ecowitt®



Soil Moisture Sensor Manual

Model: WH51L

https://s.ecowitt.com/XWRGTY

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1. Introduction

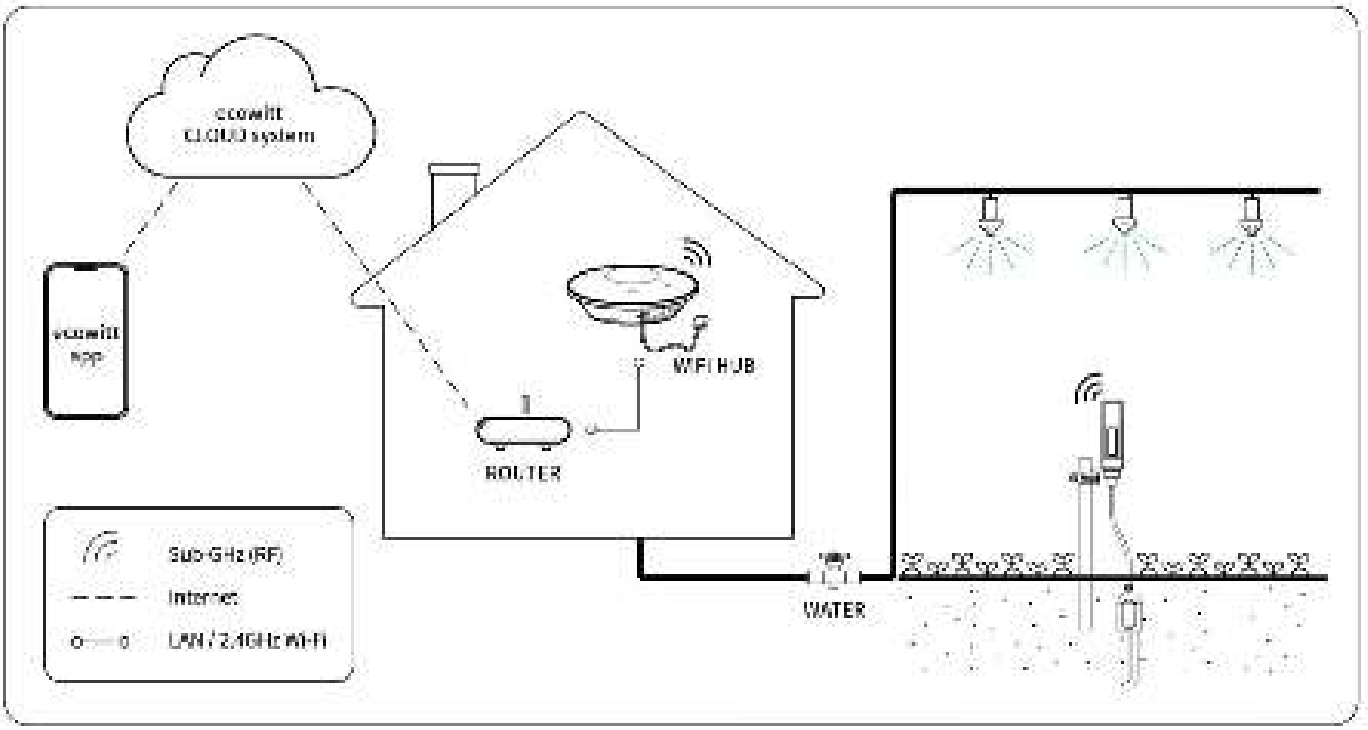
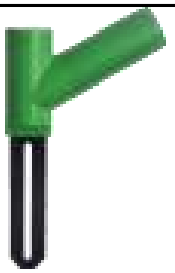


Figure 1 ECOWITT Ecosystem

Thanks for purchasing this WH51L soil moisture sensor. This device with 1m/3.28ft PVC sensor wire could measure soil moisture. The data can be streamed by Ecowitt Wi-Fi Gateway (sold separately). They can be viewed on the Ecowitt APP after the Wi-Fi configuration is done. Or a receiver console(sold separately) can be used to display the received sensor value.

Picture		
Model Number	WH51	WH51L
Moisture Range	0~100%	Ecowitt APP, display consoles, and website can display 0~100%; while the sensor's LCD can display 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 Probe: IP68
Quantity of Channels	8	8

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

2. Installation

2.1 Part List

1 x Soil Moisture Sensor

1 x Screw ST D5.8*M3*15 Stainless Steel PA for Mounting

1 x Stainless Steel Loop 19~29 8mm for Mounting

1 x Fix Bracket 35.1*21*20mm Stainless Steel for WH51L

1 x User Manual

2.2 Installation

When you receive the WH51L soil moisture sensor, please follow the below process to finish installing battery, pairing it with the Wi-Fi gateway/console, and testing whether the device can normally work or not.

