Laser displacement sensor Operating instruction

●Please confirm whether the product meets your needs.

●Please read this manual thoroughly before use and strictly follow the instructions below.

●Please read the precautions in the instructions carefully and use it after understanding the relevant content.

⚠WARN	Indicates that the use of this product without following the specified operating instructions may result in a degree of personal injury or property damage.

⚠WARN

●The light source of this product uses a visible semiconductor laser. Do not directly or indirectly reflect a laser beam from a reflecting object into the eye. There is a risk of blindness if the laser beam enters the eye.

●This product does not have explosion-proof structure. Do not use in flammable, explosive, explosive gas or explosive liquid environment.

●Do not remove or alter this product as it is not designed to automatically turn off the laser emission when the body is turned on. Disassembly or modification of this product by the client may result in personal injury, fire or electric shock.

●Use of controls, adjustments or procedures other than those specified herein may result in a dangerous release of radiation.
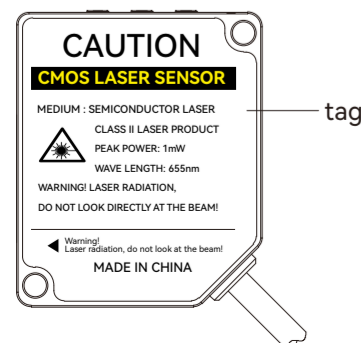
⚠ Look out

●It is dangerous to connect or disconnect interfaces when the power is on. Be sure to turn off the power before operation
●Failure may occur when installed in the following locations.
1. Places covered with dust or steam
2. where corrosive gases will be generated
3. will directly receive the spatter of water or oil location
4. Places that have suffered severe vibration or shock
● This product is not suitable for outdoor use
● Do not use the sensor in an unstable state shortly after the power is turned on (about 15 minutes of warm up time)
● If switching power regulator must be used, please ground the grounding terminal
● Do not connect with high voltage cable or power line, operation
failure will lead to induction or damage failure,
Because each product is different, there may be slight differences in the detection characteristics of the workpiece.
● Do not use this product in water.
● Please do not disassemble, repair or modify this product without
authorization, otherwise it may lead to electric shock, fire or injury to the human body.
● Dust off the transmitting or receiving elements to maintain proper
detection. In addition, avoid direct impact of foreign objects on the product.
● Operate within the rated range.

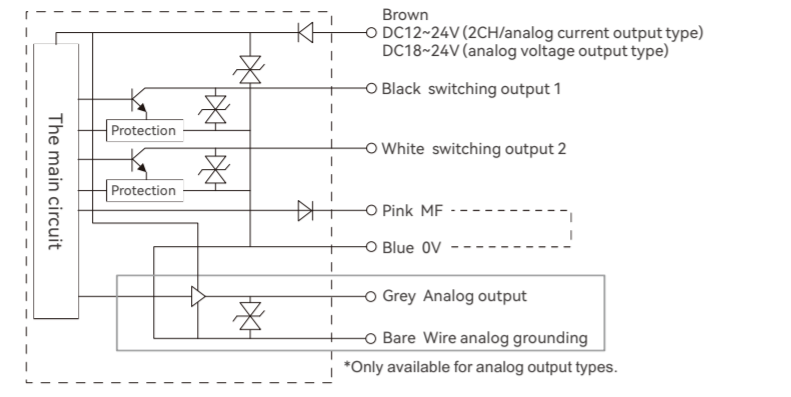| ⚠	This product cannot be used as a safety device to protect the human body

Laser use precautions

●Laser tag

The product is classified as a Class 2 (III) laser product by the JISC6802/IEC/FDA laser safety standard.
If the white laser label on the machine is covered when installing the product, attach the attached laser label in a visible position.
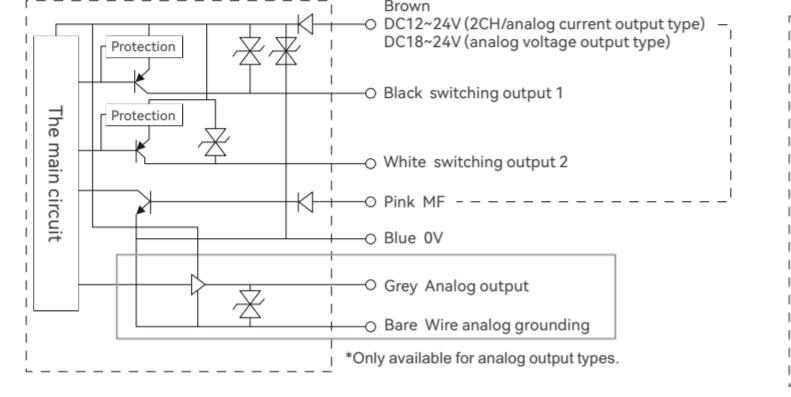

CAUTION
CMOS LASER SENSOR
MEDIUM: SEMICONDUCTOR LASER
CLASS II LASER PRODUCT
PEAK POWER: 1mW
WAVE LENGTH 655nm
WARNING LASER RADIATION,
DO NOT LOOK DIRECTLY AT THE BEAM
Warning!
Laser radiation, do not look at the beam!
MADE IN CHINA

tag

Wiring diagram

NPN type (current/voltage/dual switching output type)

Brown DC12~24V (2CH/analog current output type) DC18~24V (analog voltage output type)
Black switching output 1
White switching output 2
Pink MF
Blue 0V
Grey Analog output
Bare Wire analog grounding
*Only available for analog output types.

