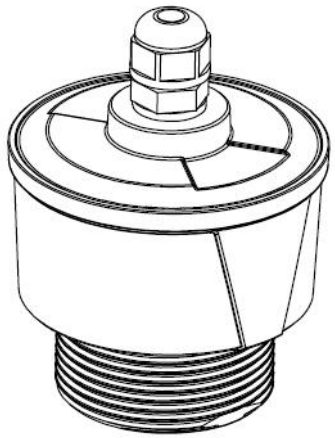
80G Radar Level Transmitter



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Preface

Thank you for purchasing the radar level transmitter. Please read this manual carefully before operating and using it correctly to avoid unnecessary losses caused by false operation.

Note

- Modification of this manual's contents will not be notified as a result of some factors, such as function upgrading.
- We try our best to guarantee that the manual content is accurate, if you find something wrong or incorrect, please contact us.
- This product is forbidden to use in explosion-proof occasions.

Version

U-SUP-WSR200-EN1

Safety Precautions

In order to use this product safely, be sure to follow the safety precautions described.

About this manual

- Please submit this manual to the operator for reading.
- Please read the operation manual carefully before applying the instrument. On the precondition of full understanding.
- This manual only describes the functions of the product. The company does not guarantee that the product will be suitable for a particular use by the user.

Precautions for protection, safety and modification of this product

- To ensure safe use of this product and the systems it controls, Please read carefully the operation manual and understand the correct application methods before putting into operation, to avoid unnecessary losses due to operation mistakes. If the instrument is operated in other ways not described in the manual, the protections that the instrument give may be destroyed, and the failures and accidents incurred due to violation of precautions shall not be borne by our company.
- When installing lightning protection devices for this product and its control system, or designing and installing separate safety protection circuits for this product and its control system, it needs to be implemented by other devices.
- If you need to replace parts of the product, please use the model specifications specified by the company.
- This product is not intended for use in systems that are directly related to personal safety.Such as nuclear power equipment, equipment using radioactivity, railway systems, aviation equipment, marine equipment, aviation equipment and medical equipment.If applied, it is the responsibility of the user to use additional equipment or systems to ensure personal safety.

- Do not modify this product.
- The following safety signs are used in this manual:

Hazard, if not taken with appropriate precautions, will result in serious personal injury, product damage or major property damage.

Warning:Pay special attention to the important information linked to product or particular part in the operation manual.

- Confirm if the supply voltage is in consistent with the rated voltage before operation.
- Don’t use the instrument in a flammable and combustible or steam area.
- To prevent from electric shock, operation mistake, a good grounding protection must be made.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at is-electric level, shielded, wires shall be located rationally, SPD surge protector shall be applied properly.
- Some inner parts may carry high voltage. Do not open the square panel in the front except our company personnel or maintenance personnel acknowledged by our company, to avoid electric shock.
- Cut off electric powers before making any checks, to avoid electric shock.
- Check the condition of the terminal screws regularly. If it is loose, please tighten it before use.
- It is not allowed to disassemble, process, modify or repair the product without authorization, otherwise it may cause abnormal operation, electric shock or fire accident.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine or other organic solvents. Prevent all kinds of liquid from splashing on the product. If the product falls into the water, please cut off the power

immediately, otherwise there will be leakage, electric shock or even a fire accident.

- Please check the grounding protection status regularly. Do not operate if you think that the protection measures such as grounding protection and fuses are not perfect.
- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life and fire.
- Please strictly follow the instructions in this manual, otherwise the product's protective device may be damaged.

- Don’t use the instrument if it is found damaged or deformed at opening of package.
- Prevent dust, wire end, iron fines or other objects from entering the instrument during installation, otherwise, it will cause abnormal movement or failure.
- During operation, to modify configuration, signal output, startup, stop, operation safety shall be fully considered. Operation mistakes may lead to failure and even destruction of the instrument and controlled equipment.
- Each part of the instrument has a certain lifetime, which must be maintained and repaired on a regular basis for long-time use.
- The product shall be scrapped as industrial wastes, to prevent environment pollution.
- When not using this product, be sure to turn off the power switch.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

Disclaimer

Upon opening the packaging box, please ensure to verify the contents before commencing any operations. Should you discover any discrepancies in the model or quantity, or any physical damage to the appearance, please contact our company.

