RK900-12 Ultrasonic Automatic Weather Instrument User Manual

Revision Time	Reviser	Current Version	Remarks
20250513	SUN	V5.0	

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User Notice

Please read this manual carefully before use to ensure safe and optimal operation. Retain this manual for future reference.

Pre-Use Instructions

- Carefully review this manual and follow all operational and safety guidelines to prevent malfunctions and hazards.

Unpacking Inspection

- Upon receipt, carefully inspect the sensor device and accessories for any shipping damage.
- If damage is detected:
- Immediately notify the manufacturer and distributor.
- Retain all packaging materials for return or replacement processing.

Parts List

Item	Quantity	Remarks
Ultrasonic Automatic Weather Instrument	1	
Cable	1	The length depends on the order

1. Product Introduction

The RK900-12 small automatic weather station is a civilian comprehensive weather station, which can simultaneously measure six major meteorological elements, including atmospheric temperature, atmospheric humidity, wind speed, wind direction, air pressure, and rainfall. The RK900-12 uses a low-power chip with a power consumption of only 1.7W, making it particularly suitable for solar or battery powered environments with power consumption requirements. Due to the adoption of new technologies and processes, the structure is more compact. You can also choose solar radiation and solar irradiance detection modules, which are very suitable for supporting agricultural meteorological systems. The shell is made of ASA engineering plastic.

2. Product Features

- High accuracy, fast response
- Easy to install, all-weather measurement
- RS485/RS232/SDI-12 output
- No moving parts, maintenance free
- Use radar measurement of precipitation, accurately
- Reflect the rainfall and start-stop moment
- Low power consumption

3. Specification

Item	Technical Specification		
	Range	Resolution	Accuracy
Wind Speed	0-70m/s	0.1m/s	±3%
Wind Direction	0-359°	1°	±3°
Atmospheric Temperature	-40℃－+80℃	0.1℃	±0.5℃
Atmospheric Humidity	0－100%	1%	±3%
Atmospheric Pressure	300－1100hPa	0.1hPa	±1
Rainfall	0-200mm/hr.	0.1mm	±5%
Altitude	-500m - 9000m	1m	±5%
Solar Radiation	0-2000W/m2	0.1 W/m2	±5%
Illumination	0-200000lux	0.1 lux	±5%
PM2.5,PM10	0-2000μg/m3	1μg/m3	±5%
Visibility	10-10000m	1m	±15%
Noise	30-130 dB	0.1dB	±3dB
Item	**Technical Specification**		
Power Supply	12-24VDC		
Power Consumption	<1.7W		
Output Signal	RS232/RS485(Modbus or NMEA-183), SDI-12		
Operating Temperature	-20℃-+70℃		
Ingress Protection	IP65		
Dimension	Φ110*(217-298)mm(Dimensions will vary depending on the parameters)		
Weight(Unpacked)	0.39kg		
Main Material	ASA		

4. Electrical Connections

Cable	RS485	RS232
Red	V+	V+
Black	V-	V-
Yellow	RS485A	TXD
Green	RS485B	RXD
White		Signal GND

