

Length Angle Sensor

LWG200



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User's Manual

Version: Bv2

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User's Manual

Length Angle Sensor

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Version History

Versions	Date	Release	Author	Change
Av1	2021/10/26	N	Chenmo	First Edition
Av2	2021/10/27	N	Chenmo	Adding communication protocols
Av3	2022/5/13	N	Chenmo	Modify communication protocol
Av4	2022/5/17	N	Chenmo	Modify the effect image
Av5	2022/5/20	N	Chenmo	Modify the installation method
Av6	2022/5/24	Y	Chenmo	Modify the drawing
Bv1	2023/3/16	N	Chenmo	Modify
Bv2	2023/3/24	Y	Chenmo	Add mounting gasket instructions, add length redundancy signal accuracy, add length signal deviation alarms

1. Security instructions

1.1. Copyright

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1.2. Company Statement

This manual has been verified and reviewed for accuracy. The instructions and descriptions contained in this manual are accurate for the LWG200 Series Length Angle Sensor at the time of publication. However, future LWG200 Series Length and Angle Sensors and their manuals are subject to change without notice. Xuzhou Mook Electro-Hydraulic Control Co.,Ltd. shall not be liable for damages arising directly or indirectly from errors, omissions or discrepancies between the product and the manual.

1.3. Signs and meanings used in the manual

Icons	Meaning	Detailed description
	Danger	Predictable leading to unavoidable serious injury, death or property damage
	WARNING	Likely to result in unavoidable serious injury, death or property damage
	Caution	May result in minor injuries and damages
	Hints	Non-safety related use instructions and information
	Note	Additional instructions or recommendations for use

2. Products

2.1. Products

LWG200 series length angle sensor consists of length detecting unit and angle detecting unit, which can realize length and angle measurement. This series of length and angle sensors are suitable for length measurement of telescopic mechanism and inclination measurement of luffing mechanism, such as crane two-section boom length measurement, telescopic aerial work truck and outrigger length measurement and other applications.

2.2. Technical Parameters

Technical Parameters	
Operating Voltage	8~36V DC
Operating Temperature	-40℃~+85℃
Storage Temperature	-40℃~+85℃
Signal Type	CANOpen
Supported Maximum Stretch Rate	1m/s
Length Measurement Range	0~5m/0~7m/0~10m/0~12.5m/0~15m
Length Measurement Accuracy	Length signal: $\pm 0.5\%$ FS, redundant length signal: $\pm 1\%$ FS
Length signal deviation alarm	$\pm 1.6\%$
Length measurement repeatability error	$\pm 0.1\%$ FS
Angle Measurement Range	360°
Angle Measurement Accuracy	$\pm 0.3^\circ$
Protection class	IP66/IP67
Test Standards	
Low temperature test	Execution standard: GB/T2423.01/IEC60068-2-1 -40℃ low temperature start test, 10 times, start normal -40℃ low temperature working test 16h -40℃ low temperature storage test 72h
High temperature test	Execution standard: GB/T2423.02/IEC60068-2-2 +85℃ high temperature full load working test 16h +85℃ high temperature storage test 72h
Temperature shock test	Execution standard: GB/T2423.22/IEC60068-2-14 Low temperature -40℃, high temperature 85℃, high and low temperature conversion time 3min, cycle times 10 times
Temperature and humidity cycle test	Execution standard: GB/T2423.34/IEC60068-2-38 High temperature $65 \pm 2^\circ\text{C}$, $93 \pm 3\%$; room temperature $25 \pm 2^\circ\text{C}$, $93 \pm 3\%$; low temperature -10℃, 24h for a cycle, for ten cycles
Vibration test	Execution standard: GB/T2423.10/IEC60068-2-6 sinusoidal vibration Vibration (sinusoidal) 10~500Hz, 10g, 4h vertically, 2h horizontally left and right, front and back, total 8h
Shock test	Execution standard: GB/T2423.5/IEC60068-2-27 40g/11ms, half sine wave, 100 times in each of the three axes
Drop test	Execution standard: GB/T2423.8/IEC60068-2-32 Transportation status (with bubble bag packaging), drop height 1000mm, 2 times
Salt spray test	Execution standard: GB/T2423.17/IEC60068-2-11 Under 35℃, 5% sodium chloride salt spray environment, 96h test in uncharged state, no rust and corrosion of shell, connector and other parts after the test, and work normally after connecting to the test voltage.
EMC	EN 61000-6-2:2005; EN 61000-6-4: 2011; ISO 7637 immunity; ISO 11452 immunity; ISO 16750 immunity

