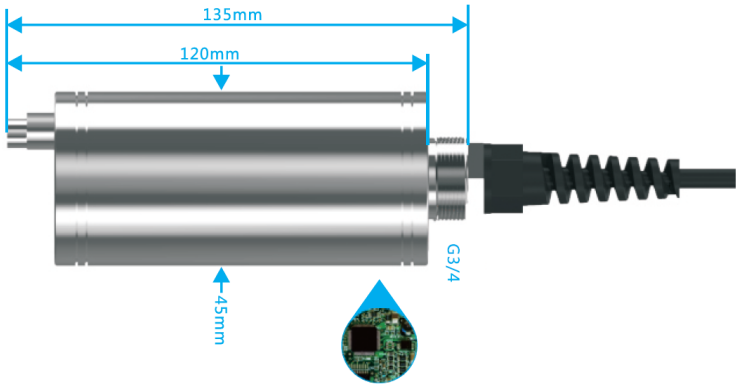
TURBIDITY SENSOR
(WATER QUALITY ANALYSIS)

User Manual for SRWQ100-ZD102-9101



Thank you for choosing L-com product. To ensure safe, accurate performance and product longevity, please take a moment to familiarize yourself with this manual before powering the device. Please keep it handy for future reference. In case of any questions regarding the installation or use of product, please call us at 800.341.5266.

Reach out to us at customerservice@l-com.com and visit our website at www.l-com.com

M_SRWQ100-ZD102-9101_05/2022_R1.0

Technical Indicators

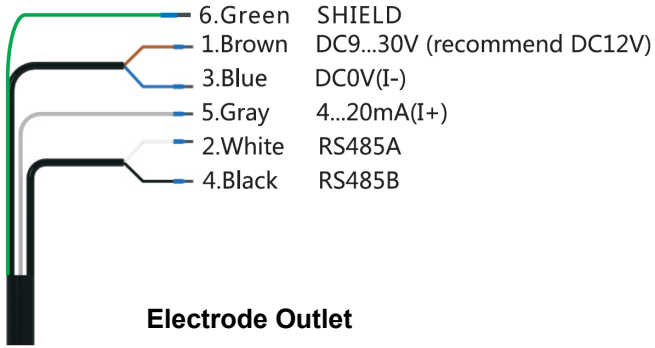
Measuring Range	0 – 4000 NTU
Principle	90˚ scattered light
Temperature Measure Range	0.0 – 80.0 ˚C
Shell Material	316 Stainless Steel
Pipe Thread	M 39*1.5
Cable Length	5m or customized
Accuracy	±5.0% FS
Protection Grade	IP68
Pressure Range	0 – 4 bar
Output	4 – 20 mA, maximum load 750Ω RS485/MODBUS-RTU
Power Supply	9 – 30 VDC (Recommend 12V)

Instructions Before Use

- During the measurement process, if there is dirt, adhesive or encrust on the electrode, the measured value will be inaccurate or fluctuate. It should be cleaned and calibrated from time to time.

Electrode Wiring

- Please follow the instructions carefully, wrong wiring will damage the product completely.
- Examine all the wiring carefully in the system. Make sure wiring is complete before switching ON the power.
- It is strictly forbidden that RS485A line and RS485B line should not touch the power line. It will permanently damage the communication of the electrode.