The product packaging contents can be found in the standard configuration list.

Standard Configuration List

No.	Name	Quantity	Note
1	80G Radar Level Transmitter	1	
2	Manual	1	
3	Certificate	1	

After opening the box, please confirm the package contents before starting the operation.If you find that the model and quantity are incorrect or there is physical damage in appearance, please contact us.

Content

Chapter 1 Production Introduction

1.1. Introduction

Radar level transmitter can perform non-contact continuous measurement of the liquid height in closed or open containers during industrial production processes. This radar level transmitter has a long detection range and low beam energy, making it suitable for installation in various metal and non-metal containers or pipelines. It is applicable in environments where dust, water mist, inert gases, and steam are present. The radar level transmitter poses no harm to humans or the environment. It is also advantageous in that it is unaffected by the specific gravity of the medium, changes in dielectric constant, and does not require on-site calibration.

The 485 interface can be debugged through the PC upper computer. Please contact the salesperson for upper computer software and debugging instructions.

1.2. Measurement Principle

The measurement principle is based on Frequency Modulated Continuous Wave (FMCW) radar technology. The FMCW radar emits signals in the high-frequency range. Within its measurement domain, the radar wave's frequency increases linearly, which is known as frequency sweep. The radar wave signal emitted by the antenna reflects off the surface of the medium and is subsequently received by the antenna after a certain time delay (t). The time difference ($t = 2d/c$) is determined by the distance (d) between the radar and the medium surface, where (c) represents the speed of light, the propagation speed of the radar wave above the medium surface. Signal processing involves comparing the difference (Δf) between the actual transmitted frequency and the received frequency. This frequency difference is directly proportional to the distance. A larger frequency difference indicates a greater distance, and vice versa. Through Fast Fourier Transform (FFT), the frequency difference (Δf) is converted into a frequency spectrum, which is then used to calculate the distance. By calculating the difference between the tank’s height value and the measured distance, the height of the material level can be obtained.

1.3. Product Features

- Utilizes 80GHz FMCW technology for higher resolution and improved detection performance;
- Maximum detection range of 15m with a minimum blind zone of 0.15m;
- Narrow beam angle and concentrated energy for strong anti-interference capability, high measurement accuracy, and reliability;
- Unaffected by adverse conditions such as lighting, rain, snow, dust, or water mist;
- Multiple output circuit interface options available;
- Extremely low radar emission power, posing no harm to humans or the environment.

Chapter 2 Technical Parameters

Table 1 Technical Parameters

Measured variable	Liquid level
Measuring range	8m / 15m
Modulation waveform	FMCW
Transmit frequency	79GHz~81GHz
Blind zone	≤0.15m
Antenna angle	±3°
Accuracy	±5mm
Repeatability	±2mm
Refresh rate	≥500ms
Ingress protection	IP67
Transmission output	(4~20)mA
Communication output	RS485
Power supply	Working Voltage：(9~36)VDC Working Current：≤80mA，24VDC
Power consumption	≤1.9W
Dielectric constant	≥3
Process pressure	(-0.1~0.3)MPa
Process temperature	(-40~85)℃

Chapter 3 Structure and Dimensions

3.1. Radar level transmitter shape structure

Radar level transmitter shape structure figure is shown as in Figure 1.

