AKUSENSE



LASER DISPLACEMENT SENSOR

MLD25 Series

User's Manual

Thank you for choosing Akusense .Please read the manual carefully before using this product.
1. The product should be applied by someone with a certain level of electrical knowledge.
2. Please read and make sure that you understand how to operate the product before using it.
3. Please keep this manual readily accessible for future reference when needed.

SYMBOL

The following symbols are important information in this manual, please be sure to observe the following.

⚠	There is the risk of causing malfunction or fire, please do not exceed the rated voltage when using.
⚠	There is a risk of rupture, do not use AC power.
⚠	Danger of burns at high temperatures. .

PRECAUTIONS

- If there is stray light around the detection point or if there are objects with high reflectivity near the detection point, measurements may be affected.
- If specular reflection light enters the receiver, accurate measurements may not be possible.
- Pay attention to the installation if the detected object's reflectivity is high.
- For high-precision measurements, simulate scaling and span adjustments in the actual installation state.
- To ensure performance, preheat the device for 30 minutes after turning on the power before use.
- Do not install in the following locations:
  - Areas with a lot of dust, iron filings, or salt.
  - Areas with flammable materials nearby.
  - Locations with strong vibrations and impacts.
  - Places exposed to direct sunlight.
  - Areas where water, oil, or chemicals may splash.
  - Locations where loads are applied to the device.
- Use within the temperature range of -10℃ to 45℃, avoiding areas where freezing may occur.
- The lifespan of the semiconductor laser depends on the operating environment temperature.
- When used near heating areas, try to reduce the ambient temperature, such as through cooling.
- Ensure good heat dissipation during installation. When using at temperatures of 40℃ or higher, install on aluminum or iron surfaces with an area of 200 square centimeters or more.
- In strong electromagnetic fields, performance may be unsatisfactory.
- Keep the emitter and receiver clean, free from substances that refract light such as water, oil, and fingerprints. Avoid materials that obstruct light.

NOTED FOR USE LASER

Laser label

The product is classified as class 2 (II) laser product according to laser safety standard.
If the laser label on the machine is covered when installing the product, please stick the attached laser label in the visible position

CONFIRMATION OF PACKAGE CONTENTS

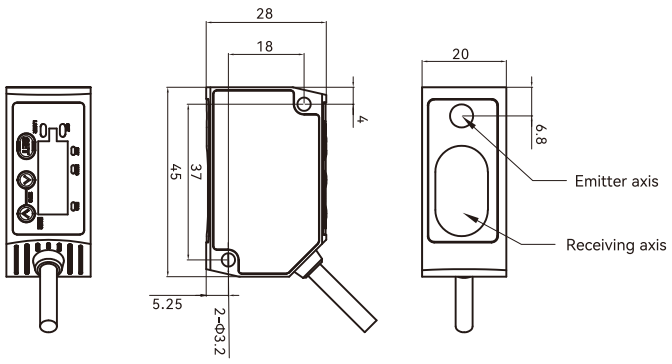
- Laser displacement meter body 1 set
- User Mannual 1 copy

SPECIFICATION

Model		MLD25-30NV	MLD25-50NV	MLD25-100NV	MLD25-200NV
	PNP	MLD25-30PV	MLD25-50PV	MLD25-100PV	MLD25-200PV
Working principle		Triangulation			
Housing		Retangular			
Optical working principle		Diffuse reflection			
Reference distance		30mm	50mm	100mm	200mm
Measuring range		25-35mm	35-65mm	65-135mm	120-280mm
Light source		Red laser, wavelength:655nm 1mW Class2			
Spot Size		ϕ40μm	Φ50μm	Φ80μm	Φ140μm
Switching mode		L.on/D.on/Botton/RS-485 switch			
Output mode		Switching output (NPN/PNP) / Analog output (Voltage 0-5V / Current 4-20mA)/RS-485 output			
Response time		< 10ms/5ms/1.5ms			
Linearity		±0.1% F.S.			±0.2% F.S.
Repeatability		10um	30um	70um	200um
Temperature drift characteristics		0.03%/℃ F.S.			
Operating voltage		12~24V DC±10%			
Current consumption		< 65mA(12V), < 40mA(24V)			< 40mA(24V), < 80mA(12V)
Load current		≤100mA			
Insulation sesistance		> 500MΩ (500V DC)			
Dielectric strength		< 0.1mA(1000V AC)			
Protection circuit		Reverse polarity protection / short circuit protection / overload protection / surge protection			
Operating temperature		-10~+45℃(No freezing)			
Operating humidity		35~85%RH(no condensation)			
Ambient illumination		Ambient light: ≤10000 lux without interference; incandescent lamp: ≤3000 lux			
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude, 2 hours for each X, Y, and Z directions			
Enclosure rating		IP67			
Connection type		2m 7-pin composite cable			
Dimension		20x28x45mm			
Material		Body: die-cast aluminum; Front cover: acrylic-based			
Weight		90g			
Accessories		Cable			

