

ecowitt®



Soil Moisture Sensor Manual

Model: WH51



<https://s.ecowitt.com/F24NPW>

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1.Ecowitt System Introduction

Thanks for purchasing the WH51 soil moisture sensor. This device measures soil moisture. The data can be streamed by Ecowitt Wi-Fi gateway(sold separately) or console (sold separately), and can be viewed on our WView Plus or Ecowitt APP after the Wi-Fi configuration is done. Or a receiver console(sold separately) can be used to display the received sensor value.

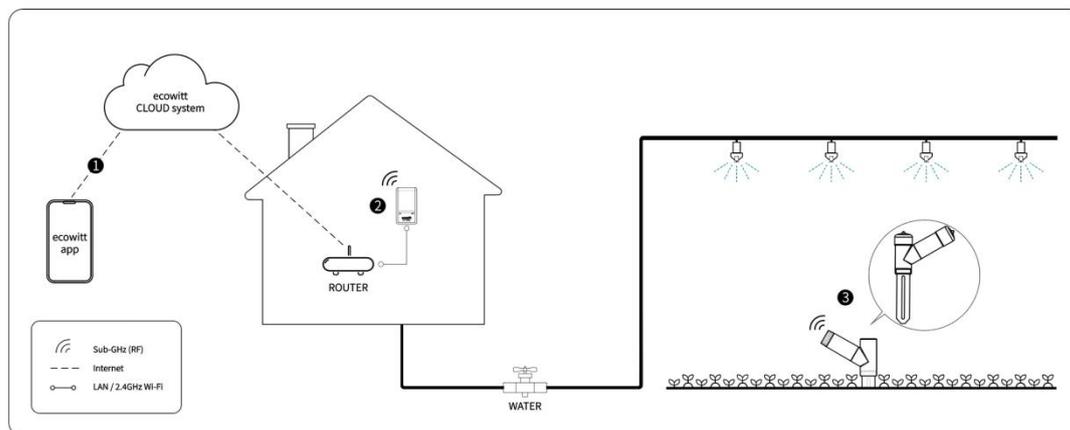


Figure 1 How Ecowitt System Work

- ① Gateway Registration in App: Download the application, log into your account, and select the option to add a new gateway.
- ② Gateway Network Connection: Power on the gateway to initiate the network pairing mode.
- ③ Sensor Discovery: Initiate the automatic discovery process within the application to search for and register all sensors.

To ensure the best product performance, I'd like you to please read this manual and keep it for future reference.

		
Model Number	WH51	WH51L
Moisture Range	0~99%	0~99%
Accuracy	± 5%	± 5%
Resolution	1%	1%
Display	×	LCD Display
Wire	×	1m/3.28ft PVC

Waterproof Level	IP66(Device's body and sensor)	Device's Body: IP66; Sensor: IP68
Channels	16	16

Table 1 Comparison between WH51 and WH51L

2. Getting Start

2.1 Part List

- 1 x Soil Moisture Sensor
- 1 x Short Silicone Cap for LED Indicator
- 1 x Long Silicone Cap for Battery Compartment
- 1 x User Manual

Note: The battery is Not Included.

2.2 Overview and Size

2.2.1 Overview

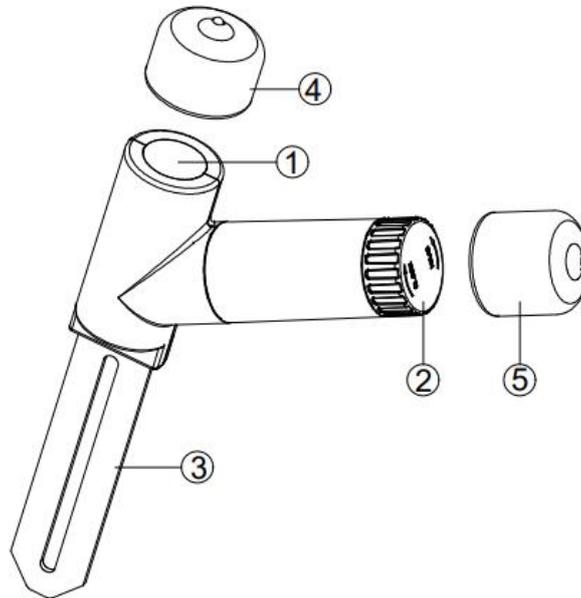


Figure 2 Overview of the Sensor

①	LED Indicator	②	Battery Compartment Cover
③	Soil Moisture Sensor Probe	④	Short Cap for LED Indicator
⑤	Long Cap for Battery Compartment		