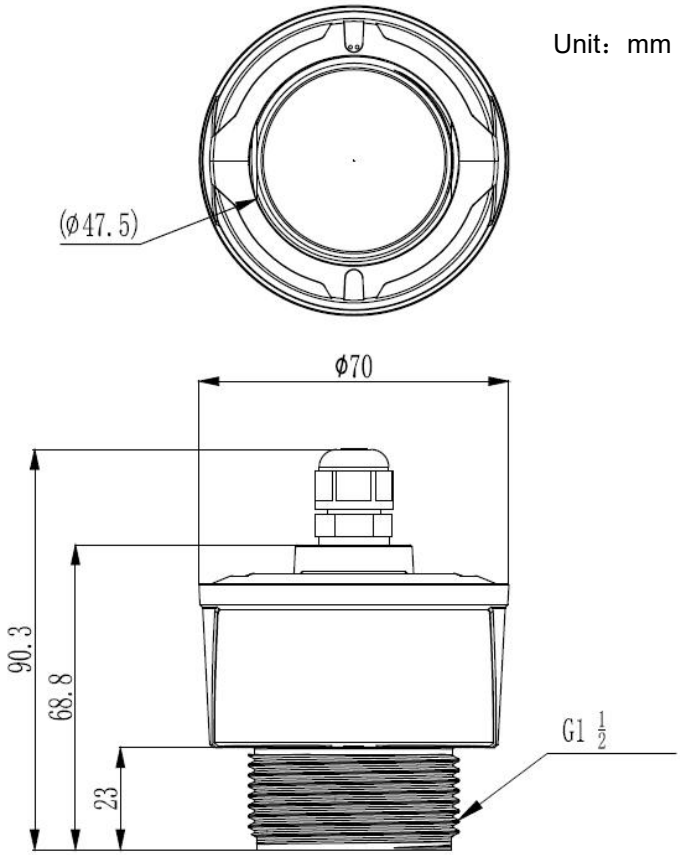

Figure 1 Radar shape structure

Chapter 4 Installation

Before installation, please make sure to read the following instructions and allocate sufficient space to ensure proper installation of the radar.

4.1. Installation Environment

The radar level gauge is commonly used for measuring the liquid level inside tanks or for level measurements in rivers or reservoirs. The installation schematic diagram is shown below:

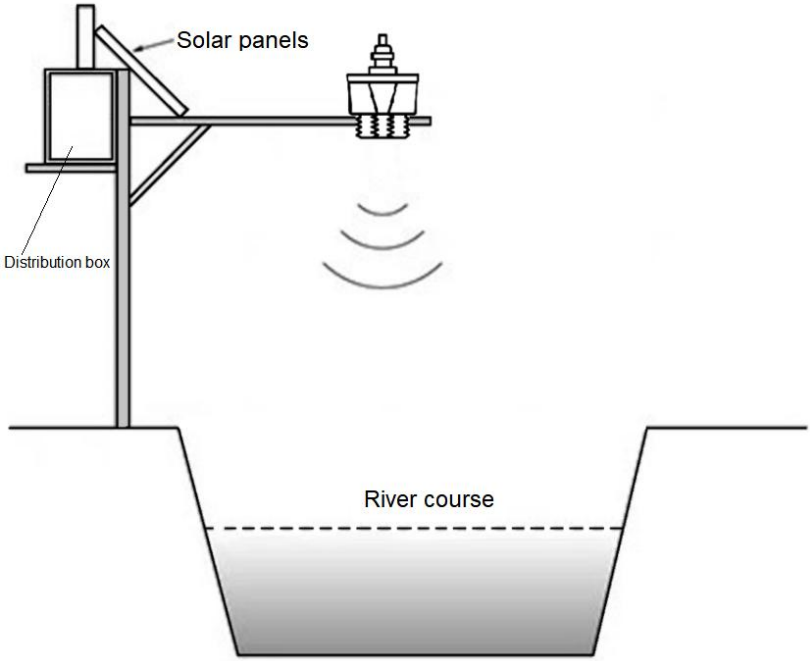

Figure 2: Installation Schematic Diagram

4.2. Installation Method

The radar can be installed according to the actual on-site environment. It can be securely fastened to the mounting bracket using expansion screws or hoops (hoops need to be prepared by the user). Please refer to the figure below for details.