5. Product Dimensions

Unit：mm

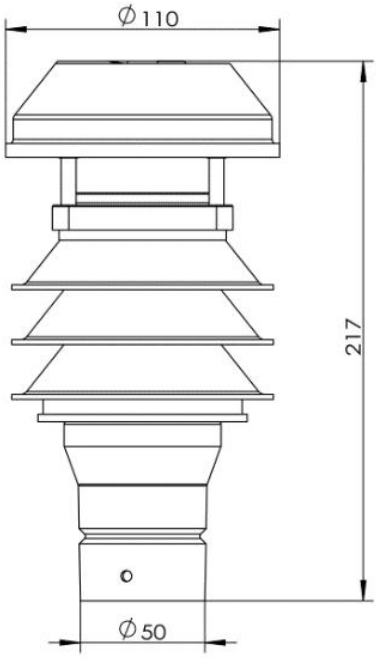

Figure 5.1
Dimensional Specification

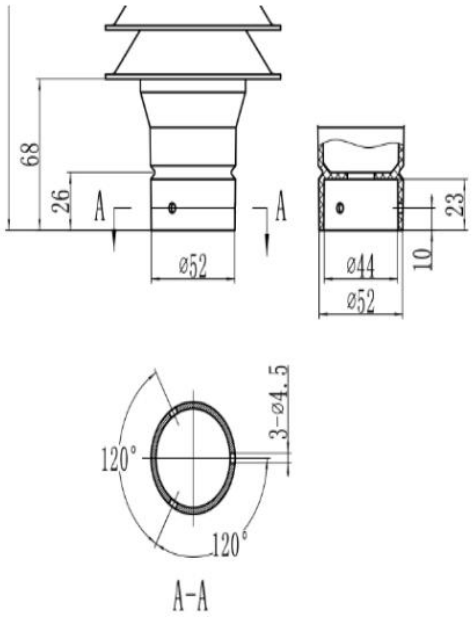

Figure 5.2
Detailed dimensions of the lower part

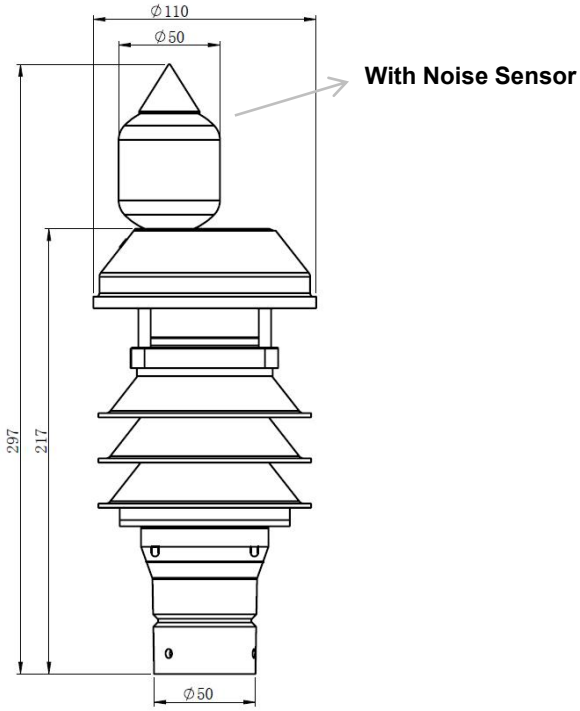

Figure 5.3
Dimensional Specification

6. Communication Protocol（MODBUS-RTU）

Parameter	Value
Data Bits	8 bits
Check Bit	EVEN
Stop Bit	1 bit
Baud Rate	9600 bps
Slave Address	0x01 (Factory Default)

6.1 Instrument Internal Register Description

Register	Byte length	Conception	Type	Range
1	16 bit	Device status	Integer type	0xA000~0xA03F Refer to Equipment Status Table 1
2	16 bit	Wind direction	Integer type	0-359°
3.4	32 bit	Wind speed	Float point type	0-40m/s
5.6	32 bit	Air Temp.	Float point type	-40~+80℃
7.8	32 bit	Air Humi.	Float point type	0-100%RH
9.10	32 bit	Air pressure.	Float point type	300-1100hPa
11	16 bit	Electronic compass	Integer type	0-359°
12	16 bit	Rain/Snow	Integer type	0x0000~0x000F
13.14	32 bit	Rainfall	Float point type	100mm/h
15.16	32 bit	Rainfall acc.	Float point type	
17	16 bit	Reserve	Integer type	
18	16 bit	Positioning status	Integer type	1.Not positioned, 2.Positioned
19.20	32 bit	Speed of ship	Float point type	Km/h
21	16 bit	Course	Integer type	0-359°
22.23	32 bit	Longitude	Float point type	East longitude is positive, West longitude is negative
24.25	32 bit	Latitude	Float point type	North latitude is positive, Southern latitude is negative
26.27	32 bit	Dust concentration	Float point type	ug/m3
28.29	32 bit	Visibility	Float point type	m
30.31	32 bit	Illuminance	Float point type	Lux
32.33	32 bit	Radiation(accu.)	Float point type	KJ
34.35	32 bit	Radiation	Float point type	W/m2
36.37	32 bit	Real wind direction	Float point type	0-359°

