

## STA-LD30X 3km Laser Rangefinder LRF Module



### Product Introduction

The STA-LD30X adopts the 1535nm eye-safe erbium glass laser module independently developed by Jioptics, which has the characteristics of low power consumption, small size, high precision and eye safety.

Maximum measuring range: 3000m (2.3x2.3m vehicle) 6000 m (White wall)

Ranging accuracy  $\pm 1\text{m}$

Measurement accuracy  $\geq 98\%$

Weight  $\leq 75\text{g}$

### 1. General

STA-LD30X laser ranging module is the eye safety laser ranging module in the photoelectric system, which can detect the target distance and transmit the measured distance to the host computer through serial communication.

### 2. Structure composition and main function index

The STA-LD30X laser ranging module consists of a laser, a transmitting optical system, a receiving optical system and a control circuit. The main performance is as follows:

#### 2.1 Operating range

Visibility under visible conditions is not less than 6km, diffuse reflectance  $\geq 0.3$ , humidity  $\leq 80\%$ , the vehicle (2.3m $\times$ 2.3m target) ranging distance  $\geq 3\text{km}$ .

#### 2.2 Features

The main functions of the laser ranging module are:

- | single ranging and continuous ranging;
- | Range strobe, front and rear target indication;
- | Self-inspection function.

## 2.3 Performance fou 3km Laser Rangefinder module

Project name	Performance index
Model	STA-LD30X
Laser grade	Class1 Human eye safety
laser wave length	1535±5nm
Laser divergence Angle	≤0.6mrad
Receive caliber	Φ16mm
Divergence angle	~6mrad
Maximum range	Visibility ≥ 16km, target with 0.6 reflectivity for Typical Big Targets Range:≥ <b>5km</b>
	Visibility ≥ 12km, target with 0.3 reflectivity for 2.3m × 2.3m vehicles Range:≥ <b>3km</b>
Minimum range	<20m
Ranging accuracy	Better than ± 1m (RMS)
Measuring frequency	1~10Hz
Range resolution	≤30m
Accuracy rate	≥98%
false alarm rate	≤1%
Multi-target detection	3 (Maximum number)
Data interface	RS422 Serial Port (Customized TTL Serial Port)
Service voltage	DC 6~36 V
Average power consumption	1.5W (10Hz at work)
Peak power consumption	≤5W
Standby power consumption	0.3W (power consumption during distance loss)
Sleep power consumption	2 mW (POWER_ EN pin when pulled down)
Outline dimension	≤48mm × 21mm × 31mm
Weight	35g±1g
Working temperature	-40 °C ~+65 °C
Storage temperature	-50 °C ~+70 °C
Shock	75g, 6ms

Vibration	5~200~5 Hz, 12min, 2.5g
Reliability	And MTBF 1,5 million times
Function	Single ranging / continuous ranging / multi-target ranging / distance pass / front and rear target indication / self-test function / external power control

