ERDI LASER®

Diode Laser Rangefinder Module 905nm - 2000m

1 PRODUCT DESCRIPTION

This product is developed based on a 905nm semiconductor laser and primarily consists of a laser emission unit, receiving antenna,detection components, hardware circuit board, and main structural housing.It features a compact size, lightweight design, and long measurementrange. Applications include handheld rangefinders, micro unmanned aerial vehicles(UAVs),and ranging telescopic sights.It is equipped with a UART(TTL_3.3V) data transmission interface and comes with host computer software and a communication protocol instruction set, making it convenient for users to carry out secondary development.

2 TECHNICAL SPECIFICATIONS

Performance Indicators	
Eye safety class	Class 1(IEC 60825-1)
Laser wavelength	905±10nm
Laser divergence angle (typical)	3×6mrad
Average laser power	8.43mW
Laser pulse width	40ns
Receiver field of view	~8mrad
Maximum range (Visibility ≥ 6Km)	≥2000m @70% reflectivity, building targets
Minimum range	5m
Ranging accuracy (Construction target)	d≤200m:±0.7m d>200m:±（0.7+0.04%*d）m (d represents distance, in meters)
Measurement frequency	1~3Hz
Accuracy rate	≥98%
False alarm rate	≤1%
Electrical Specifications	
Baud rate	15200bps (factory setting)/57600bps/38400bps/9600bps
Interface type	UART(TTL_3.3V)
Supply voltage	DC 3.3±0.1V
Standby power consumption	≤0.5mW (Power on pulled low)

Operating power consumption (+3.3Vin)	≤0.35W (Power on pulled high)
	≤1.5W@25℃
	≤1.75W@70℃
	≤1.38W@-20℃
Startup time	≤550ms
Physical characteristics	
Weight	11±0.5g
Dimensions	26×25×14.5mm(L×W×H)
Shock	1200g,1ms
Vibration	5~50~5 Hz, 1 octave/min, 2.5g
Environmental adaptability	
Operating temperature	-20～+70℃
Storage temperature	-25～+75℃
Reliability	MTBF≥1500h

Note: Visibility refers to visibility in fog and haze weather, and the impact is greater in sandstorm weather.

3 HARDWARE INSTALLATION GUIDE

Packing list

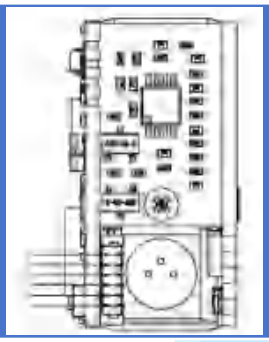
1	Laser ranging module × 1	
2	Power connection cable × 1	

Interface Definition

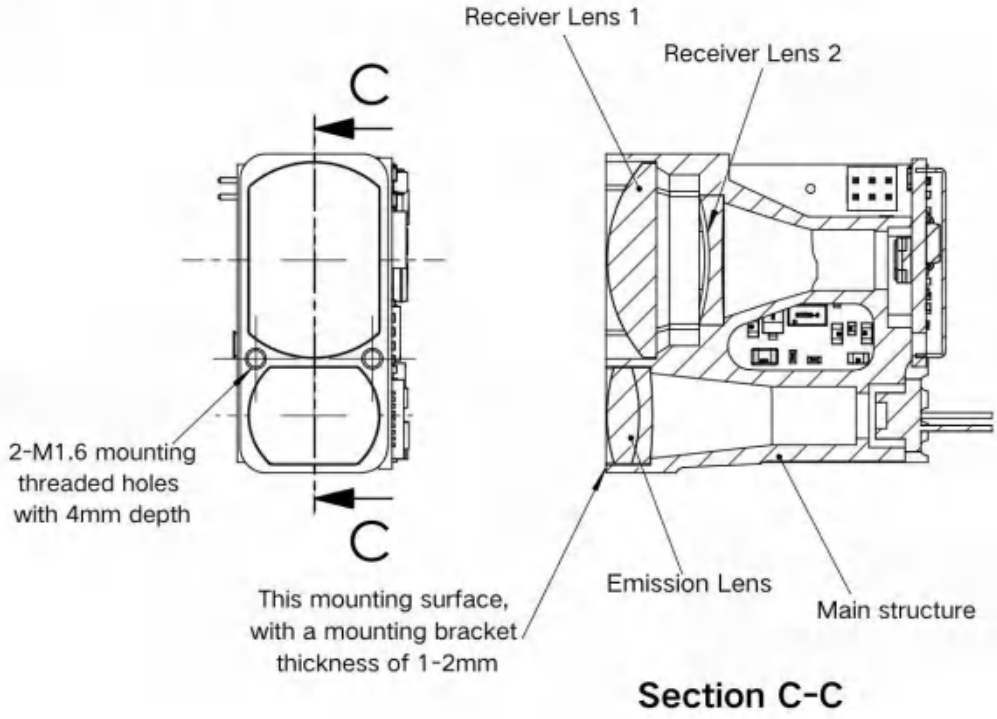
Interface Type: UART (TTL_3.3V)