2.3. Part numbers

No.	Material No.	Material Description	Output Signal	Redundancy	Measuring Range
1	234791	LWG200-050360-130-Na	CAN	Non-redundant	0~5m
2	234792	LWG200-050360-110-Na	4~20mA	Non-redundant	
3	236638	LWG200-050360-330-Na	CAN	Redundant	
4	231878	LWG200-100360-130-Na	CAN	Non-redundant	0~10m
5	231712	LWG200-100360-110-Na	4~20mA	Non-redundant	
6	231879	LWG200-100360-330-Na	CAN	Non-redundant	
7	235282	LWG200-150360-130-Na	CAN	Non-redundant	0~15m
8	234794	LWG200-150360-110-Na	4~20mA	Non-redundant	
9	236637	LWG200-150360-330-Na	CAN	Non-redundant	
10	234793	LWG200-125360-110-Na	4~20mA	Non-redundant	0~12.5m

2.4. Product Code Description

LWG 200 - 050 360 - 1 3 0 - Na

Product Model
LWG: Length Angle Sensor

Series Code
200: 200 series

Measuring length range
050: 0~5m
070: 0~7m
100: 0~10m
125: 0~12.5m
150: 0~15m

Measuring Angle Range
360: 360°

Security Architecture Code
1: Non-redundant
3: Redundant

Output signal
1: 4~20mA
3: CANOpen

Length measurement line code
0: Wire rope

Other symbols
Na: No other symbols

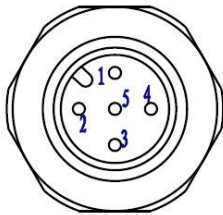
3. Port Description

3.1. Connectors

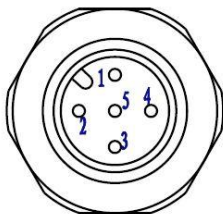
The LWG200 series length and angle sensors utilize the M12 five-pole pin socket as the product connector.

3.2. Pin Definition

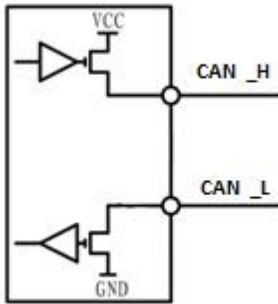
3.2.1. CAN type

	Pin	Pin Definition
	1	Shield
	2	Power
	3	Ground
	4	CAN_H
	5	CAN_L

3.2.2. Current Type

	Pin	Pin Definition
	1	Power supply
	2	Ground
	3	Length Signal
	4	Angle Signal
	5	Spare

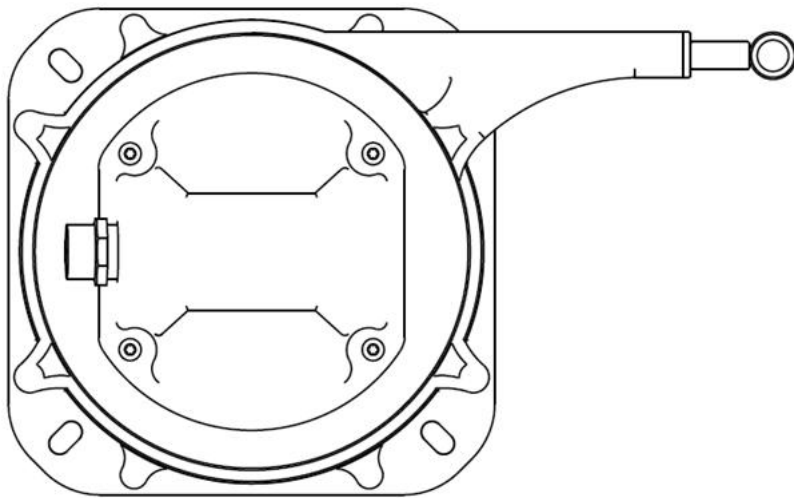
3.3. Communications port

Schematic	
Communication Protocol	CAN2.0B
Port Protection	CAN_H and CAN_L have short circuit protection for UB and GND respectively.
Termination Resistor	No built-in termination resistor

