KH.WLX Radar Water Level Meter

Product Introduction

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CONTENTS

Warning:

- **Be sure to read this operating manual carefully before using this radar water level meter for the first time.**
- **The product has no explosion-proof design, not applicable to flammable and explosive environment, flammable and explosive environment, please select the explosion-proof model.**
- **Non-contact radar products have the potential for inaccurate measurements due to electromagnetic interference in complex, confined environments.**
- **Please install and use this product correctly, non-correct installation will result in inaccurate measurement data.**
- **Strictly follow the methods in this operation manual for operation and use, and keep the operation manual for reference.**
- **If the instrument malfunctions, be sure to hand it over to the after-sales service.**

Statement:

- **The Company reserves the right to make periodic changes to the contents of this manual without prior notice. Changes will be added to the new version of the manual, so please contact us for the latest information.**

I Product Overview

The product is a ranging radar specially designed and developed for hydrological detection. The radar adopts FMCW mode, non-contact installation design, small size and compact structure. High precision, low power consumption, strong anti-interference ability. It is suitable for water level monitoring of lakes and rivers, flash flood warning, water storage ponds, sewage pipe networks and so on.

Figure 1-Product Effect

II Product main parameters and indexes

Parameter	Notation	Minimum Value	Typical Value	Maximum Values	Unit	Clarification
Transmitters						
Frequency of Emission	f	77		81	GHz	Bandwidth 4G
Output power (EIRP)	P_{out}		13	20	dBm	
Antenna angle (Refer to Figure 4)						
Beamwidth (-3dB)	Horizontal Direction		14		°	
	Vertical Direction		10		°	
Power Supply						
Operating Voltage	V_{CC}	9	12	24	V	
Operating Current	I_{CC}		20		mA	Typical Value
Exports	RS485 communication mode, default baud rate 9600, ASCII/Modbus protocol can be freely switched.					
Matrix						
Operating Temperature	T_{OP}	-45		+ 85	℃	
Overall Dimensions (LxWxH)	89x69x35 mm					
Measurement Metrics:						
Measuring Range	0.15~40m					
Accuracy	±5mm					
Resolution	1mm					
Activation Time	Fastest at 100ms					

Description: The radar works in the frequency band of 80GHz, the range of 40 meters is the maximum measurement range, according to the size of the object RCS, the maximum value of the detection distance will be deviated. Radar factory default configuration is compatible with ASCII\MODBUS two protocols, you can switch the protocol mode according to the corresponding instructions (detailed protocol file electronic version and special debugging host computer please ask our company separately).

