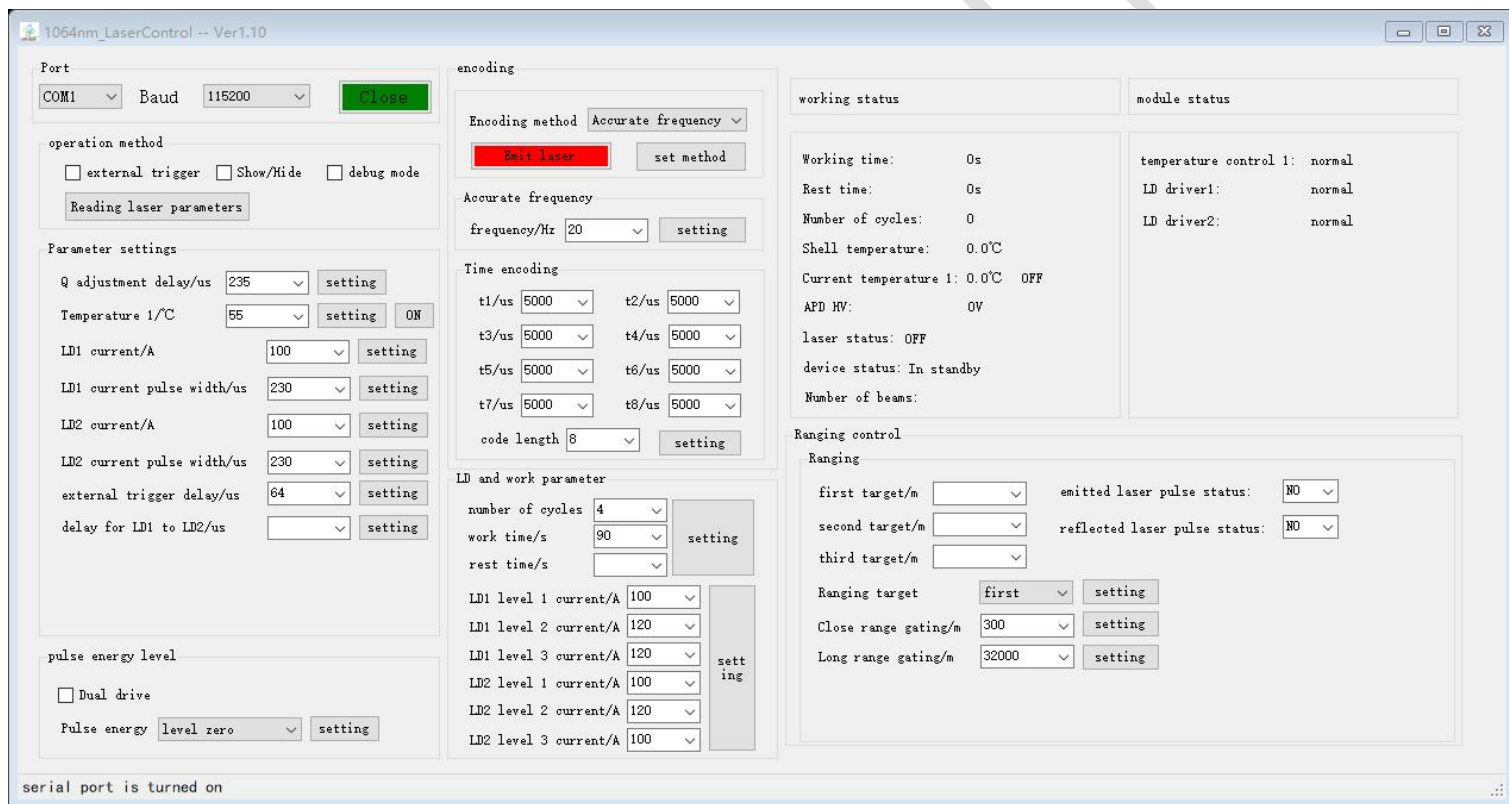
INTRODUCTION TO POWER-ON AND OPERATION

Figure 4.1 Laser Ranging Target Designator upper computer

Operation steps

- Use USB to RS422 serial line to connect PC and laser.
- Open the laser host computer and open the serial port.
- Connect the laser power line and turn on the power supply.
- Turn on the external enable switch of the laser and power on the laser.
- Check the status and current temperature of the laser through the host computer, and start the temperature control (the red box button below).

Note: Before starting the laser, it is necessary to start the temperature control first and wait for the temperature to reach the set value.