4. Installation Instructions

4.1. Pre-installation inspection

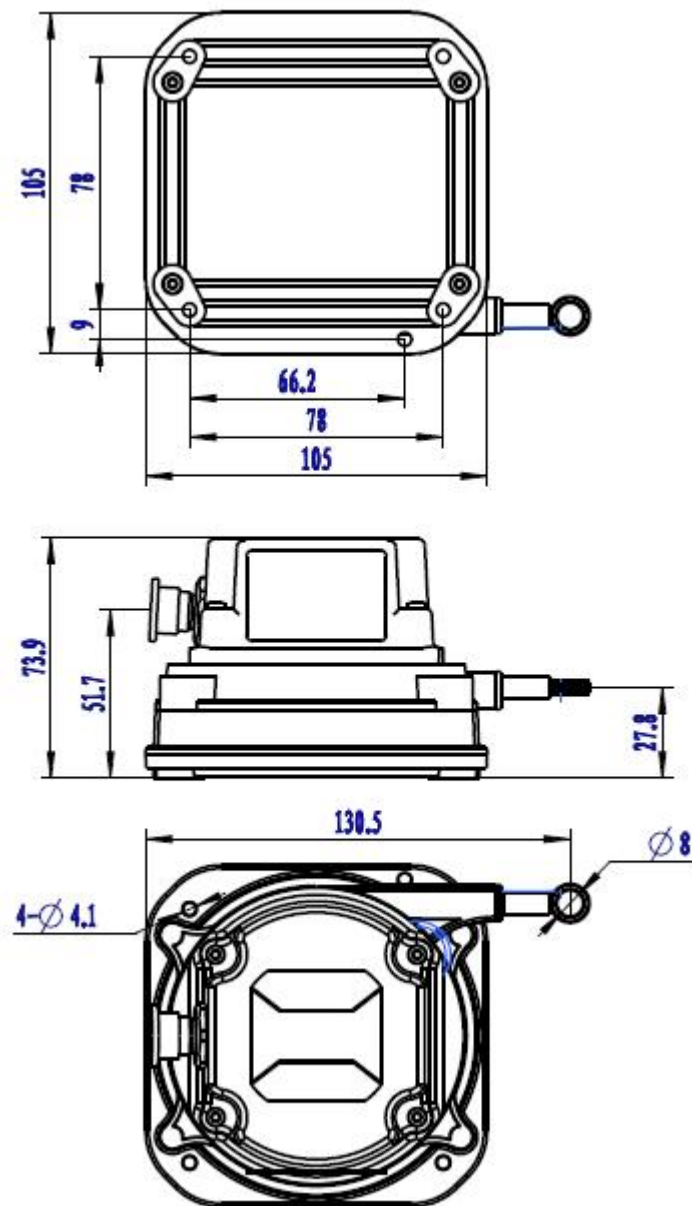
	Tip. LWG200 series length and angle sensors have been pre-tensioned at the factory, before installation, please check whether the product status is intact, no bumps, please make sure that the wire rope is wrapped around the collar, and the tie is intact. Please make sure that the wire rope is wrapped around the collar and tightened properly, as shown in the figure below:
---	---



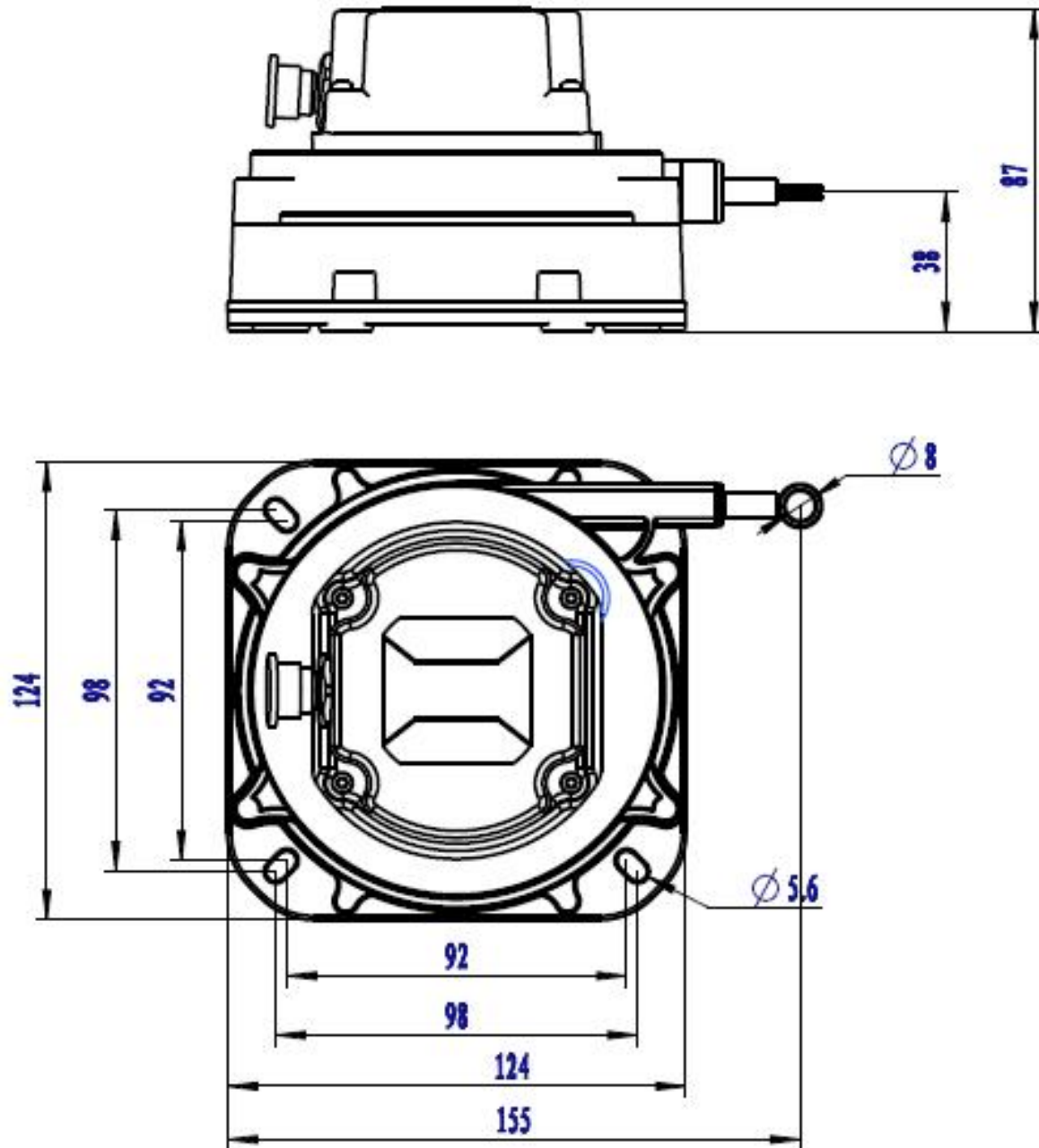
	Caution. (1) If you find that the sensor wire rope is not firmly connected to the ring before installation, please do not carry out the installation operation, please contact our service personnel to solve the problem; (2) Before the sensor is installed, the crane telescopic boom (or other telescopic equipment) on which the sensor is to be installed should be in a fully retracted state.
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4.2. Outline and Installation Dimension Drawing