NPN type (RS485 communication type)

Brown DC12~24V
Black switching output 1
Pink MF
Grey RS485(A+)
Shield RS485(B–)
485 Device
Blue 0V

PNP type (current/voltage/dual switching output type)

Brown DC12~24V (2CH/analog current output type) DC18~24V (analog voltage output type)
Black switching output 1
White switching output 2
Pink MF
Blue 0V
Grey Analog output
Bare Wire analog grounding
*Only available for analog output types.

PNP type (RS485 communication type)

Brown DC12~24V
Black switching output 1
Pink MF
Grey RS485(A+)
Shield RS485(B–)
485 Device
Blue 0V

MF input (Multi-function input)

In the menu external input select: Zero, Teach, Stop laser.
NPN type: Grey MF wire connected to the negative terminal of the power supply (0V) is more than 20ms and disconnected for triggering once.
PNP model: The grey MF wire is connected to the positive electrode of the power supply (24V) for more than 20ms and disconnected for triggering once.
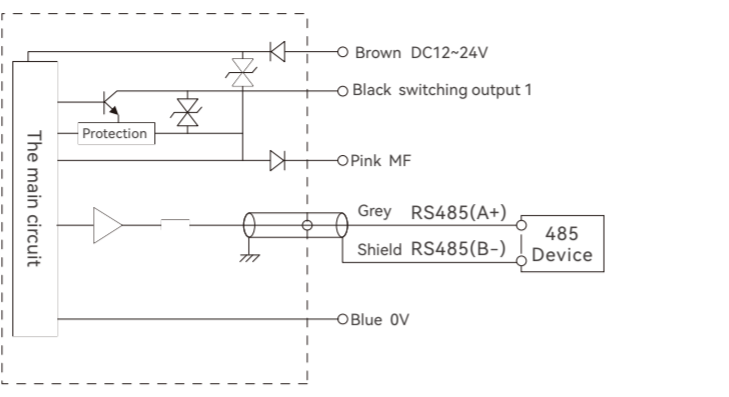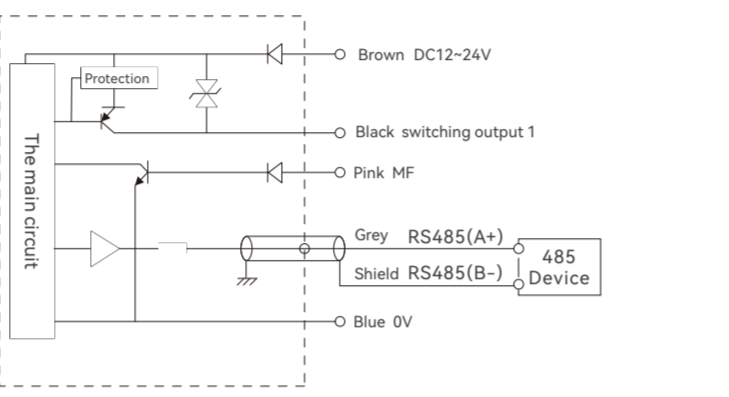
Note 1. Check whether the cables are correctly connected before switching on the power.
In particular, the white line (analog output line) must not touch other lines.
1.   The blue wire (0V) and the shielded wire (mode is not grounded) are connected in the internal circuit.
However, please use the blue wire (OV) to connect the negative terminal of the power supply, and the shielded wire (analog ground) is used to simulate the output.