Connector Model: HC-0.8-6PWT

Pin	Definition	Description	Color
1	GND	Ground wire	Green
2	Power Supply	3.3V DC power supply	Yellow
3	NC	No connection (NC)	Orange
4	TTL_TXD	Serial port transmitter, TTL_3.3V level	Red
5	TTL_RXD	Serial port receiver, TTL_3.3V level	Brown
6	Enable Pin	Low level to power on	Black



Assembly Diagram



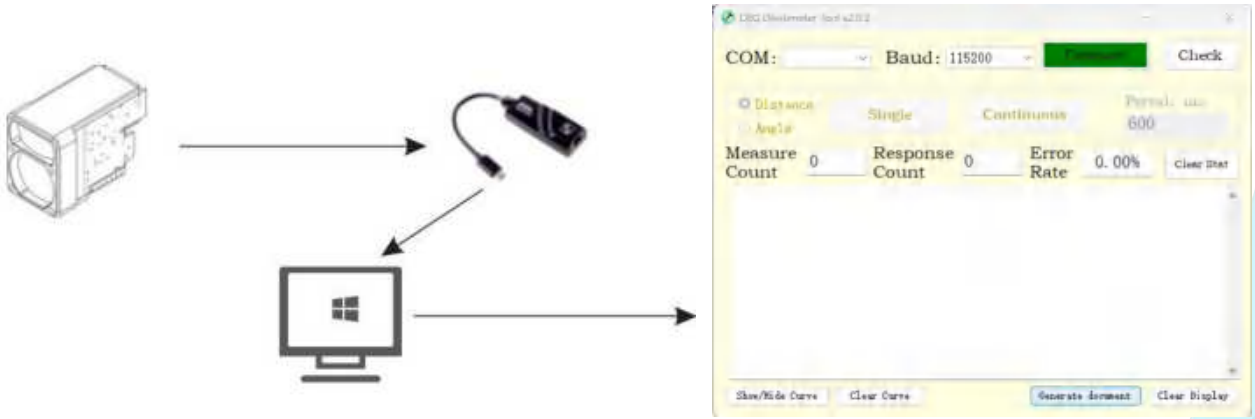
Operating Steps:

Step 1: Insert the data cable into the ranging module to supply power to the module and output measurement data at the same time.

- Note 1: Do not insert the plug reversely, and strictly control the power supply voltage within the range of 3.3±0.1V.
- Note 2: The enable pin needs to be pulled low (connected to GND).

Step 2: Install the serial port assistant software and connect it to a computer or other control devices through an adapter.

Step 3: After the software is installed, open the display interface.