Parameter settings
- Q adjustment delay/us 235
- Temperature 1/°C 55 [ON]
- LD1 current/A 100
- LD1 current pulse width/us 230
- LD2 current/A 100
- LD2 current pulse width/us 230
- external trigger delay/us 64
- delay for LD1 to LD2/us

● After starting the temperature control, wait for the temperature to reach the set temperature (the default value is 55°C, do not change it at will). The red box is the real-time temperature of the temperature control.

Working time: 0s
Rest time: 0s
Number of cycles: 0
Shell temperature: 0.0°C
Current temperature 1:   0.0°C   OFF
APD HV: 0V
laser status: OFF
device status: In standby
Number of beams:

● After the temperature is reached, click the "Emit laser" button to launch the laser.

Encoding method Accurate frequency
[Emit laser]   set method

● After working, please turn off the power

Parameters Description

● As shown in Figure 4.1, the host computer interface includes laser irradiator parameter setting and data display. Laser triggering mode (internal triggering, external triggering), encoding mode (precise frequency, time encoding), working time, driving current, etc. can be set.

● **Debug mode:** no limitation on the working time of laser light emission

☐ debug mode

● **Trigger mode:** "external trigger" means the use of external differential signal to trigger the laser, the light pulse frequency follows the frequency of the external signal. "internal trigger" means the trigger signal is generated by the information processing board.

☐ external trigger

● **Q-switching delay:** the delay between Q-switching signal and LD drive signal, whose value and LD drive pulse width affect the laser energy. Generally, when the LD drive pulse width is 230us, Q-switching delay is 235us.

Q adjustment delay/us 235   setting

- **LD drive current:** the change of drive current will cause the change of laser output energy. The larger the current, the larger the output energy. Generally, the LD drive current does not exceed 120A. To change the LD drive current, the value of the current needs to be set first, and then click the laser gear position 0, and the current binding is completed.

Pulse energy level setting

Level zero: please refer to above item for any LD current setting(＜120A

Level 1 : LD1 100A, LD2:55A (pulse energy is 85mj)

Level 2: LD1 100A, LD2:100A(pulse energy is 165mj)

Level 3: LD1 110A, LD2:110A (backup for pulse energy compensation))

- **LD drive pulse width:** signal pulse width, generally 230us.This value is the default, remain unchanged.
- The working time indicates the laser light time, when the light time reaches the set value, the laser stops output, the laser ranging target designator starts to enter the rest state, after the completion of the rest automatically light, laser ranging target designator light 1 times increase 1 times the cycle, when the cycle times reach the set number of cycle times, no longer cycle light.
- The range finding part of the parameters only range finder, the closest range gating and the furthest range gating these three parameters.

Ranging target	first ∨	setting
Close range gating/m	300 ∨	setting
Long range gating/m	32000 ∨	setting

ᛦ BUILT-IN CODING DEFINITIONS

Precise frequency
The pulse frequency of light emission. For example, if the frequency is set (bound) to 20Hz, the light emission frequency of the laser is 20Hz.

Time coding
Time coding consists of 8 time values and code length. The time value refers to the interval time between two successive laser emission.For example, the 8 time values are 40ms, 43ms, 46ms, 49, ms, 50ms, 53ms, 56ms and 60ms respectively.If the code length is 3, the first 3 time values are taken to participate in the laser emission cycle, that is, the first and second laser interval is 40ms, the second and third laser interval is 43ms, the third and fourth laser interval is 46ms, and the laser interval time repeats the three time interval values.If the code length is 5, the laser interval time repeats the first five time intervals.

ᛦ COMMUNICATION PROTOCOL

1. Physical layer
Interface standard: RS422
baud rate: 115200bps, 8 bits data bit, 1 bit stop bit, no check bit.
Communication format: (case insensitive)

2. Message
that is, sent by the host computer (such as computer) corresponding message.

3. Message Format
The structure of the message is as follows:

Header	command word	Data length	Data	Checksum
2 bytes	1 byte	2 bytes	N bytes	2 bytes

- **Header:** When the message is sent from the upper computer to the lower computer, the first byte is 0xAA, and the second byte is 0xBB, which is fixed.When the message is sent from the lower computer to the upper computer, the first byte is 0xAA, and the second byte is 0xBB, which is fixed.