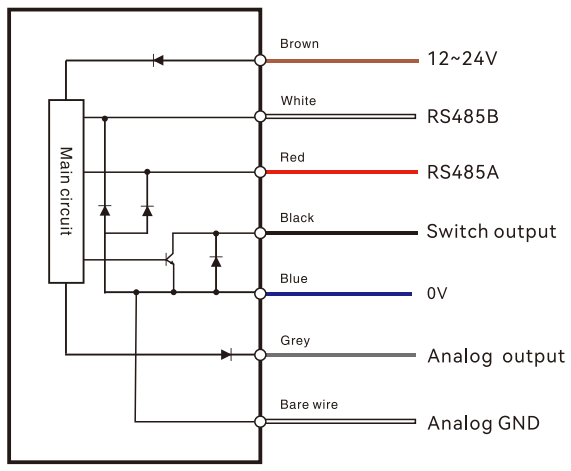
SIZE SPECIFICATION

Unit: mm

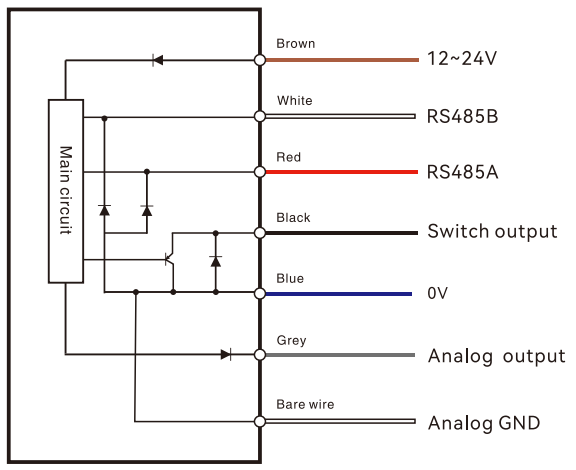


CIRCUIT DIAGRAM

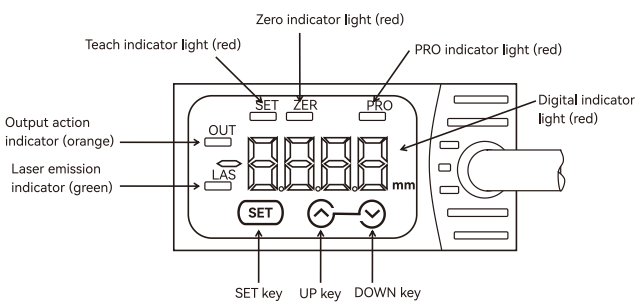
NPN Output



PNP Output



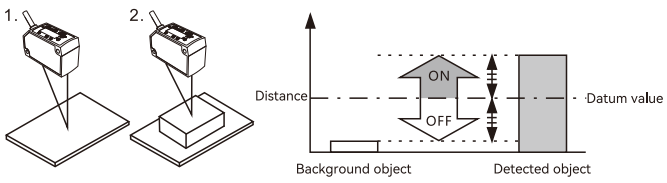
DESCRIPTION OF EACH PART



TEACH

(1) 2-point teaching

Basic teaching methods

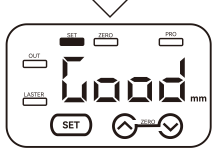




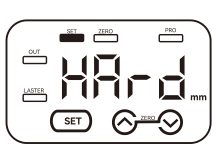
1. In the state of background objects, press the SET key.



2. In the state of detecting objects, press the SET key.



If it can be detected stably, Good is displayed.