III Product Specifications and Wiring Definitions

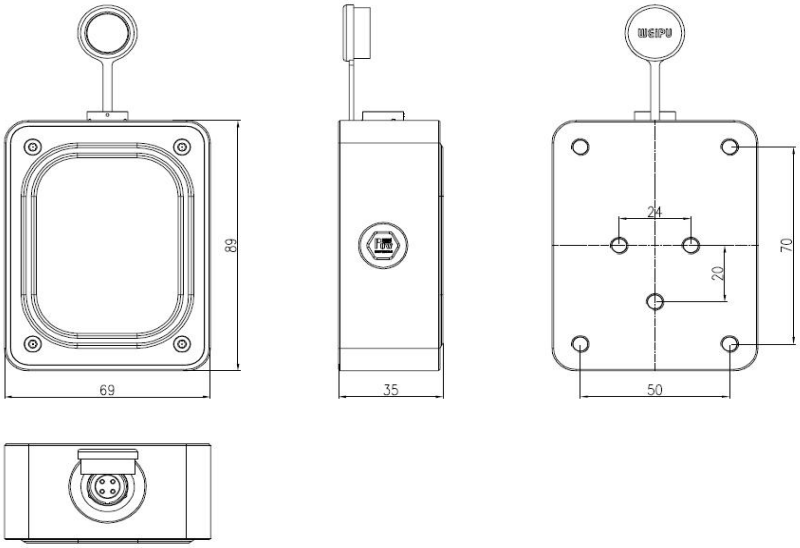


Figure 2-Product Specification Chart

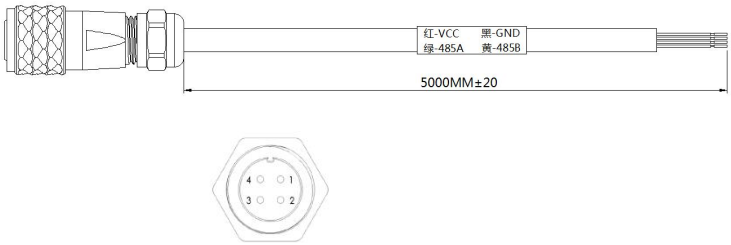


Figure 3 - External interface using pure copper IP67 waterproof aviation plugs

Pin	Color	Name	Clarification
1	Red	Vcc	12V DC Power Supply
2	Black	GND	DC Power Supply Negative
3	Green	485A+	
4	Yellow	485B-	

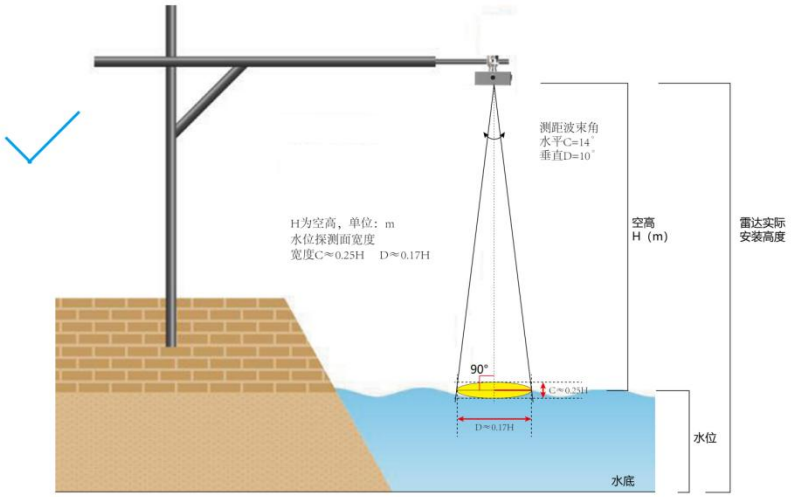
IV Product bracket mounting instructions

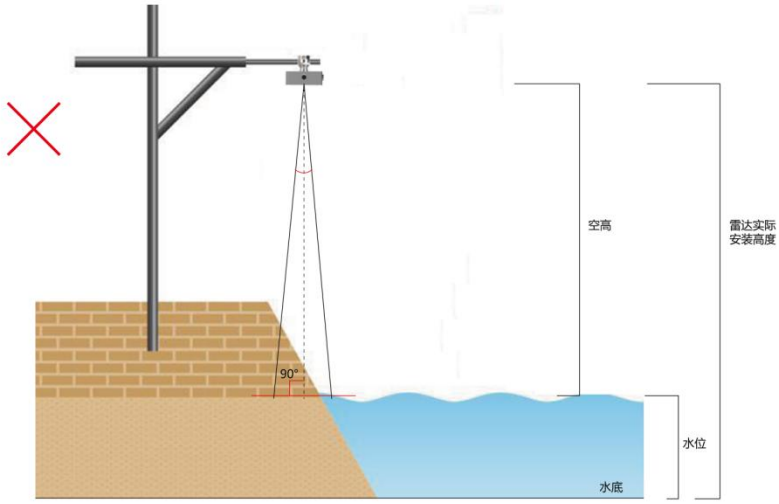
The following are instructions for installing the supporting bracket for the radar water level meter, please read and understand carefully and follow the instruction document.