Table 2

2.2.2 Size of the Sensor

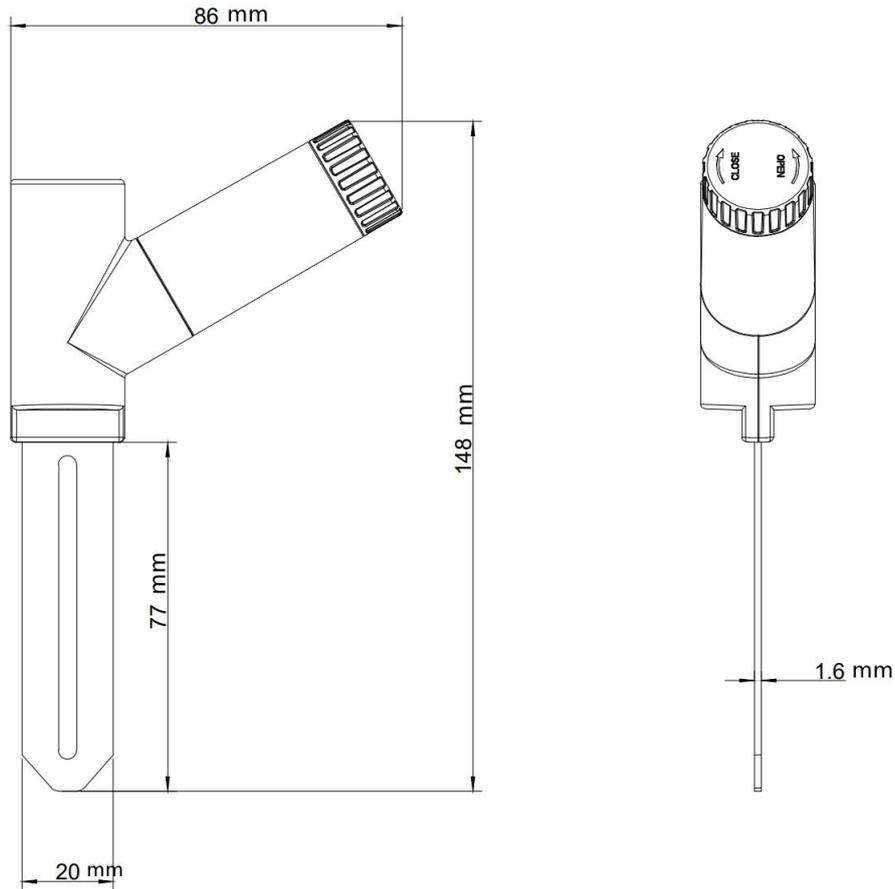


Figure 3 Size of the Sensor

2.3 Installation

When you receive the WH51 soil moisture sensor, please follow the below process to finish installing the battery, the LED indicator cap and the waterproof battery compartment cap, pairing it with the Wi-Fi gateway/console, and testing whether the device can normally work or not.