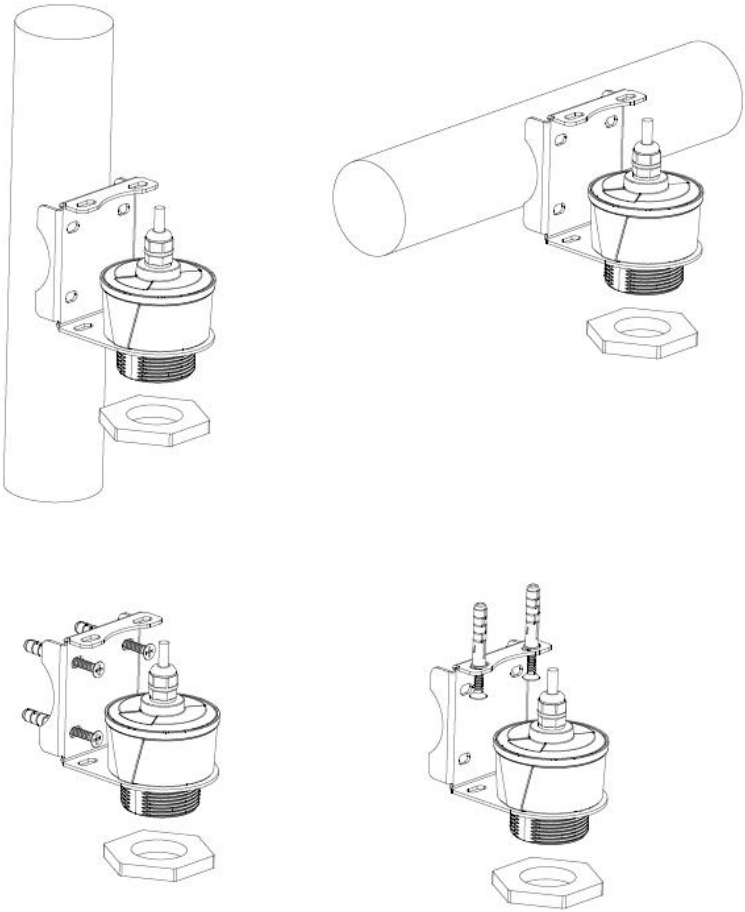

Figure 3: Radar Installation Method

4.3. Installation Requirements

The radar level meter should be placed vertically above the surface of the liquid medium in order to obtain optimal measurement results in a liquid environment. Please refer to the figure below for reference.

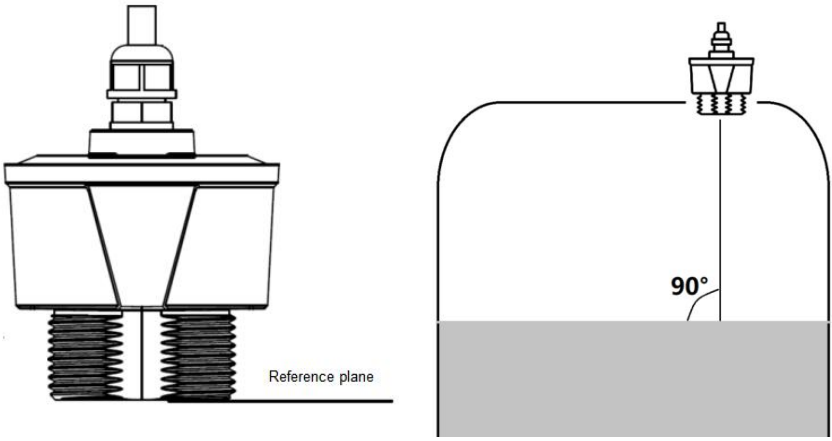

Figure 4: Liquid Level Measurement Method of Radar

To ensure detection of a smooth and flowing surface of the medium, please avoid installing the radar directly above the inlet of the flowing medium, as shown in the figure below.