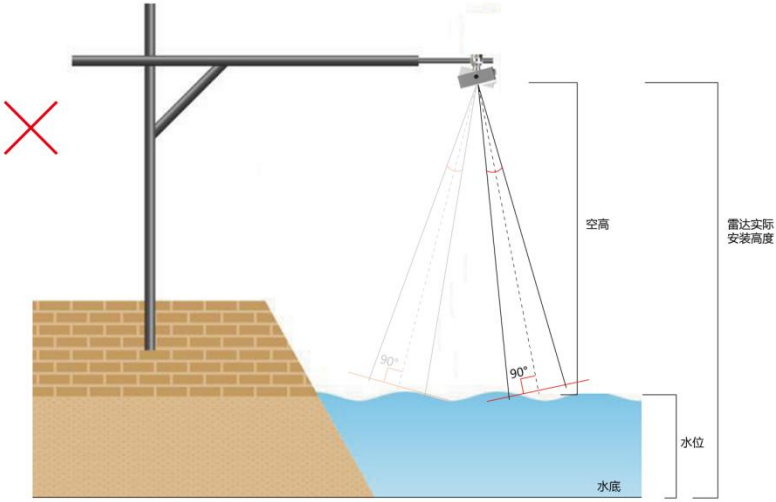
4.1 The standard materials include: 1 radar machine, 1 universal joint duckbill bracket, 1 set of hoop, 1 special waterproof aerial plug cable, supporting screws.

4.2. Bracket screw mounting schematic:

4.3 Radar water level meter in the river actual installation of the correct schematic and error schematic:


测距波束角
水平C=14°
垂直D=10°
H为空高，单位：m
水位探测面宽度
宽度C≈0.25H D≈0.17H
空高
H（m）
雷达实际
安装高度
90°
C≈0.25H
D≈0.17H
水位
水底


空高
雷达实际
安装高度
90°
水位
水底


空高
雷达实际
安装高度
90°
90°
水位
水底

V Millimeter-wave radar indoor testing considerations

Millimeter-wave radar, is a radar that operates in the millimeter-wave band. Millimeter-wave (Millimeter-Wave, abbreviation: MMW), refers to the length of 1~10mm electromagnetic waves. The higher the frequency, the shorter the wavelength, the higher the resolution, the stronger the penetration capability, but the greater the loss in the propagation process, the shorter the transmission distance; relatively, the lower the frequency, the longer the wavelength, the stronger the bypass capability, the longer the transmission distance. So compared with microwave, millimeter wave has high resolution, good directivity, strong anti-interference ability and good detection performance. Compared with infrared, millimeter wave has small atmospheric attenuation, better penetration of smoke and dust, and is less affected by weather. These qualities make millimeter-wave radar capable of all-weather operation. For radar testing, please follow the diagram below.

雷达水位计测试环境


注：测试空间上下不能有干扰物
雷达需要摆放在桌面边缘并与被测目标物保持统一水平线
目标物必须为实心墙 或金属面板等最佳


雷达摆放不平导致测试数据不稳定或测不到数据
障碍物
不能是纸张、塑料
玻璃等类似物品

VI MODBUS-RTU Commands

Processor Register	Read&Write	Parameter Meaning	Directives	Remarks
0x0000	R/-	air-to-air ratio	01 03 00 00 00 01 84 0A	Unit: cm filtered data, when measuring the distance, read the air height can be measured when measuring the water level, you need to set the installation height in advance. The value of water level read = installation height - air height, the data under the private protocol is air height data.
0x0001	R/-	air-to-air ratio	01 03 00 01 00 01 D5 CA	Unit mm, filtered data
0x0002	R/-	water level	01 03 00 02 00 01 25 CA	Unit cm, filtered data
0x0003	R/-	water level	01 03 00 03 00 01 74 0A	Unit mm, filtered data
0x0004	R/-	signal strength	01 03 00 04 00 01 C5 CB	Greater than 30dB signal good
0x0005	R/W	Mounting Height	01 03 00 05 00 01 94 0B 01 06 00 05 [aa]	Unit: cm The distance from the radar to the bottom of the water, the water