2.3.1 Install Battery and Silicone Cap

1. Insert one AA battery into the battery compartment, like the Figure 4.

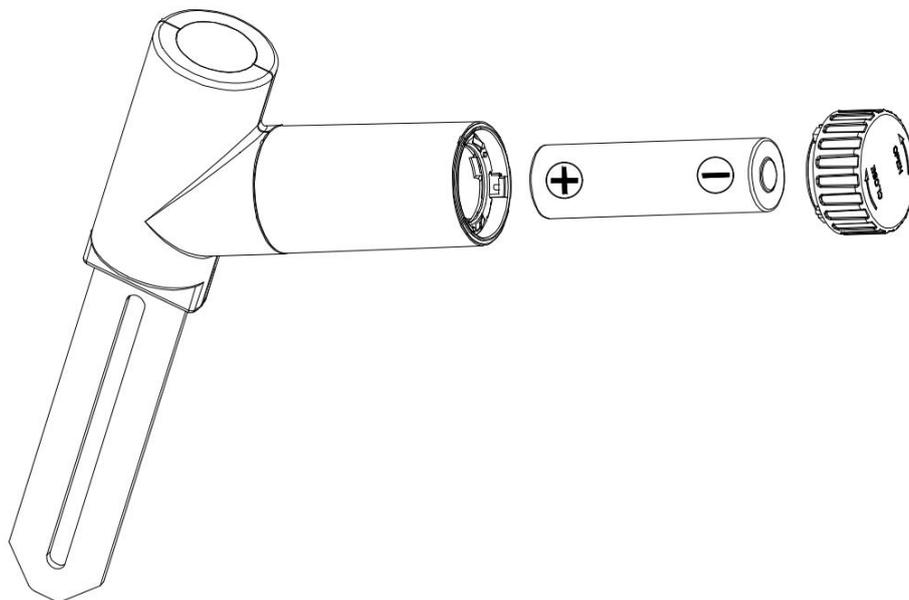


Figure 4

2. Install the long silicone cap to cover the battery compartment and the short silicone cap to cover the LED indicator, like figure 5.

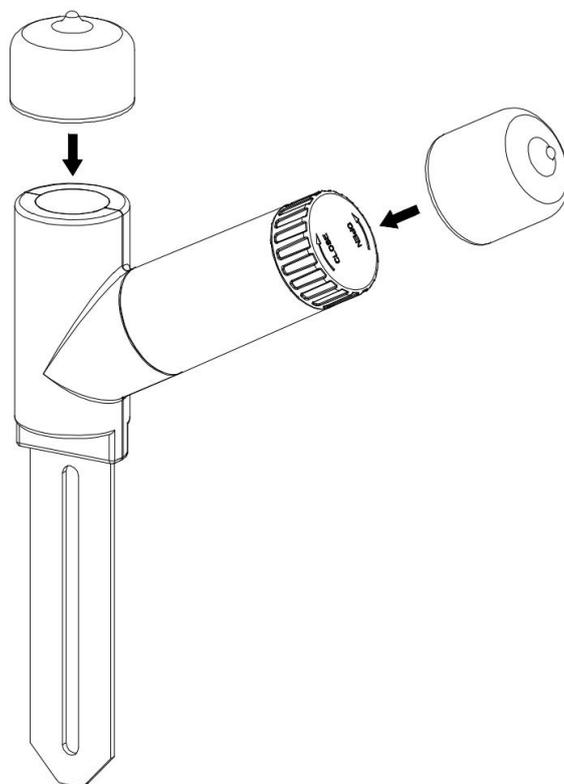


Figure 5

3. Before install the sensor into its permanent location, we would suggest test the sensor in air, and see if moisture reading is 0. And then put the sensor into a cup of water, the sensor should have its reading increased to 90% or above. Once sensor detected a significant data change, sensor will transmit every 10s. Once sensor has been confirmed working correctly, then you can go to next step.

4. Insert the sensor totally into the soil of your desired location. Please do not use excessive force to push the sensor into the soil to avoid any damage.

2.3.2 Wi-Fi Configure

To view the soil moisture data on your mobile application and receive email alerts on our weather server, you need to pair this device with our Wi-Fi gateway or weather station console (sold separately).

2.3.2.1 Pair with Gateway

If the gateway has been in operation, and you have never had any WH51 soil moisture sensor setup before, just power up the sensor and gateway will pick soil moisture data automatically.

Note: The gateway can support max 16 soil moisture sensors. Each new sensor will be recognized as a new channel according to the Power-on sequence. You may attach a label of the channel on each sensor for distinction. The channel name can be edited both on the app and ecowitt.net (will not sync).

(1) The compatible gateways are listed on the table 3.

Compatible Gateway:			
Gateway Model	Picture	Upload data	Quantity of the Channel
GW1100		✓	16 (V2.3.6)
GW2000		✓	16 (V3.1.5)
GW1200		✓	16 (V1.3.3)
GW3000		✓	16 (V1.0.2)
GW3010		✓	16 (V1.0.2)
WS6210		✓	16

Table 3

(2) Wi-Fi Connection for the Gateway

For this part, please refer to the quick start and user manual of the gateway.

Any question, please contact the customer service.

2.3.2.2 Pair with Display Console

(1) The compatible display consoles are listed on the table 4.