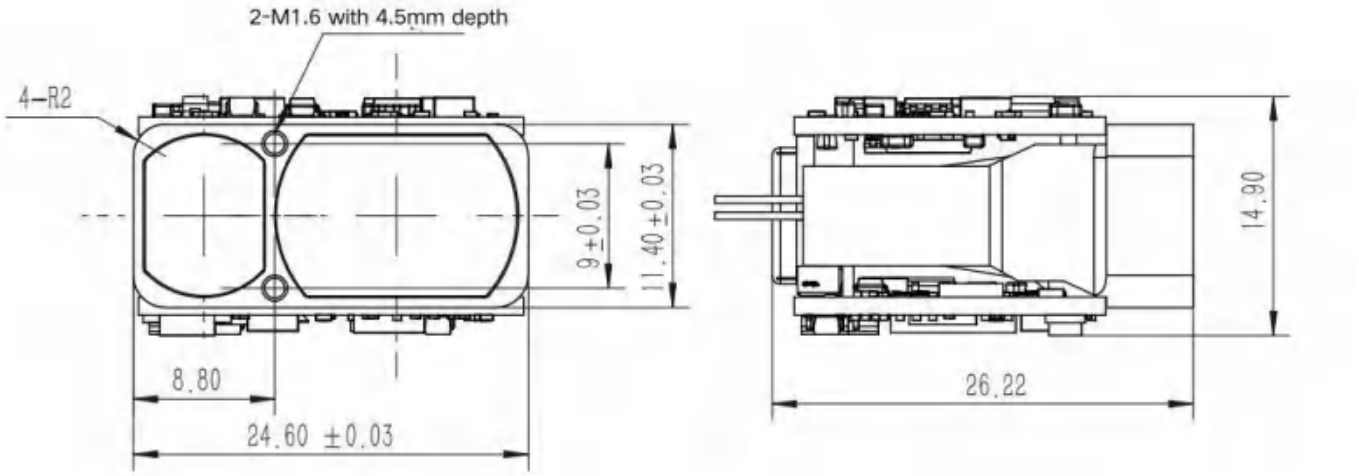


Step 4: Debugging and Testing

Select the serial port number: Set the corresponding serial port number in the software according to the computer's serial port number.

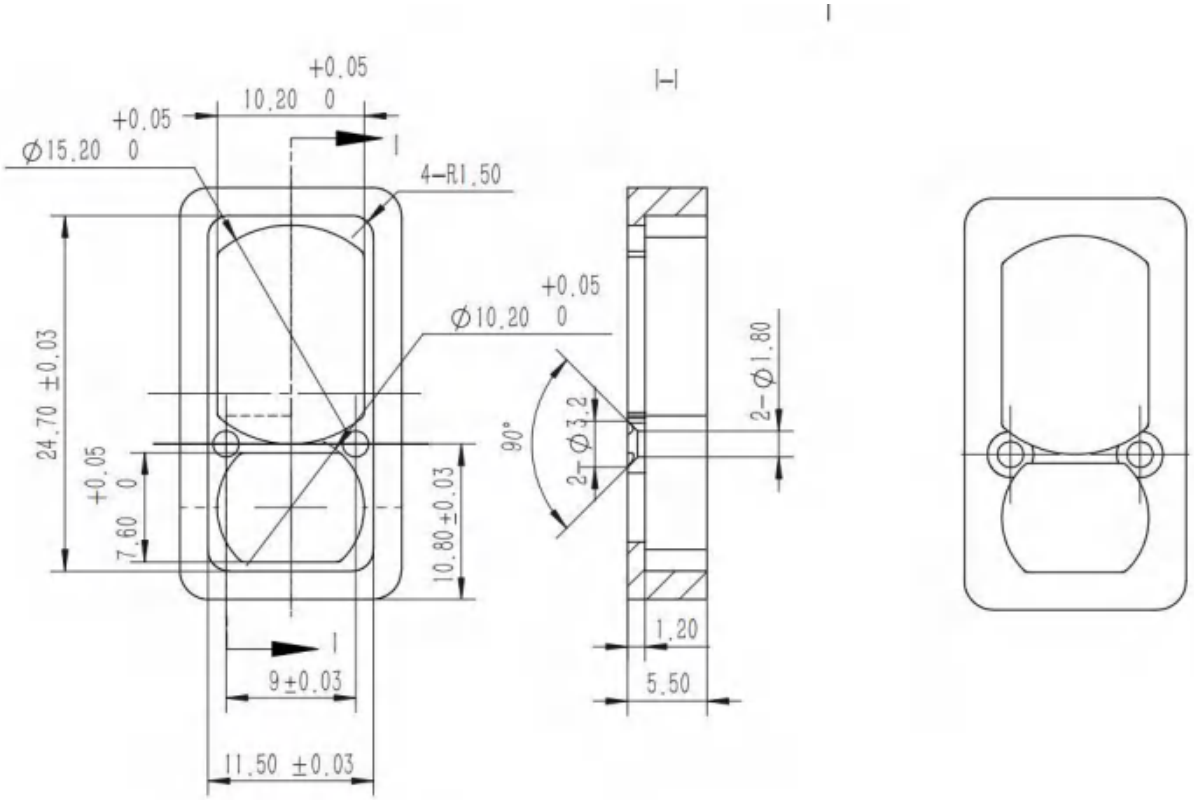
Baud rate setting: Open the software interface, where the baud rate can be set. The optional baud rates include 9600, 115200... (see the communication protocol).