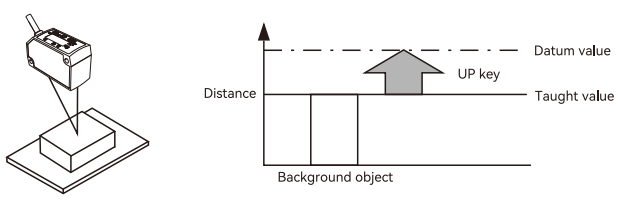


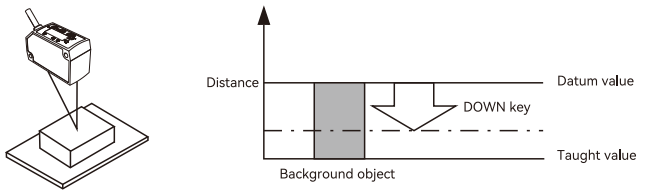
When stable detection cannot be performed, HArd is displayed.

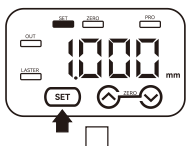
(2) Limited teaching

It is very convenient to use this teaching method when there are tiny objects and background objects.

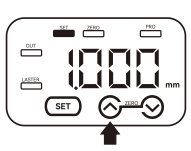
〈When the detection object is the reference>

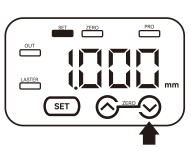






1. In the state of background objects, press the SET key.





2. In the state of background objects, press the UP key to increase the reference value.In the state with background objects, press the DOWN key to lower the reference value.

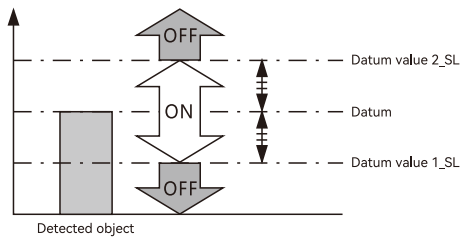
automatic



3. Teaching ends.

(3) 1-point teaching (window comparison mode)

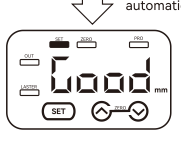
For the distance from the reference surface of the sensing object, the method of setting the upper limit and lower limit is performed instead of one-point teaching. exist use this function when judging within the upper and lower limits.
When implementing 1-point teaching (window comparison mode), please set it to [1-point teaching (window comparison mode) in the detection output setting of PRO mode in advance.port compare mode)].
For the setting method, please refer to "PRO Mode Operation Instructions".





1. In the state of background objects, press the SET key twice. (first time: SET mode, second time: teaching)

automatic

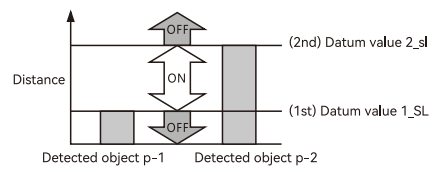


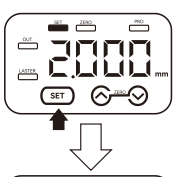
2. Teaching ends.

(4) 2-point teaching (window comparison mode)

This is the method to execute 2-point teaching and set the reference value range.
When 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 in advance.or compare mode).

For the setting method, please refer to "PRO Mode Operation Instructions".
When performing teaching, use sensing objects with different distances (P-1, P-2).





1. Press the SET key when there is the detection object P-1. (first)



2. Press the SET key in the state where the detection object P-2 is present. (the second time)



In the case of stable detection.

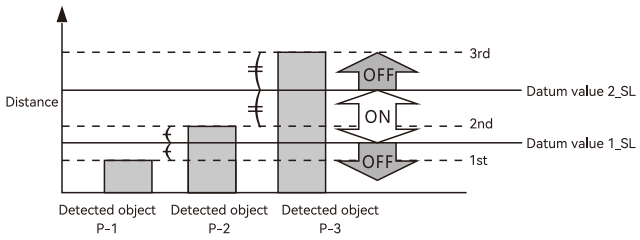


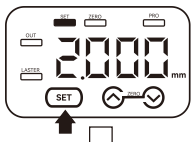
When the detection cannot be performed stably.

(5) 3-point teaching (window comparison mode)

Perform 3-point (P-1, P-2, P-3) teaching, as shown in the figure below,
set the reference value 1_SL between the 1st and 2nd time,It is a method to set the threshold value 2_SL between the first and third times and set the threshold value range.When performing 3-point teaching (window comparison mode), please set it to [3-point teaching (window comparison mode) in the detection output setting of PRO mode in advance.port compare mode)].

