MADECO Smart Radar Water Level Meter Operating Instruction Model : MDRA9

Chapter 1 Product Overview

1.1 Introduction

80G radar water level gauge is a high-precision radar water level measuring instrument. It uses 80G millimeter radar waves as the carrier signal. Based on the leading patented sensor technology and microsecond time resolution, it achieves millimeter-level measurement accuracy, and the measurement results are more accurate and stable. Radar sensors are highly robust against any natural sources of interference such as noise, dust, color, direct or scattered light.

1.2 Principle

The high-frequency radar pulse wave emits narrow microwave pulses, which are transmitted downward through the antenna. After the microwave pulses touch the surface of the measured medium, they are reflected back (ie, echo pulses), and are received again by the antenna system and transmitted to the electronic circuit part. Automatically convert to water level signal. (Because microwaves travel so fast, the time it takes for the microwaves to reach the target and reflect back to the receiver is almost instantaneous.)

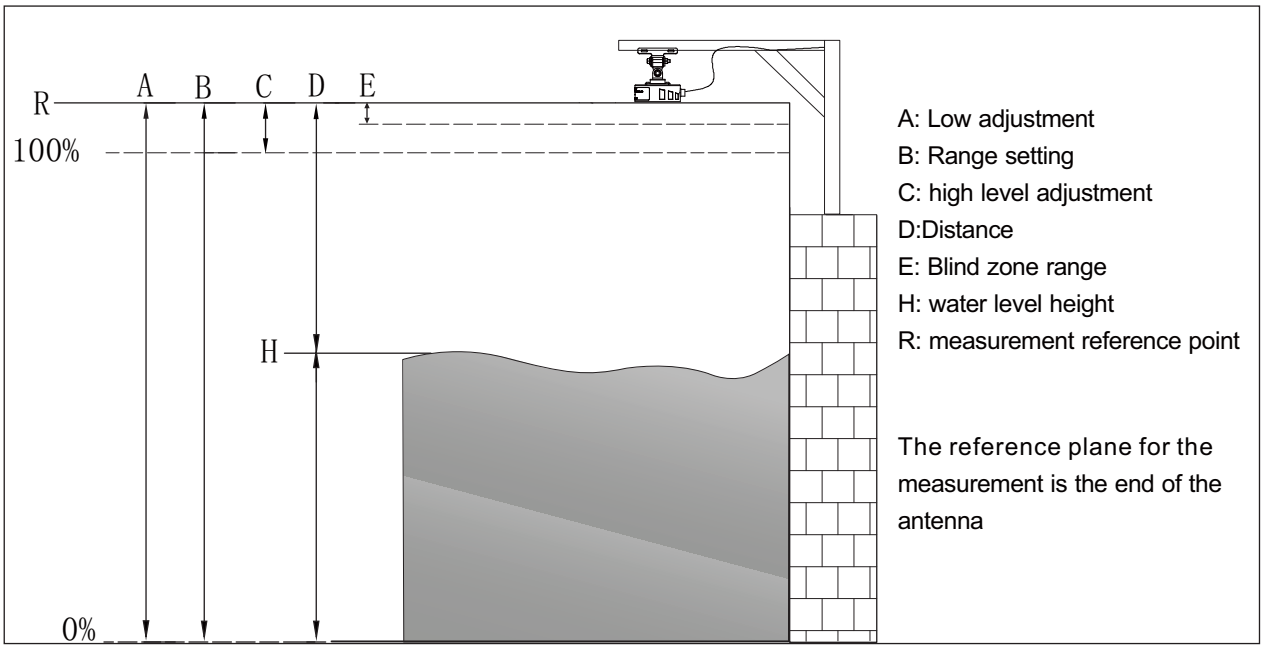


Figure 1 Water level measurement

Note: When using radar water level meter, be sure to ensure that the highest water level cannot enter the measurement blind area (area shown by E in Figure 1)

1.3 Features

The radar water level gauge uses a transmission frequency up to 80GHz and has the following characteristics:

- Non-contact measurement, no wear, no pollution;
- The antenna is small in size and easy to install;
- The beam angle is small and the energy is concentrated, which not only enhances the echo capability, but also helps to avoid interference;
- Almost unaffected by corrosion and foam;
- Almost unaffected by changes in atmospheric water vapor, temperature and pressure;
- High signal-to-noise ratio for better performance even under fluctuating conditions.

Chapter 2 Instrument Introduction

 MDRA91	Product features: stable performance, with angle measuring function, with level, simple installation, high precision, strong anti-interference ability, small and light, can be used for serial debugging, low power consumption, small beam angle.
	Applications: urban road and bridge water monitoring, reservoirs, rivers, hydropower stations, geological disasters, debris flow monitoring, irrigation canal water level monitoring.
	Maximum range: 15m/45m
	Beam angle: 8°
	Accuracy: ±2mm
	Process connection: universal bracket
	Working temperature: (-40~70)℃
	Repeatability: ±1mm
	Shell Material: Aluminum
	Frequency: 80GHz
	Working voltage: 6~30V DC
	Signal output: RS485 Modbus protocol
	Protection class: IP68
 MDRA92	Product features: stable performance, with angle measurement function, simple installation, high precision, strong anti-interference ability, small and light, can be used for serial port debugging, low power consumption, small beam angle.
	Applications: urban road and bridge water monitoring, reservoirs, rivers, hydropower stations, geological disasters, debris flow monitoring, irrigation canal water level monitoring.
	Maximum range: 45m/85m
	Beam angle: 6°
	Accuracy: ±2mm
	Working voltage: 6~30V DC
	Process connection: M66*2 thread/flange/bracket
	Working temperature: (-40~70)℃
	Repeatability: ±1mm
	Shell material: ABS
	Operating frequency: 80GHz
	Signal output: RS485 Modbus protocol
	Protection class: IP68
 MDRA93	Product features: One-piece lens antenna, small blind area, simple installation and high precision.
	Application range: reservoir, hydropower station, river water level height measurement.
	Maximum range: 85m/120m
	Beam angle: 3°
	Accuracy: ±3mm
	Process connection: G3½"A thread/T-bracket
	Working temperature: (-40~70)℃
	Repeatability: ±1mm
	Frequency: 80GHz
	Working voltage: 6~26V DC
	Signal output: RS485 Modbus protocol
	Protection class: plastic IP67/aluminum IP68

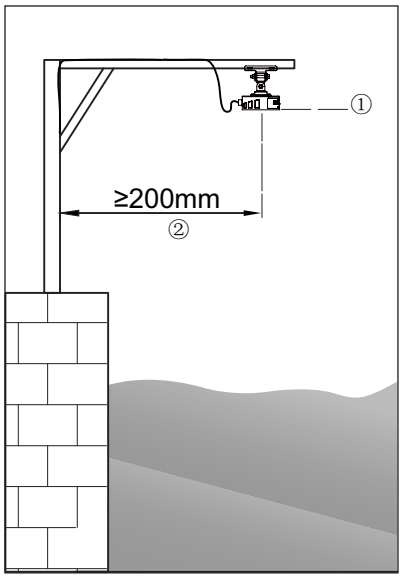
Chapter 3 Installation

Please note the following to ensure that the meter can be installed correctly:

1. Please reserve enough space for installation;
2. Please avoid strong vibration installation occasions;
3. Avoid obstacles during installation;
4. The highest water level shall not enter the measurement blind area.