			[bb] [cc] [dd]	level is equal to the installation height minus the air height. To read the water level, first set the installation height.
0x270F	R/-	heartbeat register	01 03 27 0f 00 01 be bd	Add 1 to the value for each reading to determine if the radar is working properly.
0x03E7	-/W	Switch to private protocol	01 06 03 e7 55 aa 86 96	Switch to private protocol to maintain current baud rate
0x03E7	-/W	Switch to private protocol	01 06 03 e7 55 bb 46 9a	Switch to private protocol to restore original baud rate
0x3E8	R/-	Ranging output value	01 03 03 e8 00 01 04 7a 01 03 03 e8 00 02 44 7b	(After filtering, in mm) Filtered data with less interference, slower changes, high 16bit
0x3E9	R/-	Ranging output value	01 03 03 e9 00 01 55 ba	(filtered, in mm) Filtered data with less interference, slower changes, lower 16 bit
0x3EA	R/-	Ranging output value	01 03 03 ea 00 01 a5 ba 01 03 03 ea 00 02 e5 bb	(Before filtering, in mm) Data before filtering will be disturbed and change fast, high 16bit
0x3EB	R/-	Ranging output value	01 03 03 eb 00 01 f4 7a	(Before filtering, in mm) Before filtering data will

				be disturbed, change faster, lower 16bit
0x3F4	R/W	device address	01 03 03 F4 00 01 C5 BC 01 06 03 f4 [aa] [bb] [cc] [dd]	Range: 0x01-0xFD support broadcast 0xFF
0x3F6	R/W	baud rate adjustment	01 03 03 f6 00 01 64 7c 01 06 03 f6 [aa] [bb] [cc] [dd]	48 96 144 192 384 560 576 1152 1290 Read and write baud rates, actual baud rate/100
0x3F7	R/W	Switching to air-height automatic mode	01 03 03 f7 00 01 35 bc 01 06 03 f7 [aa] [bb] [cc] [dd]	Write 0 to turn off air-height auto, write 1 to turn on air-height auto.
0x3F8	R/W	Restore background modeling	01 06 03 f8 55 aa b7 50	
0x041E	-/W	Radar reboot	01 06 04 1E 00 01 29 3C	Reboot the radar if necessary
0x07D1	R/W	distance jump	01 03 07 d1 00 01 d5 47 01 06 07 d1 [aa] [bb] [cc] [dd]	Range: 0x01-0xFF When the distance jump is greater than DeltaR, the output remains at the original value.
0x07D2	R/W	distance jump	01 03 07 d2 00 01 25 47 01 06 07	Range: 0x01-0xFF When a jump occurs, update the

			d2 [aa] [bb] [cc] [dd]	output value to the new value when the number of frames in the jump is greater than DeltaT
0x07D4	R/W	range (of scales or measuring equipment)	*01 03 07 d4 00 01* c5 46 01 06 07 d4 00 [aa] [bb] [cc]	Default: 0X0A, unit m Maximum range is related to the product type
0x07D5	R/W	IF Gain AGC	01 03 07 d5 00 01 94 86 01 06 07 d5 00 [aa] [bb] [cc]	0 auto, 1-11 fixed gain, min 0, max 11
0x07D6	R/W	Blind Zone Parameter Setting	01 03 07 d6 00 01 64 86 01 06 07 d6 00 [aa] [bb] [cc]	Range 0x01-0xFF in 0.01 meters
0x07D7	R/W	firing power	01 03 07 d7 00 01 35 46 01 06 07 d7 00 [aa] [bb] [cc]	Minimum value is 7, maximum value is 0
0x07D8	R/W	Initial value correction	01 03 07 d8 00 01 05 45 01 06 07 d8 00 [aa] [bb] [cc]	Range 0x01-0xFF,01 is equivalent to increase 1mm, 02 is equivalent to increase 2mm; FF is equivalent to subtract 1mm, FE is equivalent to subtract 2mm
0x07D9	R/W	Sensitivity	01 03 07	Range 1-20, the

		adjustment:	d9 00 01 54 85 01 06 07 d9 00 [aa] [bb] [cc]	smaller the value the more sensitive it is
0x07DA	R/W	Sample Rate Adjustment	01 03 07 da 00 01 a4 85 01 06 07 da 00 [aa] [bb] [cc]	Range 0x01-0xFF, modifying the sampling rate can adjust the radar power consumption
0x07DB	R/W	Spectrum search mode	01 03 07 db 00 01 f5 45 01 06 07 db 00 [aa] [bb] [cc]	Mode switching: 4, peak search, 5, domain value search
0x07DC	R/W	background modeling	01 03 07 DC 00 01 44 84 01 06 07 dc 00 [aa] [bb] [cc]	8: Turn off the background difference 9: Turn on the background difference 10: Rebuild the background To rebuild the background, be sure to turn on the background difference mode first, otherwise it won't be saved
0x07DD	R/W	Setting the filter queue length	01 03 07 DD 00 01 15 44 01 06 07 dd 00 [aa] [bb] [cc]	Range: 0x08-0xFF Factory default: 128 Filter buffer queue duration = filter queue length/sample rate

