

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.

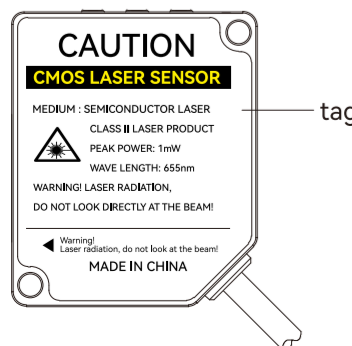
⚠️ Look out

- 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.
 - Places covered with dust or steam
 - where corrosive gases will be generated
 - will directly receive the spatter of water or oil location
 - 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.

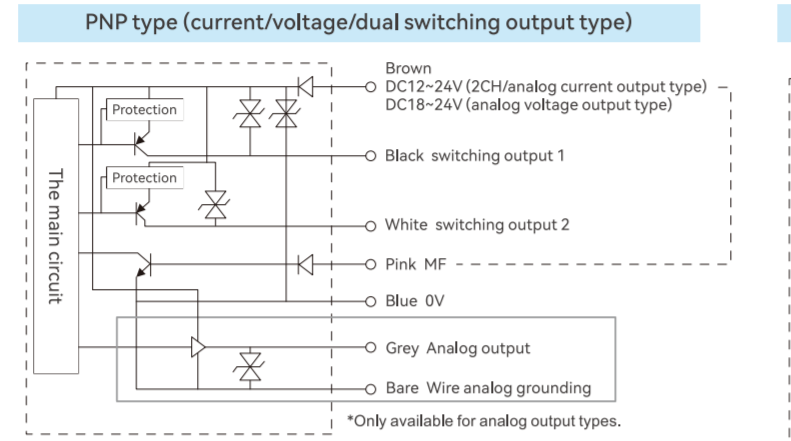
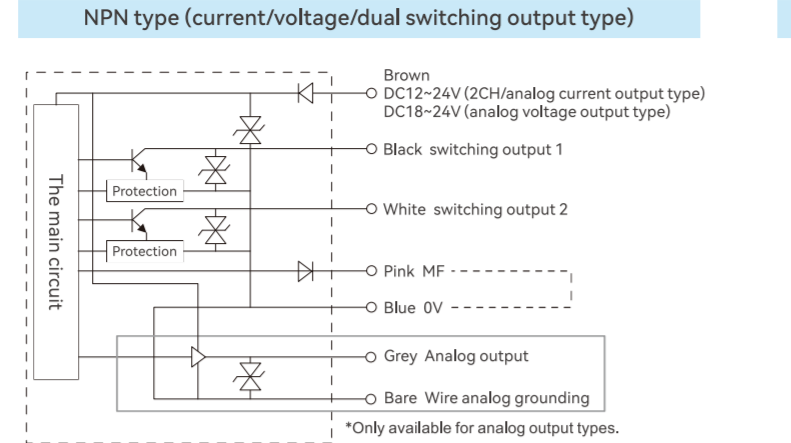
⚠️ This product cannot be used as a safety device to protect the human body

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.

