# LRF50VB Single-Point LiDAR Based on DTOF Principle

100Hz Measuring Frequency / 50 meters Range / Ambient Light Immunity 60Klux / High Cost-performance

## Features



- Based on DTOF principle (Direct Time of Flight)
- Maximum Measuring Range：50m
- Measuring Blind Zone：5cm
- Measuring Frequency：100Hz
- Accuracy：±5cm(<5m), 1%(≥5m)
- Resolution：1mm
- Operating Temperature：-20℃ ~ +60℃
- Supply Voltage：3.3 ~ 5VDC
- Compact Size：18.7 x 11.8 x 13.3 mm
- Weight：1.3g
- Ambient Light Immunity：10m@60KLux



## Applications

- Drone Altitude Holding and Obstacle Avoidance
- Robots Obstacle Avoidance
- Industrial Grade Light Curtain
- AGV Obstacle Avoidance
- High-speed Measuring and Safety Monitoring in Traffic and Industrial Automation

## 1. Product Overview

The LRF50VB LiDAR is our newly launched laser ranging product and is specially designed for applications such as drones, sweeping robots, and industrial robots. Based on the DTOF principle, it features a compact size, low cost, superior performance, and high resistance to ambient light interference. This product is easy to use, flexible to install, convenient for expansion, and extremely cost-effective.

## 2. Specifications

| # | Model | LRF50VB |
|---|---|---|
| 1 | Range | 0.05m ~ 50m (90%reflectivity),<br>0.05m ~ 20m (10%reflectivity) |
| 2 | Frequency | 100Hz |
| 3 | Accuracy | ±5cm(<5m), 1%(≥5m) |
| 4 | Repeatability | ±30mm |
| 5 | Ambient Light Immunity | 10m@60KLux |
| 6 | Central Wavelength | 905nm |
| 7 | Photobiological Safety | Class 1 |
| 8 | FOV | 1.9° |
| 9 | Wavelength for Indication | N/A |
| 10 | Photobiological Safety for Indication | N/A |
| 11 | Supply Voltage | 3.3~5VDC |
| 12 | Peak Current | 5V@70mA |
| 13 | Average Current | 5V@40mA |
| 14 | Average Power Consumption | 0.2W |
| 15 | Communication Interface | UART/IIC |
| 16 | Protection Level | N/A |
| 17 | Dimension | 18.7 x 11.8 x 13.3mm |
| 18 | Weight | 1.3g |
| 19 | Operating Temperature | -20℃ ~ +60℃ |
| 20 | Wire Specification | 4pin 1.0mm terminal, 10cm tinned stranded wires |
| 21 | Customization | available in appearance / structure / output protocol |

(Note: 1. This parameter was measured at 25°C in an indoor environment.
2. This parameter was measured with a 90% reflector in an outdoor environment at 25°C.)