				Filter initial output time = filter queue length/sample rate/4 When the length of the filter queue changes from small to large, you need to wait for the data in the queue to be replenished to 1/4 before the value is output, and when the length changes from large to small, you don't need to wait.
0x07DE	R/W	0-255		The distance value 1, in units of 0.1 m, is rejected for background modeling, and the echo signals 0.5 m before and after this value are rejected during modeling, represented by linear interpolation, and no region is rejected when set to 0.
0x07DF	R/W	0-255		Excluding distance values for background modeling2
0x07E0	R/W	0-255		Background

				modeling excludes distance values3
0x07E1	R/W	0-255		Excluding distance values for background modeling4
0x07E2	R/W	0-255		Exclusion of distance values for background modeling5
0x07E3	R/W	0-255		Excluding distance values for background modeling6
0x07E4	R/W	0-255		Excluding distance values for background modeling7

Other notes:
1. Read and write function code 03, write a single register 06, the default address is: 1
2. Data format: 8N1 Validation: CRC16 (polynomial A001)
3. The above register numbers are decimal and need to be converted to hexadecimal to operate these registers via MODBUS protocol.
For example, to turn on domain value search mode, we need to send 01 06 07 DB 00 05 38 86
First byte, device address
Second byte, function code 0x03 reads the value of the register, 0x06 rewrites the value of the register
Third quadruple byte, register address
Fifth six bytes, at function code bit 0x03: number of registers to read
Function code bit 0x06: data to be deposited into registers
Section 7.8, CRC check.
When we need to write registers, there will be [AA] [BB] [CC] [DD]
These parameters need to be determined according to the needs of the value of these parameters

VII Device Software Commissioning

After the installation of this equipment on site is completed, if you need to modify the parameters of the equipment and upgrade the program, you can do it in 2 ways:

- Our host computer

Please refer to "Radar Water Level Meter Upper Unit Instruction Manual".

(Please consult the after-sales staff for software and documentation)

- Other serial port tools

Refer to the Radar Water Level Meter Protocol Guide

(Please consult the after-sales staff for documentation)

VIII Fault messages

Q: The upper unit is not receiving any values?

A：1）Please check whether the power supply is input correctly, whether the voltage is too low, and whether the access power is DC, please re-power on after confirming;

2) Are the serial port number and serial port baud rate set correctly;

(3) Radar water level meter electrical interface is RS485, connect the computer whether RS485 to RS232 converter; and check whether the RS485 AB two lines are connected to the reverse; and confirm that there is no failure of the communication conversion cable;

(4) whether the communication protocol is operated according to the instructions, check whether the communication address is correct, check to make sure that there is no error in the instructions, re-power on, if it still can not be normal communication, may be the line or the instrument failure;

Q: Do the measured values jump a lot and frequently?

A: 1) Please check if the power supply voltage is too low;

2) Whether there are obstacles in the measurement range;

(3) Whether the installation position is fixed, and whether the plane of the installed radar water level meter is parallel to the measuring water surface;

(4) You can appropriately set the setting of jump suppression, refer to the parameter setting.

Q: Why is the measured value always zero?

A: 1) Please check if the radar sensor is aligned with the measurement target;

2) Please check whether the measuring distance is less than the set minimum range;

3) Please check for obstacles within the radar beam range.

Q: Large measurement error?

A: 1) Indoor narrow space testing due to multipath reflections;

2) Whether the reflective flat plate is flat or not.

Contact Us

Should you have any questions or require technical support, please do not hesitate to contact us.

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