Mechanical Interface and Center of Mass Position

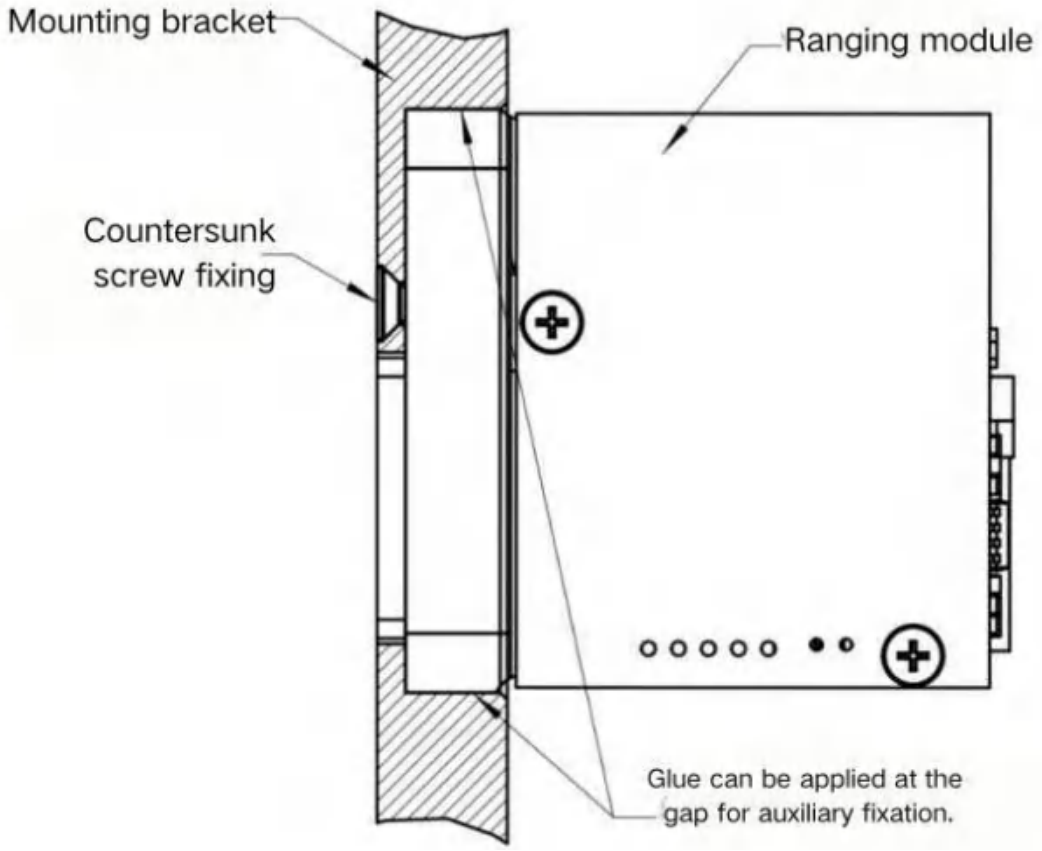


Structural Installation

The recommended dimensions of the mounting bracket are as follows:



Installation Diagram:



The thread length of the countersunk head screw must not exceed 3.5mm.

Suggestions for Optical Window Selection and Coating:

1. **Material Recommendations**

It is recommended to use Chengdu Guangming Optical Glass H-K9L for the optical window material. H-K9L is the most common colorless optical glass, suitable for the laser range of 300nm to 2100nm, with high cost performance and excellent physical properties.

