# FUWEI

# Guangzhou FUWEI Electronic Technology Co.,Ltd

## 20m/50m/100m Laser Ranging Sensor Product Manuals

## 1.Features and Applications

FLR series industrial-grade laser sensors provide accurate and stable distance measurement and can be integrated into various industrial applications. The red laser beam hits the reflective surface and non-contact measurement is performed based on the return signal.

● Features
◇ Phase method distance measurement, high accuracy and fast speed.
◇ Precision optics can ensure high accuracy even outdoors and in harsh environments.
◇ Metal die-cast shell, IP67 safety protection level.
◇ Output interface: RS232/RS485, 2-way switching output, voltage/current output.
◇ With buttons and display screen, it is convenient to set the working parameters of the instrument.

● Applications
◇ Industrial measurement of position, displacement, thickness, distance, etc.
◇ Industrial automation and production intelligent management.
◇ High-altitude cable erection measurement and railway catenary measurement.
◇ Material level/liquid level detection.
◇ Monitoring of slope and dam deformation.
◇ Building safety monitoring.

## 2.Technical Parameters

| Output | RS485/232+analog voltage and current output+NPN output | | |
|---|---|---|---|
| Model | FLR-2000N-UIR | FLR-5000N-UIR | FLR-10000N-UIR |
| Measuring distance | 0.2m-20m | 0.2m-50m | 0.2m-100m |
| Voltage/current output | Can be set to 0~5V / 0~10V / 4~20mA / 0~20mA /0~24mA output *Note 2 | | |
| Voltage output error | 0.2%+0.5mV | | |
| Current output error | 0.2%+0.005mA | | |
| Communication interface | RS232/RS485 (switchable) | | |
| Measuring frequency | 1Hz-40Hz | | |
| Laser type | Class II, 660±15nm, ≤1mW | | |
| Measurement resolution | 1mm | | |
| Measurement error | ±(2mm+d * one ten thousandth) *Note 1 | | |
| Indicator light | Red laser | | |
| Spot size | @1m Ø6mm; @10m Ø8mm; @20m Ø12mm; @30m Ø16mm | | |
| Display | 128x32 dot matrix screen | | |
| Backlight off time | 30 minutes (can be set to normally on) | | |
| Operating mode | Off measurement, continuous measurement | | |
| Transistor switch output | 2 channels (cannot exceed DC36V 0.5A) *Note 3 | | |
| Power supply | DC15~30V | | |
| Power consumption | <3.0W | | |
| Protection grade | IP67 | | |
| Shell material | Die-cast zinc alloy | | |
| Working temperature | -10°C~50°C | | |
| Storage temperature and humidity | -20°C~60°C, 20%~85%RH | | |
| Overheating protection | When the body temperature is higher than 70°C, the measurement will be shut down and when the temperature is lower than 70°C, the measurement will be resumed | | |
| Body size | 88.45x40x59.3mm (including connection base) | | |

*Note 1: When [Speed Level] is 1.
  "d" represents the actual distance. In harsh environments, such as when the sun is too strong and the ambient temperature fluctuates too much, there will be a large error in the measurement results. In this case, the effect is better when used with a target reflector.
*Note 2: Current and voltage can't be output at the same time.
*Note 3: If the external DC output of the transistor switch exceeds the limited voltage or current, it may cause permanent damage to the instrument.

## 3.Main Unit Wiring and Networking Instructions

| No. | Wire color | Interface definition | Description |
|---|---|---|---|
| 2 | Brown | DC+ | Positive pole of external power supply DC 15~30V (input) |
| 7 | Blue | DC- | Power- (input) |
| 8 | Red | AO+ | Analog output+ 4~20mA / 0~20mA / 0~24mA 0~5V / 0~10V |
| 1 | White | AO- | Voltage/current output dedicated ground terminal |
| 3 | Green | RS232RX/RS485-B | 232 or 485 communication line |
| 4 | Yellow | RS232TX/RS485-A | 232 or 485 communication line |
| 5 | Gray | Q1 | Switching output 1 |
| 6 | Pink | Q2 | Switching output 2 |
| | Shielded wire | EARTH | Connected to the ground |

## 4.Display and Buttons

● Display

```
1    9.999  m
```
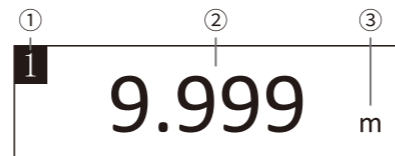
① Station number
② Measuring distance
③ Unit of measurement distance

● Buttons

| Button | Press | Hold |
|---|---|---|
| SET | Confirm in setting mode | Enter parameter setting mode |
| ESC | Return to setting mode | Backlight switch setting |
| ▲ | Adjust option content | Adjust position forward |
| ▼ | Adjust option content | Adjust position backward |