38.39	32 bit	Altitude	Float point type	m
40.41	32 bit	Real wind speed	Float point type	m/s
42.43	32 bit	Snow thickness	Float point type	m
44.45	32 bit	UV radiation	Float point type	W/m2
46.47	32 bit	PM1.0	Float point type	ug/m3
48.49	32 bit	PM10	Float point type	ug/m3
50.51	32 bit	Reserve	Reserve	Reserve
52	16 bit	Device status2	Integer type	0x0000 to 0xFFFF Refer to Equipment Status Table 2
53.54	32 bit	Average relative wind speed within 10	Float point type	0 to 60m/s
55.56	32 bit	Maximum relative wind speed within 10	Float point type	0 to 60m/s
57.58	32 bit	Minimum relative wind speed within 10	Float point type	0 to 60m/s
59	16 bit	Average relative wind direction within 10	Integer type	0 to 359°
60	16 bit	Maximum relative wind direction within 10	Integer type	0 to 359°
61	16 bit	Minimum relative wind direction within 10	Integer type	0 to 359°

6.2 Read Real-Time Data

Client sends:

01 03 00 00 00 3D 841B

Weather Station Return:

01 03 7A 0017 0038 C28F3CF5 333341E7 66664274 3E144468 000C 0001 66664256 000042F7 0201 0001 999A

4121 0143 32464125 A59C42CF 00004270 000042C8 4000459C 00004348 399A4559 14084148 33334249 A2E14034

5E354138 147B3E2E 000041D8 999A4247 ----------0019 27BB3FCF C28F3FF5CRC 00003FA0 0060 0061 0062 CRC

6.2.1 Description Of Return Data Format

No.	Conception	Byte	Description	Remarks
1	Address block	1	Address(0x01)	0x01
2	Function code	1	Only read(0x03)	0x03
3	Number of bytes	1	122bytes	0X7A
4	Device status	2	Device status1	0x00 0x17
5	Data block	2	Wind direction	0x0038(56°)
		4	Wind speed	0x3CF5C28F(0.03m/s)
		4	Air Temp.	0x41E73333 (28.9℃)
		4	Air Humi.	0x42746666(61.1%)
		4	Air pressure.	0x4468143E(929.0hPa)
		2	Electronic compass	0x000C(12°)
		2	Rain/Snow	0x0010(Snow)
		4	Rainfall	0x42566666(53.6mm/h)
		4	Rainfall acc.	0x42F70000 (123.5mm)
		2	Reserve	
		2	Positioning status	0x0001(Positioned)
		4	Speed of ship	0x4121999A(10.1)
		2	Course	0x0143(323)
		4	Longitude	0x41253246(10.324774)
		4	Latitude	0x42CFA59C(103.823456)
		4	Dust concentration	0x42700000(60.0ug/m3)
		4	Visibility	0x42C80000(100m)
		4	Illuminance	0x459C4000(5000Lux)
		4	Radiation (acc.)	0x43480000(200KJ)
		4	Radiation	0x4559399A(3475.6W/m2)
		4	Real wind direction	0x41481408(12.5°)
		4	Altitude	0x42493333(50.3m)
		4	Real wind speed	0x4034A2E1(2.82m/s)
		4	Snow thickness	0x41385E35(11.5m)
		4	UV radiation	0x3E2E147B(0.17W/m2)
		4	PM1.0	0x41D800000 (0.17ug/m³)
		4	PM10	0x4247999A(49.9ug/m³)
		4	Reserve	Reserve
		2	Device status2	0x0019
		4	Average relative wind speed within 10 minutes	0x3FCF27BB(1.61m/s)