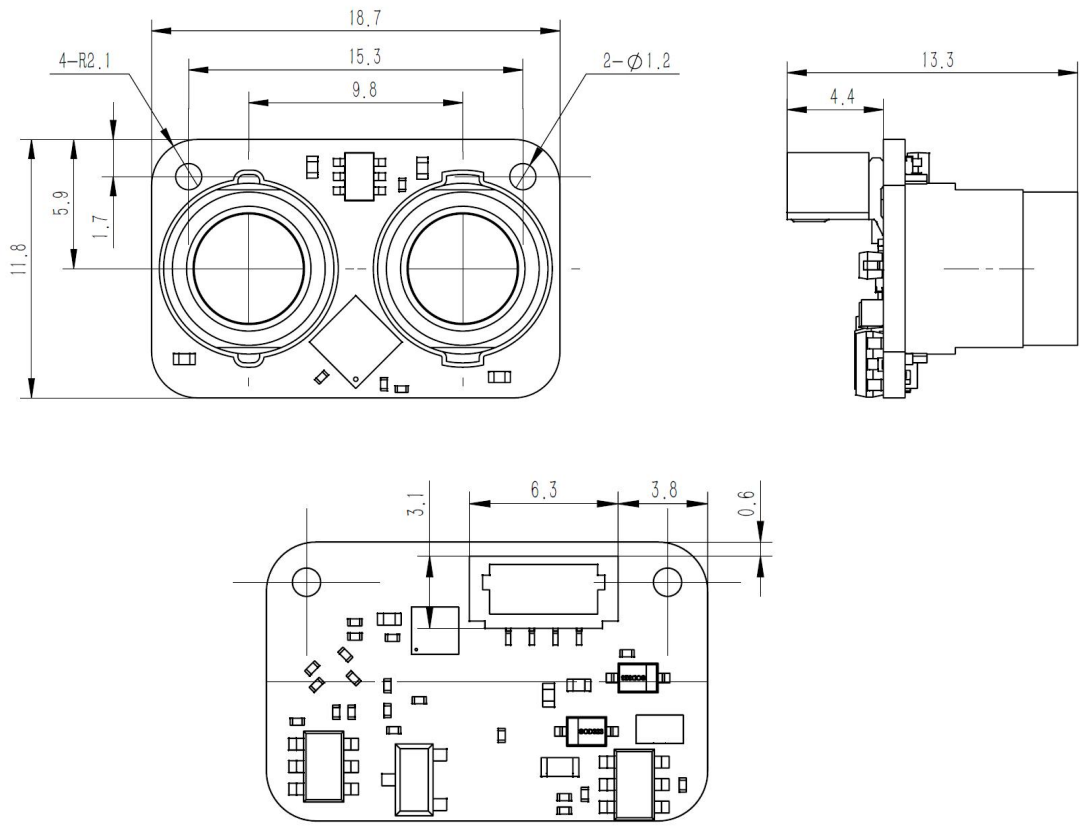
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## 3. Definitions of Pins




| No. | Definition / Wire Color | User Interface |
|---|---|---|
| 1 | GND (Black) | External Power - |
| 2 | 3.3～5V (Red) | External Power + |
| 3 | RX （SDA）(Green) | TX（SDA） |
| 4 | TX（SCL） (Yellow) | RX（SCL） |

## 4. Dimensions

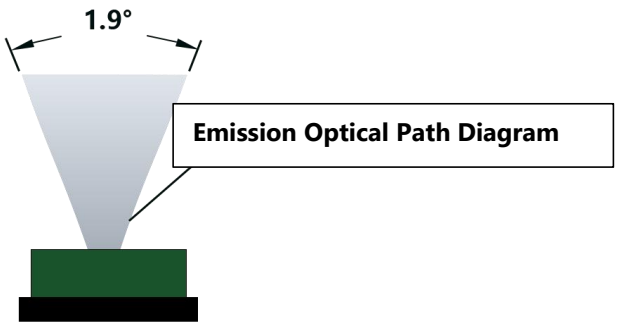





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## 5. Measuring Characteristic

Because of the divergence angle, there would be a light spot with changing size on the target surface depending on the distance. In actual use, the surface area of the target object should be larger than the light spot so that the distance can be accurately measured.




| Distance | 1m | 2m | 5m | 10m | 20m |
|---|---|---|---|---|---|
| Diameters of the light spot | 3cm | 6cm | 15cm | 30cm | 60cm |

The diameters of the light spot of LRF50VB in different distances are shown below:

## 6. Communication Protocol: UART

### 6.1 Communication Interface

| UART | |
|---|---|
| Protocol | Free |
| Baud Rate | 460800 (adjustable) |
| Data Bit | 8 |
| Stop Bit | 1 |
| Parity Bit | None |

### 6.2 Output Format

Both the input and output of this product adopt the Hexadecimal Little-Endian Mode.

| Frame Header | Distance 2 Bytes | | Check Byte |
|---|---|---|---|
| 5C | 02 | 11 | EC |

4 Bytes Output

5C: Fixed Frame header 1 byte



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02 11：Distance value 2 bytes means the measuring distance is 4354mm, little-endian, range 0-50000.