2. **Processing Recommendations**

The wedge angle tolerance of the optical window should be as small as possible, and we recommend a wedge angle tolerance of ≤3′ (tolerance grade ≤7);

The optical surface of the optical window should be as smooth as possible, and we recommend the arithmetic mean deviation of the profile (Ra) to be 0.012.

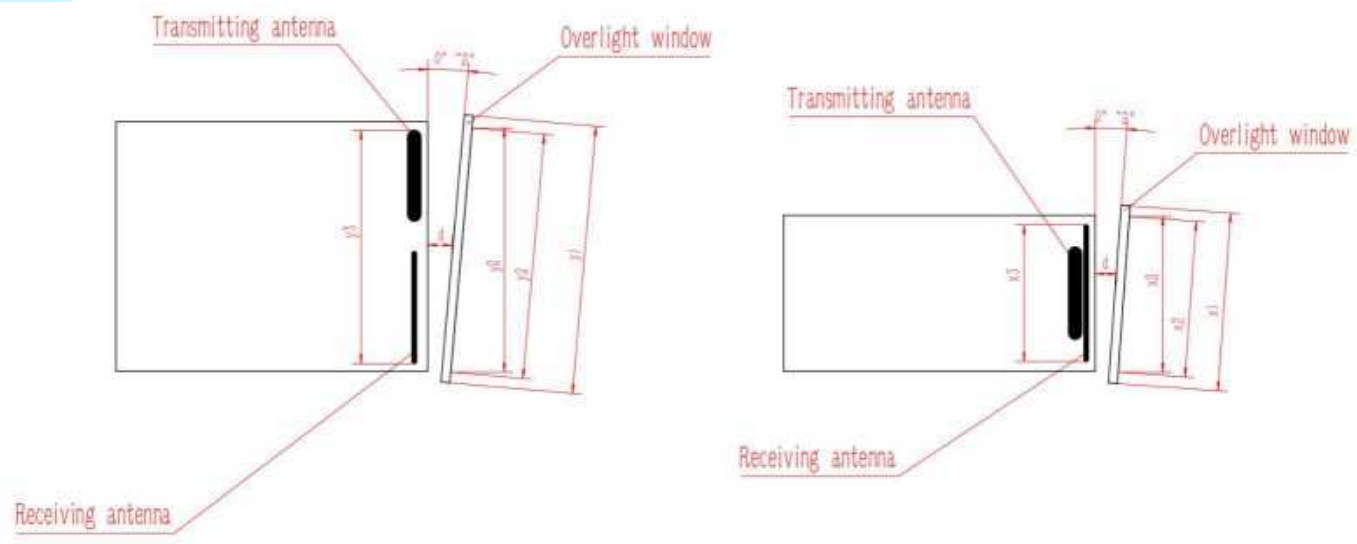
3. **Coating Recommendations**

For the optical window of the 905nm laser rangefinder, it is recommended to coat an anti-reflection film for 855nm to 955nm, with a transmittance of ≥99.5%. According to the specific use environment of the product, other protective films such as hydrophobic film or hard film can be optionally coated on the outer surface of the optical window. Other indicators refer to GJB2485-95, with a transmittance of ≥98%.

4. **Recommendations for Optical Window Shape and Usage**

The effective aperture of the optical window depends on different products, and its overall dimensions should ensure that the effective aperture of the optical window minus the outer diameter of the optical window is ≥2mm, and the outer diameter of the rangefinder antenna minus the projected size of the effective aperture of

the optical window is ≥1.5mm, as shown in the schematic diagram below. Since the optical window has a certain absorption of laser, it is recommended that the thickness of the optical window itself be controlled within 2-4mm according to its overall dimensions. Due to the high transmittance of the optical window, it is recommended that the emission optical axis be parallel to the normal line of the optical window, and the schematic diagram of the positions of the optical window and the two lens barrels is shown below. Meanwhile, the air gap between the optical window and the rangefinder should be less than 0.5mm, and Figure 5 shows the schematic diagrams of two ways of placing the optical window.