		4	Maximum relative wind speed within 10 minutes	0x3FF5C28F(1.92m/s)
		4	Minimum relative wind speed within 10 minutes	0x3FA00000(1.25m/s)
		2	Average relative wind direction within 10 minutes	0x0060(96°)
		2	Maximum relative wind direction within 10 minutes	0x0061(97°)
		2	Minimum relative wind direction within 10 minutes	0x0062(98°)
6	Check block	2		CRC CRC

6.3 Landing Condition（HEX）

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
0	0	0	0	0	0	0	0
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	0	Solidity 0/1	Snow 0/1	Rain 0/1

Note:When only the lower three digits are used and the corresponding digit is 1, the status is valid.

Device Status Table 1

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Color temperature	UV	Water log	Real wind speed	Real wind direction	Altitude	Visibility	Illuminance
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
Solar radiation	Dust concentration	GPS	Rainfall	Electronic compass	Pressure	Wind speed and direction	Temperature & humidity

The high three digits are fixed numbers, and the remaining values of each digit are 0 or 1.

For example, the device status is restored to 0xA082, and the binary is converted to 1010000010000010, corresponding to the above table, indicating the following parameters : solar radiation, wind speed, wind direction.

Device Status Table 2

Bit7	Noise output
Bit6	The maximum, minimum, and average values of the actual wind direction can be adjusted within 2 minutes
Bit5	Adjustable maximum, minimum, and average real wind speed within 2 minutes
Bit4	Adjustable maximum, minimum, and average relative wind speed and direction within 2 minutes
Bit3	Gust (3 seconds)
Bit2	The maximum, minimum, and average values of the actual wind direction can be adjusted within 10 minutes
Bit1	Adjustable maximum, minimum, and average real wind speed within 10 minutes
Bit0	Adjustable maximum, minimum, and average relative wind speed and direction within 10 minutes

6.4 Clear Rainfall Acc.

Client sends:

01 10 00 0F 00 02 04 00 00 00 00 B3 EF

Weather

Station Return:

01 10 00 0F 00 02 71 CB

6.5 Instrument Configuration(you can choose ASCII or Hex)

Through the connecting with the instrument, some parameters of the instrument can be configured, such as changing the communication address and changing the Baud rate.

- **Command One: Enter The Settings Mode**

Sent

(ASCII) >*\r\n

(Hex) 3E 2A 0D 0A

Response

(ASCII) \n>CONFIGURE MODE\r\n

(Hex) 0A 3E 43 4F 4E 46 49 47 55 52 45 20 4D 4F 44 45 0D 0A

- **Command Two: Set The Serial Port Configuration**

Sent

(ASCII) >CUS 9600 8-N-1\r\n

(Hex) 3E 43 55 53 20 39 36 30 30 20 38 2D 4E 2D 31 0D 0A

Response

(ASCII) >CMD IS SET\r\n

(Hex) 3E 43 4D 44 20 49 53 20 53 45 54 0D 0A

Note: The CUS is required followed by the serial port parameters that will need to be set. If it is not followed by the parameters, the command becomes the current query configuration.(Such as sent: '>CUS\r\n ', Response:' \n>COM USART SET: 9600 N-8-1\r\n')

- **Command Three: Set The Address**

Sent

(ASCII) >ID 2\r\n

(Hex) 3E 49 44 20 32 0D 0A

Response

(ASCII) >CMD IS SET\r\n

(Hex) 3E 43 4D 44 20 49 53 20 53 45 54 0D 0A

Note: This 2 is the address you want to set(set according to the need,1-255),which must be in decimal format, If 'ID' is not followed by address, the command becomes the current query address(Such as sent: >ID\r\n, Response: ID(HEX) : 02\r\n)

- **Command Four: Reset**

Sent:

(ASCII) >RESET\r\n

(Hex) 3E 52 45 53 45 54 0D 0A

After the instrument receives this command successfully,Soft reset is performed.