3.1 Installation location

When installing, calculate the length of the instrument mounting bracket according to the beam angle and height of the water level gauge. The minimum distance of the length is 200mm. Please refer to the beam angle on pages 13-14.



Note: ① Datum plane
② Bracket length

Figure 2 Installation position

3.2 Pole installation

MDRA91 River Water Level Height Measurement

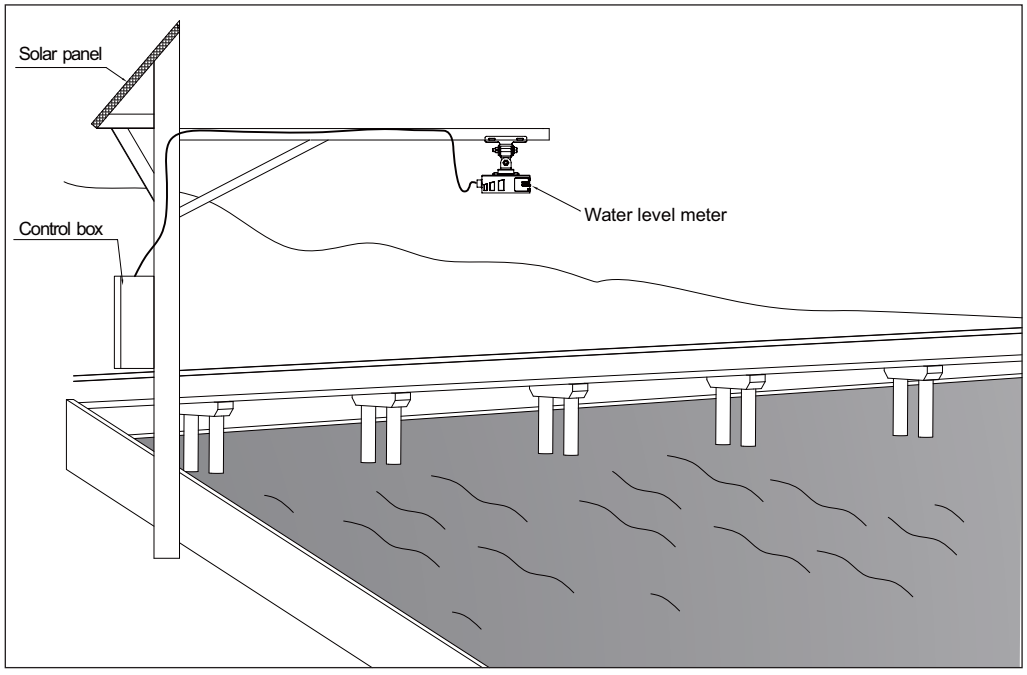


Figure 3

MDRA92 Irrigation Canal Water Level Height Measurement

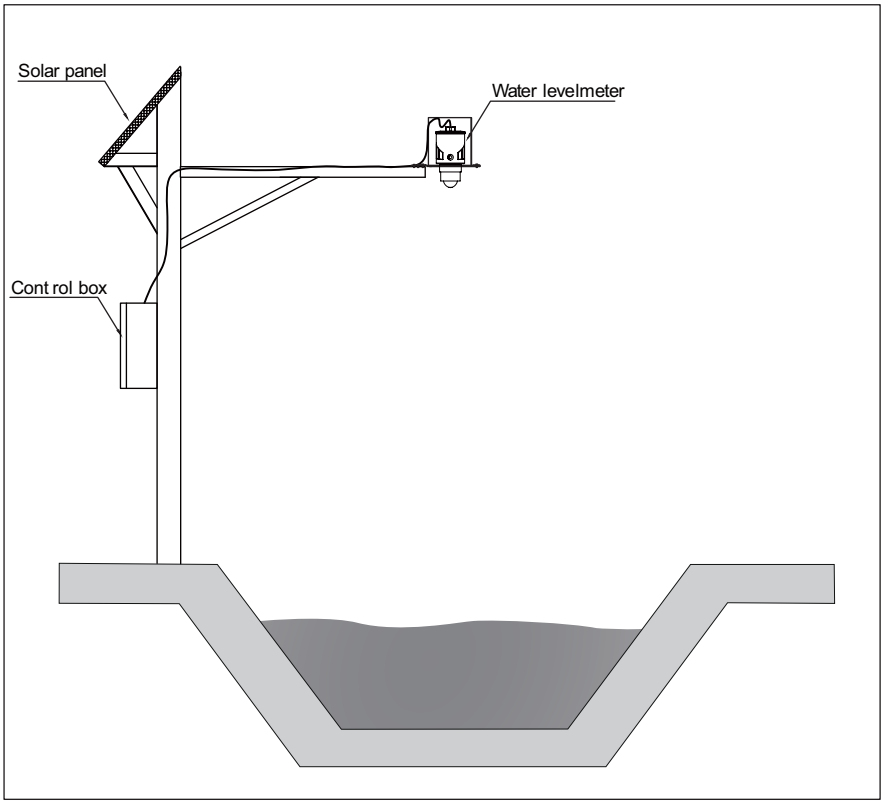


Figure4

MDRA93 Reservoir height measurement

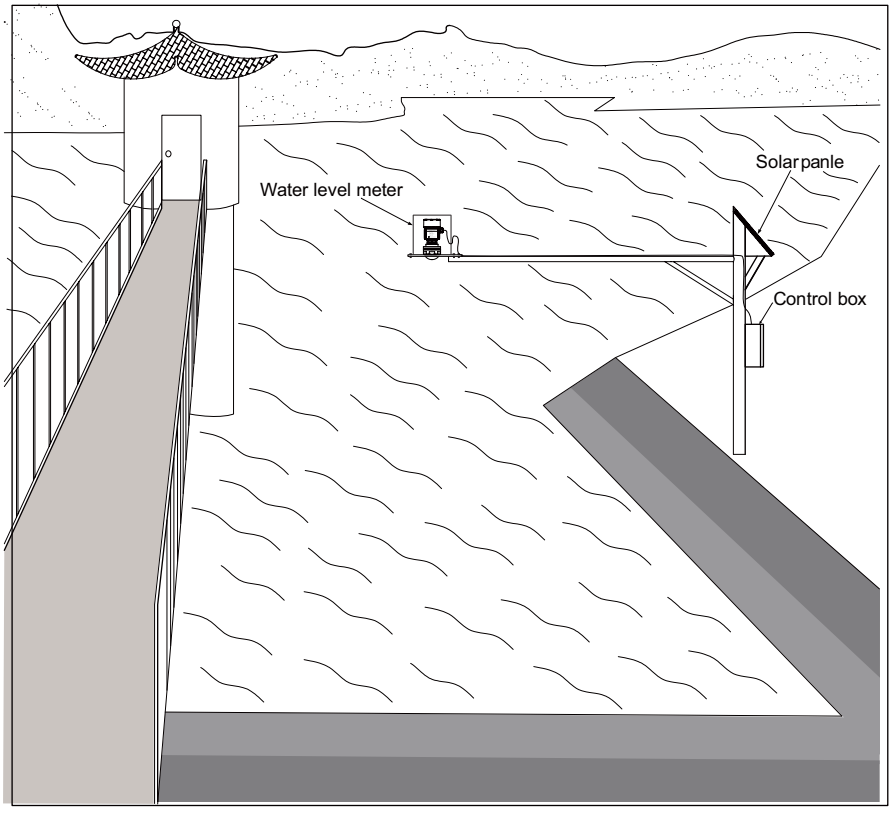