Electrode Outlet

Electrode Calibration

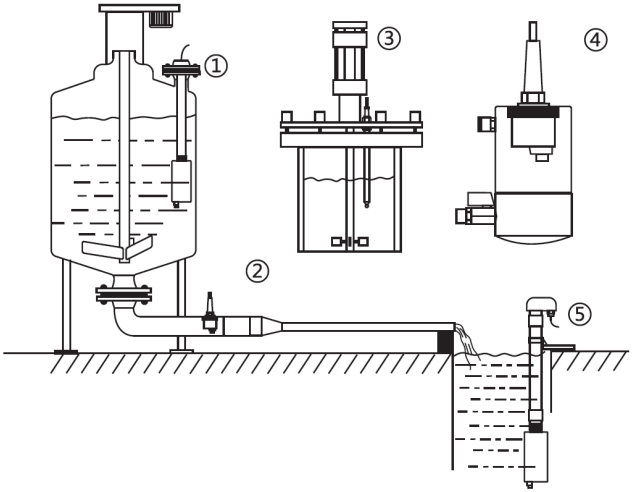
- The turbidity electrode calibration uses the formazin standard substance promulgated by the State Bureau of Technical Supervision, such as GBW12001 400 degree turbidity standard substance, the uncertainty is ±3%, and the effective use period is 1 year.
- The standard solution with different turbidity is obtained by using zero turbidity water, qualified capacity equipment and accurately prorata diluting the turbidity standard substance.

- Standard substance above 400 NTU should be kept in dark place and stored in the fresh cabinet of a refrigerator for (4-8 °C). The standard solution that is diluted to low turbidity value is unstable and should not be stored. It should be diluted whenever needed.
- IWhen the standard solution is difficult to obtain, it can be configured according to the method specified in ISO7027 and strictly control the conditions and dosage of reagent. The methods are as follows:

Solution concentration (NTU)	Volume 50ml Injecting ml of stock solution 400NTU	Volume 50ml Injecting ml of stock solution 4000NTU	Volume 100ml Injecting ml of stock solution 400NTU	Volume 100ml Injecting ml of stock solution 4000NTU
10	1.25	0.125	1.25	0.25
100	12.5	1.25	12.5	2.5
200	25	2.5	25	5
300	37.5	3.75	37.5	7.5
400	50	5	50	10
500	I	6.25	I	12.5
600	I	7.5	I	15
700	I	8.75	I	17.5
800	I	10	I	20
900	I	11.25	I	22.5
1000	I	12.5	I	25

Electrode Installation

Installation Method:



① Top flange installation
② Pipe installation
③ Top installation
④ Flow cell installation
⑤ Immersion installation

During Installation

- Turbidity sensor must avoid light, otherwise it will affect the measurement.
- Turbidity sensor should be more than 30mm away from bottom and wall in closed container.
- If it is installed in open space, the sensor should be placed 1 meter under water, because light will interfere with turbidity measurement.

Electrode Communication

Default Communication Instructions:

- Data starting at 0x represents hexadecimal.
- The check code is 16CRC, the low byte is in the front and the high byte is in the back.
- Floating point number occupy four bytes.

Communication Description (Factory Default):

Baud Rate	9600 (Default)
Data Bit	8
Stop Bit	1
Check Bit	No
Address	1 (Default)

Host Computer Transmission Format:

	Data Type	Description	Remarks
Integer	16-Bit Integer	The high-low bytes of word component are not reversed	Ex: O x 0032 to decimal number is 50
Floating Point Number	(CDAB) 3412	The high-low word of the double-byte component is reversed, but the high-low byte of the word is not reversed.	Example: 72 37 41 DB transfer to floating point number. CDAB change order is ABCD. Eg: 41 DB 72 37 transfer to floating point is 27.4

Function Code Description:

- This product supports 03, 06,16 and other common function codes.
- The output register uses 16 function codes when writing double word data or writing multiple data in batches.

03	Read single or multiple registers
06	Write single register
16	Write multiple registers

Read Floating Point Number

Host Computer Transmission Format:

Eg. / Read Measured Value	ID Address	Function Code	Register Start Address		Qty. Of Registers		CRC16	
			High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x01	0x03	0x00	0x01	0x00	0x02	0xCB	0x95

Slave Computer Response Format:

Eg. / Measured Value Return	ID Address	Function Code	Qty of Registers	Read Register Data in Hexadecimal Floating Point Number				CRC16	
				C	D	A	B	High Byte	Low Byte
	0x01	0x03	0x04	0x2C	0x81	0x40	0x91	0xE7	0x52

Note: 72 37 41 DB transfer to floating point number, CDAB change order is ABCD, i.e., 41 DB 72 37 transfer to floating point is 27.4.