Specification

Detection distance		30mm	50mm	85mm	120mm	250mm
Detection range (f. s.)		±4mm	±10mm	±20mm	±60mm	±150mm
Light source		Red semiconductor laser				
		(Wavelength: 655nm, maximum output power: 1mw)				
Laser type	IEC/JIS	class2				
	FDA	classII				
Spot size * 1	Close range	0.15×0.15mm	0.6×1.2mm	0.9×1.5mm	1.2×1.8mm	1.5×2.5mm
	Center position	0.1×0.1mm	0.5×1.0mm	0.75×1.25mm	1.0×1.5mm	1.75×3.5mm
	Remote	0.15×0.15mm	0.4×0.9mm	0.6×1.0mm	0.5×0.8mm	2.0×4.5mm
Linear accuracy		±0.1%f.s. (f.s.=8mm)	±0.1%f.5. (f.s.=20mm)	±0.1%f.8. (f.s.=40mm)	±0.1%f.s. (f.s.=120mm)	±0,3%f.s. (f.s.=300nm)
Resolution ratio		2um (In fast mode 4μm)	5um (In fast mode 8μm)	10um (In fast mode 15μm)	30um (In fast mode 45μm)	75μm (In fast mode 150μm)
Response time * 2	Quick mode	Max.2ms: average sampling frequency 1 time (1ms)+sensitivity switching time (max.1ms)				max.2.5ms
	Standard mode	Max.11.5ms: average sampling frequency 16 times (8.5ms)+sensitivity switching time (max.3ms)				max.15.5ms
	High resolution mode	Max.36.5ms; Average sampling frequency 64 times (32.5ms)+sensitivity switching time (max. 4ms)				max.48.5ms
Sampling period		※ Factory value: 500 μs (250mm type: 750 μs)				
Temperature drift characteristics		±0.08%F.S./℃				
Pilot lamp	Distance indicator light	LED light display on the operation panel				
	Output indicator light	When in the ON state: Q1 and Q2 indicator lights (orange) are on				
MF input (multifunctional input)		Select from the external input menu: zero adjustment, teach, stop laser.				
		NPN model: The grey MF wire is connected to the negative pole (0V) of the power supply and disconnected for more than 20ms, which is considered to trigger once.				
		PNP model: The grey M-line is connected to the positive pole (24V) of the power supply and disconnected for more than 20ms, which is considered as triggering once.				
Protection circuit		Reverse connection protection, overcurrent protection				
Protection level		IP64				
Operating environment temperature /humidity		-10~+45 ℃ (no icing)/35~85RH (no frost)				
Storage environment temperature /humidity		-20~60 ℃ (no icing)/35~95RH (no frost)				
Environmental illumination		Sunlight; Incandescent lamps below 10000lx; Below 3000lx				
Vibration resistance		10~55Hz dual amplitude 1.5mm, 2 hours in x, y, z directions				
Impact resistance		Approximately 50G (500m/s²) X. 3 times in each direction of Y and Z				
Internal circuit stability time		About 1.5s				
Preheating time		Max. 15 minutes				
Material quality		Shell: aluminum alloy lens: PMMA				
Weight	Cable type	65g(Excluding cable lines)				
	Plug-in type	90g				

Output specification

Model		Analog current output type	Analog voltage	RS485 comm
		GFL-G-①	GFL-G-②	GFL-G-③
Supply voltage		DC12~24V (+10%/—5%)	DC18~24V (+10%/—5%)	DC12~24V (+10%/—5%)
Consumption current		Max 60mA with analog output value	Max 40mA	
Output	Switching output 1	NPN/PNP max 100mA/DC30V residual voltage 18V	—	
	Switching output 2	NPN/PNP max 100mA/DC30V residual voltage 18V		
	Analog output	4-20mA Load impedance: below 300 Ω	0-10V Output impedance: 100 Ω	—
Communication		—		RS485
Connection type	Cable type*3	φ 5 6-core 2-meter long cable (PVC) AWG24		φ 5 8-core 2-meter cable (PVC) AWG24

<Test conditions>
The test conditions without special designation are: ambient temperature: 23℃ (normal temperature), power supply voltage: DC24 V , response time: high-resolution mode, sampling period: 550μs, detection distance: center position, test target: 50 ×50mm white ceramic.
*1 Defined by 1/e2 (13.5%) of the center beam intensity. When there is light leakage outside the defined spot size range, or there is an object with a higher reflectivity than the object being measured around the beam, false detection may occur.

Mounting (diffuse reflection type)

In order to obtain a good detection position, install the detection surface as close as possible to the detection center of the sensor. Install the sensor using M4 screws with a tightening force smaller than 0.8N-m.
For the installation method of the positive reflection type, please refer to the positive reflection type manual.

·   When mounting, keep the lens surface of the sensor parallel to the surface of the object.
·   Please note that when there is light leakage outside the spot or an object with a higher reflectivity than the measured object is present around the beam, the measurement error may be caused.

Detection center position
Casting light optical axis
43.2
47.5
Object surface
Unit (mm)

Name of operating unit

Threshold Setting
Current Value
Indicator light 1
Indicator light 2
SET button
"+/-" button
30.0000 OUT1 Th-Va 29.1526
OUT2 SET