Figure5

3.2 False echo storage

If there are obstacles in the area radiated by the emitted acoustic beam, such as steps on the well wall, it will cause interference and lead to measurement errors. If it is affected, a new false echo needs to be created to remove interference for measurement.

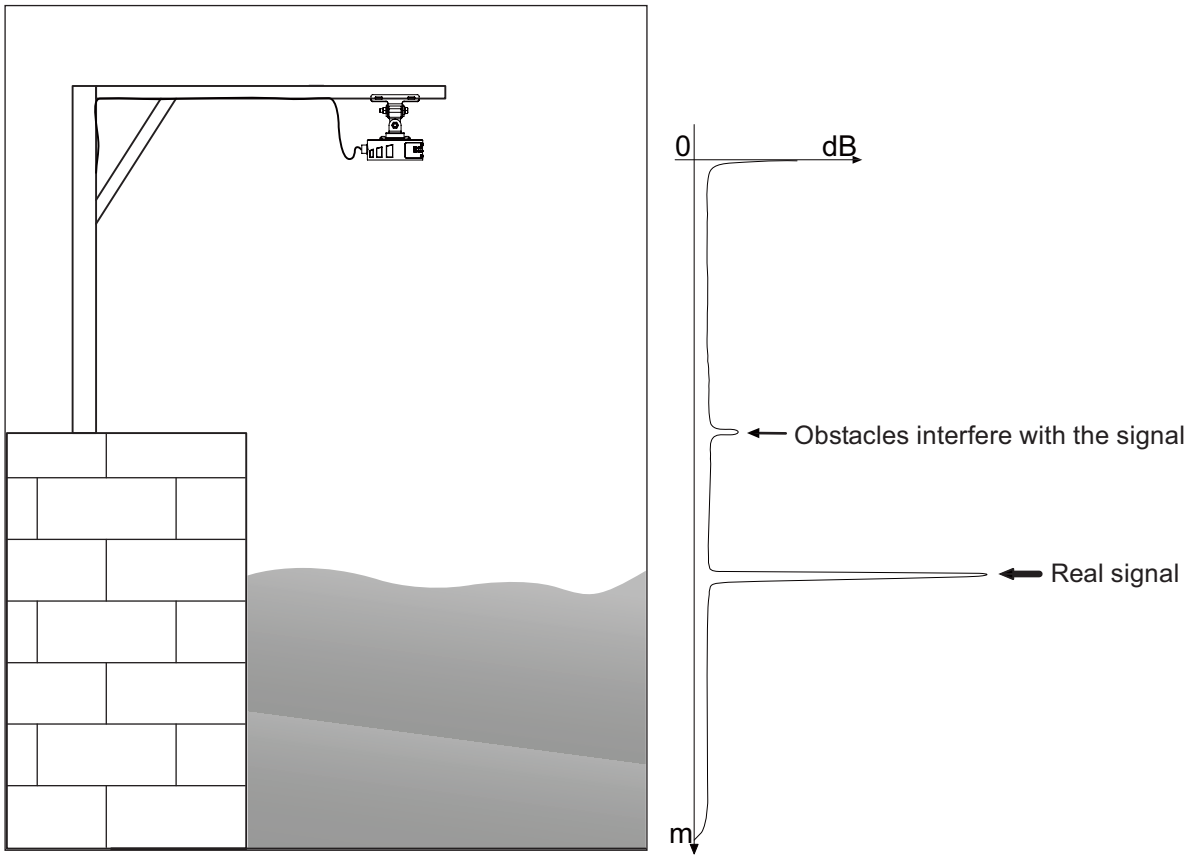


Figure 6 Obstacle interference signal

If you want to get a normal water level echo, the false echo storage can store the false echo in the following figure with the envelope from the starting point to the target signal and define it as a false signal, so a normal water level echo signal is obtained.