When out of range,output would be 50000.

EC：The checksum byte is calculated by summing all bytes from the second byte (02) to the second-last byte (11), then inverting the result.

### 6.3 UART Commands

| # | Description | Send | Return | Note |
|---|---|---|---|---|
| 1 | Reading serial no. | 5A 0D 02 0D 0D 0D 0D BC(checksum) | 5A 8D 02 10 01 00 00 5F(checksum) | 10 01 00 00 means the serial no. is 272: little-endian, the serial no. shown in the upper computer is: S0000000272 (Add S before the number). |
| 2 | Reading software version no. | 5A 16 02 16 16 BB(checksum) | 5A 96 02 03 02 62(checksum) | 03 02 means the software version no. is V2.3: little-endian, 02 represents 2, 03 represents 3, Add a point (.) in the middle. |
| 3 | Baud rate setting | 5A 06 02 80 04 73(checksum) | 5A 86 02 80 04 F3(checksum) | 60 00 (9600)<br>C0 00 (19200)<br>80 01 (38400)<br>80 04 (115200)<br>00 09 (230400)<br>00 0A (256000)<br>00 12 (460800)<br>Any other baud rate is not available |
| 4 | **Set Frequency** | 5A 0B 02 E7 03 08(checksum) | 5A 8B 02 E7 03 88(checksum) | E7 03 (little-endian) represents the frequency divisor: 999.<br>Output frequency: f=10000/(999+1)=10Hz.<br>Supported frequencies: 100/50/20/10/1Hz. |
| 5 | **Read Frequency** | 5A 1B 02 1B 1B AC(checksum) | 5A 9B 02 31 00 31(checksum) | 31 00 (little-endian) indicates the current divisor: 49.<br>Output frequency: f=10000/(49+1)=200Hz.<br>Supported frequencies: 200/100/50/20/10/1Hz |
| 6 | **Switch to IIC** | 5A 1F 02 1F 1F A0(checksum) | 5A 9F 02 1F 1F 20(checksum)` | 5A 9F 02 1F 1F 20<br>Response confirms successful switch. |
| 7 | **. Stop Ranging** | 5A 0A 02 00 00 F3 | 5A 8A 02 00 00 73 | Stops distance measurement. |
| 8 | **Start Ranging** | 5A 0A 02 02 00 F1 | 5A 8A 02 02 00 71 | 5A 8A 02 02 00 71<br>Initiates distance measurement. |



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### 6.4 Check Function

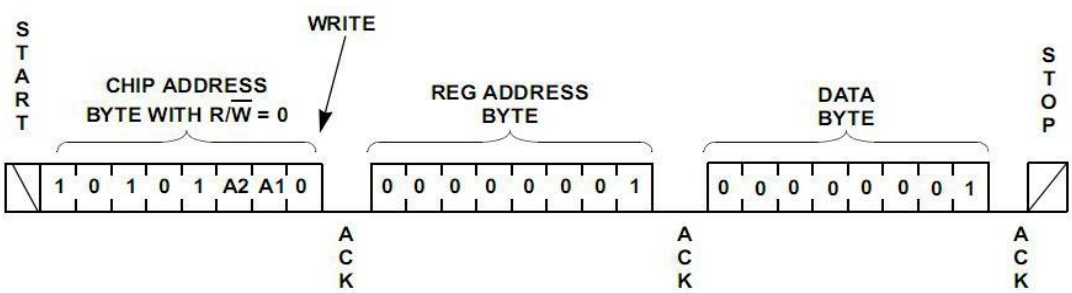
Begin with the second byte and end with the last second byte, find the inverse of the sum.

```
uint8_t Check_Sum(uint8_t *_pbuff, uint16_t _cmdLen)
{
uint8_t cmd_sum=0;
uint16_t i;
for(i=0;i<_cmdLen;i++)
{
  cmd_sum += _pbuff[i];
 }
 cmd_sum = (~cmd_sum);
 return  cmd_sum;
}
```