Read Integer

Host Computer Transmission Format:

Eg. / Read Warning Status	ID Address	Function Code	Register Start Address		Qty. Of Registers		CRC16	
			High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x01	0x03	0x00	0x07	0x00	0x01	0xCB	0x35

Slave Computer Response Format:

Eg. / Measured Value Return	ID Address	Function Code	Qty of Registers	Read Register Data in Hexadecimal Floating Point Number		CRC16	
				A	B	High Byte	Low Byte
	0x01	0x03	0x02	0x00	0x00	0x44	0xB8

Write Floating Point Number »

Host Computer Transmission Format:

Eg / Write Value Offset	ID	Function Code	Register Start Address		Qty. Of Registers		Qty Of Byte	Register Data in Hexadecimal Floating Point Number				CRC16	
			High Byte	Low Byte	High Byte	Low Byte		C	D	A	B	High Byte	Low Byte
	0x01	0x10	0x00	0x12	0x00	0x02	0x04	0x 00	0x 00	0x 3F	0x 80	0x2A	0x63

Slave Computer Response Format:

Eg: / Return Value Offset	ID Address	Function Code	Register Start Address		Qty. Of Registers		CRC16	
			High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x01	0x13	0x00	0x12	0x00	0x02	0xCD	0xE1

Note: The measured value if offset by 1.00, floating point number 1.00 coverts to hexadecimal 0X3F800000, transpose the high and low positions 0X00003F80 and write 0X0012.

Write Integer »

Host Computer Transmission Format:

Eg: / Write Device Address	ID Address	Function Code	Register Start Address		Register Data in Hexadecimal Integer		CRC16	
			High Byte	Low Byte	A	B	High Byte	Low Byte
	0x01	0x06	0x00	0x19	0x00	0x02	0xCC	0xD9

Slave Computer Response Format:

Eg: / Device Return Address	ID Address	Function Code	Register Start Address		Register Data in Hexadecimal Integer		CRC16	
			High Byte	Low Byte	A	B	High Byte	Low Byte
	0x01	0x06	0x00	0x19	0x00	0x02	0xCC	0xD9

Note: Change the local computer address 1 to address 2 and write the hexadecimal number 0X00 02 into register 0X00 19.

Calibration Instructions

Before Calibration:

- Write values of the 1st, 2nd, 3rd and 4th point respectively to the sensor before calibration. If the value of the 1st point calibration is 1.000, write data 0x 3F 80 00 00 to register 0x20. Send command: 01 10 00 20 00 02 04 00 00 3F 80 E1 E7.
- If the value of the 2nd point calibration is 10.000, write data 0x 41 20 00 00 to register 0x24. Send command: 01 10 00 24 00 02 04 00 00 41 20 C1 CC.
- If the value of the 3rd point calibration is 20.000, write data 0x 41 A0 00 00 to register 0x28. Send command: 01 10 00 28 00 02 04 00 00 41 A0 C0 39.
- If the value of the 4th point calibration is 30.000, write data 0x 41 F0 00 00 to register 0x32. Send command: 01 10 00 32 00 02 04 00 00 41 F0 C1 F6.

Start Calibration: The sensor is cleaned and dried. Put it into 1st, 2nd, 3rd and 4th point calibration solution respectively and follow the procedure.
Send command: 01 03 00 66 00 01 64 15. After the measured ADC value is stable, read the ADC value in the 0x66 register. Write the current ADC value to the 0x22 register.