Compatible consoles:				
Console Model	Picture	Upload data	Display the data	Quantity of Channel
WH0291		✗	✓	1
HP2550		✓	✓	16 (V 2.0.2)
HP2560		✓	✓	16 (V 2.0.2)
WN182X		✓	✗	16 (V1.3.4)
WS38X0		✓	✗	16 (V1.3.3)
WS39X0		✓	✗	16 (V1.3.3)
WN1920/1980		✓	✗	16 (V1.3.4)

Table 4

(2) Wi-Fi Connection for the Console

For this part, please refer to the quick start and user manual of the console.

Any question, please contact the customer service.

2.3.3 Test the Device

After installing the battery and finishing the Wi-Fi configuration with the gateway, please totally insert the WH51 sensor probe into the water for about 1 minute. Then you observe the readout on Ecovitt App.

If the readouts of WH51 significantly change, this sensor could normally work. Otherwise, it might be faulty and please feel free to contact our technical support team.

3.Instructions for Use

3.1 Features

Soil Moisture Sensor

- **Advanced Capacitive Sensing:** Utilizes the principle of soil dielectric permittivity to measure moisture levels, where water presents the highest reading and air the lowest. This method provides a reliable correlation between the sensor's reading and actual soil water content.
- **Calibration Modes:** For scientific and industrial applications requiring high accuracy, manual calibration is recommended. For consumer users, Trend-Based on app graph eliminates complex calibration—simply monitor the moisture trend graph, record your watering habits, and establish personalized dry and wet thresholds for optimal plant watering care.
- **Robust IP66 Waterproof Design:** Built with an IP66 rating to withstand harsh outdoor conditions. An additional silicone protective cap is included for enhanced waterproofing in exceptionally severe environments.
- **Wireless Data Transmission & Simple LED Indication:** The probe itself does not have a display. It transmits measurement data via RF signals to a compatible gateway or console for reading and analysis. A simple red LED on the body clearly indicates data transmission and any operational faults.
- **Long-Range & Extendable Wireless Range:** Boasts a robust wireless range of up to 100 meters under standard conditions. For deployments in challenging environments with dense foliage or physical obstructions, an optional high-gain antenna is available to extend the effective range up to 200 meters in open fields.
- **Proper Installation for Sensor Safety:** To ensure accurate readings and prevent damage, the sensor must be placed in a pre-dug hole in the soil, avoiding forceful insertion into hard, compact earth. For standard use, bury the probe up to the indicated depth mark on its body.

3.2 Calibration Modes

When you finish Wi-Fi configuration and log in ecowitt APP, you can calibrate the soil moisture sensor by enable the Custom mode. (Click 'Weather Station' - choose the gateway that configured to your router - click upper right '...' - choose Calibration - choose 'Multi_CH Soil' and then you could manually calibrate the data.)

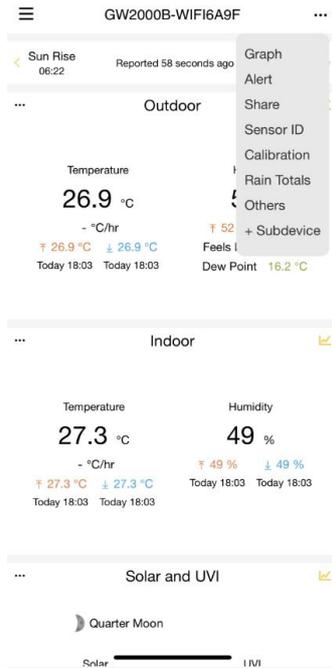


Figure 6



Figure 7

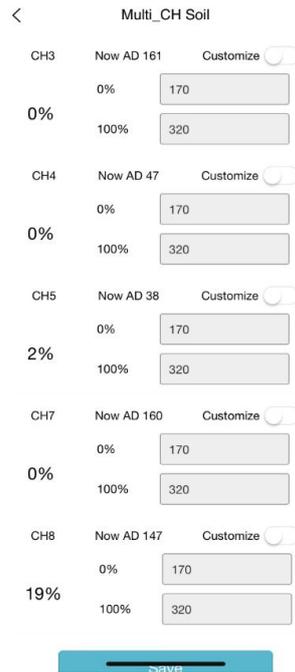


Figure 8

Custom OFF:

Moisture level is calculated based on default dry and wet definition:

Dry (0%AD) AD: 70

Wet (100% AD) AD: 500

$$\text{Soil Moisture} = (\text{moisture AD} - 0\%AD) * 100\% / (100\% AD - 0\%AD)$$

Example: when sensor moisture AD is 310, calculated moisture is:

$$(310 - 70) * 100\% / (500 - 70) = 56\%.$$

This is a fixed slope rate linear system.