The effective aperture of the optical window y_2 - the outer diameter of the optical window y_1>2mm
The outer diameter of the rangefinder antennay$_3$-the projection size of the effective aperture of the optical window y_2，>1.5mm
The air gap d between the optical window and the rangefinder should be as small as possible

The effective aperture of the optical window x_2 - the outer diameter of the optical window x_1>2mm
The outer diameter of the rangefinder antenna x_3-the projection size of the effective aperture of the optical window x_2，>1.5mm
The air gap d between the optical window and the rangefinder should be as small as possible

Schematic diagrams of two ways of the external dimensions and placement of the optical window

5 EMBEDDED SOFTWARE

Communication mode: using serial communication mode

Baud rate: 115200 (default)

Data Bits: 8 Bits

Length of a frame: 8 bytes

DATA PROTOCOL									
		Frame header H	Frame header L	Function word	D1	D2	D3	D4	Calibration
	Send	55	AA						SUM(function word

									+DATA1+...+DATA4)
	Reply	55	AA						SUM(frame header H + frame header L + ...+DATA4)

MEASUREMENT INSTRUCTION									
Single ranging	Send	55	AA	88	FF	FF	FF	FF	SUM[3：7]
		55 AA 88 FF FF FF FF 84							
	Reply	55	AA	88	STA	FF	DIS_H	DIS_L	SUM[1：7]
		STA = 0 measurement failure; STA = 1: The measurement was successful DIS_H: high bytes of the measured result; DIS_L: The lower bytes of the measurement result Data returns are returned in hexadecimal, and all data results are output by multiplying the real data by 10							
Continuous ranging	send	55	AA	89	FF	FF	FF	FF	SUM[3：7]
		55 AA 89 FF FF FF FF 85							
	Reply	55	AA	88	STA	FF	DIS_H	DIS_L	SUM[1：7]
		STA = 0 measurement failure; STA = 1: The measurement was successful DIS_H: high bytes of the measured result; DIS_L: The lower bytes of the measurement result Data returns are returned in hexadecimal, and all data results are output by multiplying the real data by 10							
Stop ranging	send	55	AA	8E	FF	FF	FF	FF	SUM[3：7]
		55 AA 8E FF FF FF FF 8A							
	Reply	55	AA	8E	STA	FF	FF	FF	SUM[1：7]
		STA= 0 closes multiple measurement failures; STA = 1 closes multiple measurements successfully							
Angular measurement	send	55	AA	8A	FF	FF	FF	FF	SUM[3：7]
		55 AA 8A FF FF FF FF 86							
	Reply	55	AA	8A	STA	FF	ANG_H	ANG_L	SUM[1：7]
		STA= 0 Measurement failure; STA= 1: Measurement success ANG_H: Measurement result high byte; ANG_L: Measurement result low byte, data return to hexadecimal return, all data results will be the real data multiplied by 10 output, only in the movement with an angle sensor effective							

POWER-ON SELF-TEST									
Self-test information	Reply	55	AA	80	STA	00	00	ErrCode	SUM[1：7]
		STA= 0 Boot initialization failed, ErrCode is the error code; STA= 1 Boot initialization success. By default, initialization success does not reply to such messages.							

SETTING UP THE SYSTEM								
		55	AA	TYPE	FF	FF	FF	FF	SUM[3：7]
Baud rate	Send	TYPE = 01 sets the baud rate to 9600 bps TYPE = 02 Set the baud rate to 14400 bps TYPE = 03 Set the baud rate to 19200 bps TYPE = 04 Set the baud rate to 38400bps TYPE = 05 Set the baud rate to 56000 BPS TYPE = 06 Set the baud rate to 57600bps							

		TYPE = 07 Set the baud rate to 115200bps TYPE = 08 Set the baud rate to 128000bps TYPE = 09 Set the baud rate to 230400bps The baud rate does not change immediately after it is set and only takes effect after a restart
	Reply	55 AA TYPE STA FF FF FF SUM[1：7]
		STA = 0 setting failure; STA = 1 is set successfully
External circuit enable	Send	55 AA 70 AB CD 00 00 SUM[3：7]
		55 AA 70 AB CD 00 00 E8
	Reply	55 AA 70 STA 00 00 00 SUM[1：7]
		STA = 0, enable failure; STA = 1, enabling success
		55 AA 71 AB CD 00 00 SUM[3：7]
		55 AA 71 AB CD 00 00 E9
		55 AA 71 STA 00 00 00 SUM[1：7]
		STA = 0, disable failure; If STA = 1, it is disabled successfully