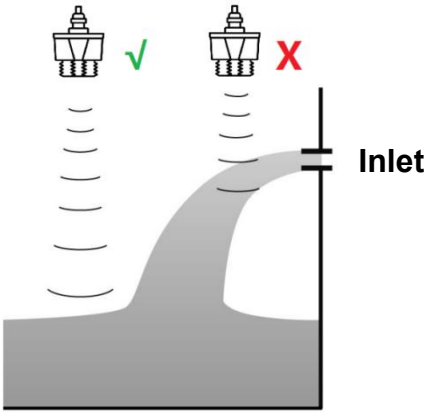

Figure 5: Installation Method Corresponding to the Inlet

Chapter 5 Electrical Connection

The radar level transmitter is powered by a wide voltage range (9~36VDC). However, due to the potential voltage drop caused by long customer-side wiring harnesses, it is recommended to supply power at 24V. The wiring harness is defined as follows:

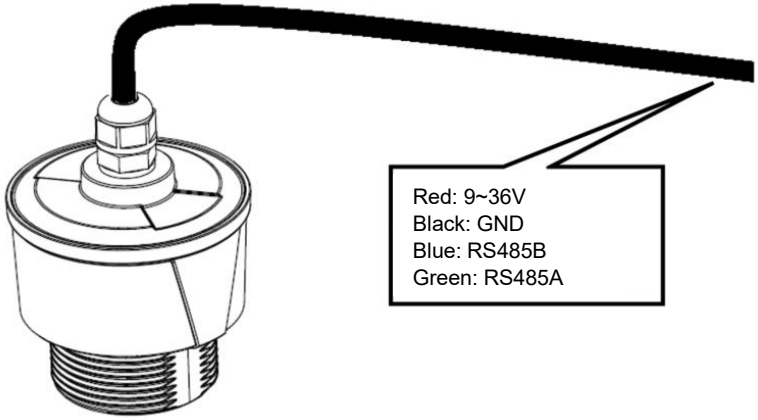

Figure 6: Wiring Harness Definition

The radar level gauge can be connected using the following wiring methods:

(1) 4-wire/RS485 Modbus

Table 6: Four-wire/RS485/ Wiring Definition

Wire Color	Definition
Red	24VDC +
Black	GND
Blue	485B
Green	485A

(2) 2-wire/(4~20)mA

Table 7: Two-wire/(4~20)mA Wiring Definition

Wire Color	Definition
Red	24VDC +
Black	GND

Chapter 6 Maintenance and Repair

The radar possesses advanced technical features and requires professional handling. Before use, please carefully read the product user manual and relevant documentation.

Usage Precautions:

- Strictly adhere to the specified power supply model as stated in the specification sheet to avoid damage to the radar's mainboard and potential impact on measurement accuracy.
- Ensure that the radar is securely installed to prevent measurement errors caused by movement during the measurement process.
- Prior to use, thoroughly review the specifications and parameters outlined in the radar specification sheet, and refrain from exceeding the measurement range.
- Configuration of radar level transmitter parameters should be performed under the guidance of a qualified professional.

Chapter 7 Warranty & After-sales Service

We guarantees customers that any product quality issues during the warranty period will be covered by our unconditional three-guarantee policy, which includes free repairs, replacements, or returns. Non-customized products can be returned or exchanged within 7 days (excluding products damaged due to misuse), while the warranty terms for customized products are based on the agreements specified in the contract.

Disclaimers:

- During the warranty period, product faults caused by the following reasons are not in the scope of Three Guarantees service
- Product faults caused by improper use by customers.
- Product faults caused by disassembling, repairing and refitting the product.

After-sales service commitment:

- We promise to deal with the customer's technical questions within 2 hours.
- For the instruments returned to the factory for maintenance, we promise to issue the test results within 3 working days and the maintenance results within 7 working days after receiving them.

Chapter 8 Communication

8.1. Physical Interface

The radar level meter is connected to the PC host through a USB-to-RS485 serial cable. The communication is set to a baud rate of 115200, using an asynchronous serial communication format with no check bit, 8 data bits, and 1 stop bit.