Custom ON:

When pot soil at dry or wet condition is not giving the moisture sensor output value that is close to its default assumption, it will give inaccurate moisture level results. It is commonly happening with different soil type that gives very different output value at same moisture level condition. We introduced this custom mode to make this slope flexible so that it can match your soil type.

This becomes a variable slope rate linear system.

Adjusting principle:

0%AD is used to adjust for dry condition reading inconsistency.

When the displayed moisture readings are too high at dry soil condition, you could lower the slope rate by increasing the 0%AD value.

100%AD is used to adapt for wet condition reading inconsistency.

When the displayed moisture readings are too low at extremely wet soil condition, you could decrease the 100%AD value to fix it.

Please refer to the below example for better understanding.

For example:

When you use this product at the first time, you may turn off the custom mode and test the product at the following two situations:

Situation One:

Place the sensor into a glass of fresh water, and the displayed moisture readings is much lower than 95%(e.g.70%).

Solution:

Enable custom mode, and adjust the 100%AD value.

Calculate the 100%AD value with the formula:

$$\text{Soil Moisture} = (\text{moisture AD} - 0\%AD) * 100\% / (100\% AD - 0\%AD)$$

If:

$$\text{Now AD} = 183$$

$$0\%AD = 70$$

$$\text{Target Soil Moisture Reading} = 95\%$$

Then:

$$95\% = (183 - 70) * 100\% / (100\%AD - 70)$$

$$\text{Result: } 100\%AD = 188(\text{take the Integer part})$$

Then you can adjust the default 0%AD value to 188 and touch the screen for once to update the data. When you get your expected moisture reading, click Save to save the setting.

Situation Two:

Leave the sensor aside without touching any water, and the displayed moisture readings are much higher than 10% (e.g.40%).

Solution:

Enable the custom mode and adjust the 0%AD value.

Calculate the 0%AD value with the formula:

$$\text{Soil Moisture} = (\text{moisture AD} - 0\%AD) * 100\% / (500 - 0\%AD)$$

If:

$$\text{Now AD} = 183$$

$$100\%AD = 500$$

$$\text{Target Soil Moisture Reading} = 10\%$$

Then:

$$10\% = (183 - 0\%AD) * 100\% / (500 - 0\%AD)$$

$$\text{Result: } 0\%AD = 147(\text{take the Integer part})$$

Then you can adjust the default 0%AD value to 147 and touch the screen for once to update the data. When you get your expected moisture reading, click Save to save the setting.

Note: The soil moisture sensor should be inserted totally into the soil for accurate result.

Record the 0%AD and 100%AD value for future use (when WIFI network changed).

Note: In general, the sensor need to be calibrated to suit your soil type.

Note: Calibration is only saved on gateway side, so if you have two different consoles handling

this data, you will need to enable custom mode and having same calibration for 0% and 100% to make consoles showing same soil moisture.

4.Live Data and Compatibility Instructions

4.1 When paired with a Gateway

- Monitor live sensor data on the Live Data page of the WSView plus app and Ecowitt app(requires the gateway and your phone is using the same Wi-Fi network)
- Up to 16 channels supported when updated to the corresponding firmware. Channel names can be edited on the Ecowitt app.

4.2 When paired with Console WH0291

- View soil moisture data in real-time on the Display. But WH0291 display console could not upload WH51 data to Internet.
- One display console could only pair with one WH51L or WH51.

4.3 When paired with a Weather Station Console (HP2550/HP2560)

- View soil moisture data in real-time on the console's display.
- When the firmware of the HP2550/HP2560 is updated to the V 2.0.2, it is up to 16 channels supported. The channel's names could only be edited on the Ecowitt APP or website (192.168.4.1).

4.4 When paired with a Weather Station Console(WN1820/WN1821)

- View soil moisture data in real-time on the Ecowitt APP.
- When the WN182X display console's firmware is updated to the V1.3.4, it is up to 16 channels supported.
- The channel's names could only be edited on the Ecowitt APP or website (192.168.4.1).