For the setting method, please refer to "PRO Mode Operation Instructions".
When performing teaching, use sensing objects with different distances (P-1, P-2, P-3).
After teaching, P-1, P-2, P-3 will follow the automatically arranged in ascending order.




1. Press the SET key when there is the detection object P-1. (first)


2. Press the SET key in the state where the detection object P-2 is present. (the second time)


3. Press the SET key when there is the detection object P-3. (the third time)


In the case of stable detection.

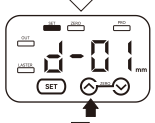

When it cannot be detected stably.

(6) Span of ascending differential mode or descending differential mode

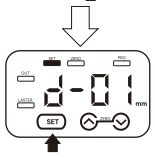
Please use it only when detecting sudden measured value changes while canceling gentle measured value changes.
When using the rising differential or falling differential mode, please set the detection output setting of the PRO mode to "rising differential" or "downward differential" in advance.down-differential mode".

For the setting method, please refer to "PRO Mode Operation Instructions"
The reference value can be set using the reference value fine-tuning function.
For the fine-tuning function of the threshold value, please refer to "fine-tuning function of the threshold value".


1. Press the SET key to enter.

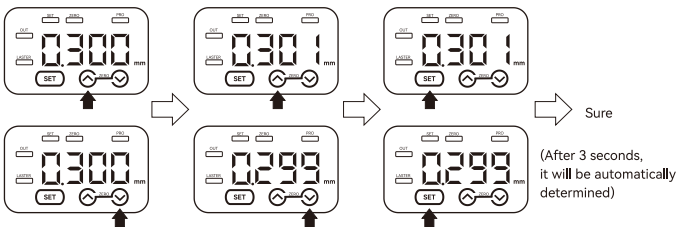

2. Press the UP key or DOWN key to select the span.

span too short ⇨ d-01 ⇨ d-02 ⇨ · · · · ⇨ d-07 ⇨ d-08 span too long


3. Press the SET key to confirm.

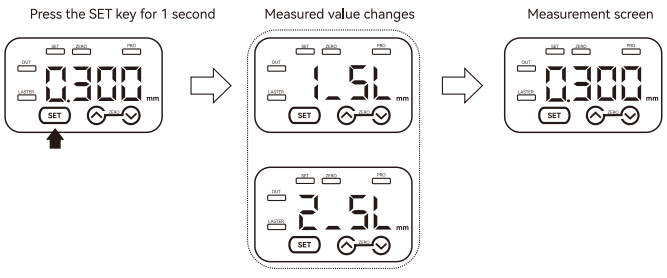
BENCHMARK FINE-TUNING FUNCTION

The reference value can be fine-tuned on the measurement screen.
The reference value can also be fine-tuned after teaching.
<Normal detection mode, rising differential mode or falling differential mode>

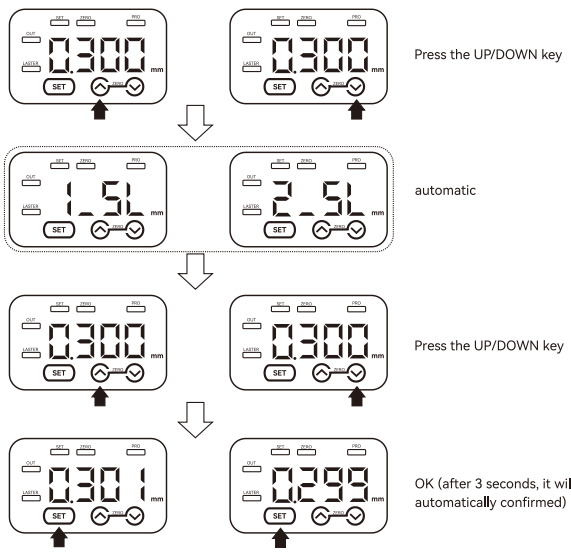


<window comparison mode>

When the detection output is set to the window comparison mode, press the SET key for 1 second to change the display of "1-5L" and "2-5L"switch.