ErrCode		
Error code	Description	Remarks
0x00	No echo signal was received	
0x16	Out of range: below the minimum range	
0x18	No echo signal was received	
0x00~0x07	Hardware error	

SECONDARY LOW- POWER MODE

1. In this mode, the device's power consumption is reduced, and the MCU is in standby mode, capable of responding to other commands.
2. Send the "External Circuit Disabled" command to switch the device into secondary low-power mode.
3. When a measurement is needed, simply send a "Measurement" related command to automatically switch the device into normal working mode for measurement.
4. Alternatively, send the "External Circuit Enabled" command to switch the device into normal working mode independently.

NOTES

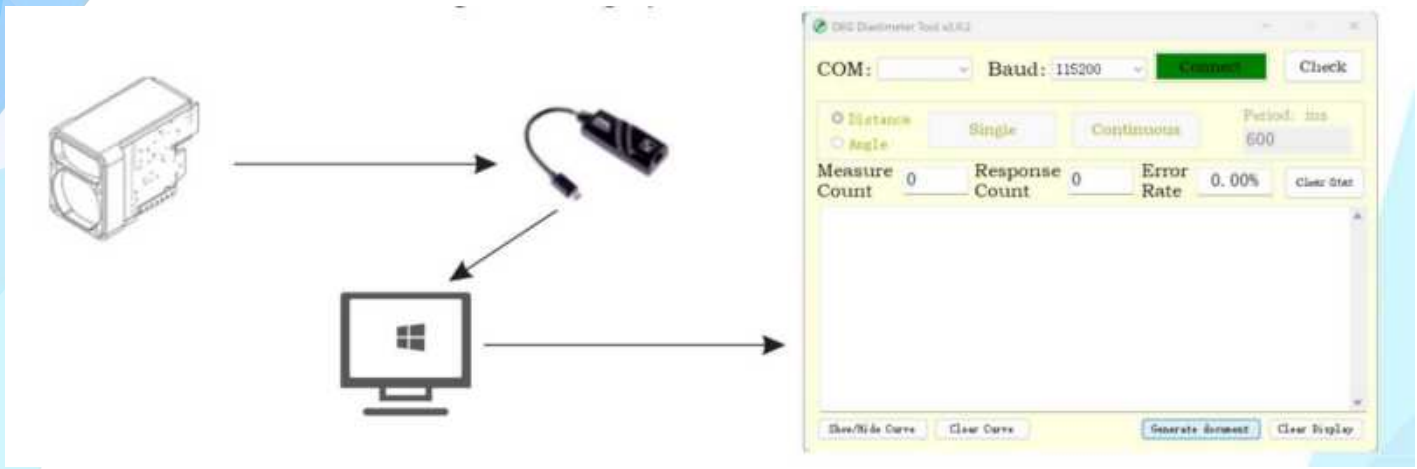
1. The verification content for sending and receiving may differ, so please pay attention to discrimination.
2. The checksum is the lower eight bits of the sum of the bytes requiring verification.
3. All data is transmitted and received in hexadecimal.

6 OPERATION STEPS

Step 1: Insert the data cable into the ranging module, which can supply power to the module and output the measurement data at the same time. (Note: Do not insert the plug in the wrong direction, and strictly control the power supply voltage range between 3.3V and 5V.)

Step 2: Install the Serial Port Genius software and connect to a computer or other control devices through an adapter interface.

Step 3: After the software is installed, open the display interface.



7 PRECAUTIONS

1. When using this module, do not look directly into the laser beam.
2. Do not use a lens barrel or other additional optical devices to operate this module to avoid increasing the risk of eye damage.
3. Do not disassemble the module. Disassembling the product will result in the loss of the right to repair.
4. When transporting, please add sufficient cushioning materials to the packaging box to avoid damage to the module.
5. Do not place the module on an unstable high place to prevent it from falling and being damaged.
6. Do not place the module in a harsh environment or near a heat source to prevent uncontrollable impacts on the module.
7. When there is a sharp change in temperature, there will be condensation fog on the surface of the main lens of the module. Do not use the module at this time.
8. If the exposed lens is dirty, gently wipe it clean with a lens cleaning cloth. Do not use other items to wipe it to avoid damaging the coating layer on the surface of the lens.
9. This module comes with a one-year quality guarantee and lifetime maintenance. In case of quality problems of its own, it can be replaced free of charge. For problems caused by human factors, repair and replacement of parts will be charged according to the actual situation of the product.