8.2. Query Data, Function Code 0x03

Read data: 0x03

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x03	Query register value
02	Query variable start address H		
03	Query variable start address L		
04	Query the number of registers H		
05	Query the number of registers L		
06	CRC16L		CRC16 of bytes 00-05
07	CRC16H		

Radar Response to Query Command Frame Format:

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x03	Query register value
02	Number of bytes		
03	First byte		
04	Second byte		
05	Third byte		
04	Fourth byte		Please note that the data content and length depend on the specific definition provided below
….	….		
...	…..		
…	Nth byte		
…	CRC16L		
…	CRC16H		

8.3. Set Single Register Data, Function Code 0x06

Set Command Frame Format:

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x06	Set single register value
02	Set register start address H		
03	Set register start address L		
04	First byte		Please note that the data content and length depend on the specific definition provided below
05	Second byte		
06	CRC16L		
07	CRC16H		

Radar Response to Set Command Frame Format:

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x06	Set single register value
02	Set register start address H		
03	Set register start address L		
04	First byte		
05	Second byte		
06	CRC16L		CRC16 of bytes 00-05
07	CRC16H		

8.4. Set Multiple Register Data, Function Code 0x10

When the HMI or host computer sends a parameter setting command frame, the radar module receives the correct command and responds by sending data back to the HMI or host computer. The format is as follows (data transmission mode: big-endian):

Set Command Frame Format:

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x10	Set register value
02	Set register start address H		Please note that the data content and length depend on the specific definition provided below
03	Set register start address L		
04	Set the number of registers H		
05	Set the number of registers L		
06	Data byte length		
07	First byte		
08	Second byte		
….	….		
….	Nth byte		
….	CRC16L		
….	CRC16H		

Radar Response to Set Command Frame Format:

Byte index	Description	Data	Remarks
00	Address	0x01	Radar address 01
01	Function code	0x10	Set register value
02	Set register start address H		Please note that the data content and length depend on the specific definition provided below
03	Set register start address L		
04	Set the number of registers H		
05	Set the number of registers L		
07	CRC16L		
08	CRC16H		

8.5. Length and Definition of Data Content

Data Content and Length Definition (Data Transmission Mode: Big-endian):

No.	Register address	Name	Access rights	Length	Data type	Description
1	0x0000	Distance	R	4	Float	Primary variable Unit: meter
2	0x1801	High calibration position	R/W	4	Float	Range: 0~low calibration position Unit: m
3	0x1803	Low calibration position	R/W	4	Float	Range: 0~15 Unit: m
4	0x180E	Output mode	R/W	2	Uint16_t	0：Material height (default) 1：Empty height 2：Percentage
5	0x0400	FFT data	R/W	2*1024	Uint16_t	2K fft data
6	0x189F	Frame period	R/W	4	Uint32_t	Range：≥500ms
7	0x03FA	RF board version number	R	4	Uint32_t	Big endian: for example 01 02 03 04 Version number: V1.2.3.4
8	0x03FC	Baseband board version number	R	4	Uint32_t	Big endian: for example 01 02 03 04 Version number: V1.2.3.4
9	0x19FA	Slave address	R/W	2	Uint16_t	1-247
10	0x19FB	Baud rate	R/W	2	Uint16_t	1：2400 2：4800 3：9600 4：19200 5：38400 6：57600 7：115200 8：128000 9：230400
11	0x180D	Peak selection mode	R/W	2	Uint16_t	0：First peak 1：Second peak 2：Max peak (default)
12	0x1813	Distance offset	R/W	4	Float	Range: -1~1 Unit: m
13	0x1807	Measuring	R/W	4	Float	Range: 0~16