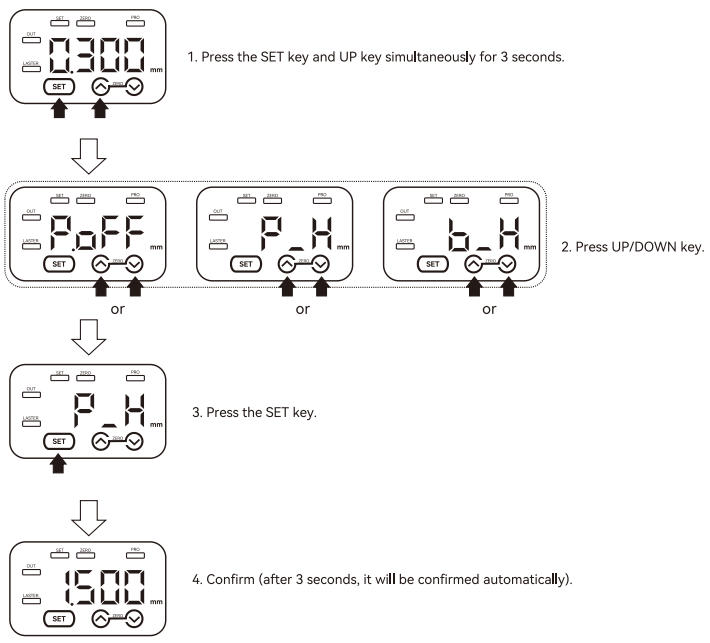
To fine-tune the reference value of "1-5L" or "2-5L", press the UP key or DOWN key to display "1-5L" or after "2-5L", you can fine-tune the reference value.



PEAK VALUE AND VALLEY VALUE HOLD FUNCTION

The peak and valley hold function refers to the function of displaying peak and valley values.
When the peak and valley hold function is set to "peak hold" or "valley hold", the measured value held when the zero adjustment function is executed the set value will be reset to zero.

Array display	Name	Function
P.oFF	Release hold function	Contact hold state, output the current measured value
P_H	Peak Hold	Hold the maximum value of the measured value
b_H	Valley Hold	Keep the measured value to a minimum

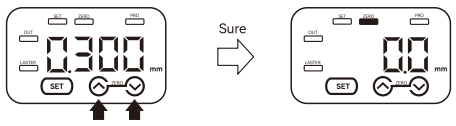


ZERO ADJUSTMENT FUNCTION

The zero-adjustment function is a function to forcibly "zero-adjust" the measured value.
When zero adjustment is set, the zero adjustment indicator (red) lights up.
When the peak value and bottom value hold functions are enabled, once the zero adjustment function is executed, the held measurement values will be reset.
Indicates that when the offset is set, the zero adjustment function cannot be set.

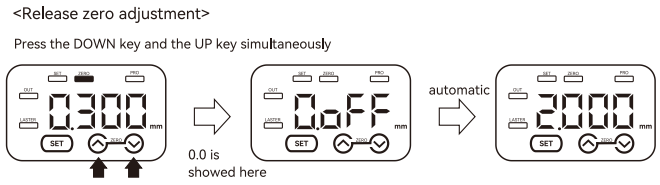
<ZERO ADJUST SETTING>

Press the DOWN key and the UP key simultaneously



<Release zero adjustment>

Press the DOWN key and the UP key simultaneously

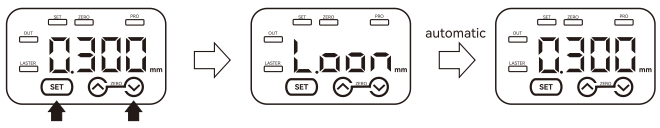


KEY LOCK FUNCTION

The key lock function means that the key operation is not accepted, so as not to change the setting conditions in each setting mode by mistake.
After setting the key lock, if the key is operated, the display of "Loc" will appear on the digital display.