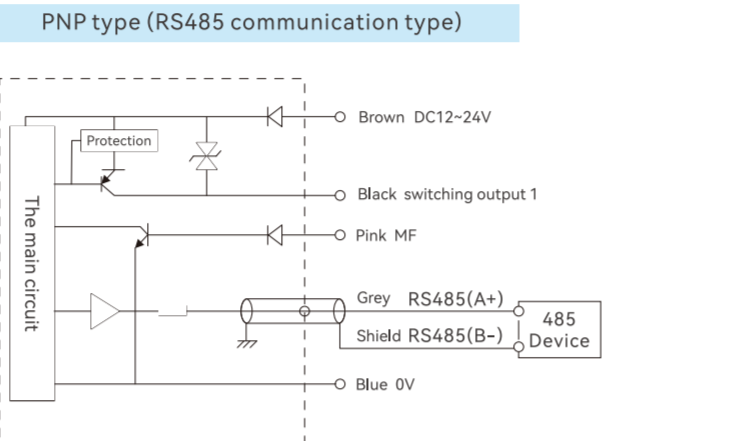
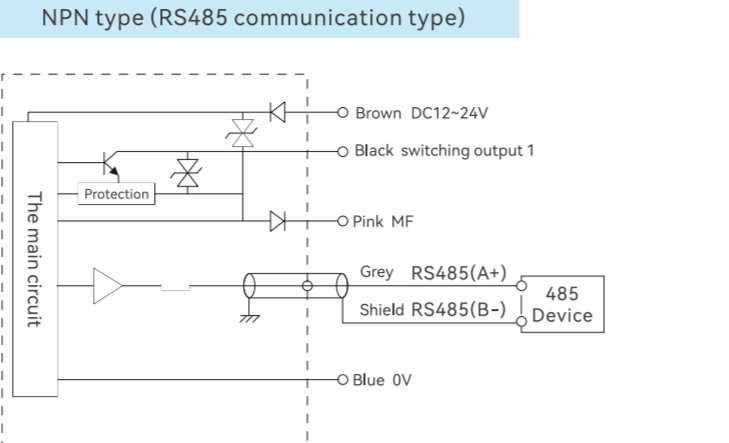


Wiring diagram



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 (0V) 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	2μm (In fast mode 4μm)	5μm (In fast mode 8μm)	10μm (In fast mode 15μm)	30μm (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./°C					
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 °C (no icing)/35~85RH (no frost)					
Storage environment temperature /humidity	-20~60 °C (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/s ²) 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

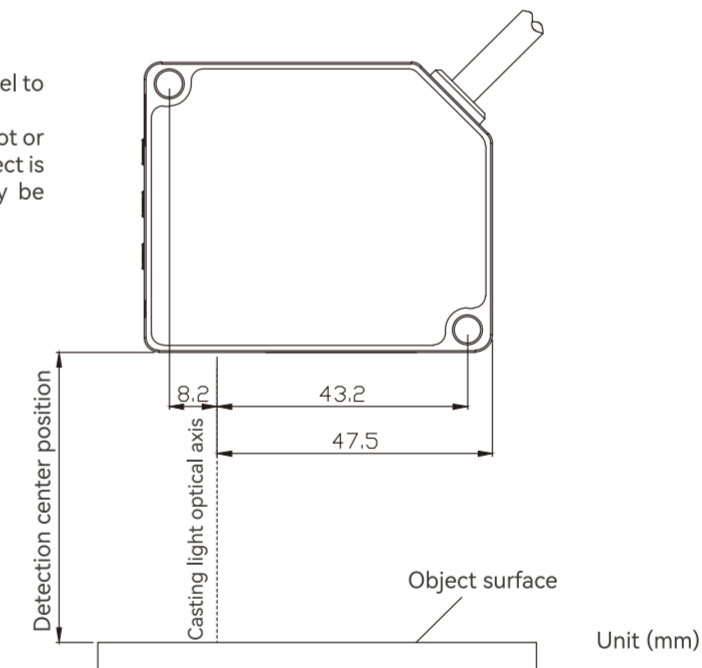
Model	Analog current output type		Analog voltage	RS485 comm
	DK-GFL-G-①		DK-GFL-G-②	DK-GFL-G-③
Supply voltage	DC12~24V (+10%/−5%)		DC18~24V (+10%/−5%)	DC12~24V (+10%/−5%)
Consumption current	Max 60mA with analog output value		Max 40mA	
Output	Switching output 1	NPN/PNP max 100mA/DC30V residual voltage 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°C (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.