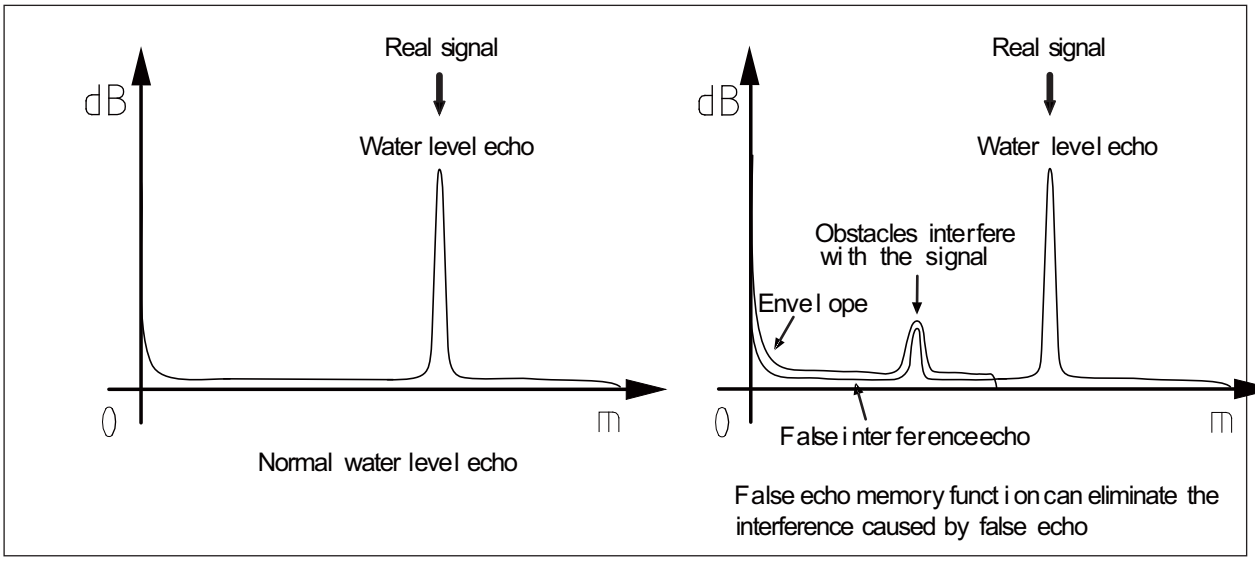


Figure 7 False echo storage

Comparison before and after zero-point echo

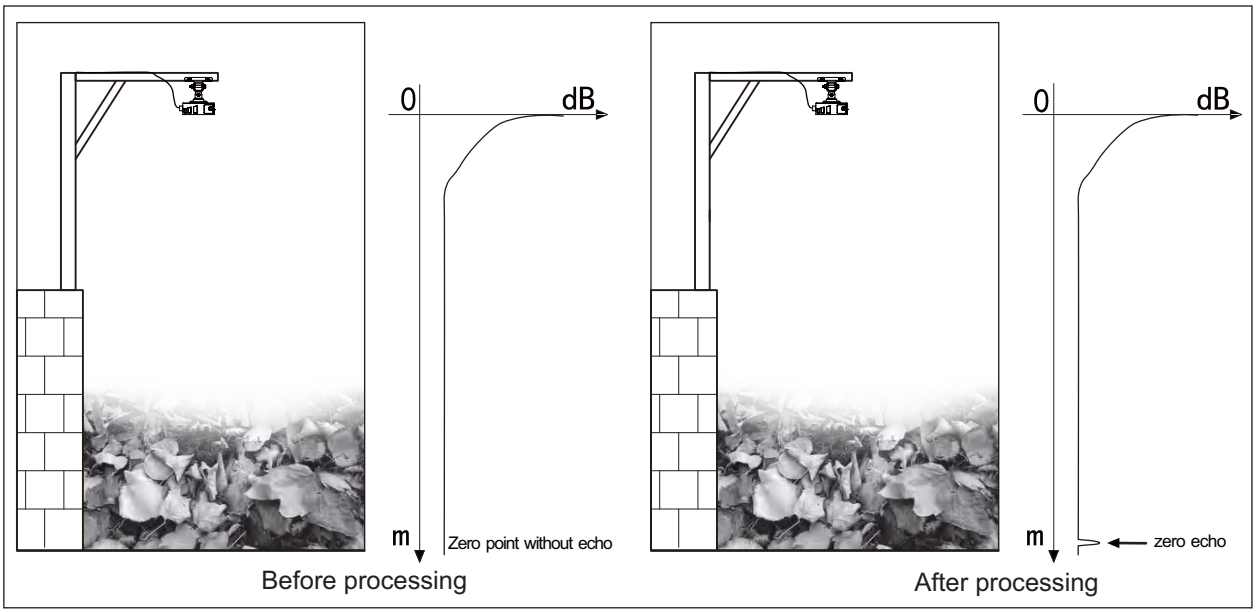


Figure 8 Zero echo processing

Chapter 4 Electrical Connection

4.1 Power supply/communication

Power supply: 6~30V DC Communication: RS485/Modbus communication protocol

4.2 Installation of connecting cable

See technical data on page 7 for details

Note: The five-core cable is generally used for wiring. Since the electric drive device, the power cord or the transmitting device often produces electromagnetic interference, it is necessary to use a shielded cable.

4.3 Wiring method

Figure 9 MDRA91/MDRA92 wiring diagram

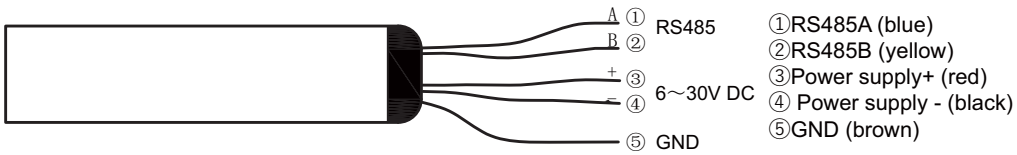
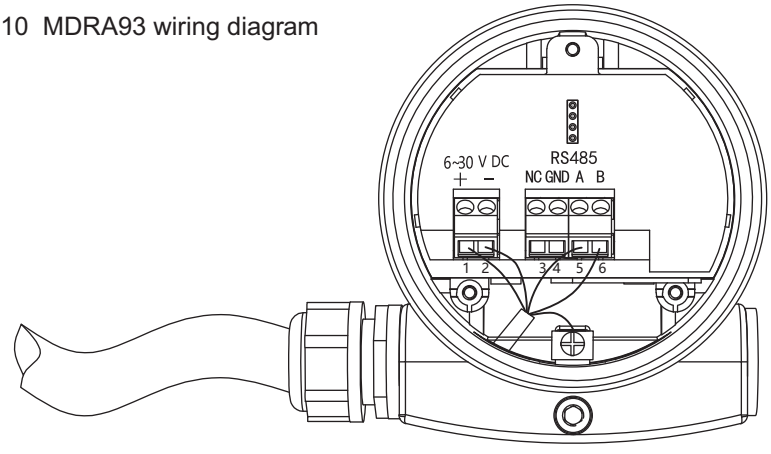


Figure 10 MDRA93 wiring diagram



4.4 Safety Instructions

- All electrical connection work must be carried out under the condition of power failure, please follow the instructions in the instrument manual!
- Follow local electrical installation regulations.
- Follow local health and safety regulations for personnel. All operations on the electrical components of the instrument must be done by formally trained professionals.
- Please check the meter's nameplate to ensure that the supplied product specifications meet your requirements. Please make sure that the power supply voltage is consistent with the requirements on the instrument nameplate.