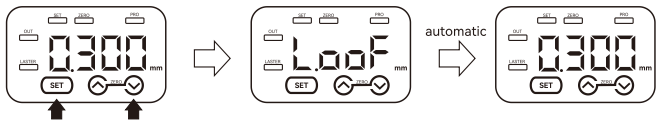
<Set key lock>

Simultaneously press the keys SET and DOWN for 3 seconds



<Unlock key lock>

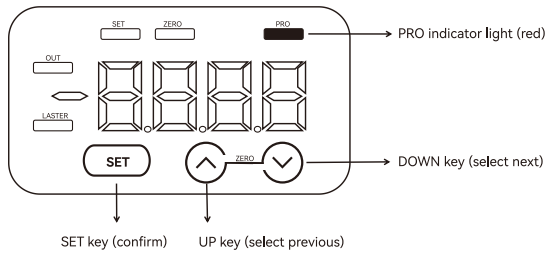
Simultaneously press the keys SET and DOWN for 3 seconds



PRO MODE SETTING

Press the DOWN key for more than 3 seconds to enter the PRO mode. When the PRO mode is set, the PRO indicator (red) will light up.
In the process of setting PRO mode, if the DOWN key is pressed for 3 seconds or more, it will return to the measurement screen.

Key description of each part of PRO



PRO mode setting content:

Project	Initial state	Contents
Set reaction speed	H.rSo	Set the reaction time. H.rSo: High precision 20 times average 10ms Std : Standard 10 average 5ms FASt: High speed 3 times average 1.5ms
Set output state	L-on	Select the operating state mode of the control output. L-on: Light incident on, normally off d-on: the incident light is normally open
Set detection output	_ _ [^	Set the detection output. _ _ [^ : Normal detection mode _ N_. 1: 1 point teaching _ N_. 2: 2 point teaching _ N_. 3: 3 point teaching d_L : rising differential d ^ [: Descent Differential
Set hysteresis	0.2	Set the hysteresis when comparing output, the range is 0.1mm~80.0mm.
Set timer	non	Set the action state of the timer. non: no timing oFD: delayed shutdown ond: delayed action oSD: single shot mode
Set delay output	5.0	Set output delay time 0.1~999.9ms.
Set analog output	U_5	Set the analog output mode. U_5 : 5V voltage output I.oUE: current output mode
Set display	Std	Set the display method of measured values. Std : standard, display +80 ~ -80mm InvE : reverse, display -80 ~ +80mm oFSt: offset, display 160 ~ 0 mm
Set hold	OFF	Control output and mode when measurement error occurs (insufficient light, light saturation, outside the measurement range) Analog output settings. OFF: off, over-range display "-----" ON: open, keep the last valid measurement value, and flash
Automatic screen off setting	OFF	If there is no button operation within 30s, the display screen goes out and the current consumption is controlled. OFF: off ON: Turn on, turn off the digital tube display if there is no key operation for 30 seconds
Device address setting	1	Device address setting range 1~247
Baud rate setting	115.2	Set the baud rate of 485 communication. 9600、19200、38400、57600、115200、128000、230400、256000、460800、512000、600000、750000、921600
Reset settings	NO	Erase the memory to save and return to the original state. Yes: Confirm reset (restore factory settings) NO: Do not reset

PRO mode operation instructions:

① On the measurement screen, press and hold the DOWN key for 3 seconds to enter the PRO mode;
② Press the SET button in PRO mode to confirm the selection;
③ Press the UP key in PRO mode to select the previous one;
④ Press the DOWN key in PRO mode to select the next one;
⑤ In PRO mode, long press the DOWN key for 3 seconds to exit.

Introduction to PRO menu operation

A menu	Secondary menu	Submenu
Measurement screen	SPEd: set reaction speed	H.rSo: high precision
		Std: standard
		FASt: high speed
	L-d: set the output state	L-on : Light incident on, normally off
		d-on : the incident light is normally open
	SEnS : Set detection output	_ _ [^ : Normal detection mode
		_ n_. 1: 1 point teaching
		_ n_. 2: 2 point teaching
		_ n_. 3: 3 point teaching
		d_L : rising differential
		d ^ L : Falling Differential
	HYS: set hysteresis	Set the hysteresis when comparing the output, the range is 0.1mm~80.0mm
	dELY set timer	non: no timing
		oFd: delayed shutdown
		ond: delayed action
		oSd: single shot mode
	dLYn: set delay output	Set output delay time 0.1~999.9ms
	A.oUt: set analog output	U_5 : 5V voltage output
		I.oUt: current output mode
	dISP: setting display	Std : standard, display +80 ~ -80mm
		InvE : reverse, display -80 ~ +80mm
		oFSt: offset, display 160 ~ 0 mm
	HoLd: setting hold	oFF: off, over-range display "-----" on: on, keep the last valid measured value, and flash
	Eco: automatic screen off setting	oFF: off
		on: open, no button operation for 30 seconds to turn off the digital tube display
	ArrD Device address setting	Device address setting range 1~247
	bAud: baud rate setting	9.6
		19.2
		38.4
		57.6
		115.2
		128.0
		230.4
		256.0
		460.8
		512.0
		600.0
		750.0
		921.6
	rSEt: reset setting	Yes: Confirm reset (restore factory settings)
		no: do not reset