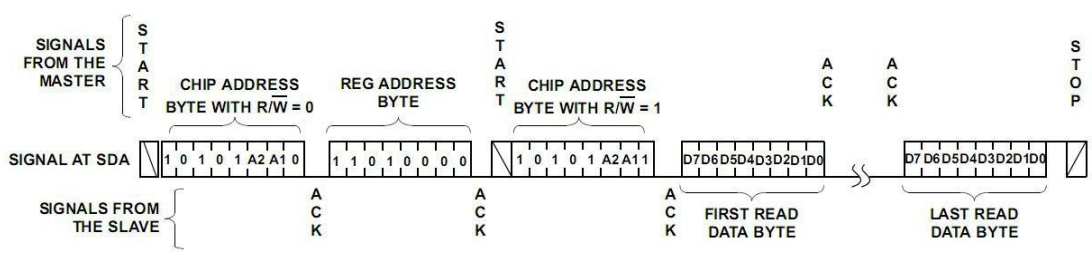
## 7. Communication Protocol: IIC

LRF50VB LiDAR IIC slave interface supports maximum clock frequency 400K. The default address is 0x52 (7bit address mode).

I2C single register write sequence is as follow:




I2C multiple registers read sequence is as follow:






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Definitions of registers

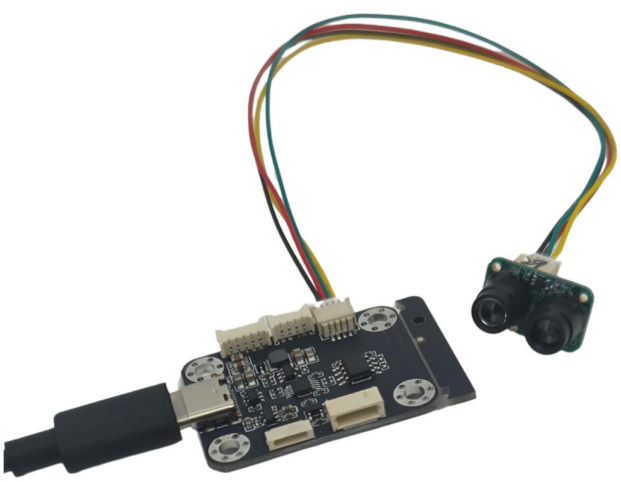
| No. | Register address | Register definition | Attribute | Remarks |
|---|---|---|---|---|
| 0 | 0x00 | Distance-High byte | read only | 2byte for distance |
| 1 | 0x01 | Distance-Low byte | read only | 2byte for distance |
| 3 | 0x02 | Laser control | write only | 0: laser off; 1: laser on |
| 4 | 0x03 | LiDAR ID | read only | default 0x4A, be used to communicate read&write tests |
| 5 | 0x04 | IIC to UART Switch | Write-only | Write 0xA5 to register 0x04 and 0x5A to register 0x05 simultaneously |
| 6 | 0x05 | | write only | |
| 7 | 0x06 | Software Version - High Byte | Read-only | Software version is 2 bytes, high byte first, then low byte<br>- |
| 8 | 0x07 | Software Version - Low Byte | Read-only | |
| 9 | 0x08 | Serial Number - High Byte | Read-only | Serial number is 4 bytes, high byte first, range: 1-4294967294<br>-<br>-<br>- |
| 10 | 0x09 | Serial Number - Sub-high Byte | Read-only | |
| 11 | 0x0A | Serial Number - Sub-low Byte | Read-only | |
| 12 | 0x0B | Serial Number - Low Byte | Read-only | |
| 13 | 0x0C | IIC Slave Address | Read/write | IIC slave address in 7-bit mode, range: 0-127 |
| 14 | 0x0D | Factory Reset | Write-only | Write 0x01 to perform factory reset |