- **Command word:** 1 byte, see below.
- **Data length:** The number of bytes of data to be sent, excluding the number of bytes itself.
- **Data:** The actual data to be sent. If it is 16-bit data, it is decomposed into two bytes, with the high byte in front and the low byte after.
- **Checksum:** Add all data bytes (8 bits, excluding header, command word and data length), take the lowest 16 bits, and then decompose them into two bytes, with the high byte in front and the low byte after. If there is no data byte, the two bytes of the checksum are 0x00.

4. Command words

Command word	Define	Byte	Data	clarification
0x00	Read irradiator parameter information	0	No data bytes	
0x01	Standby			
0x02	Set trigger mode	1	0x00: Internal Trigger 0x01: External Trigger	Default internal trigger External trigger mode, light output delay can be set, i.e., the rising edge of the external trigger signal to the laser output time, default 304us±1us
0x03	Set Q-switching delay	2	Delay value	1LSB=1us Range:0-300us Default value: 0us
0x04	Standby (originally set working time)			
0x05	Set working mode	1	Ox00: Debug mode 0x01: Timing mode	Default timing mode
0x06	Set temperature of thermostat 1	2	S16 Temperature Value	1LSB=0.1℃ Range:0-65℃ Default value: 25℃
0x07	Start/stop thermostat 1	1	0x00: Stop 0x01: Start	Default startup upon power-on
0X08	Standby			
0X09	Standby			
0x0A	Set driver 1 current	1	Current value	1LSB=1A Range:0-150A Default value：150A
0x0B	Set laser power shift	1	0x00: Gear 0 0x01: Gear 1 0x02: Gear 2 0x03: Gear 3	Working according to the current pulse width set by the parameter in gear 0 Fixed current of driver 1 and driver 2 according to the relevant gear set Laser appears
0x0C	Set driver 1 pulse width	2	pulse width value	1LSB=1us Range: 0-250us Default value：180us
0x0D	Set driver 2 current	1	Current value	1LSB=1A Range:0-150A Default value：150A
0x0E	Standby			
0x0F	Set driver 2 pulse width	2	Pulse Width Value	1LSB=1us Range:0-250us Default value：180us
0x10	Standby			
0x11	Start/stop laser	1	0x00: Stop 0x01: Start	Laser Start/Stop 1. Start/Stop Frequency Signal 2. Start/Stop Driver 1 and Driver 2
0x12	binding light frequency	1	Frequency value	1LSB=1Hz Range:1-30Hz

				Default value：20Hz
0x13	binding time code	17	Code length + Time value 1 Time value 2 Time value 3 ... Time value 8	Length: 8bit, number of time values 1LSB=1us Range:40000-60000us The default value of 8 time values is 50ms. One time value is 16 bits (high byte in front, low byte in the back).
0x14	standby			
0x15	set coding mode	1	0x01: Precision frequency 0x02: Time coding 0x03：NA	
0x16	set manual high pressure value	2	0-500V, 1V step	Invalid when automatic high-voltage control is started
0x17	close range gating	2	Close range gantry in m	Minimum 100m
0x18	long range gating value	2	Far range gantry in m	Maximum 50000m
0x19	set external trigger light delay	2	Voltage value	1LSB=1us Range: 0-600us Default value：50us
0x1A	standby			
0x1B	set automatic high pressure control	1	00: Manual high pressure 01: Start automatic high pressure	
0x1C	rangefinder set target	1	0x01: Single target 0x02: First and last target 0x03: Three target	
0x1D	set gain voltage	2	Voltage value	1LSB=1mV Range:0-5000mV
0x1E	cycle working parameter setting	3	Loop times 1 byte Working time 1 byte NA Standby	Loop times: 0--100 Working time: 0-255 seconds
0x1f	Set 3 levels of energy current	6	0-150A, step 1A AA 1 speed AA 2-speed AA 3-speed DD 1-speed DD 2-speed DD 3-speed	The currents of the first, second, and third stages of driver 1 and the first, second, and third stages of driver 2 are shown in turn.
0x20	Select single drive, 2 drives	2	1: Single-drive AA 2: Dual-drive AA DD	
0x21	Trigger delay from drive 1 to drive 2	2	0-30us, 1us step	
0x22	MCU program serial port update	0		After sending this command, the MUC reboots and enters firmware update mode.

5. Introduction to Reply Packet

● **Irradiator Parameter Packet**

This packet is obtained by the upper computer sending the command (0x00) to read the irradiator parameter information.