- **Command Five: Manually Exit The Settings Mode**

Sent:

(ASCII) >!\r\n

(Hex) 3E 21 0D 0A

Response:

(ASCII) \n>NORMAL MODE\r\n

(Hex) 0A 3E 4E 4F 52 4D 41 4C 20 4D 4F 44 45 0D 0A

6.5.1 Steps:

Set the address:

'Command one' => 'Command three' => 'Command five' => 'Command four

Set the serial port configuration:

'Command one' => 'Command two' =>' Command five' =>' Command four'

Notes:

1.There are two spaces in the 'CUS 9600 8-N-1'to note,'8-N-1' separated by'-', no spaces.

Baud Rate	Data Bits	Check Bit	Stop Bits
2400-115200	8	N:NONE, E:EVEN, O:ODD	1 2

2.Any setting instruction(2, 3)must first let the instrument enter the setting mode, and the setting mode will be automatically closed if no operates on setting within 15-second. so the setting instruction must be input within 15 seconds. and the 15-second countdown reset restart after successful input.

3.After setting the instrument, "Command four must be sent to make the instrument soft reset before the new setting can take effect.

4."\r\n" is the carriage return line feed, corresponding to HEX (0x0D,0x0A).

7. Installation Guidelines

- Recommends keeping the following distance from some nearby radio receiving antennas.
- Do not install on a flat surface with any radar scanner, at least at a distance of 2m or more.
- If the cable is cut and not properly connected, or if the cable shield is not properly maintained, EMC may decrease.
- Do not need to create a ground loop, please connected according to the installation instructions.
- Ensures the continuous power supply of RK900-12 Ultrasonic Automatic Weather Instrument in operation.
- Avoid turbulence generated by surrounding buildings such as trees, power poles, tall buildings, etc., which can affect the accuracy of ultrasonic wind speed and direction detector.The detector is best mounted on one side of the prevailing wind.

The WMO (World Meteorological Organization) makes the following recommendations:

- Installation standard of anemometer: over 10 meters above ground in open area.The definition of open area is that the distance between the anemometer and any obstacle is more than 10 times the height of the obstacle.
- If mounted on a building, the wind meter should theoretically be installed at a height of 1.5 times that of the building.
- The length of the boom or branch must be at least twice the minimum diameter or diagonal of the tower if it is mounted on the boom or mast.The boom needs to be mounted on the prevailing wind side.

7.1 Mechanical Installation

7.1.1 Installation of Land Meteorological Stations

Location:Generally, RK900-12 is installed on a vertical installation pipe to ensure the measurement on the same horizontal.

For indoor use, the sensors can be installed in any desired direction to measure wind speed and direction on different horizontal.

Alignment:The upper part of the sensor is marked with a white triangular arrow. Please align this marker to face north, which also indicates the zero point direction of the sensor's wind orientation.

Note: When installing,use the compass to determine the appropriate mark and direction, which will make installation easier.

Installation: Installation Pipe need 3 isometric holes,M5 screws, and its position away 7.5mm from the pipe top. Feed the cable (waterproof aviation plug) through the installation pipe.

Notes:

- You must do proper stress relief for cables. You can connect the plug to the socket of the RK900-12 ,by rotating the plug and gently pushing it in. When the plug is connected, the outer sleeve can be rotated clockwise, and then the plug will be locked.
- RK900-12 can be fixed on the installation pipe by three stainless-steel screws (the maximum installation torque of the screws is 4nm).
- You must ensure that the RK900-12 is installed in an open area to avoid obstruction or turbulence caused by surrounding buildings. Do not install it close to high-power radar or radio transmitters.