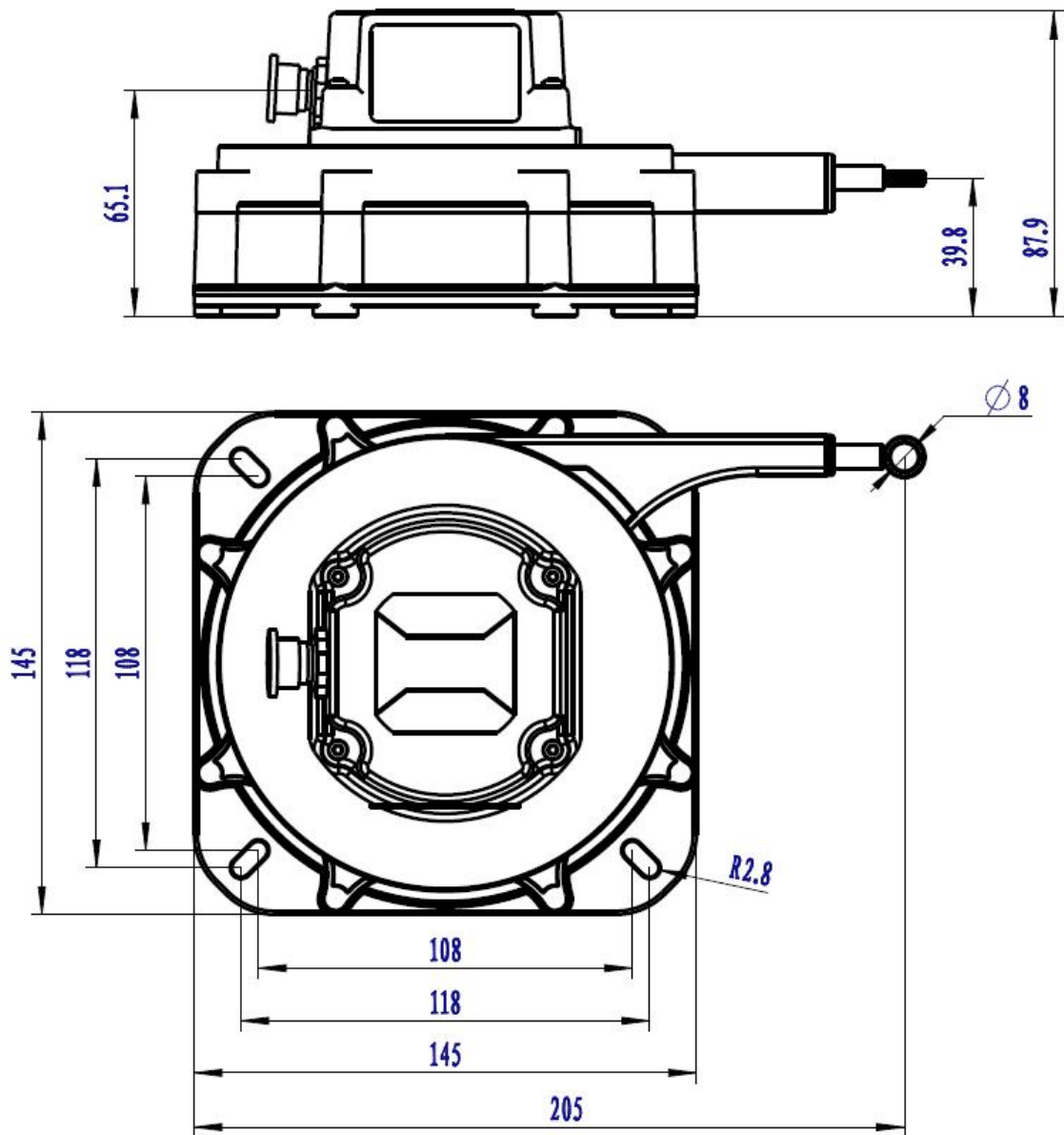
4.2.1. 0~5m/0~7m Sensor



4.2.2. 0~10m/0~12.5m Sensor



4.2.3. 0~15 meter sensor



4.3. Installation

(1) The sensor mounting surface should be installed parallel to the vertical surface, and the angle α with the vertical surface should meet $-1^\circ \leq \alpha \leq +1^\circ$, as shown in Figure 4.3-1.

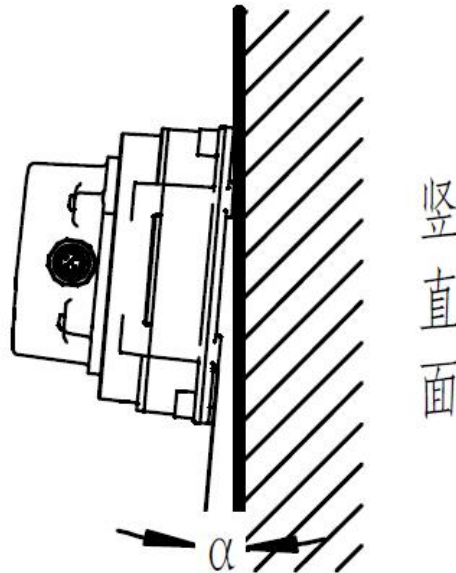


Figure 4.3-1

(2) When the centerline of the sensor is placed parallel to the horizontal plane as shown in Figure 4.3-2, the angular output value of the sensor is 0° . Rotating the sensor clockwise, the angle value increases; counterclockwise rotation of the sensor, the angle value decreases. Customers should determine the initial position of the sensor according to their own applications.

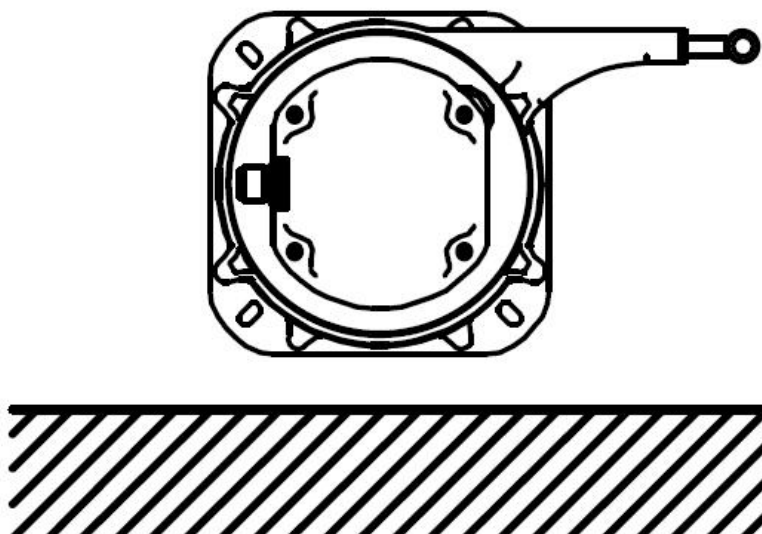


Figure 4.3-2

(3) A collar for securing the wire rope is provided at the front of the sensor as shown in Figure 4.3-3.