Command word	Element		Instructions
0	0xAA		Information header
1	0xBB		
2	0x00		command word
3	0x00		Data length: 51

4	0x33	
5	Trigger Mode	0x00: Internal Trigger 0x01: External Trigger
6	Q-switching Delay	1LSB=1us
7	Working Time Setting Value	1LSB=1s
8	Cycle Number Setting Value	
9	Working Mode	Ox00: Debug mode 0x01: Timing mode
10	Temperature Setting Value of Temperature Control 1	S16,1LSB=0.1℃
11		
12	Temperature Setting Value of Temperature Control 2	Alternate (00), not resolved at this time
13		
14	Driver 1 Current Setting Value	1LSB=1A
15	Driver 1 Pulse Width Setting Value	1LSB=1us
16	Driver 2 Current Setting Value	1LSB=1A
17	Driver 2 Pulse Width Setting Value	1LSB=1us
18	Emitting Frequency Setting Value	1LSB=1Hz
19	Time Code Length	
20	Time Code 1	1LSB=1us
21		
22	Time Code 2	1LSB=1us
23		
24	Time Code 3	1LSB=1us
25		
26	Time Code 4	1LSB=1us
27		
28	Time Code 5	1LSB=1us
29		
30	Time Code 6	1LSB=1us
31		
32	Time Code 7	1LSB=1us
33		
34	Time Code 8	1LSB=1us
35		
36	Coding method	0x01: Precision Frequency 0x02: Time code 0x03: Alternate (00)
37	Laser signal delay (external trigger delay) occurs.	1LSB=1us Range:50-300us
38		
39	APD high voltage setting value, the actual value of	1LSB=1V
40		
41	Close proximity gating value	1LSB=1m
42		
43	Long-range switching value	1LSB=1m
44		
45	Automatic high pressure control	0x00:Stop 0x01:Start
46	LD1 1st-mode current	1LSB=1A
47	LD1 2nd-mode current	
48	LD1 2nd-mode current	
49	LD2 1st-mode current	
50	LD2 2nd-mode current	
51	LD2 2nd-mode current	
52	Energy-mode selection	00~03
53	Single/Dual drive flag	1: Single drive 2: Dual drive

54	Automatic/manual high-voltage signals	0: Manual high pressure 1: Automatic high pressure
55	Target Indicator	0x01:Single target 0x02:First and last target 0x03:Triple target
56	Checksum high byte	
57	Checksum low byte	

- **Laser ranging target designer status message**

This message is obtained by automatically sending it from the lower unit at a frequency of 1 Hz.

Command word	Element	Instructions
0	0xAA	Message header
1	0xBB	
2	0x01	Command word
3	0x00	Data length: 22
4	0x16	
5	Lighted Time/Operating Time	1LSB=1s
6		
7	Rested time/stop time	1LSB=1s
8		
9	Number of light out cycles	
10	Shell temperature	S16,1LSB=0.1℃
11		
12	Temperature control 1 current temperature	S16,1LSB=0.1℃
13		
14	Temperature control 2 current temperature	S16,1LSB=0.1℃
15		
16	Temperature control 1 state	0x00: Stop 0x01: Start
17	Temperature control 2 status	0x00: Stop 0x01: Start
18	Laser Status	0x00: Stop 0x01: Start
19	Laser Status	0x01:Standby... 0x02:Out of light... 0x03:Resting... 0x04:Malfunctioning...
20	Number of pulses	Number of pulses emitted for this power-up
21		
22		
23		
24	Fault Code	bit0: 0:Temperature 1 fault 1:Normal bit1: 0:Temperature 1 overcurrent fault 1:Normal bit2: 0:Temperature 2 fault 1:Normal bit3: 0:Temperature 2 overcurrent fault 1:Normal bit4: 0:LD1 overcurrent fault 1:Normal bit5: 0:LD1 charging voltage overvoltage fault 1:Normal bit6: 0:LD2 overcurrent fault 1:normal bit7: 0:LD2 charging voltage overvoltage fault 1:normal
25	Main wave state	0x00:No 0x01:Yes
26	Echo Status	0x00:No 0x01:Yes
27	Checksum High Byte	
28	Checksum Low Byte	

- **Return distance data**

This message returns distance data, uploaded at the frequency (consistent with the ranging frequency)

Command word	Element	Instructions
1	0xAA	Header
2	0xBB	
3	0x02	Command word
4	0x00	Data length:9
5	0x09	
6	Objective 1	Uint:0.1m 1LSB=0.1m
7		
8		
9	Goal 2	Uint:0.1m 1LSB=0.1m
10		
11		
12	Target 3	Uint:0.1m 1LSB=0.1m
13		
14		
15	Checksum High Byte	
16	Checksum low byte	