## 5.Setting Mode

Communication function
— Station No.
— Port
— Communication format setting
  — Baud rate 9600  Data bits 8
  — Check digit NO  Stop bit 1

Analog output
— Type
— Lower limit
— Upper limit

Miscellaneous settings
— Switching output
  — Q1 Positive polarity
  — Q1_L Low value of Q1 switching range
  — Q1_H High value of Q1 switching range
  — Q2 Reverse polarity
  — Q2_L Low value of Q2 switching range
  — Q2_H High value of Q2 switching range
— Speed level
— Reset

Product information
— Product model
— Software version
— Compilation date
— Instrument temperature

### 5.1 Setting Menu

The setting menu includes: communication function, analog output, miscellaneous settings, and product information.

| Menu | Communication Function |
|---|---|
| | Analog Output |
| | Miscellaneous Settings |
| | Product Information |

1) Press ▲ to adjust the previous option;
2) Press ▼ to adjust the next option;
3) Press SET to enter the selected menu item;
4) Press ESC to return to the previous interface;

Note: "Analog output" function is only available for UIR

### 5.2 Communication Function

Select the "Communication Function" option in the menu, refer to [5.1 Settings Menu].

| Communication Function | Station No. 01 |
|---|---|
| | Port       RS485 |
| | Communication format setting |

1) Press ▲ to adjust the previous option;
2) Press ▼ to adjust the next option;
3) Press SET to enter/select the selected menu item;
4) Press ESC to return to the previous interface/cancel the selection;

#### 5.2.1 Station No.

Select the "Station No." option in the communication function, refer to [5.2 Communication Function].

| Communication Function | Station No. 01 ▲▼ |
|---|---|
| | Port   RS485 |
| | Communication format setting |

1) Press ▲ to adjust the station number value upward;
2) Press ▼ to adjust the station number value downward;
3) Press SET to confirm the selected menu item;
4) Press ESC to cancel the selected menu item;

#### 5.2.2 Port

Enter the "Port" option in the communication function, refer to [5.2 Communication Function].

| Communication Function | Station No. 01 |
|---|---|
| | Port  RS485 ▲▼ |
| | Communication format setting |

1) Press ▲ to adjust the port upward;
2) Press ▼ to adjust the port downward;
3) Press SET to confirm the selected menu item;
4) Press ESC to cancel the selected menu item;

The port provides two options: RS485 and RS232

#### 5.2.3 Communication Format Setting

Enter the "Communication Format Settings" option in the communication function, refer to [5.2 Communication Function]; there are four options: B (baud rate), D (data bit), P (parity check), and S (stop bit).

| Communication Function | B 9600   D 8 |
|---|---|
| | P Even   S 1 |

1) Press ▲ to adjust the option upward/adjust the value of the selected option;
2) Press ▼ to adjust the option downward/adjust the value of the selected option;
3) Press SET to select/uncheck the menu item;
4) Press ESC to cancel the selected menu item;

B (Baud rate) option: 1200/2400/4800/9600/19200/38400/57600/115200
D (data bit) option: 8/9
P (parity) option: Even/Odd/None
S (stop bit) option: 1/1.5/2

### 5.3 Analog Output

Enter the "Analog Output" option in the setting menu, UIR only, refer to [5.1 Settings Menu].

| Analog Output | Type No-Out ▲▼ |
|---|---|
| | Lower limit 00000 |
| | Upper limit 10000 |

Output mode options: No-Out/0~5V / 0~10V / 4~20mA / 0~20mA / 0~24mA

1) Press ▲ to adjust the option upward/adjust the value of the selected option;
2) Press ▼ to adjust the option downward/adjust the value of the selected option;
3) Press SET to select/uncheck the menu item;
4) Press ESC to cancel the selected menu item;
5) Hold ▲ to switch to the previous bit of the selected value;
6) Hold ▼ to switch to the next bit of the selected value;

### 5.4 Miscellaneous Settings

Enter the "Miscellaneous Settings" option in the settings menu, refer to [5.1 Settings Menu].

| Miscellaneous Settings | Switching output |
|---|---|
| | Speed level 5 |
| | Reset |

1) Press ▲ to adjust the option upward;
2) Press ▼ to adjust the option downward;
3) Press SET to enter the selected menu item;
4) Press ESC to return to the previous interface;

## 5.4.1 Switching Output

Enter the "Switching Output" option in the miscellaneous settings, refer to [5.4 Miscellaneous Settings].

| Switching Output | Q1 | Positive polarity |
|---|---|---|
| | Q1_L | 01000 |
| | Q1_H | 02000 |
| | Q2 | Reverse polarity |
| | Q2_L | 01000 |
| | Q2_H | 02000 |

