

## YDLIDAR X2 DATA SHEET



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## 1 PRODUCT OVERVIEW

YDLIDAR X2 is a 360 degrees 2D LiDAR (hereinafter referred to as X2) developed by EAI team. Based on the principle of Triangulation, it is equipped with related optics, electricity, and algorithm design to achieve high-frequency and high-precision distance measurement. The mechanical structure rotates 360 degrees to continuously output the angle information as well as the point cloud data of the scanning environment while ranging.

### 1.1 Product Features

- 360 degrees scan ranging
- High accuracy, stable performance
- Wide measuring range
- Strong resistance to ambient light interference
- Low power consumption, small size, stable performance and long service life
- Class I eye safety
- Motor speed adjustable, the proposed speed is 6Hz
- Ranging frequency up to 3kHz

### 1.2 Applications

- Robot navigation and obstacle avoidance
- Robot ROS teaching and research
- Regional security
- Environmental scanning and 3D reconstruction
- Navigation and obstacle avoidance of home robots/ robot vacuum cleaners

### 1.3 Installation and Dimensions

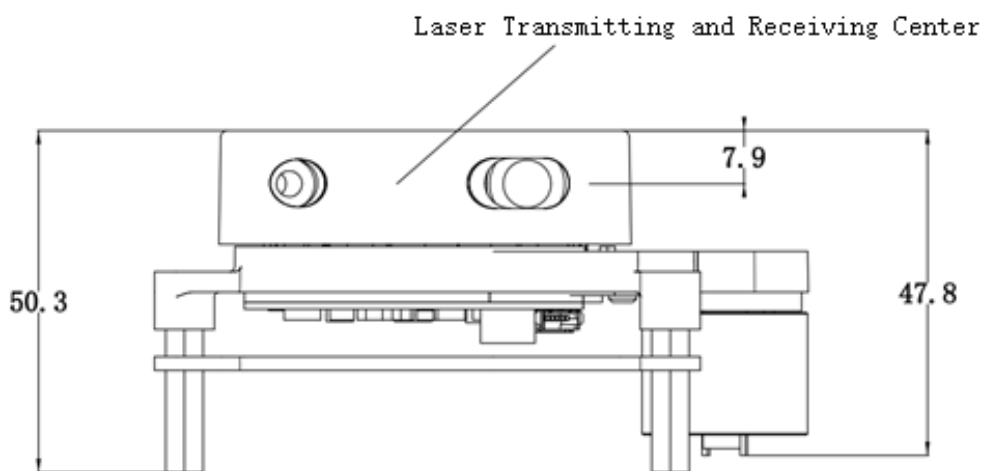


FIG 1 YDLIDAR X2 FRONT STRUCTURE SIZE (UNIT:MM)

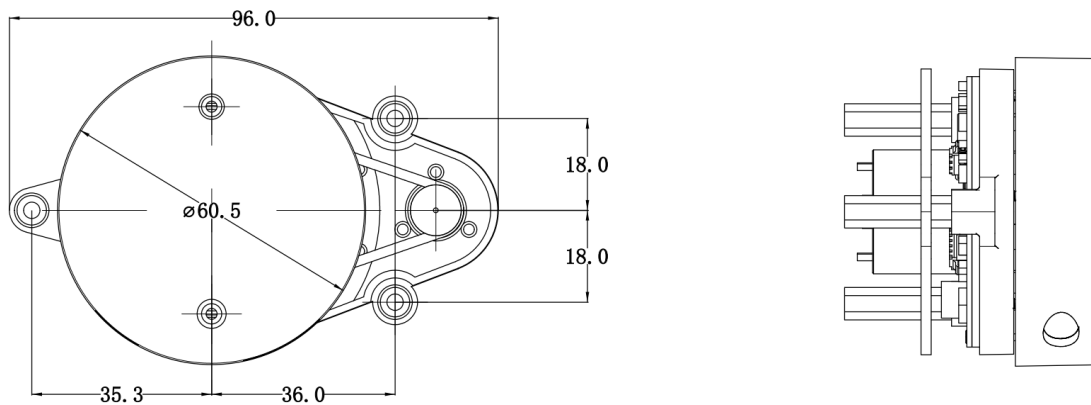


FIG 2 YDLIDAR X2 MECHANICAL DIMENSIONS (UNIT:MM)