+V supply voltage 12~24V ±10%
0V
External input
Switching output 2
Switching value NPN/PNP output
Analog voltage/current output
Analog grounding AGND
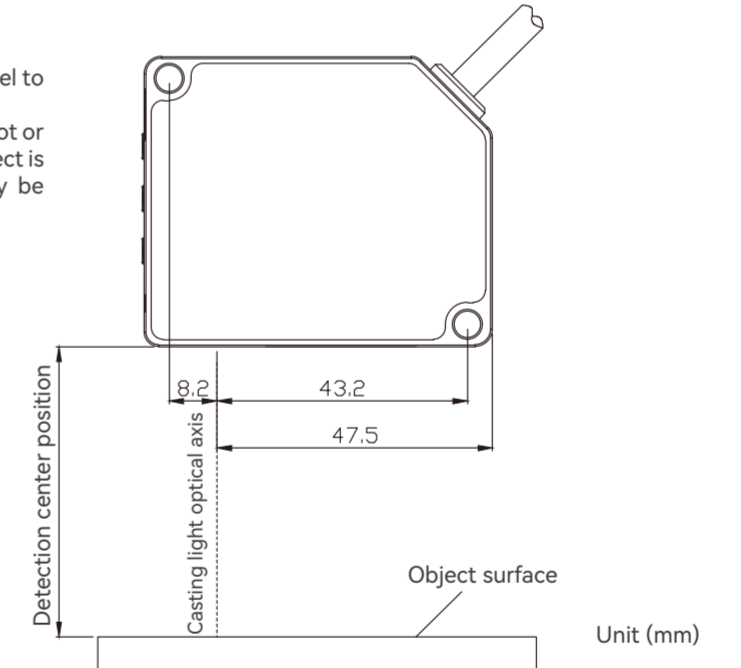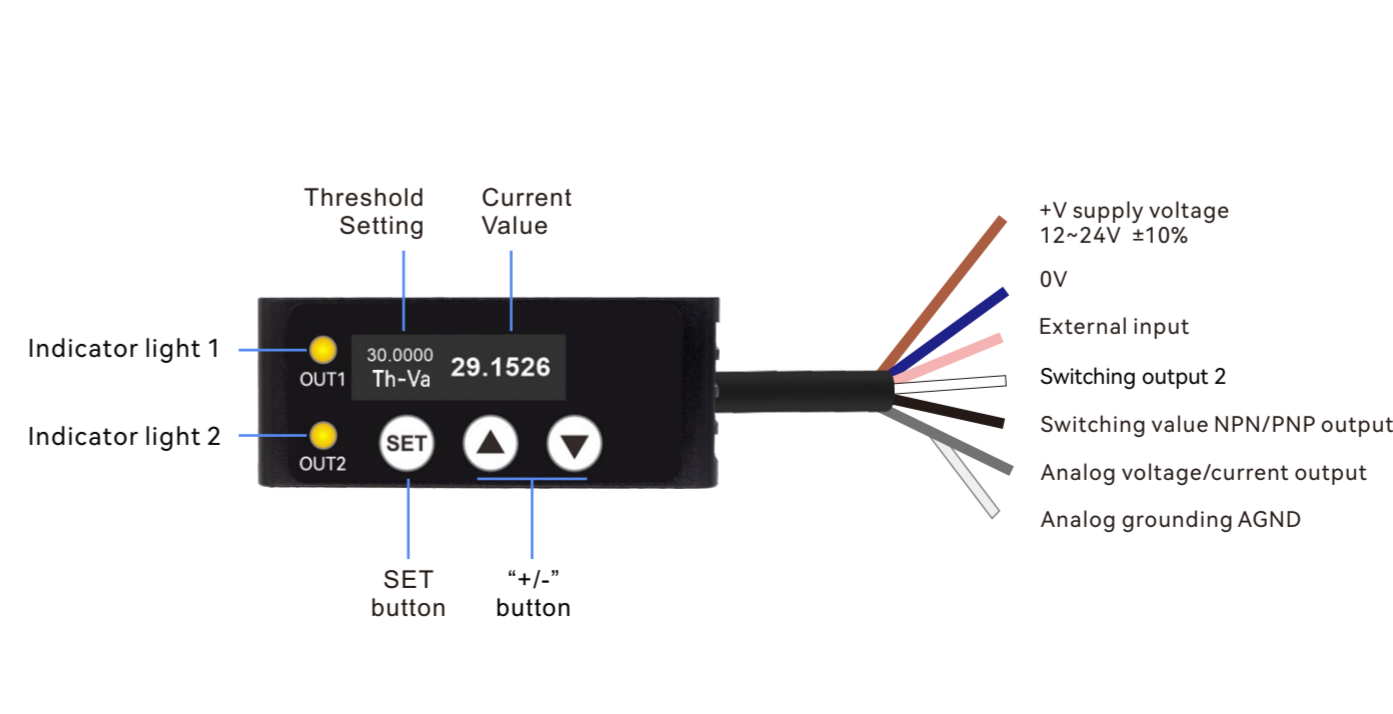
Outline dimensional drawing