1) Press ▲ to adjust the option upward/adjust the value of the selected option;
2) Press ▼ to adjust the option downward/adjust the value of the selected option;
3) Press SET to select/uncheck the menu item;
4) Press ESC to cancel the selected menu item;
5) Hold ▲ to switch to the previous bit of the selected value;
6) Hold ▼ to switch to the next bit of the selected value;

Trigger level options: Off/positive polarity/reverse polarity

## 5.4.2 Speed Level

Enter the "Speed Level" option in the miscellaneous settings, refer to [5.4 Miscellaneous Settings]. Speed level: The instrument provides a total of 5 levels of speed from 1 to 5 for users, Level 1 is the slowest with an output rate of about 10Hz, Level 5 is the fastest with an output rate of about 40Hz, The ranging accuracy is inversely proportional to the speed. Users can flexibly choose according to actual conditions.

| Miscellaneous Settings | Switching output |
|---|---|
| | Speed level    5 ▲▼ |
| | Reset |

1) Press ▲▼ to adjust;
2) Press SET ESC to return to the previous interface;

## 5.4.3 Reset

Enter the "Reset" option in miscellaneous settings, refer to [5.4 Miscellaneous Settings], and restore to factory settings.

| Reset |
|---|
| Confirm to reset? |

1) Press SET to confirm reset;
2) Press ESC to cancel and return to the previous interface;

## 5.5 Product Information

Enter the "Product Information" option in the Settings menu, refer to [5.1 Settings Menu];
The product model, software version, compilation date, and instrument temperature are scrolled.

| Product Information | |
|---|---|
| Product Model | FLR-2000N-UIR |
| Software Version | V.1.20 |
| Compilation Date | 20230601 |
| Instrument Temperature | 38℃ |

1) Press ESC to return to the previous interface;

## 5.6 Backlight Status Setting

The backlight has two states: ① Automatically extinguishes after 30 minutes, Press any button and the backlight will automatically turn on; ② The backlight is always on;

In the instrument measurement state, press and hold the ESC for about 3 seconds to switch between the two states;

| Auto OFF | The display backlight will automatically turn off after 30 minutes. |
|---|---|
| ON | The display backlight is always on. |

# 6.Analog conversion and communication wiring

## 6.1 Conversion formula for analog quantity calculation

Calculation formula for analog current laser displacement measurement value:

$$I_{out} = \frac{(I_{max} - I_{min}) * (D - D_{min})}{D_{max} - D_{min}} + I_{min}$$

In the formula, $I_{out}$ is the output current;

$I_{max}$ is the maximum value of the output current range, $I_{min}$ is the minimum value of the output current range;

$D$ is the present measurement distance;

$D_{min}$ is the minimum distance value of analog output;

$D_{max}$ is the maximum distance value of analog output.

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Calculation formula of analog voltage laser displacement measurement value

$$I_{out} = \frac{(I_{max} - I_{min}) * (D - D_{min})}{D_{max} - D_{min}} + I_{min}$$

In the formula, $I_{out}$ is the output current;

$I_{max}$ is the maximum value of the output current range, $I_{min}$ is the minimum value of the output current range;

$D$ is the present measurement distance;

$D_{min}$ is the minimum distance value of analog output;

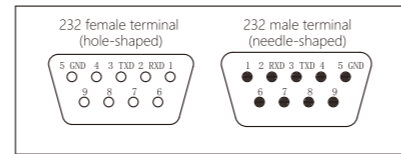$D_{max}$ is the maximum distance value of analog output.

## 6.2 RS232 Wiring Method

This function has an open-drain (collector) output inside the instrument. It can only input DC current and cannot directly output voltage and current. Please note that the current sink cannot exceed DC36V 0.5A.
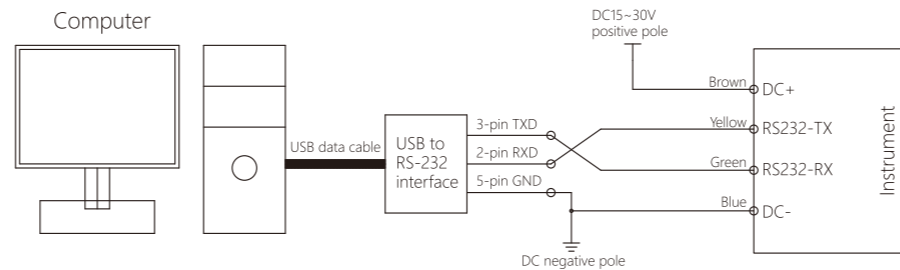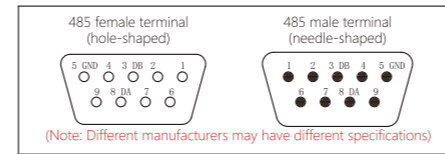


Note: RXD and TXD on the computer side and instrument side need to be cross-connected. RS232 has three connections: RX (green) TX (yellow) GND (blue).