ERROR DISPLAY

The following actions should be taken when an error is displayed:

Error display	Contents	Deal with
<Save OFF> ---- <Save ON> Measured value blinks	The amount of reflected light is insufficient, and the detected object is out of range.	Please confirm whether the detection object is within the measurement range. please adjust the installation angle of the sensor.
Er01	The flash memory is damaged, or its service life has expired.	Please consult our company.
Er11	detects the excessive current caused by the output load short circuit.	Please cut off the power and confirm the load.
Er31	· Failed to measure properly during zero adjustment. · The zero adjustment function cannot be used because the display setting is set to offset.	· Please confirm whether the detection distance is within the specification range. · Set the display setting to something other than offset.
Er41	Failed to measure normally when performing teaching.	Please confirm whether the detection distance is within the specification range.

COMMUNICATION COMMAND FORMAT AND COMMAND LIST

- Communication Command Format: Follows the standard Modbus RTU protocol.
- Supported baud rates: 9.6k, 19.2k, 38.4k, 57.6k, 115.2k (initial), 128k, 230.4k, 256k, 460.8k, 512k, 600k, 750k, 921.6k
- Supported Communication Addresses: 0001H~00F7H, default address 01H.

● Command Format Examples:

Note: The register address, register quantity, data, and CRC are all in high byte first order.

03 Send: Slave Address + Function Code + Register Address + Register Quantity + CRC16
03 Response: Slave Address + Function Code + Byte Count + Data + CRC16

06 Send: Slave Address + Function Code + Register Address + Data + CRC16
06 Response: Slave Address + Function Code + Register Address + Data + CRC16

10 Send: Slave Address + Function Code + Register Address + Register Quantity + Byte Count + Data + CRC16
10 Response: Slave Address + Function Code + Register Address + Register Quantity + CRC16

● Example: Retrieve Measurement Value

Send Command: 01 03 25 12 00 02 6F 02
Response Command: 01 03 04 00 12 51 1A E6 6D
Data Content: 0x0012511A = 1200410，that is 1200410/10000 = 120.0410mm
The response data is magnified by 10000 times. The magnification factor varies by model.

Send Command Format			Response Command Format		
Device Address	01H		Device Address	01H	
Function Code	03H		Function Code	03H	
Register Address High Byte	25H		Response Byte Count	04H	
Register Address Low Byte	12H		Response Data High Byte	00H	
Register Quantity High Byte	00H			12H	
Register Quantity Low Byte	02H		Response Data Low Byte	51H	
CRC High Byte	6FH			1AH	
CRC Low Byte	02H		CRC High Byte	E6H	
			CRC Low Byte	6DH	

● For example, write output mode

Send Command: 01 06 25 15 00 01 52 C2
Response Command: 01 06 25 15 00 01 52 C2
Data Content: 0x0001, which means the output mode is normally closed

Send Command Format			Response Command Format		
Device Address	01H		Device Address	01H	
Function Code	06H		Function Code	06H	
Register Address High Byte	25H		Register Address High Byte	25H	
Register Address Low Byte	15H		Register Address Low Byte	15H	
Register Quantity High Byte	00H		Response Data High Byte	00H	
Register Quantity Low Byte	01H		Response Data Low Byte	01H	
CRC High Byte	52H		CRC High Byte	52H	
CRC Low Byte	C2H		CRC Low Byte	C2H	

● For example, the continuous write output mode is normally closed and the output response speed is high.