## 2.4 Interface

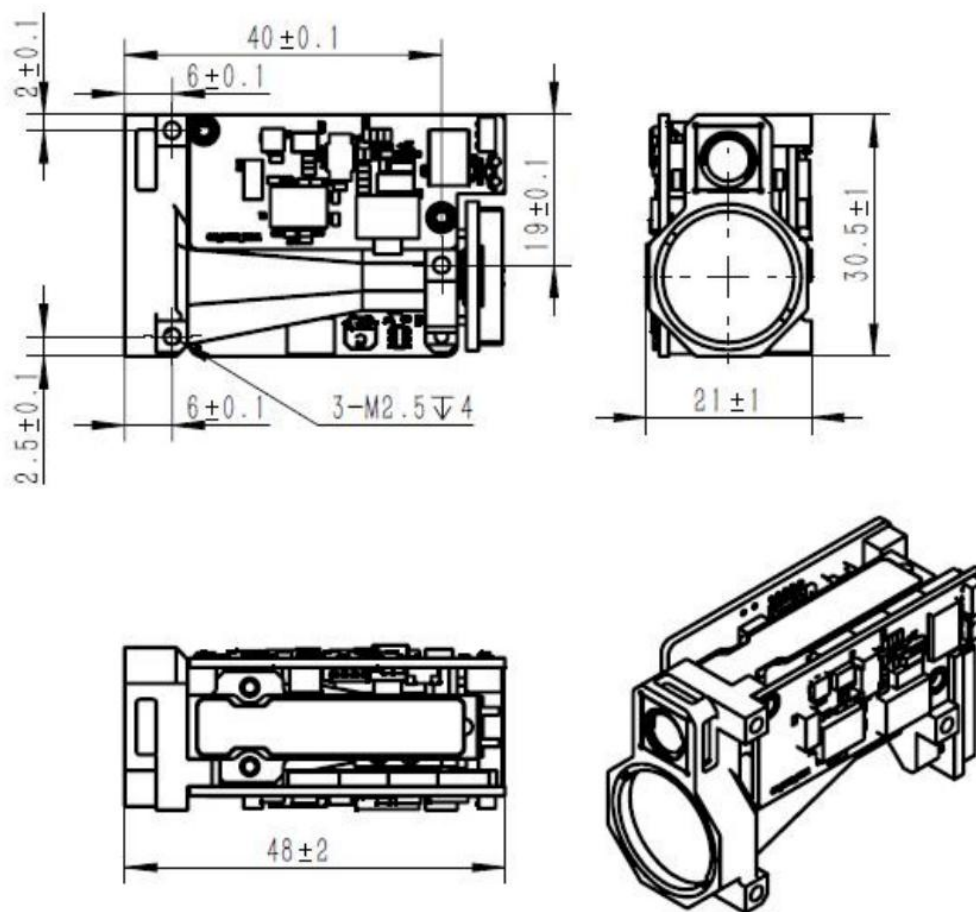
Communication interface: RS422, 115200bps

Electrical interface: The interface model is A1002WR-S-8P. The interface definition is described in the following table.

8P socket wiring definition			
Wire No	Definition	Wire color	Remarks
1	VIN+	Purple	Power input +
2	VIN-	Blue	Power input -
3	RS422 TX+	Green	RS422 emission +
4	RS422 TX-	Orange	RS422 emission _
5	RS422 RX-	Yellow	RS422 receive -
6	RS422 RX+	White	RS422 receive +
7	POWER_EN	Red	Module power enable, TTL_3.3V Module on ( > 2.7V or hanging) Module off ( < 0.3V)
8	GND	Black	communication interface ground

Sequence description: The serial number of the terminal pins of the interface is 1 to 8 from top to bottom.

## 2.5 Installation Dimension



### 3. Precautions for use

- The laser emitted by the rangefinder is 1535nm for human eye safety laser, although it is a human eye safety wavelength, but it is recommended not to look directly at the laser;
- When adjusting the parallelism of the optical axis, the receiving lens must be blocked, otherwise the detector will be permanently damaged due to excessive echo;
- The measuring module is non-airtight, and must ensure that the relative humidity of the use environment is less than 80%, and ensure that the use of the environment is clean and sanitary, so as not to damage the laser;
- The range measurement of the rangefinder is related to the atmospheric visibility and the nature of the target, and the range measurement will be reduced in the case of fog, rain and wind sand. Green leaf clusters, white walls, exposed limestone and other targets have better reflectivity, which can increase the measurement range. In addition, when the Angle of the target to the laser beam increases, the measurement range will be reduced.
- It is strictly forbidden to emit laser to strong reflection targets such as glass and white walls within 20 meters, so as to avoid too strong echo, resulting in damage to the APD detector;
- Do not plug and unplug the cable in the energized state;
- Ensure that the power supply polarity connection is correct, otherwise it will cause permanent damage to the equipment;

### Erbium glass laser ranging universal communication protocol

Communication format: default baud rate 115200bps;

Data format: eight bits of data, one start bit, one stop bit, no parity check. The data consists of the header byte , command part, data length, parameter part, and check byte.

Communication mode: master and rangefinder adopt the master-slave communication mode, the master sends the control command to the rangefinder, and the rangefinder receives and executes the command. The range finder sends back the data and status of the range finder according to the range finder period, and the communication format and command content are shown in the following table

a) Master transmitting

The format of the sent packet is as follows:

STX0	CMD	LEN	DATA1H	DATA1L	CHK
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Description of the format of the sent packet

Serial Number	Name	Description	Code	Remarks
1	STX0	Message Start Flag	55(H)	
2	CMD	Command Code	See Table 3	
3	LEN	Data Length	Referring to the length of the parameter.	
4	DATAH	Parameters	See Table 3	
5	DATAL			
6	CHK	XOR Checksum	XOR all bytes except for the checksum byte.	