Chapter 5 Technical Parameters

Model		MDRA91	MDRA92	MDRA93
General Instructions	Maximum range	15m/45m	45m/85m	85m/120m
	Blind spot	≤0.2m	≤0.01m	≤0.1m
	Working frequency	80GHz		
	Response delay	About 1 second (depending on parameter settings)		
Electrical parameters	Operating Voltage	6~30V DC		
	Protocol	Rs485 Modbus protocol		
	Ripple allowed	＜100Hz Uss＜1V		
		(100~100K)Hz Uss＜10mV		
Cable parameters	Cable entry/plug	Insulated cable Cable diameter 6mm	PG9 Cable diameter 6mm	M20*1.5 Cable diameter 7~9mm
Mechanical properties	Process connection	Universal bracket	M66*2 thread/bracket	G3½"A thread/T bracket
	Protection class	IP68	IP68	Plastic IP67/Aluminum IP68
	shell material	Aluminum	ABS	Plastic /Aluminum
	Antenna material	ABS	ABS	ABS
surroundings	Storage and Shipping Temperature	(-20~60)℃		
	Operating temperature	(-40~70)℃		
	Relative humidity	＜95%		
	Vibration resistance	Mechanical vibration 10m/s², (10~150) Hz		

Chapter 6 Debugging

6.1 Serial Communication Ddebugging

Hardware interface: RS485

Communication protocol: Modbus

Baud rate: 9600 (adjustable)

Data format: 8N1 (adjustable)

Check CRC16: Polynomial A001

6.1.1 Information frame format and description

1. The command format of the host consists of slave address, function code, register start address, number of read points and
The composition of the CRC code is shown in Table 1.

Host sends:	Station number (1B)	Function code (1B)	Register start address (2B)	Reading Points (2B)	CRC (2B)
	01	03	00 XX	00 XX	XX XX
	Station number (1B)	Function code (1B)	Register start address (2B)	Reading Points (2B)	CRC (2B)
	01	06	00 XX	XX XX	XX XX

Table 1 Host Command

6.1.2 Detailed description of host commands

- Station number: slave address (0-99);
- Function code: 03 to read the value of the register; 06 to change the value of the register;
- Register start address: two bytes, see Table 3 for detailed description;
- Number of read points: 2 bytes, if reading 16-bit integer data, set it as 0001, read 32-bit integer data, it is set to 0002;
- Storage data: 2 bytes, convert the storage data to hexadecimal, the high byte is first, and the low byte is after;
- CRC: Check code, two bytes.

The slave response has two formats. When the function code is 03, its format consists of station number, function code, data length, data area and CRC code, as shown in Table 2; when the function code is 06,its format is the same as that of the master command frame.

As shown in Table 1, that is, repeat the command sent by the host.

the slave responds:	stationary period	Station number (1B)	Function code (1B)	return data length	data (nB)	CRC(2B)
	T1 T4	01	03	n	XX XX XX XX	XX XX XX XX

Table 2 Slave response

- Station number (address): one byte, returns the address sent by the host;
- Function code: one byte, return the function code sent by the host;
- Response data bytes: the number of data bytes followed;
- Data: The corresponding data is returned for the host command, the high byte is first, and the low byte is after;
- CRC: Check code, two bytes.

Detailed description of register address: Register 0x0000~0x0003 data is signed integer data, which is the current measurement value; 0x0010 is the current instrument status, indicating whether there is a fault; 0x0011~0x0014 is the installation range of the slave, the dead zone, and the zero-to-full point of the water level .

Register address	Description (cannot be read continuously)
0x0000	Read the current empty height value of the meter, the unit is cm (read only)
0x0001	Read the current empty height value of the meter, the unit is mm (read only)
0x0002	Read the current water level value of the meter, the unit is cm (read only)
0x0003	Read the current water level value of the meter, the unit is mm (read only)
0x0010	Read measurement status (read-only); ==0 normal, if it is greater than 0, there is an error
0x0011	Slave range unit cm (read and write)
0x0012	Slave dead zone unit cm (read and write)
0x0013	Slave low position adjustment Unit cm (read and write)
0x0014	Slave height adjustment unit cm (read and write)

Table 3 Register address description

6.1.3 Examples

(1) Read the water level value of the meter, in mm

Host send: 01 03 00 03 00 01 CRC16/01 03 00 03 00 02 CRC16

Meter response: 01 03 02 XX XX CRC16/01 03 04 XX XX XX XX CRC16

(2) Modify the parameters of the instrument, and modify the range to 10m (1000cm)

Host send: 01 06 00 11 03 e8 xx xx

The instrument responds: 01 06 00 11 03 e8 xx xx indicates that the modification is successful; if the return value is different, it indicates that the modification fails or the preset data exceeds the limit.

6.1.4 Communication protocol example

Commands sent by the host when reading the water level and distance under different station number addresses:

Station No.	Function Code	Starting Address	Reading Points	Check Code	Significance
01	03	0000	0001	840A	Read the empty height, in cm
01	03	0001	0001	D5CA	Read the empty height, in mm
01	03	0002	0001	25CA	Read the water level value, in cm
01	03	0003	0001	740A	Read the water level value, in mm
02	03	0000	0001	8439	Read the empty height, in cm
02	03	0001	0001	D5F9	Read the empty height, in mm
02	03	0002	0001	25F9	Read the water level value, in cm
02	03	0003	0001	7439	Read the water level value, in mm
03	03	0000	0001	85E8	Read the empty height, in cm
03	03	0001	0001	D428	Read the empty height, in mm
03	03	0002	0001	2428	Read the water level value, in cm
03	03	0003	0001	75E8	Read the water level value, in mm
04	03	0000	0001	845F	Read the empty height, in cm
04	03	0001	0001	D59F	Read the empty height, in mm
04	03	0002	0001	259F	Read the water level value, in cm
04	03	0003	0001	745F	Read the water level value, in mm

Table 4 Examples of Communication Protocols

6.2 PC debugging software

The instrument can communicate with the host computer software through the RS485 to USB interface, as shown in Figure 10 below: the interface after the Precision Wave debugging software is successfully connected to the water level gauge. The measurement situation of the instrument can be observed in real time, and the waveform curve of the water level gauge can be read and the false wave storage can be established.