## 2 SPECIFICATIONS

### 2.1 Performance Parameter

CHART 1 YDLIDAR X2 PERFORMANCE PARAMETER

| Item              | Min                      | Typical                  | Max                      | Unit | Remarks                                                            |
|-------------------|--------------------------|--------------------------|--------------------------|------|--------------------------------------------------------------------|
| Ranging frequency | /                        | 3000                     | /                        | Hz   | Ranging 3000 times per second                                      |
| Motor frequency   | 5                        | 6                        | 8                        | Hz   | Need to connect to PWM signal, recommended to use the speed of 6Hz |
| Ranging distance  | 0.12                     | /                        | 8                        | m    | Indoor environment with 80% Reflectivity                           |
| Field of view     | /                        | 0-360                    | /                        | Deg  | /                                                                  |
| Systematic error  | /                        | 2                        | /                        | cm   | Range ≤ 1m                                                         |
| Relative error    | /                        | 3.5%                     | /                        | /    | 1m < Range ≤ 6m                                                    |
| Tilt angle        | 0.25                     | 1                        | 1.75                     | Deg  | /                                                                  |
| Angle resolution  | 0.60<br>(frequency @5Hz) | 0.72<br>(frequency @6Hz) | 0.96<br>(frequency @8Hz) | Deg  | Different motor frequency                                          |

Note 1: It is factory FQC standard value, 80% reflectivity material object.

Note 2: The relative error value indicates the accuracy of the Lidar measurement. Relative error (mean value) = (average measured distance-actual distance)/actual distance \*100%, sample size: 100pcs.

Note 3: Lidar is a precision device, please avoid using Lidar under high or low temperature or strong vibration situation, the relative error parameter index will be relatively larger, and it may exceed the typical value.

## 2.2 Electrical Parameter

**CHART 2 YDLIDAR X2 ELECTRICAL PARAMETER**

| Item            | Min  | Typical | Max | Unit | Remarks                                                                      |
|-----------------|------|---------|-----|------|------------------------------------------------------------------------------|
| Supply voltage  | 4.8  | 5       | 5.2 | V    | Excessive voltage might damage the Lidar while low affect normal performance |
| Supply current  | 1000 | /       | /   | mA   | Instantaneous peak current at start-up                                       |
| Working current | /    | 300     | 500 | mA   | System work, motor rotation                                                  |

## 2.3 Interface Definition

X2 provides MX1.25-4P receptacle to realize power and data communication function.

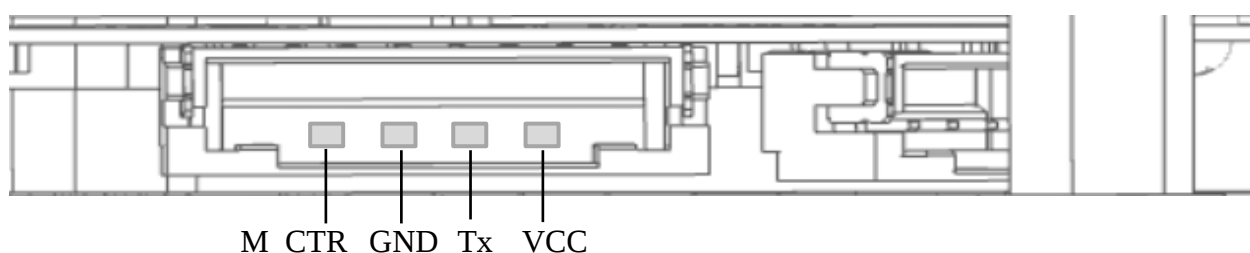


FIG 3 YDLIDAR X2 INTERFACES

**CHART 3 YDLIDAR X2 INTERFACE DEFINITION**

| Pin   | Type         | Description                  | Defaults | Range     | Remarks                                          |
|-------|--------------|------------------------------|----------|-----------|--------------------------------------------------|
| VCC   | Power supply | Positive                     | 5V       | 4.8V-5.2V | /                                                |
| Tx    | Output       | System serial port output    | /        | /         | Data stream: LiDAR→Peripherals                   |
| GND   | Power supply | Negative                     | 0V       | 0V        | /                                                |
| M_CTR | Input        | Motor speed control terminal | 1.8V     | 0V-3.3V   | Voltage speed regulation or PWM speed regulation |