The factors that affect the ranging ability, ranging response speed, and speed measurement accuracy include:

Target reflectivity: Generally, the higher the target reflectivity, the better the ranging ability and the faster the ranging response speed. For example, for a target with medium reflectivity, a distance of 1500 meters can be measured, for a target with high reflectivity, a distance of not less than 1800 meters can be measured, and for a target with low reflectivity, it may only be possible to measure a distance of 600 meters. (Targets that are difficult to form diffuse reflection, such as the water surface, may not be measurable.)

Target shape: When the area of the reflective surface of the measured target is too small or uneven, the ranging ability and ranging response speed will be correspondingly reduced.
- Measurement angle: When the laser angle is vertically incident on the reflective surface of the measured target, the ranging ability is better and the ranging response speed is faster. Conversely, the ranging ability

and ranging response speed will decrease. Using it at extreme measurement angles cannot ensure that the ranging ability and ranging response speed specified in this manual can be achieved.

Measurement environment: The factors affecting the ranging ability and ranging response speed also include the intensity of sunlight, the concentration of water vapor and suspended particulate matter in the air, the angle of deviation from the sunlight irradiation, etc. (For example, in rainy, foggy, snowy, or hazy weather conditions, the measuring range will be reduced.)

The measuring range of this series of ranging telescopes is defined under the following conditions:

1) The measured target has a medium reflectivity, such as the wall surface of a building.
2) The reflective surface of the measured target is perpendicular to the direction of laser emission.
3) The measuring weather is sunny but not under direct sunlight.

Suggestion: When measuring distant targets, please fix this module with a tripod to reduce the shaking of the module during the measurement process, so as to obtain better measurement results.

I. The factors that affect the ranging ability and ranging response speed include:

Target reflectivity: Generally, the higher the target reflectivity, the better the ranging ability and the faster the ranging response speed. For example, for a target with medium reflectivity, a distance of 600 meters can be measured; for a target with high reflectivity, a distance of not less than 800 meters can be measured; and for a target with low reflectivity, it may only be possible to measure a distance of 300 meters. (For targets that are difficult to form diffuse reflection, such as the water surface, it may not be possible to measure the distance.)

Target shape: When the reflective surface of the measured target is too small or uneven, the ranging ability and ranging response speed will be correspondingly reduced.

Measurement angle: When the laser angle is vertically incident on the reflective surface of the measured target, the ranging ability is better and the ranging response speed is faster. Conversely, the ranging ability and ranging response speed will decrease. Using it at extreme measurement angles cannot ensure that the ranging ability and ranging response speed specified in this manual can be achieved.

Measurement environment: The factors affecting the ranging ability and ranging response speed also include the intensity of sunlight, the concentration of water vapor and suspended particulate matter in the air, the angle of deviation from the sunlight irradiation, etc. (For example, in rainy, foggy, snowy, or hazy weather conditions, the measuring range will be reduced.)
II. Suitable Targets for Measurement This product can measure targets with high reflectivity (such as highway road signs), targets with medium reflectivity (such as the walls of buildings), and targets with low reflectivity (such as trees, golf flagsticks, animals, etc.). When the reflectivity drops to a certain level, the measuring range will be correspondingly reduced.

Highway road sign

The wall surface of a building

Trees

Animal

The measuring range of this module is defined under the following conditions:

1) The measured target has a medium reflectivity, such as the wall surface of a building.
2) The reflective surface of the measured target is perpendicular to the direction of laser emission.
3) The measuring weather is sunny but not under direct sunlight.

Remarks:
It is recommended that when you measure distant targets, you fix this module with a tripod to reduce the shaking of the module during the measurement process, so as to obtain better measurement results.