Description of Main Control Reception Status:

Table 3-Description of Commands and Data Words Sent by the Main Control to the Rangefinder.

Serial No.	Command Code	Function	Data Bytes	Remarks	Length	Example Code
1	0x00	Standby (Continuous Ranging Stop)	0000	Ranging Device Stops Operation	6 Bytes	550002000057
2	0x01	Single Ranging	0000		6 Bytes	550102000056
3	0x02	Continuous Ranging	DATAH=XX(H) DATAL=YY(L)	DATA represents the ranging cycle, measured in milliseconds (ms).	6 Bytes	55020203 E8 BE (1Hz Ranging)
4	0x03	Self-Check	0000		6 Bytes	55030200 0054

5	0x04	Distance Selection Nearest Distance Setting	DATAH=XX(H) DATAI=YY(L)	DATA represents the Blind zone value, measured in units of 1 meter(1m).	6 Bytes	550402006437 (100m The Nearest Distance)
6	0x06	Cumulative Number of Light Emissions Query	0000	Cumulative Number of Light Emissions Query	6 Bytes	550602000051
7	0x07	High Voltage Reference Value Setting	DATAH=XX(H) DATAI=YY(L)	Factory Command: Resolution 0.1V	6 Bytes	5507020190 C1(40V)
8	0x0B	Maximum Distance Setting (in meters)	DATAH=XX(H) DATAI=YY(L)	DATA represents the farthest displayed distance, measured in units of 1 meter(1m).	6 Bytes	550B 024E 2032 (Farthest 20000m)
9	0x11	APD Power On	0000		6 Bytes	55110200 0046
10	0x12	APD Power Off	0000		6 Bytes	55120200 0045
11	0x1A	Clear Laser Light Emission Count		Factory Command		
12	0x1C	AMR Program Update		Factory Command		
13	0x20	Laser Continuous Operation Timeout Setting	DATAH=XX(H) DATAI=YY(L)	DATA Indicates the continuous working timeout duration (unit: 1 minute)	6 Bytes	55200200 1463 (20min)
14	0x23	Set TPG	DATAH=XX(H) DATAI=YY(L)	Factory Command	6 Bytes	

15	0x28	Ranging Parameter Query	0000			55280200 007F
16	0xEB	Number Query	0000	Number Query	6 Bytes	55 EB 0200 00 BC

## b) Main Control Reception Format

The format of the received message is as follows:

STX0	CMD	LEN	DATAN	DATA0	CHK
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Table 4-Description of the Received Message Format.

Serial No.	Name	Description		Code	Remarks
1	STX0	Message Start Flag		55(H)	
2	CMD_JG	Data Code	Command	See Table 5	
3	LEN	Data Length		Referring to the length of the parameter	
4	Dn	parameters		See Table 5	
5	DO				
6	CHK	XOR Checksum		XOR all bytes except for the checksum byte.	

## Description of Main Control Reception Status:

Table 5-Description of Data Words Sent from the Rangefinder to the Main Control.

Serial No.	Command Words	Function	Data Bytes	Remarks	Total Length
1	0x00	Standby (Continuous Ranging Stop)	0000	Same Request Frame	6 Bytes

2	0x01	<p>Single Ranging (For a single target: Second and third targets are zero. For the first and last targets: Third target is zero.)</p>	D9 D8 D6 D5 D3 D2 D0	D7  D4  D1	<p>D8-6:1st Target Distance (in units of 0.1meters)</p> <p>D5-3:2nd Target Distance (in units of 0.1 meters)</p> <p>D2-0 Third Target Distance (unit:0.1m) 3 Targets arranged from nearest to farthest</p> <p>D9(bit7-bit0)Status Byte: D9 bit 7 indicates the main wave;1:Main wave present,0:No main wave.</p> <p>D9 bit 6 indicates the presence of an echo;1:Echo present,0:No echo.</p> <p>D9 bit5 indicates laser status; 1:Laser functioning normally, 0:Laser malfunction.</p> <p>D9 bit 4 is the timeout flag;1: Normal,0:Timeout.</p> <p>D9bit 3 is invalid (set to 1) D9 bit 2 indicates the status of the APD (Avalanche Photodiode);1:Normal,0&gt;Error.</p> <p>D9 bit 1 indicates the presence of a preceding target;1:Target present,0:No target(Targets before the main target are considered preceding targets).</p> <p>D9 bit 0 indicates the presence of a following target;1:Target present,0:No target (Targets after the main target are considered following targets)."</p>	14 Bytes
3	0x02	Continuous Ranging	D9 D8 D7		D8-6 First Target Distance	14 Bytes