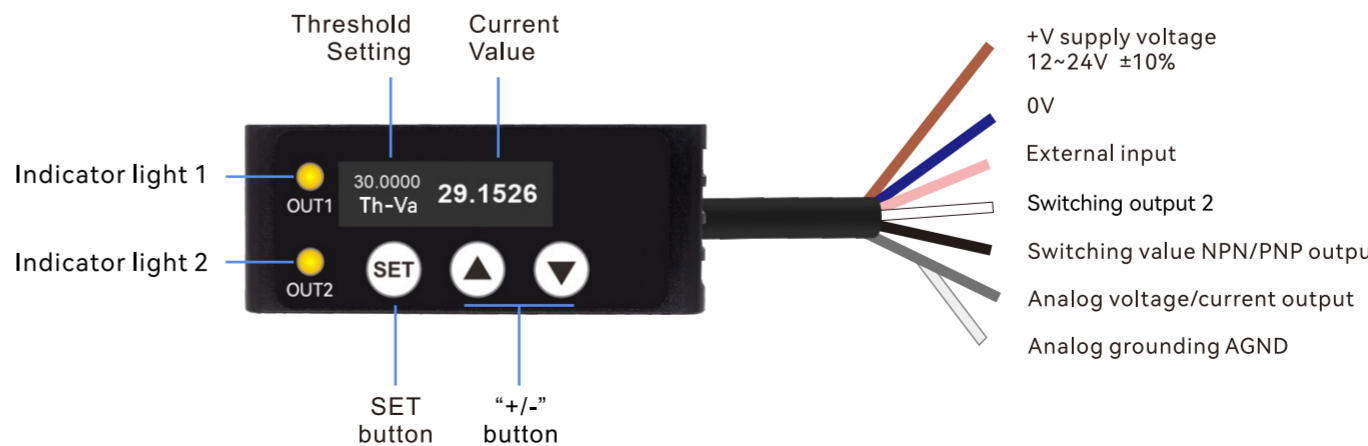
Mounting (diffuse reflection type)

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.

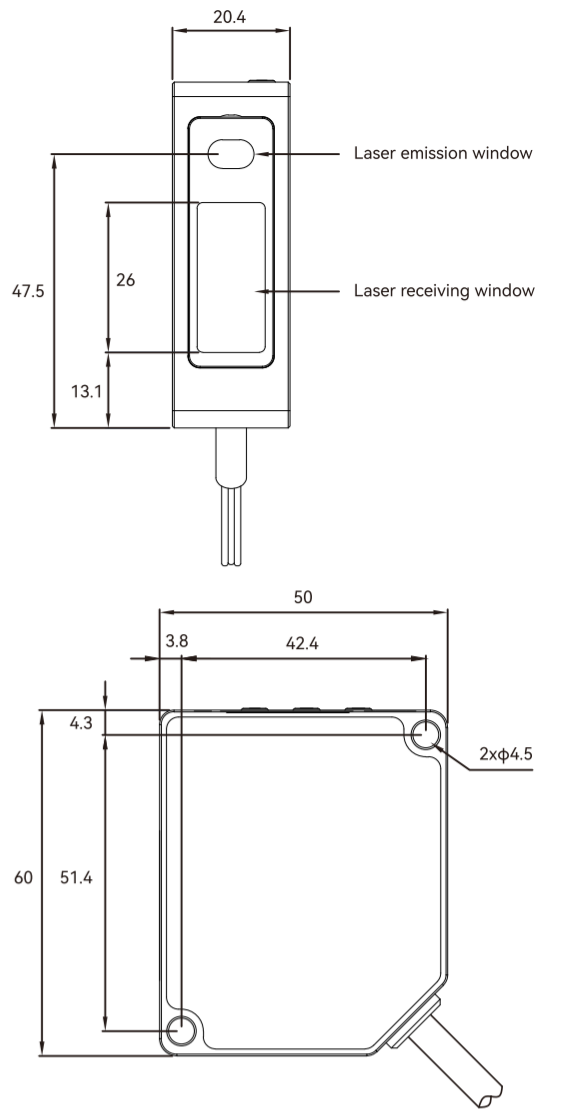
- When mounting, keep the lens surface of the sensor parallel to the surface of the object.
- Please note that when there is light leakage outside the spot or an object with a higher reflectivity than the measured object is present around the beam, the measurement error may be caused.