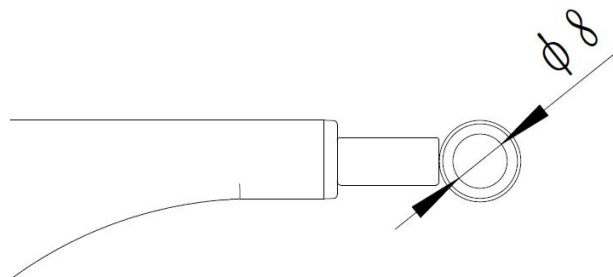


Figure 4.3-3

If it is necessary to reserve a mounting hole to fix the ring at the ring mounting position, the distance between the mounting hole and the center of the arm S should be equal to the distance between the center of the sensor reel (i.e., the position of the wire outlet) and the center of the arm M. If it is not possible to ensure that the above distances are equal due to the process, etc., you can open a few adjusting holes on the mounting bracket to facilitate the adjustment of the assemblers during the assembly process. As shown in Figure 4.3-4. Note that the use of the process should ensure that the wire rope is pulled out horizontally, and there will be no oblique pulling, as shown in Figure 4.3-5.

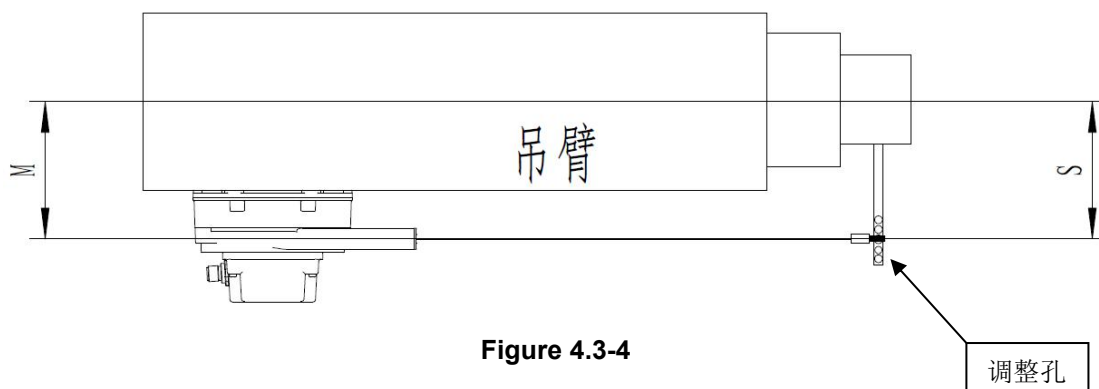
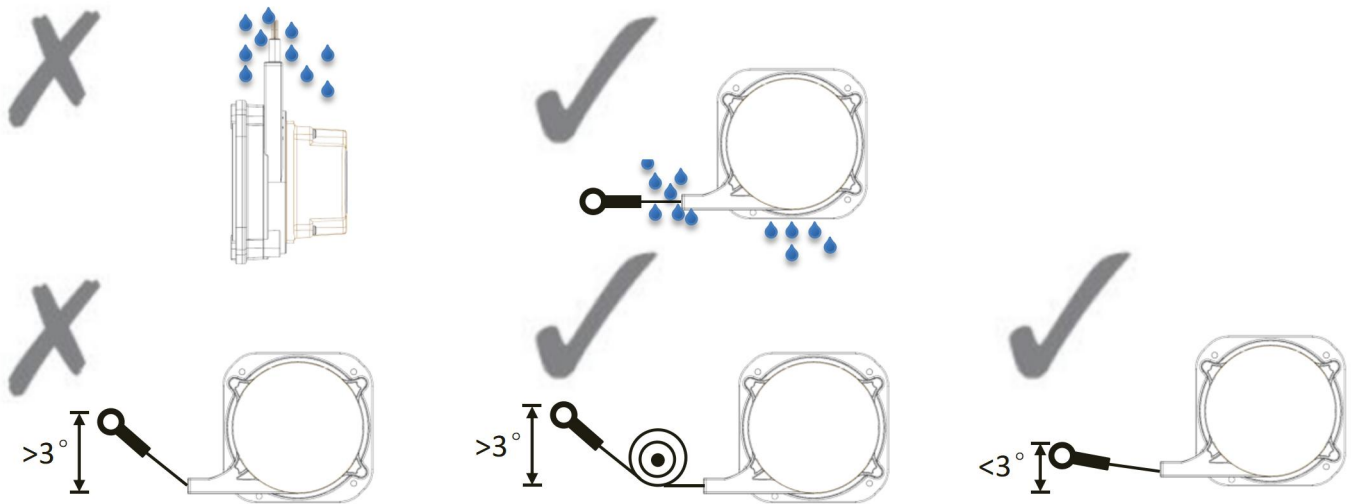


Figure 4.3-4



Figure 4.3-5

(4) For this sensor, because there is a pull cord part, the pull cord cannot completely avoid the entry of water as it pulls out and retracts. For this reason this, several installation requirements need to be followed when using the sensor:



	Caution. The customer uses it with the outlet facing inward and when the big arm is raised, the outlet faces up. If the customer does not retract the large arm in time when it rains, it can cause water to enter the sensor reel.
--	--

4.4. Caveat

- (1) The wire rope collar and the fixing point should be fixed firmly and securely, and there shall be no loose slipping.
- (2) When installing, add mounting shims above the mounting hole position.
- (3) There is a strong spring inside the sensor, non-professionals should not disassemble it without authorization to avoid personal injury.
- (4) found that the sensor length or angle of the output value and the true value of the error is not within the range, should promptly contact the company's service personnel for troubleshooting, it is strictly prohibited in the absence of service personnel to guide the user privately open the lid debugging.