## 2.4 Data Communication

With a 3.3V level serial port (UART), users can connect the external system and the product through the physical interface. After that, you can obtain the real-time scanned point cloud data, device information as well as device status. The communication protocol of parameters are as follows:

**CHART 4 YDLIDAR X2 SERIAL SPECIFICATION**

| Item              | Min | Typical | Max | Unit | Remarks                               |
|-------------------|-----|---------|-----|------|---------------------------------------|
| Baud rate         | /   | 115200  | /   | bps  | 8-bit data bit, 1 stop bit, no parity |
| High signal level | 2.4 | 3.3     | 3.5 | V    | /                                     |
| Low signal level  | 0   | 0       | 0.6 | V    | /                                     |

## 2.5 Motor Control

X2 has its own motor driver with motor speed control function. The peripheral can control the X2 motor by inputting control signals through the M\_CTR pin in the interface. M\_CTR is the motor speed control signal, which can be adjusted by voltage and can also be debugged by PWM wave. The higher the voltage/the greater the PWM duty cycle, the higher the motor speed.

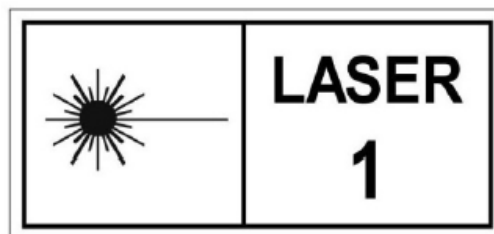
Among them, the PWM signal of M\_CTR has the following requirements:

**CHART 5 YDLIDAR X2 MOTOR PWM SIGNAL SPECIFICATION**

| Item             | Min | Typical | Max  | Unit | Remarks                                         |
|------------------|-----|---------|------|------|-------------------------------------------------|
| PWM frequency    | /   | 10      | /    | KHz  | PWM is a square wave signal                     |
| Duty cycle range | 0   | 35%     | 100% | /    | The larger the duty cycle, the faster the speed |

## 2.6 Optical Characteristic

The infrared point pulse laser used in X2 can ensure the safety of human and pet. The lidar has passed testing and conformed to Class I, 21 CFR 1040.10 and 1040.11 safety level, except for IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.



The laser and optical lens finish the transmission and reception of the laser signal to achieve high-frequency ranging while working. To ensure system ranging performance, please keep the laser and optical lens clean. The detailed optical parameters are as follows:

**CHART 6 YDLIDAR X2 LASER OPTICAL PARAMETERS**

| Item             | Min                                                                                                    | Typical | Max | Unit | Remarks       |
|------------------|--------------------------------------------------------------------------------------------------------|---------|-----|------|---------------|
| Laser wavelength | 775                                                                                                    | 793     | 800 | nm   | Infrared band |
| FDA              |  Class I IEC60825-1 |         |     |      |               |

Note: The personal adjustment or reassembly of the Lidar may result in hazardous radiation exposure.

## 2.7 Polar Coordinate System Definition

In order to facilitate secondary development, X2 internally defines a polar coordinate system. The polar coordinates of the system take the center of the rotating core of X2 as the pole, and the specified Angle is positive clockwise. The zero Angle is located directly in front of the X2 motor. Due to individual differences, there is a deviation of plus or minus 3 degrees, as shown in the figure:

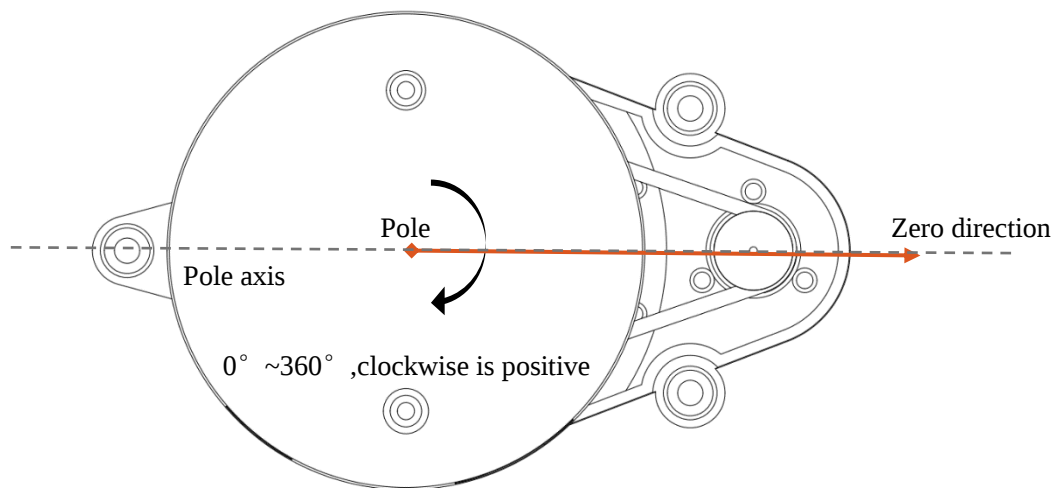


FIG 4 YDLIDAR X2 POLAR COORDINATE SYSTEM DEFINITION

## 2.8 Others

**CHART 7 YDLIDAR X2 OTHERS**

| Item                  | Min | Typical | Max  | Unit | Remarks            |
|-----------------------|-----|---------|------|------|--------------------|
| Operating temperature | 0   | 20      | 40   | °C   | No condensation    |
| Storage temperature   | -10 | /       | 60   | °C   | With package       |
| Lighting environment  | 0   | 550     | 2000 | Lux  | For reference only |
| weight                | /   | 126     | /    | g    | N.W.               |

## 3 DEVELOPMENT AND SUPPORT

X2 provides a wealth of software interfaces, which can realize the motor enabling control, speed control, range unit enabling control and output control of the system. On this basis, users can also implement the power control and scan control purpose.

Also, the 3D model of X2 is disclosed. YDLIDAR provides the graphics debugging Workstation under Windows, as well as the corresponding SDK and ROS development kit to users, which could be downloaded from our website: <https://www.ydlidar.com/>.

In order to facilitate users' development, X2 development manual, SDK development manual and ROS user manual are also provided. Please download them from [our website](#).

## 4 POINTS FOR ATTENTION

This lidar uses a non-enclosed brushed motor. According to the operating principle of the brushed motor, this product cannot be used in volatile and releasing environments containing low molecular compounds such as Si (silicon), S (sulfur), P (phosphorus):

➤ Risk analysis

The electrical contacts between the brush and the commutator in a brushed motor will repeatedly connected and disconnected during the operation of the motor, generating electrical sparks. When the motor is in an environment with vapor such as silicon, sulfur, and phosphorus, molecules or compounds such as silicon, sulfur, and phosphorus (such as SiC, SiO<sub>2</sub>, etc.) will be adsorbed at the contact, causing the increases in the contacts resistance between the brush and the commutator electrical contact, which may lead to poor contact, blocked rotation or other situations.

➤ Usage suggestions

1. Avoid using volatile and releasing materials containing compounds such as Si, S, P, etc., including but not limited to heat dissipation adhesive, insulation adhesive, AB adhesive, etc.
2. In terms of structural design, keeping away from the volatilization and releasing environment and materials containing low molecular compounds such as Si (silicon), S (sulfur), P (phosphorus), etc., and reserve a certain space to ensure air flow and reduce the possible concentration of low molecular compounds.

## 5 REVISE

| Date       | Version | Content                                                    |
|------------|---------|------------------------------------------------------------|
| 2018-06-20 | 1.0     | Compose a first draft                                      |
| 2021-07-22 | 1.1     | Update electrical parameters and serial port specification |
| 2024-01-24 | 1.2     | Add section 4                                              |