Name of operating unit

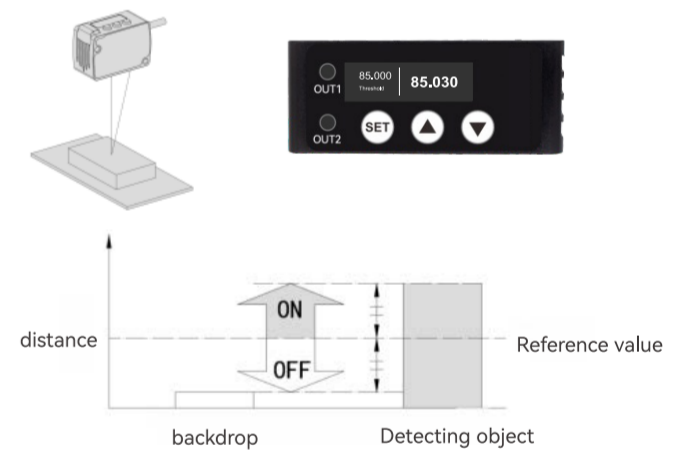


Outline dimensional drawing

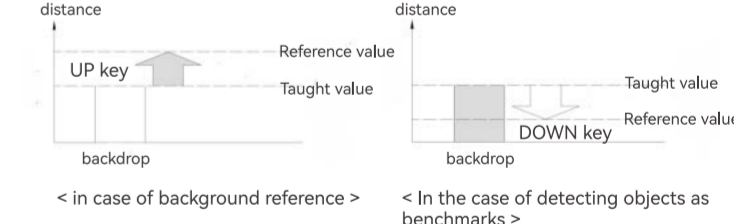


Function setting procedure

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)

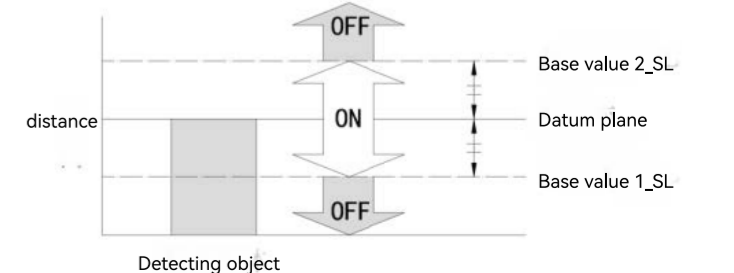


* Qualified Teaching
 In the case of small objects and backgrounds, how to use this teaching method is very convenient.



- 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.

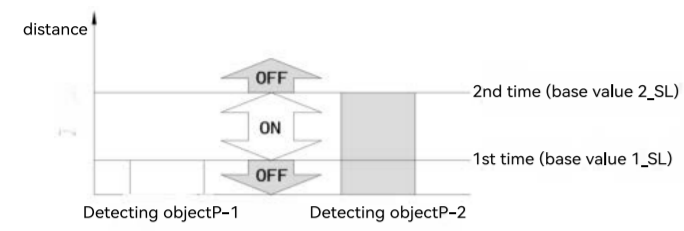
*1 point teaching (window comparison mode)
 - The method of setting the upper and lower limits is applied instead of the 1-point instruction for the distance from the datum surface of the detected object. This function is used to distinguish between the upper and lower limits.
 - In the case of 1-point 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"



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



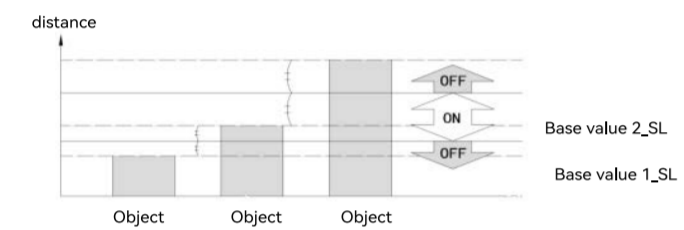
- * 2-point teaching (window comparison mode)
- Implement the 2-point instruction to set the benchmark value range method
- In the case of implementing 2-point teaching (window comparison mode), please set it to [2-point teaching (window comparison mode)] in the detection output setting of PRO mode. 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)



- 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.