## 8. Quick Test

TTL to USB converter board

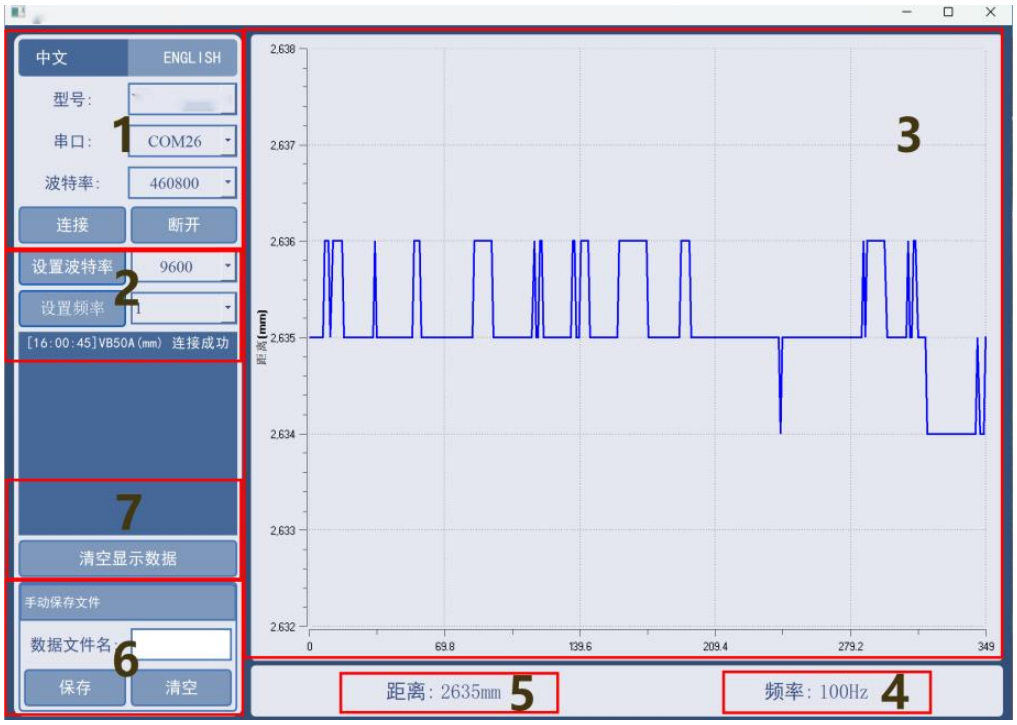
3.3V power supply / Alternatively, use our self-developed universal test kit + Type-C data cable (as shown in the figure below)

Host computer / serial port assistant



After the LRF50VB successfully connected to your computer， select the baud rate and click “connect”, then the data can be monitored on the upper computer.

Here is a sample figure of upper computer:




| Region | Function Description |
|---|---|
| **Region 1** | Set serial port baud rate and other parameters for corresponding models |
| **Region 2** | Configure baud rate and frequency |
| **Region 3** | Real-time distance point-line graph |
| **Region 4** | Read real-time frequency values |
| **Region 5** | Read real-time distance values |
| **Region 6** | Save data to file |
| **Region 7** | Clear all displayed data |

## 9. Attentions

There is NO protection for reverse polarity and overvoltage, please strictly follow the specification for correct power supply and wiring.

- The photobiological safety of this product is Class 1, so please DO NOT look straight at the lens after successfully connected.

- When operating this product in a dusty place, it is better to add a piece of red transparent glass or acrylic plate over the lens for dust prevention. (905nm wavelength needs a transmittance ≥ 85%.)

- When touching this product, please wear anti-static gloves to prevent the product from failing.

- There is a risk of failure when using this product to measure high-reflective objects (such as 3M tapes) and mirrors.

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## 10. Update History

| Version | Date (YY/MM/DD) | Content |
|---|---|---|
| V0.5 | 24/04/29 | Mass produced first editions |
| V1.0 | 24/12/30 | Updated the format |
| V2.0 | 25/03/05 | Revised some parameters |
| V2.1 | 25/03/31 | Added the IIC protocol |
| V3.0 | 25/06/09 | Expanded Function,New Host Computer Added |



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