- **1st point**: For example, the current ADC value is 100. Send command: 01 10 00 22 00 02 04 00 00 42 C8 41 58.
- **2nd point:** For example, the current ADC value is 100. Send command: 01 10 00 26 00 02 04 00 00 44 7A C3 7E.
- **3rd point:** For example, the current ADC value is 100. Send command: 01 10 00 2A 00 02 04 00 00 44 FA C2 8B.
- **4th Point:** For example, the current ADC value is 100. Send command: 01 10 00 2E 00 02 04 00 00 45 3B 2A B8.

Address Description

Name	Data Address	Data Type	Length	Read/ Write	Description
Measurements	0x 00 01	Floating Point	2	Read	Storage location for measured value
Temperature measurement	0x 00 03	Floating Point	2	Read	Storage location for measured temperature
Current output value	0x 00 05	Floating Point	2	Read	Output current based on turbidity measurements
Warning	0x 00 07	Integer	1	Read	01: Measurement exceeds the upper limit 02: Measurement exceeds the lower limit 03: Temperature exceeds the upper limit 04: Temperature exceeds the lower limit
Upper limit of measurement	0X 00 0A	Floating Point	2	Read/ Write	Upper limit of measured value (20mA corresponding value)
Lower limit of measurement	0X 00 0C	Floating Point	2	Read/ Write	Lower limit of measurement value (4mA corresponding value)
Upper temperature limit	0X 00 0E	Floating Point	2	Read/ Write	Upper temperature limit
Lower temperature limit	0x 00 10	Floating Point	2	Read/ Write	Lower temperature limit
Measured value offset	0x 00 12	Floating Point	2	Read/ Write	Adjust measurement value
Temperature offset	0x 00 14	Floating Point	2	Read/ Write	Adjust temperature value
Damping coefficient	0x 00 16	Integer	1	Read/ Write	0-10
Device address	0x 00 19	Integer	1	Read/ Write	1-255
Baud rate	0X 00 1A	Integer	1	Read/ Write	0=2400 , 1=4800 , 2=9600 3=19200, 4=38400

Name	Data Address	Data Type	Length	Read/Write	Description
Restore default	0x 00 1B	Integer	1	Write	
First calibration value	0x 00 20	Floating Point	2	Read/Write	
First ADC value	0x 00 22	Floating Point	2	Read/Write	
Second calibration value	0x 00 24	Floating Point	2	Read/Write	
Second ADC value	0x 00 26	Floating Point	2	Read/Write	
Third calibration value	0x 00 28	Floating Point	2	Read/Write	
Third ADC value	0X 00 2A	Floating Point	2	Read/Write	
Fourth calibration value	0X 00 2C	Floating Point	2	Read/Write	
Fourth ADC value	0X 00 2E	Floating Point	2	Read/Write	
1-2 Slope	0x 00 30	Floating Point	2	Read/Write	
1-3 Slope	0x 00 32	Floating Point	2	Read/Write	
1-4 Slope	0x 00 34	Floating Point	2	Read/Write	