- 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 switching 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

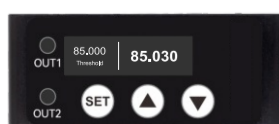
- Press the "SET" key and "▼" key at the same time to press the lock
- Press the "SET" key and "▼" key at the same time to unlock

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:



- 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



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

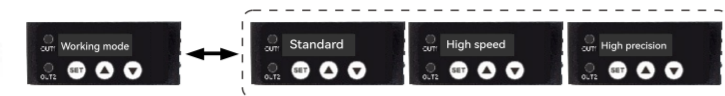
Menu setting

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



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



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)



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



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



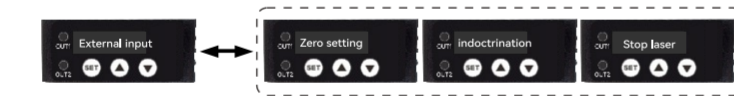
6. the difference: equivalent to the fine tuning of sensitivity, the detection of small differences can be adjusted to the lowest.



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;



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



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



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].



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



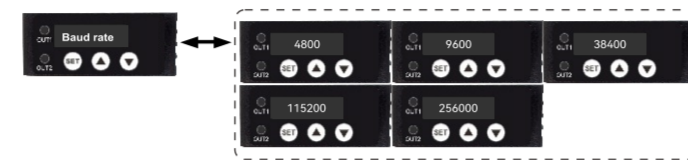
12. Language



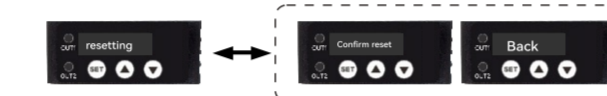
13. address (only 485 version has this menu)



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



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.