20.4
47.5
26
13.1
Laser emission window
Laser receiving window

50
42.4
3.8
4.3
60
51.4
2×φ4.5
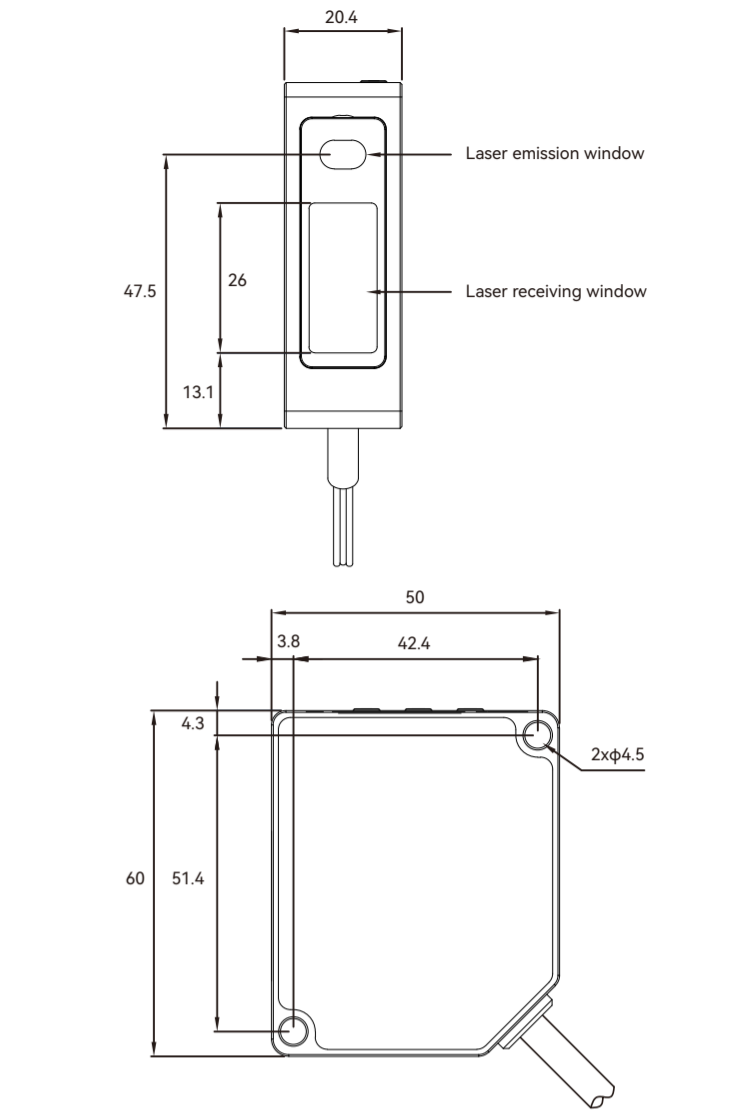
Function setting procedure

indoctrination
*2 teaching points:
Basic instruction method
① In the state of no object, press the "SET "key.
② In the state of an object, press the "SET "key.
③ Complete the calibration. (When the difference between two teachings is small, the return difference is too small, and it is necessary to expand the difference and teach again)

ON
OFF
distance
Reference value
backdrop
Detecting object
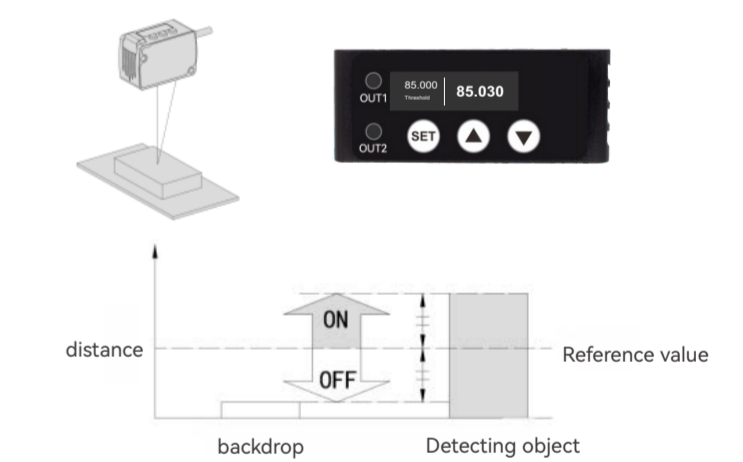
*   Qualified Teaching
In the case of small objects and backgrounds, how to use this teaching method is very convenient.

distance
UP key
Reference value
Taught value
backdrop
< in case of background reference >

distance
Taught value
Reference value
DOWN key
backdrop
< In the case of detecting objects as benchmarks >

① In the state of the background object or in the state of the detected object, press the "SET" key.
② When the background object is the reference, press the "▲" key to set the reference value in the sensor. The value set in the checked object after pressing the "▼" key when the checked object is the base.
③ Complete the calibration.
*1 point teaching (window comparison mode)
- The method of setting the upper and lower limits is applied instead of the 1-point instruction for the distance from the datum surface of the detected object. This function is used to distinguish between the upper and lower limits.
- In the case of 1-point teaching (window compare mode), please set it to [1-point teaching (window compare mode)] in the detection output setting of PRO mode.
- For setting method, please refer to "PRO Mode Operation Instructions"