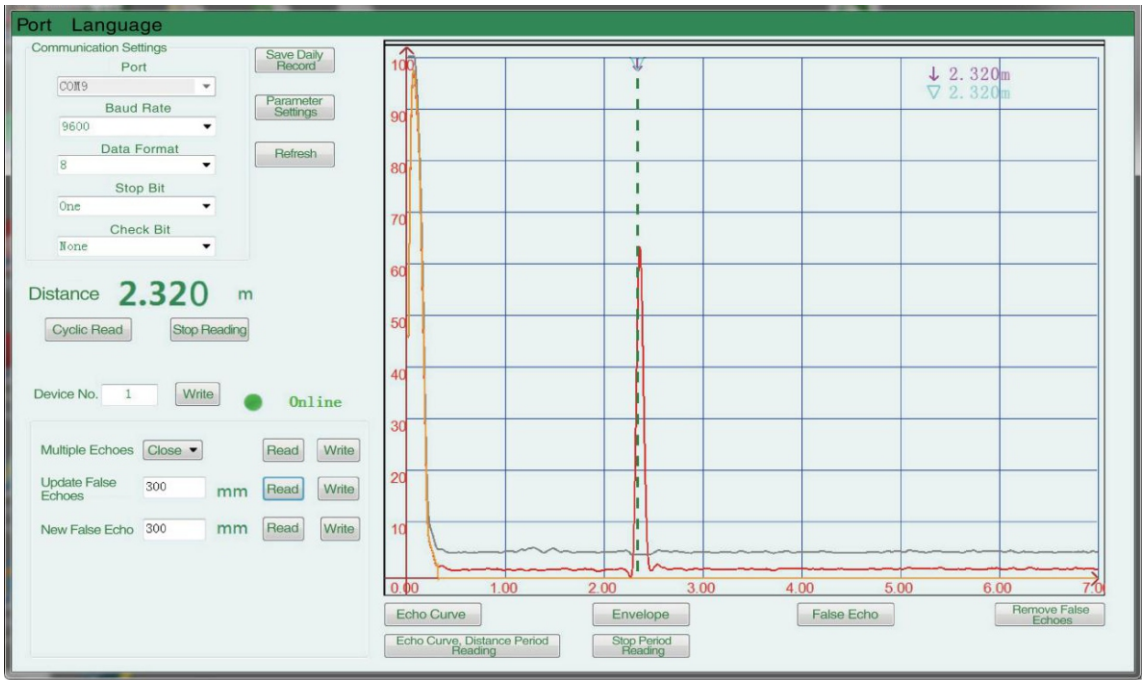


Figure 11 Successful connection interface

Parameter setting interface:

Adjust various parameters of the instrument and perform multi-point calibration, as shown in Figure 11.

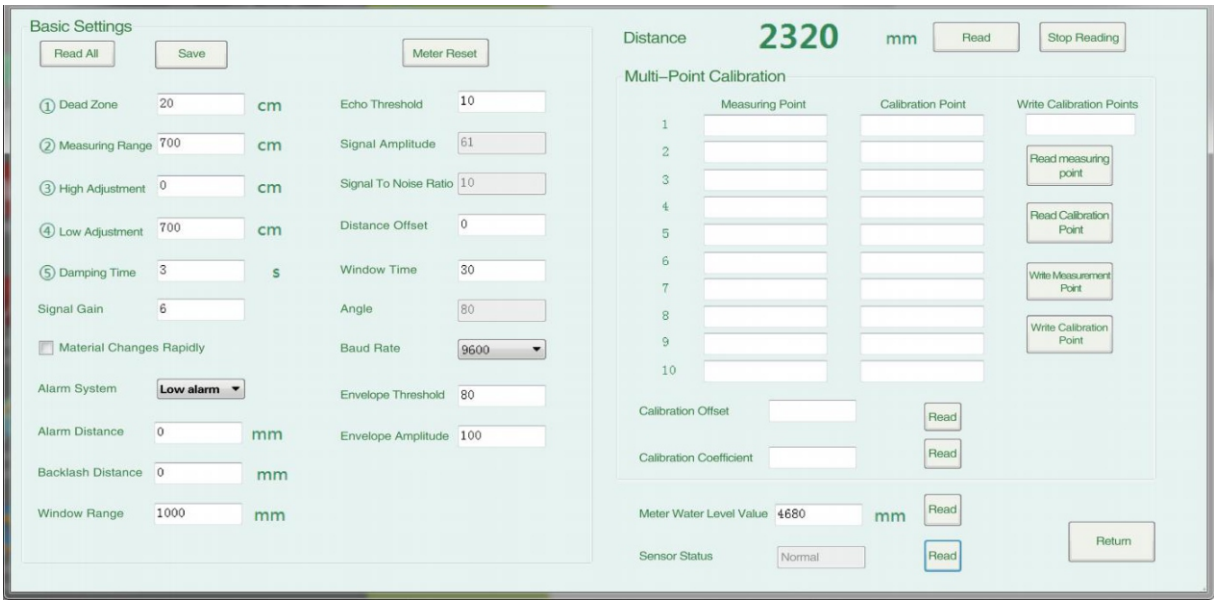
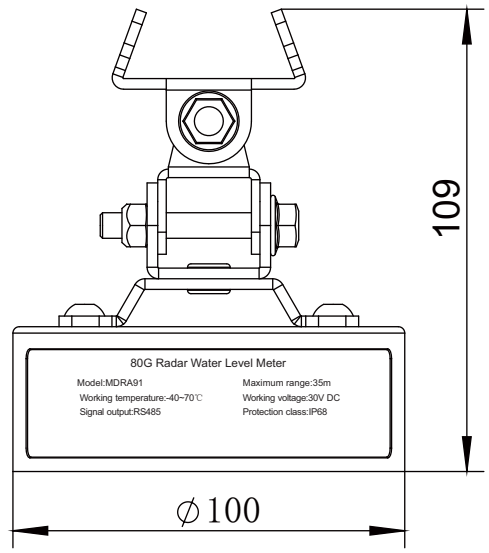


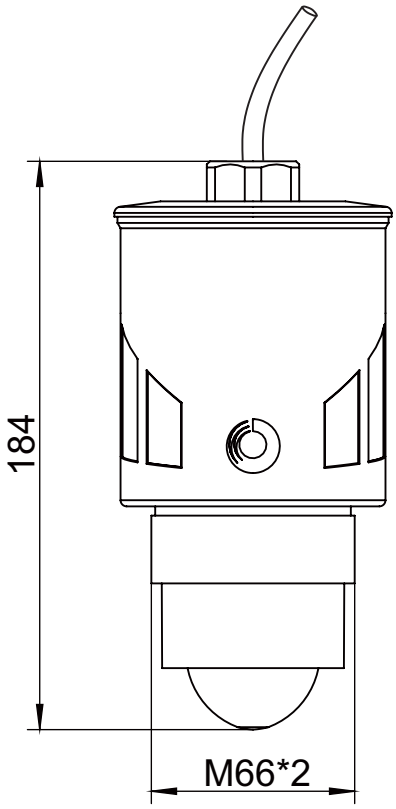
Figure 12 Parameter setting interface

Chapter7 Structural Dimensions (Unit: mm)