5. Parameter Configuration Description

- How to configure the software for the LWG200 Series Length Angle Sensor:

Configuration is carried out on site through the CAN device, one end of the CAN device is connected to the M12 five-pole pin socket on the product through the CAN cable, and one end is connected to the configuration computer through USB, and the parameter configuration is carried out through the CAN device software on the computer.

5.1. Default configuration

Default Node Number	0x04
Default Baud Rate	250K bit/s
Default Heartbeat Cycle	500ms
Default Cyclic Transmission Period	100ms

5.2. PDO message

5.2.1. Heartbeat

- Heartbeat messages are sent periodically after initialization is complete.

COB-ID	BYTE0
0x700+node_id	heartbeat

	Notes.
	Node states definition: 0: startup; 5: normal mode; 7F: pre-run mode; After CAN initialization is completed, Node states = 5, it automatically enters normal mode and starts sending PDO data.

5.2.2. PDO1 (length, resolution 0.1mm)

- 0 to 5 meter sensors:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x180+node_id	length		Length (redundancy)		0x00	0x00	0x00	0x00

	Notes.
	Length: 0~50000. Length (redundancy): The length calculation of redundant signals requires the use of FFFF minus the length (redundancy) data.

➤ 0~10 meter sensor/0~12.5 meter sensor/0~15 meter sensor:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x180+node_id	length				Length (redundancy)			

	Notes.
	Length: 0~100000/0~125000/0~150000. Length (redundancy): length calculation of redundant signals requires the use of FFFFFFFF minus the length (redundancy) data.

5.2.3. PDO2 (angle, resolution 0.1° /0.05°)

➤ 0~360°:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x280+node_id	Angle (0~3600)		Angle (3600~0)		0x00	0x00	0x00	0x00

➤ -180°~ +180°:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x280+node_id	Angle (-1800~+1800)		Angle (+1800~-1800)		0x00	0x00	0x00	0x00

5.3. SDO message

5.3.1. Object Dictionaries

Address Index	Sub-index	Command Description	Corresponding value	Read/Write
1800	02	TxPDO1 Transmit Mode	0xFE-cycle, 0xFD-request, default is 0xFE, effective immediately.	read-write
	05	TxPDO1 transmit cycle	10~3000ms, default is 100ms , effective in time	read-write
1801	02	TxPDO2 transmit mode	0xFE-cycle, 0xFD-request, default is 0xFE, effective immediately.	read-write
	05	TxPDO2 transmit period	10~3000ms, default is 100ms, immediate effect	read-write
1017	00	Heartbeat period	10~3000ms, default is 500ms, immediate effect	read-write
		Heartbeat mode	No need to set, as long as the heartbeat period is 0 can respond to remote frames; on the contrary, if the heartbeat period is non-zero, will not respond to remote frames	
2000	00	Node number	1~7F, default is 0x04	read-write
2001	00	Baud rate	0-1000 1-800 2-500 3-250 (default) 4-125 5-100 6-50 7-20 8-10	read-write

(Continued from previous page)

Address Index	Sub-index	Command Description	Corresponding value	Read/Write
2002	02	Self-start Marker	0-no self-start, 1-self-start, default is 1	
2003	01	Angle Left Right Marker	0-left setting (default), 1-right setting (left setting is clockwise, right setting is counterclockwise)	read-write
	02	Angle Mode	0-0~360(default) 1-180~180	Read-write
	03	Angular Resolution	0-0.1(default) 1-0.05	read-write
	04	Angular Filter Points	Default 3, the angular filtering parameter, is a percentage of the new value, the smaller indicates that the filtering is deeper	read-write
	05	Real-time angular filter points	Effective in real time, not saved, reads the same as 2003 04 value	Read-write
	06	Angle Bias Data		read-only
	07	Angle Bias Command	Zero 01 to take effect in time	Write-only
2004	01	Start calibration process	Send 01 to clear the length	Write-only
	02	Calibrate the specified length	Calibration to a specified length (0.1mm) can be directly calibrated to 0m	Write-only
	03	Length left and right markers	0-Clockwise (default) 1-Counterclockwise for rotary axes	Read-write
2005	01	Biss Interface Usage	0-Biss not available (default) 1-Biss available	Read/Write
	02	MHM chip status		read-only
	03	00 Address Low Byte, 02 Address High Byte	00 Address Low Byte, 02 Address High Byte	read-only
	04	Command Write Enable	All chip control commands require a command enable to be sent first.	Write-only
	05	MHM RESET		Write-only
	06	MHM PRESET		Write-only
	07	PVL RESET		Write only
	08	PVL REBOOT		Write only
	09	PVL SCLR		Write only
1011	01	All writable parameters (except serial numbers) are restored to their default values	64 61 6F 6C	
1010	01	Save all writable parameters	65 76 61 73	