4.5 When paired with a weather station console(WS38X0/WS39X0)

- Could NOT view the real-time data on the display.
- Only Support pair with WH51 and upload the data to the Internet.
- When the WS38X0/WS39X0 display console's firmware is updated to the V1.3.3, it is up to 16 channels supported.
- The channel's names could only be edited on the Ecowitt APP or website (192.168.4.1).

4.6 When paired with a weather station console(WN1920/WN1980)

- Could NOT view the real-time data on the display.
- Only Support pair with WH51 and upload the data to the Internet.
- When the WN1920/WN1980 display console's firmware is updated to the V1.3.4, it is up to 16 channels supported.
- The channel's names could only be edited on the Ecowitt APP or website (192.168.4.1).

4.7 When uploaded to Ecowitt Weather Server

- View current soil moisture data & history records & graph on the website
- Set and receive email alerts from the server
- Channel names can be edited on the website
- Remote monitoring with smart phone, laptop, or computer by visiting the website
- Note: The WH51 will be recognized as the same sensor type by the software. If you purchased both, they will share the eight channels together and the total quantity of the two sensors could not exceed eight.

5. Specification

Material of Housing	ABS+PC
Material of Probe	FR-4(Glass Fiber Reinforced Epoxy)
Measurement Principle	Frequency Domain Reflectometry
Moisture Range	0~100%
Accuracy	± 5%
Resolution	1%
Working Temperature Range	-10° C to 50° C(14°F to 122°F)
0%AD setting range	0~200; Initial value: default to factory calibration
100%AD setting range	0%AD+10~1000; Initial value: default to its factory calibration
Frequency	915/868/433MHz depending on location (North American:915MHz; Europe:868MHz; Other areas:433MHz)
Sensor reporting interval	70 seconds
Transmission distance in open field	100m(300 feet)
Waterproof Level	IP66

Power consumption

Soil moisture sensor	1xAA battery (not included)
Battery life	Minimum 12 months

6.Care + Maintenance

When batteries of different brand or type are used together, or new and old batteries are used together, some batteries may be over-discharged due to a difference of voltage or capacity. This can result in venting, leakage, and rupture and may cause personal injury.

- Do not mix Alkaline, Lithium, standard, or rechargeable batteries.
- Always purchase the correct size and grade of battery most suitable for the intended use.
- Always replace the whole set of batteries at one time, taking care not to mix old and new ones, or batteries of different types.
- Clean the battery contacts and also those of the device prior to battery installation.
- Ensure the batteries are installed correctly with regard to polarity (+ and -).
- Remove batteries from product during periods of non-use. Battery leakage can cause corrosion and damage to this product.
- Remove used batteries promptly.
- For recycling and disposal of batteries, and to protect the environment, please check the internet or your local phone directory for local recycling centers and/or follow local government regulations.

7.Warranty & Caution

7.1 Warranty

We disclaim responsibility for any technical error, printing error, or the consequences thereof.

All trademarks and patents are recognized.

We provide a 2-year limited warranty on this product against manufacturing defects or defects in materials and workmanship.

This limited warranty begins on the original date of purchase, is valid only on products purchased, and is only to the original purchaser. The purchaser must contact us for problem determination and service procedures to receive warranty service.

This limited warranty covers only actual defects within the product itself. It does not cover the cost of installation or removal from a fixed installation, standard set-up, or adjustments, claims based on seller misrepresentation, or performance variations resulting from installation-related circumstances.

7.2 FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device should not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with RF Exposure guidelines, This equipment should be installed and operated with a minimum distance between 20cm of the radiator and your body. Use only the supplied antenna.

IC Caution:

English:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two

Conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause the undesired operation.

French:

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Manufacture: Shenzhen Fine Offset Electronics Co., Ltd.

Address: 4/F, Block C, JiuJiu Industrial City, Shajing Town, Baoan District, Shenzhen City, China

8. Contact Us

8.1 After-sales Service

Order Issues:

If you encounter any missing or incorrect shipments of Ecowitt products purchased, please reach out to the respective platform's customer service from the store where you bought the product for assistance.

Usage Inquiries:

Our product is continuously changing and improving, particularly online services and associated applications. To download the latest manual, and additional help, and for any issues related to product usage feel free to contact our customer support team at support@ecowitt.com. We are committed to providing assistance and resolving any concerns you may have.

8.2 Stay in Touch

Ask questions, watch setup videos, and provide feedback on our social media outlets. Follow Ecowitt on Discord, YouTube, Facebook and Twitter.



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