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

MODBUS PROTOCOL

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

Read data					
Address code	Function code	Register Address	Number of registers N	CRC	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 1 - Screen Selection
0x01	0x04	0x000B	0x0002	0x0009	Display 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 description
0x01	0x04	0x04	0x0000	0xB930	Reverse
0x01	0x04	0x04	0x0001	0x78F0	High precision
0x01	0x04	0x04	0x0002	0x38F1	Standard
0x01	0x04	0x04	0x0000	0xB930	High speed
0x01	0x04	0x04	0x0001	0x78F0	Normally open
0x01	0x04	0x04	0x0001	0x78F0	Normally closed
0x01	0x04	0x04	0x0000	0xB930	Usually detected
0x01	0x04	0x04	0x0001	0x78F0	A little instruction
0x01	0x04	0x04	0x0002	0x38F1	Two point teaching
0x01	0x04	0x04	0x0003	0xF931	Three point teaching
0x01	0x04	0x04	0x0000	0xB930	Stress difference
0x01	0x04	0x04	0x0001	0x78F0	Zeroing
0x01	0x04	0x04	0x0002	0x38F1	Teach
0x01	0x04	0x04	0x0000	0xB930	Stop laser
0x01	0x04	0x04	0x0001	0x78F0	Unlimited
0x01	0x04	0x04	0x0002	0x38F1	Output extension
0x01	0x04	0x04	0x0003	0xF931	Delayed output
0x01	0x04	0x04	0x0000	0xB930	Single output
0x01	0x04	0x04	0x0001	0x78F0	Timing time
0x01	0x04	0x04	0x0002	0x38F1	Reverse
0x01	0x04	0x04	0x0003	0xF931	Deviation
0x01	0x04	0x04	0x0000	0xB930	Keep open
0x01	0x04	0x04	0x0001	0x78F0	Keep off
0x01	0x04	0x04	0x0000	0xB930	Transmission error
0x01	0x04	0x04	0x0001	0x78F0	Change range
0x01	0x04	0x04	0x0002	0x38F1	Zeroing value
0x01	0x04	0x04	0x0003	0xF931	Threshold 1
0x01	0x04	0x04	0x0004	0xF931	Threshold 2
0x01	0x04	0x04	0x000012C0		4800
0x01	0x04	0x04	0x00002580		9600
0x01	0x04	0x04	0x00009600		38400
0x01	0x04	0x04	0x0001C200	0xFB24	115200
0x01	0x04	0x04	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
Address code	Function code	Register Address	Number of registers N	Bytes 2N	Register value
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
0x01	0x10	0x0000	0x0001	0x02	0x0000 0xA650
0x01	0x10	0x0001	0x0001	0x02	0x0001 0x6790
0x01	0x10	0x0002	0x0001	0x02	0x0000 0xA781
0x01	0x10	0x0003	0x0001	0x02	0x0001 0x6641
0x01	0x10	0x0004	0x0001	0x02	0x0002 0x2640
0x01	0x10	0x0005	0x0001	0x02	0x0000 0xA7B2
0x01	0x10	0x0006	0x0001	0x02	0x0001 0x6672
0x01	0x10	0x0007	0x0001	0x02	0x0000 0xA663
0x01	0x10	0x0008	0x0001	0x02	0x0001 0x67A3
0x01	0x10	0x0009	0x0001	0x02	0x0002 0x27A2
0x01	0x10	0x000A	0x0001	0x02	0x0003 0xE662
0x01	0x10	0x000B	0x0001	0x02	0x0000 0xA605
0x01	0x10	0x000C	0x0001	0x02	0x0001 0x67C5
0x01	0x10	0x000D	0x0001	0x02	0x0002 0x27C4
0x01	0x10	0x000E	0x0001	0x02	0x0000 0xA636
0x01	0x10	0x000F	0x0001	0x02	0x0001 0x67F6
0x01	0x10	0x0010	0x0001	0x02	0x0002 0x27F7
0x01	0x10	0x0011	0x0001	0x02	0x0003 0xE637
0x01	0x10	0x0012	0x0001	0x02	0x0000 0xA718
0x01	0x10	0x0013	0x0001	0x02	0x0001 0x66D8
0x01	0x10	0x0014	0x0001	0x02	0x0002 0x26D9
0x01	0x10	0x0015	0x0001	0x02	0x0000 0xA6C9
0x01	0x10	0x0016	0x0001	0x02	0x0001 0x67D9
0x01	0x10	0x0017	0x0001	0x02	0x0000 0xA6FA
0x01	0x10	0x0018	0x0001	0x02	0x0001 0x673A
0x01	0x10	0x0019	0x0001	0x02	0x0001 0x66EB
0x01	0x10	0x001A	0x0002	0x04	
0x01	0x10	0x001B	0x0002	0x04	
0x01	0x10	0x001C	0x0002	0x04	
0x01	0x10	0x001D	0x0002	0x04	
0x01	0x10	0x001E	0x0002	0x04	
0x01	0x10	0x001F	0x0001	0x02	
0x01	0x10	0x0020	0x0002	0x04	
0x01	0x10	0x0021	0x0002	0x04	
0x01	0x10	0x0022	0x0002	0x04	
0x01	0x10	0x0023	0x0002	0x04	
0x01	0x10	0x0024	0x0002	0x04	
0x01	0x10	0x0025	0x0002	0x04	
0x01	0x10	0x0026	0x0002	0x04	
0x01	0x10	0x0027	0x0002	0x04	
0x01	0x10	0x0028	0x0002	0x04	
0x01	0x10	0x0029	0x0002	0x04	
0x01	0x10	0x002A	0x0002	0x04	
0x01	0x10	0x002B	0x0002	0x04	
0x01	0x10	0x002C	0x0002	0x04	
0x01	0x10	0x002D	0x0002	0x04	
0x01	0x10	0x002E	0x0002	0x04	
0x01	0x10	0x002F	0x0002	0x04	
0x01	0x10	0x0030	0x0002	0x04	
0x01	0x10	0x0031	0x0002		