		(In the case of a single target, the second and third targets are zero;when considering the first and last targets, the third target is zero.)	D6 D5 D3 D2 D0	D4  D1	(unit:0.1m) D5-3 Second Target Distance (unit:0.1m) D2-0 Third Target Distance (unit:0.1m) 3 Targets arranged from nearest to farthest D9(bit7-bit0)Status Byte: D9 bit 7 indicates the main wave;1:Main wave present,0: No main wave. D9 bit 6 indicates the presence of an echo;1:Echo present,0:No echo. D9 bit5 indicates laser status; 1:Laser functioning normally, 0:Laser malfunction. D9 bit4 is the timeout flag;1: Normal,0:Timeout. D9 bit 2 indicates the status of the APD (Avalanche Photodiode);1:Normal,0: Error. D9 bit 1 indicates the presence of a preceding target;1:Target present,0:No target (Targets before the main target are considered preceding targets). D9 bit 0 indicates the presence of a following target;1:Target present,0:No target (Targets after the main target are considered following targets).	
4	0x03	Self-Check	D7~D0		D7-6:-5V Voltage,unit:0.01V D5-4:Blind Zone Value,unit:1m. D3:APD High Voltage Value,unit:V; D2:char type,indicating APD Temperature,unit:Celsius; D1-0:+5V Voltage,unit:0.01V."	12 Bytes
5	0x04	Distance Selection Nearest Distance Setting(unit in meters)	D1 D0		DATA represents the nearest distance value,unit:1m; Higher byte followed by lower byte,matching the request frame.	6 Bytes (Power-off Save)

6	0x06	Cumulative Number of Light Emissions Query	D3~D0	DATA represents the number of light emissions,4 bytes, with the high byte first.	8 Bytes
7	0x07	High Voltage Reference Value Setting			6 Bytes
8	0x0B	Maximum Distance Setting (in meters)	D1 D0	D1 D0 represents the farthest distance write value,unit:1m; matches the request frame.	6 Bytes (Power-off save)
9	0x11	APD Power On	0000	APD Power On,Same as Request Frame	6 Bytes
10	0x12	APD Power Off	0000	APD Power Off, Same as Request Frame	6 Bytes
11	0x1A	Clear Laser Light Emission Count	0000	same as the request frame	6 Bytes
12	0x1C	ARM Program Update	0000	same as the request frame	6 Bytes
13	0x20	Laser Continuous Operation Timeout Setting	D1 D0	DATA represents the continuous operation timeout period,measured in units of 1 minute,consistent with the request frame.	6 Bytes
14	0x23	Set TPG	D1 D0		6 Bytes
15	0x28	Ranging Parameter	D17--D0	Multi-byte data,high byte first.	22 Bytes

		<b>Query</b>		<p>D17-16:Factory Parameter: TPG Parameter,high byte first                  D15-14:Factory Parameter: High Voltage Parameter,high byte first.</p> <p>D13-12: Maximum Test Distance                  D11-10:Minimum Trigger Pulse Width.                  D9-8:Maximum Trigger Pulse Width.                  D7-6:Specified Pulse Width                  D5-4:Continuous Operation Timeout Period.                  D3-2:Baud Rate                  D1:Target Mode.                  D0:Protocol Version(Factory Parameter).</p>	
16	0xEB	Number Query	D15.... D0	<p>D15 D12:Complete Machine Model Code.                  D11 D10:Product Number.                  D9 D6:Software Version.                  D5 D4:APD Number.                  D3 D2:Laser Number.                  D1 D0:FPGA Version.</p>	20 Bytes
17	0xEC	Command Word Error	0x00 0x00		6 Bytes
18	0xED	Work Timeout	0x00 0x00	Laser in operation protection, unable to perform ranging.	6 Bytes
19	0xEE	Verification Error	0x00 0x00		6 Bytes

Remarks:

① Undefined data bytes/bits default to 0.