OFF
ON
OFF
distance
Base value 2_SL
Datum plane
Base value 1_SL
Detecting object

① In the case of detection objects, press the "SET" key 2 times
② teaching is completed

85.030

*2 point teaching (window comparison mode)
- Implement the 2-point instruction to set the benchmark value range method.
- In the case of implementing 2-point teaching (window comparison mode), please set it to [2-point teaching (window comparison model)] in the detection output setting of PRO mode. Refer to the "Operation Instructions for the Mode PRO" for setting methods.
- When performing the instruction, please use a constant distance detection object (P-1, P-2)

distance

2nd time (base value 2_SL)

1st time (base value 1_SL)

Detecting objectP–1   Detecting objectP–2

① Under the condition of detecting object P-1, press the "SET" key (the first time).
② Under the condition of detecting object P-2, press the "SET" key (2nd time).
③ Complete the calibration.

* 3-point teaching (window comparison mode)
* Perform the 3-point (P-1, P-2, P-3) instruction as shown in the figure below, set the reference value 1SL between the 1st and 2nd times, set the reference value 2SL between the 2nd and 3rd times, and let the method of setting the reference value range.

- In the case of 3-point teaching (window compare mode), please set it to [3-point Teaching (Window compare mode)] in the menu detection output setting.
- After teaching, P-1, P-2, P-3 will be automatically arranged in order from smallest to largest.

distance

Base value 2_SL

Base value 1_SL

Object P–1   Object P–2   Object P–3

① In the presence of detection object P-1 state, press the "SET" key (the first time)
② In the state of detecting object P-2, press the "SET" key (the second time)
③ In the presence of detection object P-3 state, press the "SET" key (3rd time)
④ Complete calibration.

Function setting procedure

● **Threshold fine-tuning function**

* **Usually detect mode**
- Press the "▲" key or "▼" key to change the threshold directly.
* **Window comparison mode**
* Press the "▲" key or "▼" key to change the threshold directly.
* Press the "▲" key and "▼" key at the same time to switch between threshold 1 and threshold 2

* **Switch quantity setting**
- Analog output type has two channels of switching output, namely switching output out1 and switching output out 2; 485 communication type only switch output Q1.
- Switch output Q1 and switch output Q2 can set the threshold respectively, while long press the "▲" key and "▼" key for 3 seconds to switch the switch output Q1 or switch output Q2.

Key lock function
- Press the "SET" key and "▼" key at the same time to press the lock
- Press the "SET" key and "▼" key at the same time to unlock

Zero function
- Zero function is the function that forces the measurement value to "zero." When setting zero, the screen has a vertical line,
As shown below:

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Press the SET key and "▲" key at the same time to reset the Settings
Press the SET key and "▲" key at the same time to zero and cancel

85.030

Note: Zeroing can only be performed if the display mode is set to reverse mode.

Menu setting

Press and hold the "SET" key for 3 seconds under the distance display interface to enter the menu setting mode.
In the menu setting mode, hold down "SET" for 3 seconds to exit the menu setting mode.
In the menu setting mode, stop for 20 seconds without pressing any button, you can

automatically exit the menu setting mode.
After entering the menu setting mode, press the "▲" key or ▼ key to switch the menu up and down.
Press the SET key to access the corresponding menu item.

1. working mode: standard, high speed, high precision

Working mode → Standard | High speed | High precision

2. normally open and normally closed out1: press "SET" key to enter "▲" or "▼" switch selection, press "SET" to confirm.

NO NC OUT1 → NO | NC

3. normally open and normally closed out2: press the "SET" key to enter, "▲" or "▼" switch selection, press "SET" to confirm. (Only analog output versions have this menu)

NO NC OUT1 → NO | NC

4. detection output: normal mode, one point teaching, two points teaching, three points teaching.

Detection output → One teach | Two teach | Three teach

5. simulation selection: 0-10V, 4-20mA. (Only analog output versions have this menu)

Three teach → 0-10V | 4-20mA

6. the difference: equivalent to the fine tuning of sensitivity, the detection of small differences can be adjusted to the lowest.

Accept an assignment → 0.010 | 20.000

7. external input: when selecting the corresponding function.
–NPN Model: Grey MF cable connected to the negative terminal of the power supply (0V) for more than 20ms when disconnected, trigger once.
–PNP model: The gray MF cable is triggered once when it is connected to the positive electrode of the power supply (24V) for more than 20ms.
* Zero: the current value is cleared to zero, and the ± value is displayed in the range (zero is only valid in the reverse display mode);
* Instruction: can be used by pressing the "SET" key once;
* Stop laser: the sensor stops emitting laser and does not work;

External input → Zero setting | Indoctrination | Stop laser

8. output timing: output delay, delayed output, single output, output extension, no timing, default no timing.