7.1.2 Installation of Mobile Carriers (Ships or Vehicles)

Location: RK900-12 are installed on a vertical installation tube to ensure that there are no other high points 2 meters near the same horizontal plane, so as to avoid obstacles to air flow or turbulence caused by surrounding buildings.

Alignment:The upper part of the sensor is marked with a white triangular arrow. Align this arrow to face the forward direction of the mobile vehicle (e.g., the front of a car or the bow of a boat), then proceed with secure installation.

7.2 Installation Display

- **RK95-53 Bracket**

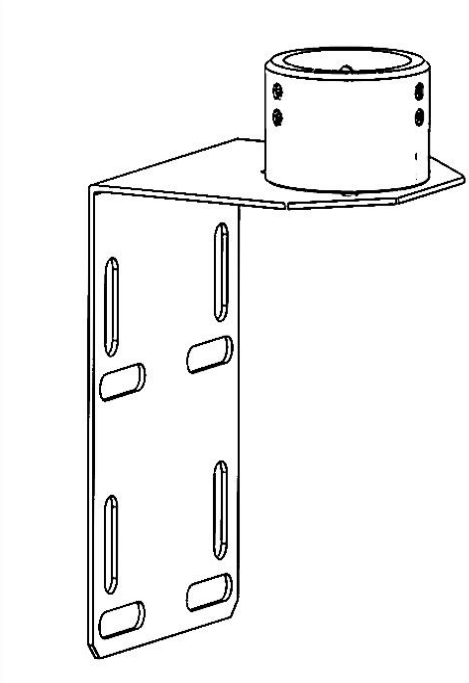

Figure 7.2.1
Bracket with slot-holed mounting plate

Figure 7.2.2
Bracket Mounting Diagram

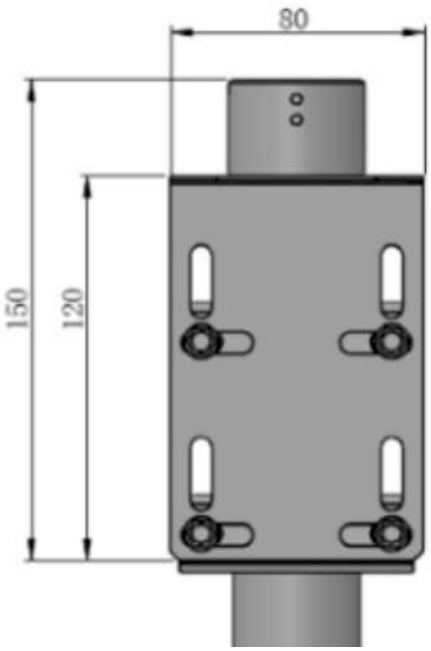

Figure 7.2.3
Bracket dimensions and hole spacing details

- **RK95-54 Bracket**

Users can design, process, and install columns or corresponding installation methods based on the measurement dimensions of the base.The following installation methods and dimensions are for reference only.