D-Sub connector RS232 pin definition        D-Sub connector RS485 pin definition



(Note: Different manufacturers may have different specifications)

# 7.Communication Protocol (MODBUS RTU)

## 7.1 Data Transmission Format

Default format Baud rate: 9600   Data bit: 8   Stop bit: 1   Parity bit: N
Baud rate, data bits, stop bits, parity bits and other parameters can be set in 5.2.3 [Communication Format Settings].

## 7.2 RS485 Interface

When the instrument is connected to 485 network, each instrument (slave) must be set with a unique address.
Because it is a slave device, when the instrument measures data, it will not actively send the data, and the host computer needs to issue instructions to obtain the data.

## 7.3 RS232 Interface

When the instrument measures data, the interface will actively upload the data in the following format:

| 01 | 03 | 04 | 00 01 0D 7E | 2F 43 |
|---|---|---|---|---|
| ① | ② | ③ | ④ | ⑤ |

① 01 indicates that the slave address is 1, only 1~64 are used in the system, and other addresses are reserved.
② 03 is the read function code, which means reading the data register.
③ 04 means returning 4 bytes of data.
④ The distance is 0x00010d7e (hexadecimal) = 68990 (decimal), which means the measured distance is 6.8990m.
⑤ Error parity bit, which allows the host and terminal to check errors during the transmission process and occupies two bytes.

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## 7.4 Function Register List (16-bit)

| Hexadecimal address | Decimal address | Attribute | Value range | Function description |
|---|---|---|---|---|
| 0x10 | 16 | R/W (reserved) | | |
| 0x11 | 17 | R/W | 0~2 | 0: Turn off measurement    2: Continuous measurement |
| 0x12 | 18 | R/W | 1~5 | Ranging speed level: 1: slowest, 5: fastest |
| 0x13 | 19 | R/W (reserved) | | |
| 0x14 | 20 | R/W | 1~64 | Slave station number |
| 0x15 | 21 | R | | High byte of distance register |
| 0x16 | 22 | R | | Low byte of distance register |
| 0x17 | 23 | R | | Ranging status register * |
| 0x18 | 24 | R/W | 0~7 | Communication baud rate |
| 0x19 | 25 | R/W | 0~4 | Voltage output 0: 0~5V 1: 0~10V Current output 2: 4~20mA 3: 0~20mA 4: 0~24mA |
| 0x1A | 26 | R/W | 0~50000 | Minimum value register of analog output |
| 0x1B | 27 | R/W | 0~50000 | Maximum value register of analog output |
| 0x1C | 28 | R/W | 0~50000 | Minimum distance of Q1 switch output |
| 0x1D | 29 | R/W | 0~50000 | Maximum distance of Q1 switch output |
| 0x1E | 30 | R/W | 0~2 | Q1 0: Off  1: Positive polarity  2: Reverse polarity |
| 0x1F | 31 | R/W | 0~50000 | Minimum distance of Q2 switch output |
| 0x20 | 32 | R/W | 0~50000 | Maximum distance of Q2 switch output |
| 0x21 | 33 | R/W | 0~2 | Q2 0: Off  1: Positive polarity  2: Reverse polarity |

Note: When this register is 0, the distance measurement is successful; when it is not 0, the distance measurement is wrong, and the value of the distance register (21, 22) is 9999999.
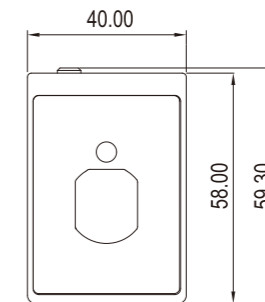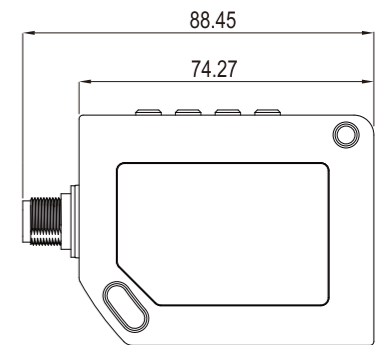
# 8.Installation Dimensions
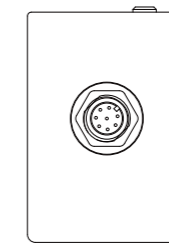


(Joint surface)
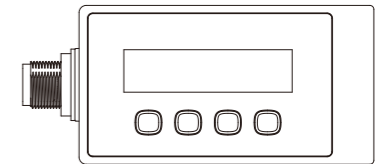
(Joint surface)

(Laser emitting surface)

(Side view of main body)