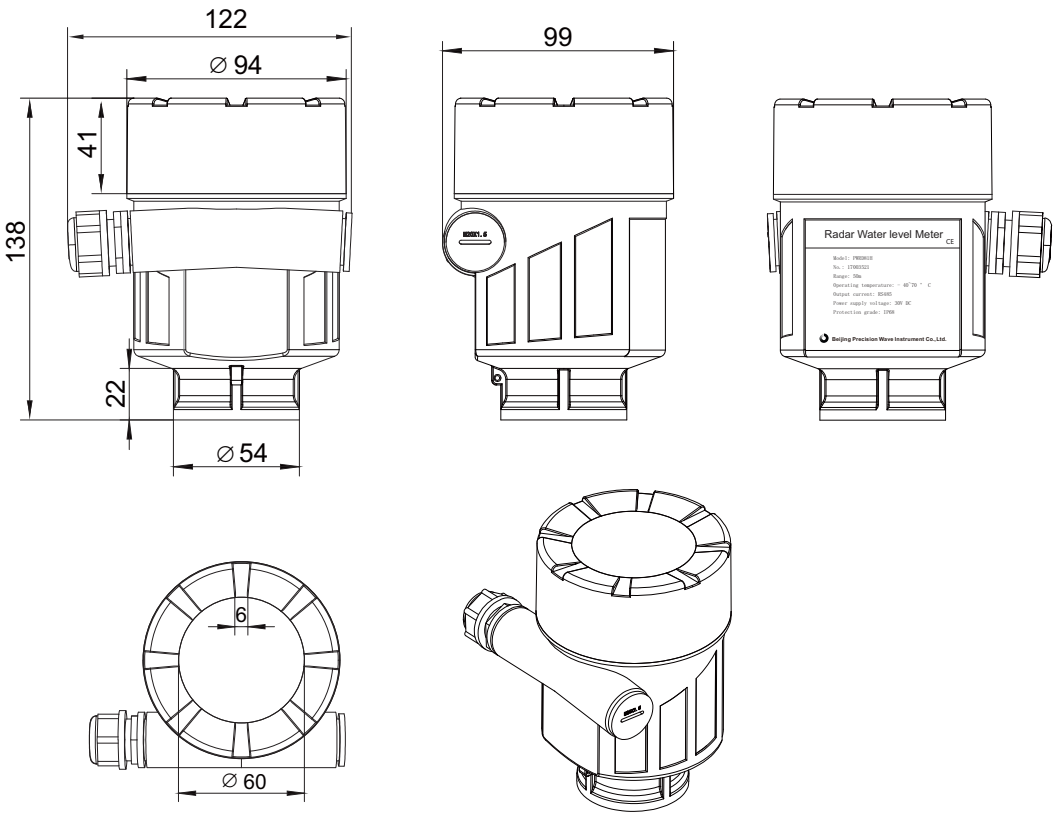
MDRA91



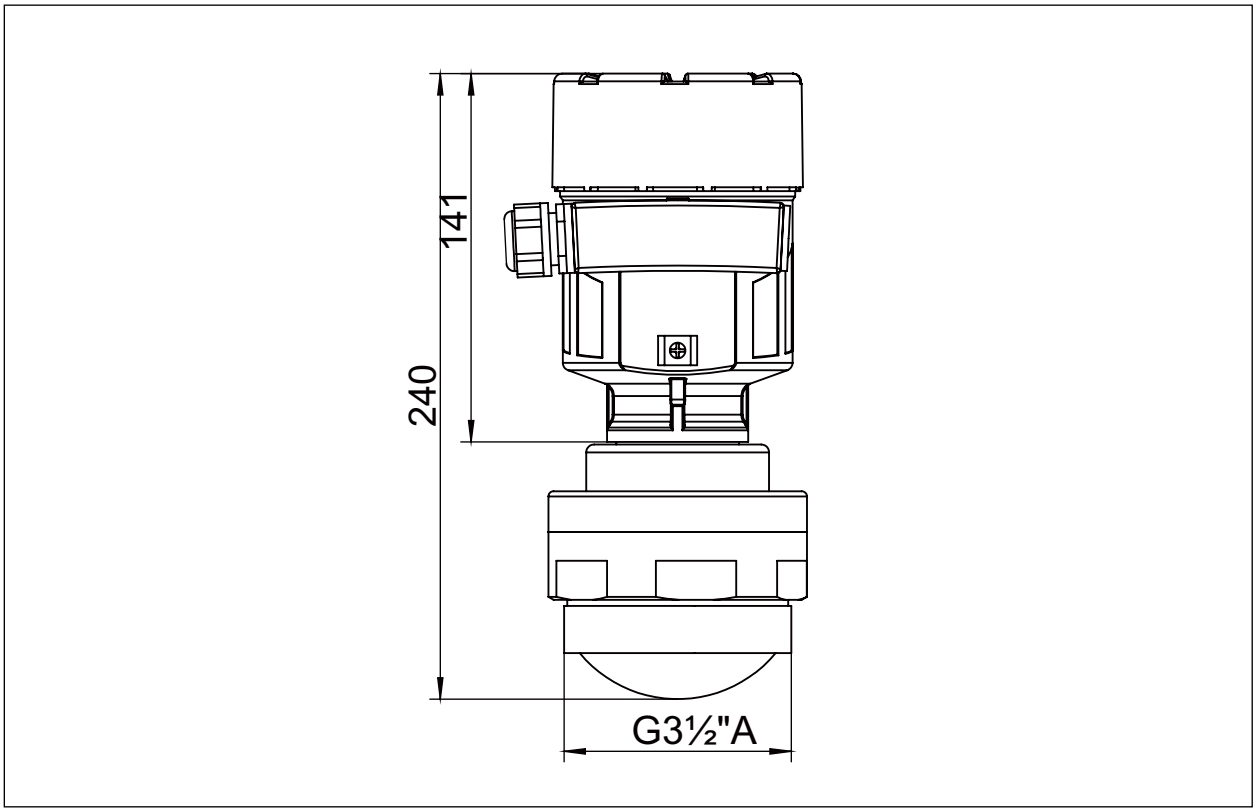
MDRA92



MDRA93 Case Dimensions (Material: Plastic)