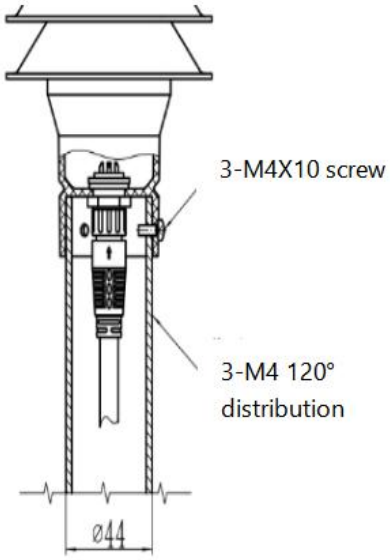

Figure 7.2.4
Installation method 1

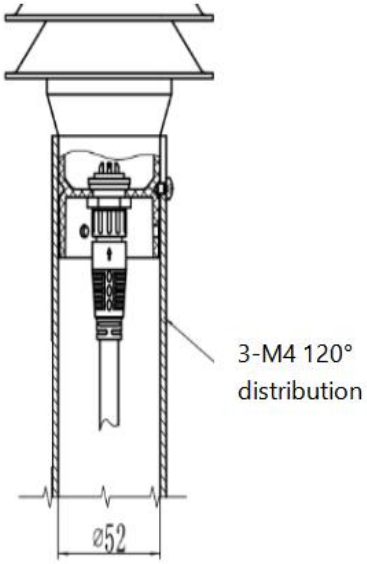

Figure 7.2.5
Installation method 2

Figure 7.2.6
Bracket Mounting Diagram

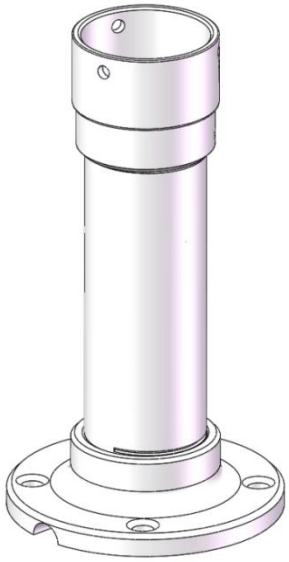

Figure 7.2.7
Bracket Diagram

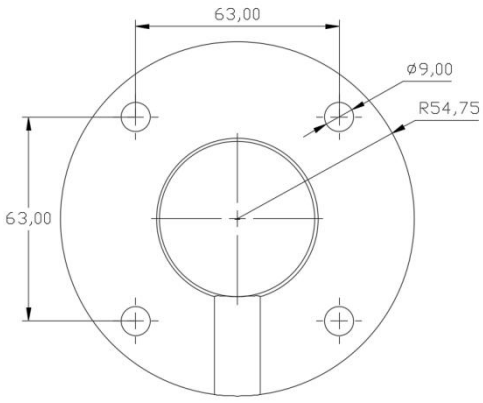

Figure 7.2.8
Bottom Dimension Diagram

8. Precautions

Powered Wiring Prohibition

- Do not connect wires while powered. Only energize the sensor after confirming correct wiring.

Component Modification Restriction

- Do not alter factory-soldered components or pre-connected wires.

Precision Handling Requirement

The sensor is a precision device. Avoid:

- Unauthorized disassembly
- Do not touch internal components to prevent product damage

Note: Unauthorized modifications void the warranty.

9. Troubleshooting

Incorrect Output Signals (Analog/RS232/RS485):

- Verify wiring correctness and secure connections.
- Check if the serial port is occupied or malfunctioning.
- Confirm serial port settings (baud rate, data/stop bits) match device requirements.

Persistent Issues:

- Contact the manufacturer if the above steps fail to resolve the problem.

10. Product Maintenance

Maintenance and Safety

- Regularly clean and inspect the sensor to maintain performance.
- Do not expose the sensor to extreme temperatures, moisture, or corrosive substances unless explicitly specified.
- If dust is deposited on the instrument, it can be lightly scrubbed with a cloth (with biodegradable) soft lotion.
- Do not use dissolving reagents and carefully scrub to avoid scratched the surface of the instrument.
- If there is snow or ice on the surface of the instrument, it should be slowly and naturally dissolved, and must not be forced to remove by tools.
- Unauthorized disassembly, modification, or repairs may void the warranty and lead to malfunctions.

Troubleshooting Protocol

- In case of malfunction, refer to the troubleshooting section of this manual.
- Do not attempt unauthorized disassembly or repairs.
- Contact the manufacturer's after-sales department directly for technical support.

11. Warranty Terms

This product comes with a one-year warranty, starting from the date of delivery. Within twelve months, the Company shall be responsible for free repair or replacement of any failure caused by sensor quality issues (non-human damage). Fees will be charged for repairs or replacements after the warranty period expires.

CE Complies with applicable CE directives.

Manual subject to change without notice.

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