Output timing → Single output | Delayed output | Output extension

9. display mode: standard [display actual distance], reverse [GFL-G85 as an example to display +20 to –20] offset [display 0 to 40].

Display mode → Standard | reversal | skew

10. hold: The default is to keep off, can be selected to keep open. That is, when the current detection value exceeds the range, the output voltage or current can be maintained. [Common application is to maintain 0 or 5v after exceeding the range].

maintain → Keep open | Hold off

11. the screen selection: steady on, timing screen.

Screen selection → Steady on | Timing screen

12. Language

Language → Chinese | English

13. address (only 485 version has this menu)

Address → 1 | 255

14. Baud rate(only 485 version has this menu)

Baud rate → 4800 | 9600 | 38400 | 115200 | 256000

15. reset press "SET" to enter the default display return, you can switch to confirm the reset, press "SET" to ensure that the display has restored factory Settings.

resetting → Confirm reset | Back

Press "SET" and "▼" keys at the same time: keyboard lock on/off.

communication mode	RS485
Synchronization method	asynchronous
Baud	9.6/19.2/38.4/57.6/115.2/256kbps
Data length	8-bit
Stop bit	1-bit
Parity check	nothing

04H instruction (read input register)

1. Communication frame format

1byte	1byte	2byte	2byte	2byte
Address code	Function code	Register Address	Number of registers N	CRC code

2. Response frame format

1byte	1byte	1byte	2N byte	2byte
Address code	Function code	Bytes 2N	Register value	CRC code

3. Error Frame Format

1byte	1byte	2byte		
Address code	Error Code	Exception Code	CRC code	

Read data

Address code	Function code	Register Address	Number of registers N	CRC	Sending code	Function Description
0x01	0x04	0x0000	0x0002	0x71CB		Acquisition - Distance
0x01	0x04	0x0001	0x0001	0x600A		Acquisition - Working Mode
0x01	0x04	0x0002	0x0001	0x900A		Acquiring - NO and NC
0x01	0x04	0x0003	0x0001	0xC1CA		Get - Detect Output
0x01	0x04	0x0004	0x0002	0x300A		Acquire - Tolerance
0x01	0x04	0x0005	0x0001	0x21CB		Get - External Input
0x01	0x04	0x0006	0x0001	0xD1CB		Acquire Output Timing
0x01	0x04	0x0007	0x0001	0x800B		Get Output Timing Time
0x01	0x04	0x0008	0x0001	0xB008		Get - Display Mode
0x01	0x04	0x0009	0x0001	0xE1C8		Get Keep
0x01	0x04	0x000A	0x0001	0x11C8		Acquisition - Screen Selection
0x01	0x04	0x000B	0x0002	0x0009		Obtain zero adjustment value
0x01	0x04	0x000C	0x0002	0xB1C8		Acquisition - Threshold 1
0x01	0x04	0x000D	0x0002	0xE008		Acquisition - Threshold 2
0x01	0x04	0x000E	0x0002	0x1008		Acquire - Baud

In response to

Address code	Function code	Bytes 2N	Register value	CRC	Response code	Response description
0x01	0x04	0x04				Distance
0x01	0x04	0x02	0x0000	0xB930		Usually detected
			0x0001	0x78F0		High precision
			0x0002	0x38F1		High speed
0x01	0x04	0x02	0x0000	0xB930		Normally open
			0x0001	0x78F0		Normally closed
0x01	0x04	0x02	0x0000	0xB930		Usually detected
			0x0001	0x78F0		A little instruction
			0x0002	0x38F1		Two point teaching
			0x0003	0xF931		Three point teaching
0x01	0x04	0x04				Stress difference
0x01	0x04	0x02	0x0000	0xB930		Zeroing
			0x0001	0x78F0		Teach
			0x0002	0x38F1		Stop laser
0x01	0x04	0x02	0x0000	0xB930		Untimed
			0x0001	0x78F0		Output extension
			0x0002	0x38F1		Delayed output
			0x0003	0xF931		Single output
0x01	0x04	0x02				Timing time
0x01	0x04	0x02	0x0000	0xB930		Routine
			0x0001	0x78F0		Reversal
			0x0002	0x38F1		Deviation
0x01	0x04	0x02	0x0000	0xB930		Keep open
			0x0001	0x78F0		Keep Off
0x01	0x04	0x02	0x0000	0xB930		Timed testing soon
			0x0001	0x78F0		Chang liang
0x01	0x04	0x04				Zeroing value
0x01	0x04	0x04				Threshold 1
0x01	0x04	0x04				Threshold 2
0x01	0x04	0x04	0x000012C0			4800
			0x00002580			9600
			0x00009600			38400
			0x0001C200	0xFB24		115200
			0x0003E800			256000

Communication example (obtaining distance)

● Dispatch orders

01 04 00 00 00 02 71 CB

Address code	Function code	Register Address	Number of registers N	CRC
01	04	0000	0002	71CB