Common Instruction Examples >>

Sr. No.	Function	Send Command	Return Command	Remarks
1	Read measured value	01 03 00 01 00 02 95 CB	01 03 04 2C 81 40 91 52 E7	The 2C814091 change order to 40912C81 and its floating point is 4.53
2	Read temperature measurement	01 03 00 03 00 02 34 0B	01 03 04 72 37 41 DB 20 BE	The 7237410B change order to 410B7237and its floating point is 27.4
3	Read current output value	01 03 00 05 00 02 D4 05	01 03 04 00 00 41 40 CB 93	The 00004140 change order to 41400000 and its floating point is 12.00
4	Read warning	01 03 00 07 00 01 35 CB	01 03 02 00 00 B8 44	0000 is the current state
5	Write upper limit of measurement	01 10 00 0A 00 02 04 00 00 41 20 42 58	01 10 00 0A 00 02 61 CA	The upper measurement limit is set to 10.00
6	Write lower limit of measurement	01 10 00 0C 00 02 04 00 00 3F 80 E3 AA	01 10 00 0C 00 02 81 CB	The lower measurement limit is set to 1.00
7	Write upper temperature limit	01 10 00 0E 00 02 04 00 00 42 C8 43 15	01 10 00 0E 00 02 20 0B	The upper temperature limit is set to 100.00
8	Write lower temperature limit	01 10 00 10 00 02 04 00 00 40 A0 C3 1B	01 10 00 10 00 02 40 0D	The lower temperature limit is set to 5.00
9	Write measured value offset	01 10 00 12 00 02 04 00 00 3F 80 63 2A	01 10 00 12 00 02 E1 CD	Set to 1.00
10	Write temperature offset	01 10 00 14 00 02 04 00 00 3F 80 E3 00	01 10 00 14 00 02 01 CC	Set to 1.00
11	Write damping coefficient	01 06 00 16 00 01 A9 CE	01 06 00 16 00 01 A9 CE	Set to 1
12	Write device address	01 06 00 19 00 02 D9 CC	01 06 00 19 00 02 D9 CC	Set to 2
13	Write baud rate	01 06 00 1A 00 00 A8 0D	01 06 00 1A 00 00 A8 0D	Set to 2400
14	Write restore default	01 06 00 1B 00 FF B9 8D	01 06 00 1B 00 FF B9 8D	Factory default values are restored after sent
15	First calibration value	01 10 00 20 00 02 04 00 00 3F 80 E1 E7	01 10 00 20 00 02 40 02	Set to 1.000

Sr. No.	Function	Send Command	Return Command	Remarks
16	First ADC value	01 10 00 22 00 02 04 00 00 42 C8 41 58	01 10 00 22 00 02 E1 C2	Set to 100
17	Second calibration value	01 10 00 24 00 02 04 00 00 41 20 C1 CC	01 10 00 24 00 02 01 C3	Set to 10.000
18	Second ADC value	01 10 00 26 00 02 04 00 00 44 7A C3 7E	01 10 00 26 00 02 A0 03	Set to 1000
19	Third calibration value	01 10 00 28 00 02 04 00 00 41 A0 C0 39	01 10 00 28 00 02 C1 C0	Set to 20.000
20	Third ADC value	01 10 00 2A 00 02 04 00 00 44 FA C2 8B	01 10 00 2A 00 02 60 00	Set to 2000
21	Fourth calibration value	01 10 00 2C 00 02 04 00 00 41 F0 C1 F6	01 10 00 2C 00 02 80 01	Set to 30.000
22	Fourth ADC value	01 10 00 2E 00 02 04 80 00 45 3B 2A B8	01 10 00 2E 00 02 21 C1	Set to 3000

Maintenance And Storage

- After long storage and cleaning of the electrode, polarize and calibrate the electrode before using it again.
- Cable connector must be kept clean, dry, free from moisture, water, acids, alkalis etc.

Maintenance Task

Maintenance task	Recommended maintenance rate
Clean sensor	Clean every 30 days
Check if the sensor is damaged	Check every 30 days

MODBUS Troubleshooting

Problem	Possible reason	Solution
Modbus no response	The baud rate, or stop bit does not match the Modbus master settings	Verify that the settings match the Modbus master device settings, and verify that the Modbus master device parity check is set to None.
	Rs232 or RS485 cable is faulty	Replace/repair cables.
	No network offsets and terminations, or network offsets and terminations are not suitable	Check the termination or offset Settings for all network devices. Only the endpoints of the network should be turned on and terminated, and there should be only a point on the network to provide an offset.
	The slave address is incorrect, or the slave address is the same as the address of another bus device	Verify that all addresses are unique and are between 1 and 247.
Modbus abnormal response	Register not supported	Verify that the register is supported
	Incorrect data type	Verify that the requested register data type matches the Mod bus master device request. For eg., user cannot access a floating point data using 2-byte integer data. When a floating point data (2 registers/ 4 bytes) is requested, two registers must be requested at the same time.