5.3.2. Object Dictionary Usage

(1) Modify the order:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x600+node_id	0x22	Index address two digits lower	Index address two digits high	subindex	Enter the appropriate value			

When the following command is received, the modification is successful:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x580+node_id	0x60	Same index address as above in the lower two digits	Same index address as above two digits higher	Same subindex as above	0x00	0x00	0x00	0x00

Example: node number modified to 0x18

Send a modification command:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x600+node_id	0x22	0x00	0x20	0x00	0x18	0x00	0x00	0x00

Node number 0x18 is modified successfully when the following command is received:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x580+node_id	0x60	0x00	0x20	0x00	0x00	0x00	0x00	0x00

Send a save command to save the modified node number:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x600+node_id	0x22	0x10	0x10	0x01	0x73	0x61	0x76	0x65

(2) Read command:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x600+node_id	0x40	Index address two digits lower	Index address two digits high	subindex	0x00	0x00	0x00	0x00

When the following command is received, it indicates the reading result:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x580+node_id	0x43	Same index address as above in the lower two digits	Same index address as above two digits higher	Same subindex as above	The corresponding value (look up the specific result in the object dictionary)			

	Annotation:
	Based on the data of BYTE0 you can read out the number of BYTEs occupied by the corresponding value. For example, when the data of BYTE0 is 0x43, the corresponding value occupies 4 BYTE (BYTE4, BYTE5, BYTE6, BYTE7). Their correspondence is as follows: 4F: 1 ↑ BYTE (BYTE4) 4B: 2 ↑ BYTE (BYTE4、BYTE5) 47: 3 ↑ BYTE (BYTE4、BYTE5、BYTE6) 43: 4 ↑ BYTE (BYTE4、BYTE5、BYTE6、BYTE7)

Example: Read node number

Send a read command:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x600+node_id	0x40	0x00	0x20	0x00	0x00	0x00	0x00	0x00

When the following command is received, the device node number is 0x18, which occupies one BYTE:

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x580+node_id	0x4F	0x00	0x20	0x00	0x18	0x00	0x00	0x00

5.4. TPDO mapping parameters

Item	primary index	subindex
Length data subindex number	2100	00
Length data 2 bytes (5m use)	2100	01
Length data 4 bytes (10m or more use)	2100	02
Length data inversion 2 bytes (5m use)	2100	03
Length data inversion 4 bytes (10m or more use)	2100	04
Angle data 2 bytes	2100	05
Angle data inverted 2 bytes	2100	06
Blank placeholder 1 byte	2100	07
Length speed mm/s	2100	08
Angular speed 0.1° /s	2100	09

5.5. warning message

COB-ID	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x80+node_id	0xFF	0x00	error register	warning message	0x00	0x00	0x00	0x00

	Annotation:
	The alarm message correspondence is as follows: 0x68: Unreliable angle measurement result: the deviation between two angle signals is greater than 1.15% and the duration is more than 150ms; 0x7C: Unreliable length measurement result: the deviation between two length signals is greater than 1.6% and the duration is more than 150ms; 0x7F: Length measurement exceeds the maximum range: the length signal continuously exceeds the maximum range (>FS+100mm).

6. Common Troubleshooting

No.	Common Problems	Solution
1	Shell water ingress	Check if the sealing strip is installed properly
2	Slackening of wire rope	Coil preload is not enough, you can preload the coil another 1-2 turns.
3	Rope cannot be retracted	Broken coil spring, replace LWG200 series sensor.
4	Rope cannot be extended	Internal wire rope entangled, replace LWG200 series sensor.
5	No output from port after power on	Check whether the power supply voltage is normal.
6	Loss of length angle signal	Check whether the action of the reel mechanism is normal, power on and observe the data, if it is not normal, contact the manufacturer for maintenance.
7	CAN communication failure after power on	Check whether the baud rate is correct, check whether the external CAN wire sequence is correctly connected, check whether the terminal resistance is matched.