● Feedback information

01 04 04 00 01 19 36 21 C2

Address code	Function code	Bytes	Register Value- Distance Value	Check digit
01	04	04	00 01 19 36	21 C2

Where 00 01 19 36 is distance information, unit: um, converted to Decimal, distance: 71990um=71.990mm

10H instruction (writing multiple holding registers)

1. Communication frame format

1byte	1byte	2byte	2byte	1byte	N*2 byte	2byte
Address code	Function code	Register Address	Number of registers N	Bytes 2N	Register value	CRC code

2. Response frame format

1byte	1byte	2byte	2byte	2byte
Address code	Function code	Register Address	Number of registers N	CRC code

3. Error Frame Format

1byte	1byte	1byte	2byte	
Address code	Error code	Exception code	CRC code	

Operating functions

Address code	Function code	Register Address	Number of registers	Bytes	Register value	CRC	Sending code	Function settings
0x01	0x10	0x0000	0x0001	0x02	0x0000	0xA650		Discontinuous output
					0x0001	0x6790		Continuous output
0x01	0x10	0x0001	0x0001	0x02	0x0000	0xA781		High precision
					0x0001	0x6641		Standard
					0x0002	0x2640		High speed
0x01	0x10	0x0002	0x0001	0x02	0x0000	0xA7B2		Normally open
					0x0001	0x6672		Normally closed
0x01	0x10	0x0003	0x0001	0x02	0x0000	0xA663		Usually detected
					0x0001	0x67A3		A little instruction
					0x0002	0x27A2		Two point teaching
					0x0003	0xE662		Three point teaching
0x01	0x10	0x0004	0x0002	0x04				Stress difference
0x01	0x10	0x0005	0x0001	0x02	0x0000	0xA605		Zeroing
					0x0001	0x67C5		Teach
					0x0002	0x27C4		Stop laser
0x01	0x10	0x0006	0x0001	0x02	0x0000	0xA636		Untimed
					0x0001	0x67F6		Output extension
					0x0002	0x27F7		Delayed output
					0x0003	0xE637		Single output
0x01	0x10	0x0007	0x0001	0x02	0x0000	0xA71B		Timing time
0x01	0x10	0x0008	0x0001	0x02	0x0001	0x66D8		Routine
					0x0002	0x26D9		Reversal
								Deviation
0x01	0x10	0x0009	0x0001	0x02	0x0000	0xA6C9		Keep open
					0x0001	0x6709		Keep off
0x01	0x10	0x000A	0x0001	0x02	0x0000	0xA6FA		Timed breathing screen
					0x0001	0x673A		Chang liang
0x01	0x10	0x000B	0x0002	0x04	0x0001	0x66EB		Zero adjustment - current measured value
0x01	0x10	0x000C	0x0002	0x04				Threshold - input threshold
0x01	0x10	0x000D	0x0002	0x04				Threshold - input threshold
0x01	0x10	0x000E	0x0002	0x04	0x000012C0	0x7ED3		4800
					0x00002580	0x6913		9600
					0x00009600	0x1D83		38400
					0x0001C200	0x7283		115200
					0x0003E800	0xCC23		256000
0x01	0x10	0x000F	0x0001	0x02	0x0000	0xA6AF		Reset

In response to

Address code	Function code	Register Address	Number of registers	CRC
0x01	0x10	0x0000	0x0001	0x01C9
0x01	0x10	0x0001	0x0001	0x5009
0x01	0x10	0x0002	0x0001	0xA009
0x01	0x10	0x0003	0x0001	0xF1C9
0x01	0x10	0x0004	0x0002	0x4008
0x01	0x10	0x0005	0x0001	0x11C8
0x01	0x10	0x0006	0x0001	0xE1C8
0x01	0x10	0x0007	0x0001	0xB008
0x01	0x10	0x0008	0x0001	0x800B
0x01	0x10	0x0009	0x0001	0xD1CB
0x01	0x10	0x000A	0x0001	0x21CB
0x01	0x10	0x000B	0x0002	0x700B
0x01	0x10	0x000C	0x0002	0x81CB
0x01	0x10	0x000D	0x0002	0xD00B
0x01	0x10	0x000E	0x0002	0x200B
0x01	0x10	0x000F	0x0001	0x31CA

● Dispatch orders

01 10 00 0E 00 02 04 00 00 00 25 80 69 13

Address code	Function code	Register Address	Number of registers	Bytes	Register value	CRC
0x01	0x10	0x000E	0x0002	0x04	0x00002580	0x6913
						CRC

● Feedback information

01 10 00 0E 00 02 20 0B

Address code	Function code	Register Address	Number of registers	CRC
0x01	0x10	0x000E	0x0002	0x200B

Note: The sensor address code can be set in the function menu, and after the address code is changed, the CRC also needs to be changed at the same time.

If there are any changes to the product specifications, no further notice will be given.
If you want to learn more information or have any questions or suggestions about this product, please feel free to contact us at any time.