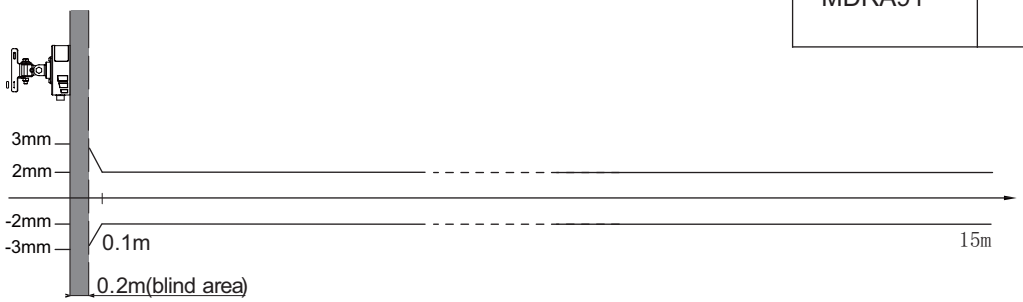


MDRA93 Dimensions

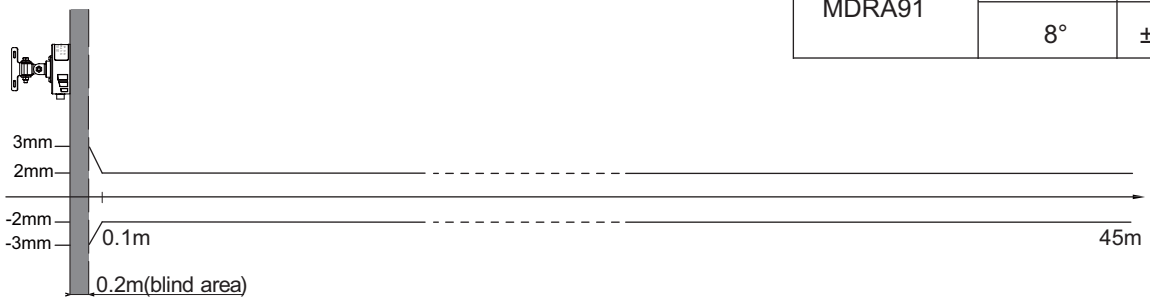


Chapter 8 Linear Graphs

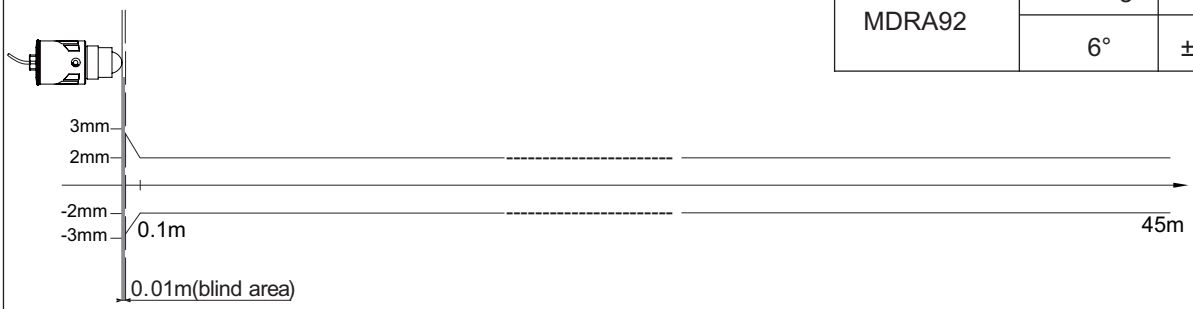
MDRA91	Beam angle	Accuracy
	8°	±2mm



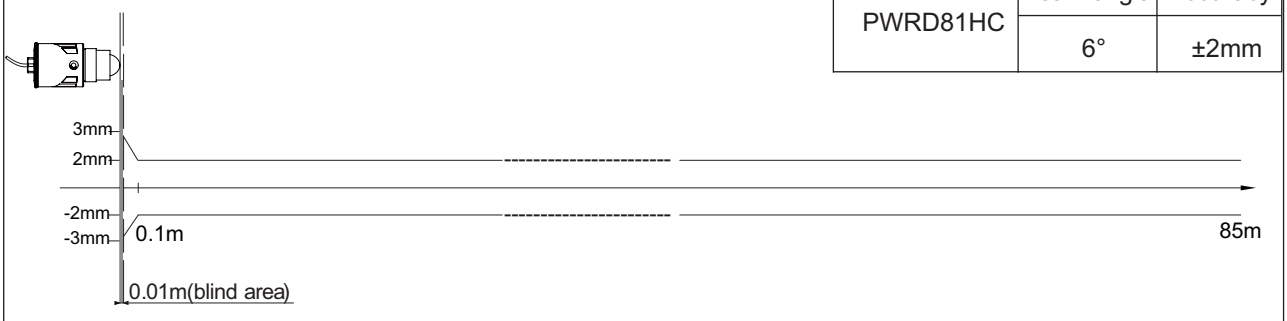
MDRA91	Beam angle	Accuracy
	8°	±2mm



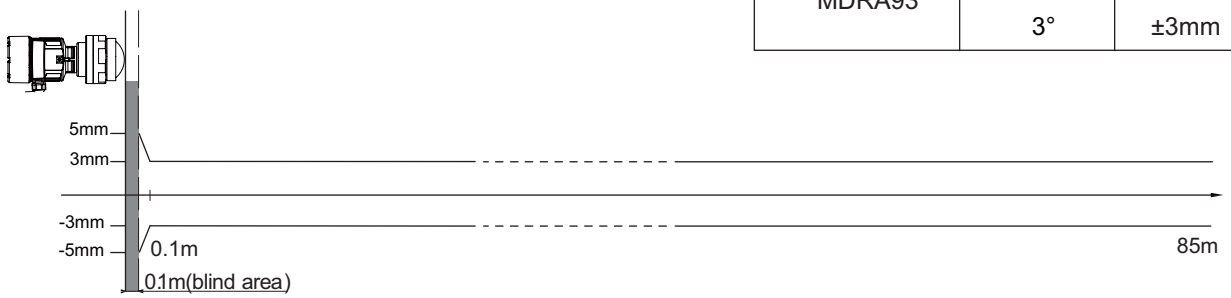
MDRA92	Beam angle	Accuracy
	6°	±2mm



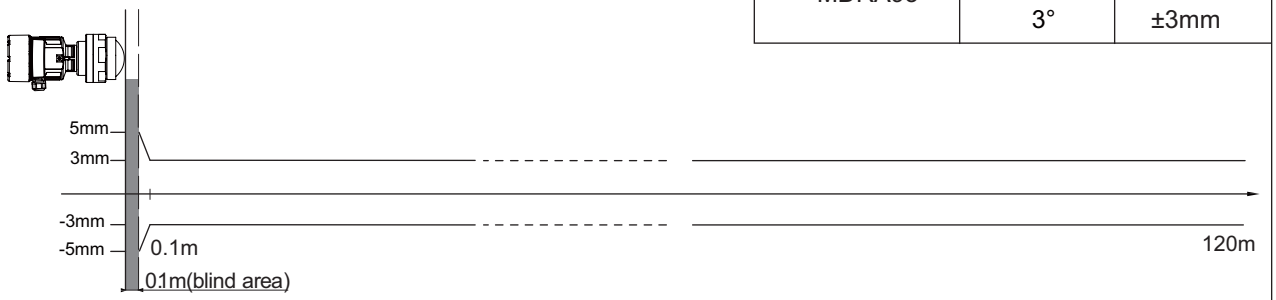
PWRD81HC	Beam angle	Accuracy
	6°	±2mm



MDRA93	Beam angle	Accuracy
	3°	±3mm



MDRA93	Beam angle	Accuracy
	3°	±3mm



Chapter 9 Transportation and Storage

In addition to the requirements of JB/T 9329, the transportation and storage conditions of the water level meter should also meet the following requirements:

1. The water level meter should be transported in strict accordance with the characteristics of the product and the requirements of the manual during transportation.
2. The water level gauge should be stored in a dry and ventilated room with a relative humidity of not more than 80% at (-20～60)℃. Do not store with corrosive substances. Instruments that have been stored for a long time should be tested before they can be sold and used.

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