No.	Register address	Name	Access rights	Length	Data type	Description
		range				Unit: m
14	0x1805	Blind zone	R/W	4	Float	0.15m~measuring range
15	0x1873	Waveform tracking setting	R/W	2	Uint16_t	0：No tracking (default) 1：Tracking
16	0x189C	Waveform tracking width	R/W	4	Float	Default: 1 meter, only effective when waveform tracking is enabled
17	0x1810	Fault mode	R/W	2	Uint16_t	0：Full range 1：Empty range 2: Keep current value (default)
18	0x1811	Warehouse size	R/W	2	Uint16_t	0: Large warehouse, 1 minute (60 frames), 1 meter 1: Medium warehouse, 30 seconds (30 frames), 1 meter (default) 2: Small warehouse, 5 seconds (5 frames), 1 meter 3: Fast measurement, i.e., no waveform tracking 4：Other, distance Threshold，continue FramesNum 5：River mode 6：Tunnel mode
19	0x1815	Damping time	R/W	4	Uint32_t	Range: 0~999 Unit: second
24	0x1898	Parameter reset	R/W	2	Uint16_t	0：Default value 0xABCD：Radar reset

8.6. Example of Reading Setting Parameters

(1) Read the main variable distance of the radar

Send: 01 03 00 00 00 02 C4 0B

Receive: 01 03 04 3F FE B8 74 E5 F0

Send analysis:

01: Slave address

03: Read function code

00 00: Starting address of the distance parameter

00 02: Number of registers to read, where the main variable of type Float occupies 4 bytes and 2 registers.

C4 0B: Modbuscrc16 checksum starting from the first byte

Reception analysis:

01: Slave address

03: Read function code

04: Data length

3F FE B8 74: Big-endian Float data, which corresponds to 1.990004 meters

E5 F0: Modbuscrc16 checksum starting from the first byte

(2) Read the frame period of the radar

Send: 01 03 18 9F 00 02 F2 85

Receive: 01 03 04 00 00 07 D0 F9 9F

Send analysis:

01: Slave address

03: Read function code

18 9F: Starting address of the distance parameter

00 02: Number of registers to read, where the frame period Uint32 type occupies 4 bytes and 2 registers.

F2 85: Modbuscrc16 checksum starting from the first byte

Reception analysis:

01: Slave address

03: Read function code

04: Data length

00 00 07 D0: Data in big-endian format of type Uint32_t, indicating 2000 ms, i.e., 2 seconds.

F9 9F: Modbuscrc16 checksum starting from the first byte

(3) Set the frame period of the radar to 5 seconds

Send: 01 10 18 9F 00 02 04 00 00 13 88 1D D5

Receive: 01 10 18 9F 00 02 77 46

Send analysis:

01: Slave address

10: Function code for setting multiple registers

18 9F: Starting address for setting parameters

00 02: Setting the length, where the frame period Uint32 type occupies 4 bytes and 2 registers.

04: Set data byte length

00 00 13 88: The data is a big-endian Uint32 type, representing 5000 (5 seconds)

1D D5: Modbuscrc16 checksum starting from the first byte

Reception analysis:

01: Slave address

10: Function code for setting multiple registers

18 9F: Starting address for setting parameters

00 02: Setting the length, where the frame period Uint32 type occupies 4 bytes and 2 registers.

77 46: Modbuscrc16 checksum starting from the first byte

(4) Read warehouse size parameters in different radar modes

Send: 01 03 18 11 00 01 D2 AF

Receive: 01 03 02 00 05 78 47

Send analysis:

01: Slave address

03: Read function code

18 11: Starting address of parameter

00 01: Radar mode parameter, Uint16 type occupies 2 bytes and 1register

D2 AF: Modbuscrc16 checksum starting from the first byte

Reception analysis:

01: Slave address

03: Read function code

02: Response data length, two bytes

00 05: Data, indicating the radar mode as 05 (River mode)

78 47: Modbuscrc16 checksum starting from the first byte

(5) Set the radar to tunnel mode (set a single register)

Send: 01 06 18 11 00 06 5F 6D

Receive: 01 06 18 11 00 06 5F 6D

Send analysis:

01: Slave address

06: Set single register function code

18 11: Starting address of radar parameters

00 06: Set data

5F 6D: Modbuscrc16 checksum starting from the first byte

Reception analysis:

01: Slave address

06: Set single register function code

18 11: Starting address of radar parameters

00 06: Set data

5F 6D: Modbuscrc16 checksum starting from the first byte