Send Command: 01 10 25 15 00 02 04 00 01 00 02 44 0C
Response Command: 01 10 25 15 00 02 5B 00
Data Content: 0x0001, which means the output mode is set to normally closed
Data Content: 0x0002, which means the output response speed is set to high-speed mode

Send Command Format			Response Command Format		
Device Address	01H		Device Address	01H	
Function Code	10H		Function Code	10H	
Register Address High Byte	25H		Register Address High Byte	25H	
Register Address Low Byte	15H		Register Address Low Byte	15H	
Register Quantity High Byte	00H		Register Quantity High Byte	00H	
Register Quantity Low Byte	02H		Register Quantity Low Byte	02H	
Write Byte Count	04H		CRC High Byte	5BH	
Write Data 1 High Byte	00H		CRC Low Byte	00H	
Write Data 1 Low Byte	01H				
Write Data 2 High Byte	00H				
Write Data 2 Low Byte	02H				
CRC High Byte	44H				
CRC Low Byte	0CH				

Function	Deposit Device (high)	Deposit Device (low)	R/W (Write/ read)	Illustrate	Remark
Model	C8H	00H	R	C8H=200mm model	
Measurements	C8H	01H	R	Range 1180~2820, 0=over range or none effect	
Read output status	C8H	02H	R	0=OFF	
				1=ON	
Output mode	C8H	03H	RW	0=L-ON normally open	
				1=D-ON normally closed	
Output response speed	C8H	04H	RW	0=high precision (10ms)	
				1=Standard (5ms)	
				2=High speed (1.5ms)	
Threshold 1	C8H	05H	RW	Setting range 1200~2800	
Threshold 2	C8H	06H	RW	Setting range 1200~2800	
Differential amount	C8H	07H	RW	Setting range 1~800	
Differential span	C8H	08H	RW	Setting range 0~7	
Hysteresis width	C8H	09H	RW	Setting range 1~800	default 0.2
Time-lapse mode	C8H	0AH	RW	0=OFF	
				1=delay off	
				2=Delay on	
				3=single output	
Delay output time	C8H	0BH	RW	Setting range 0.1~999.9ms 0=normal detection	Default 5.0ms
Detection and teaching Mode	C8H	0CH	RW	mode, basic teaching and limit fixed teaching	
				1= 1 point teaching, window comparison	
				2= 2 point teaching, window comparison	
				3= 3 point teaching, window comparison	
				4= Rising differential mode	
				5=Drop differential mode	
Zero amount	C8H	0DH	RW	Setting range 1200~2800	default 2000
Zero switch	C8H	0EH	RW	0=OFF	
				1=ON	
Display method	C8H	0FH	RW	0=normal	
				1=Reverse	
				2=offset	
Effective measurement value guarantee hold	C8H	10H	RW	0=OFF	
				1=ON	
Peak hold setting	C8H	11H	RW	0=OFF	
				1=Peak	
				2=Bottom	
				3=reset	
ECO economy mode	C8H	12H	RW	0=OFF	
				1=ON	
Key lock	C8H	15H	RW	0=OFF	
				1=ON	
Analog output Module mode	C8H	16H	RW	0=U_5(5V)	
				1= I.oUt(4~20mA)	
Baud rate	C8H	18H	RW	0= 9600	
				1= 19200	
				2= 38400	
				3= 57600	
				4= 115200	
				5= 230400	
				6= 312500	
				7= 468750	
				8= 500000	
				9= 625000	
				10= 833333	
				11= 937500	
				12= 1250000	
Setup save settings	C8H	19H	W	0=Abandon the current setting and restore the previous setting	
				1=Save, and overwrite previous settings	
Restore factory settings	C8H	1AH	W	0=OFF	
				1=ON	
Hardware version	C8H	1FH	R	sensor hardware version	
Software version	C8H	20H	R	sensor software version	
Product number	C8H	21H~ 29H	R	Product reference (18 bytes)	
Production serial number	C8H	2AH~ 35H	R	Production serial number (24 bytes)	

*1 Comply with IEE754 standard, little endian storage, such as 0xC2 0x8F 0x40 0xE5 expressed as 7.18
*2 MLD25-200 setting range: 118000-282000
MLD25-100 setting range: 640000-1360000
MLD25-50 setting range: 345000-655000
MLD25-30 setting range: 2470000-3530000"
*3 MLD25-200 setting range: 120000-280000
MLD25-100 setting range: 650000-1350000
MLD25-50 setting range: 350000-650000
MLD25-30 setting range: 2500000-3500000"
*4 MLD25-200 setting range: 100-80000
MLD25-100 setting range: 200-350000
MLD25-50 setting range: 100-150000
MLD25-30 setting range: 100-50000"

*5 For example: 0102H means version V01.02

*6 Product model such as: MLD25-200NV

Note: Writing operations are only possible in the measurement interface.