2.2.1 Install Battery

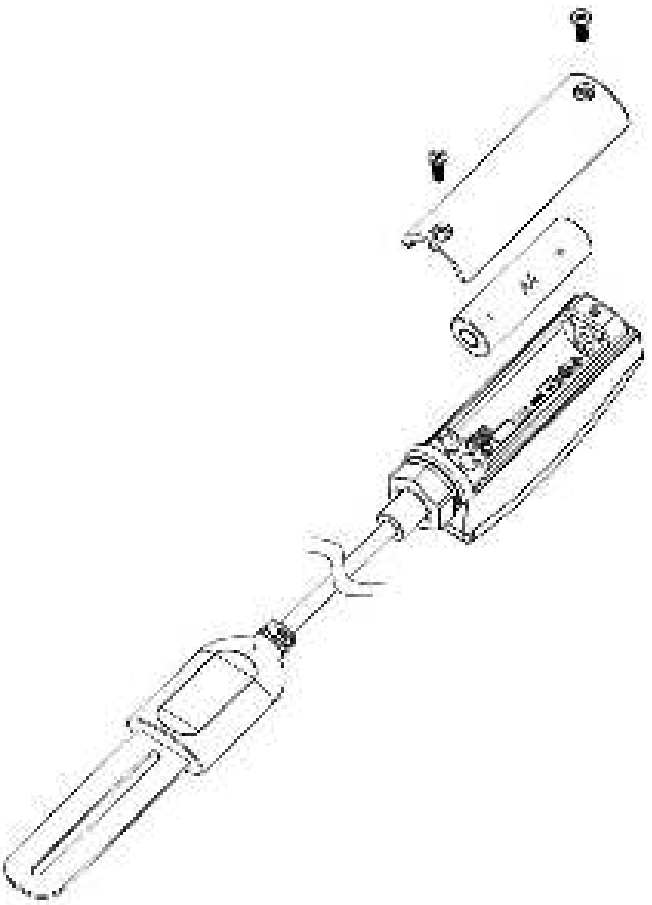


Figure 2

1. Unscrew the screws of the battery compartment.

2. Insert one AA battery and tighten the screw of the battery compartment, like the Figure 2.

3. After inserting the battery, the LCD screen will display all the sections 2 seconds, like the Figure 3.

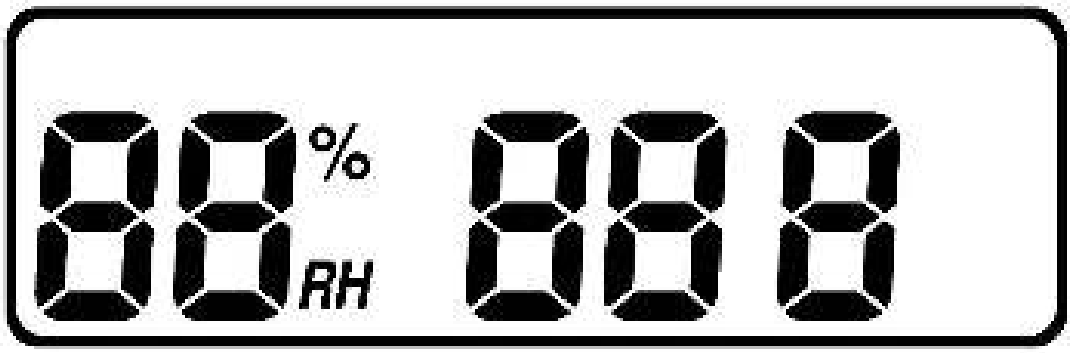


Figure 3

Then the screen would display the model number, RF frequency, and 'L' 2 seconds like Figure 4.

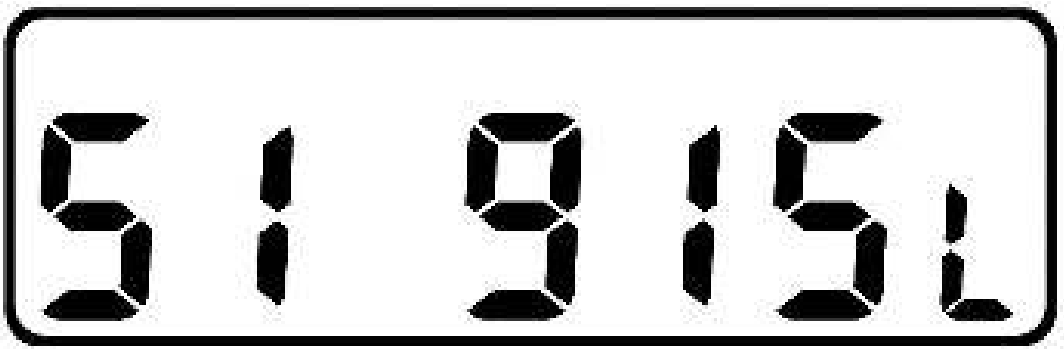


Figure 4

Finally the screen would display the 100%AD and 0%AD data 3 seconds, like Figure 5.

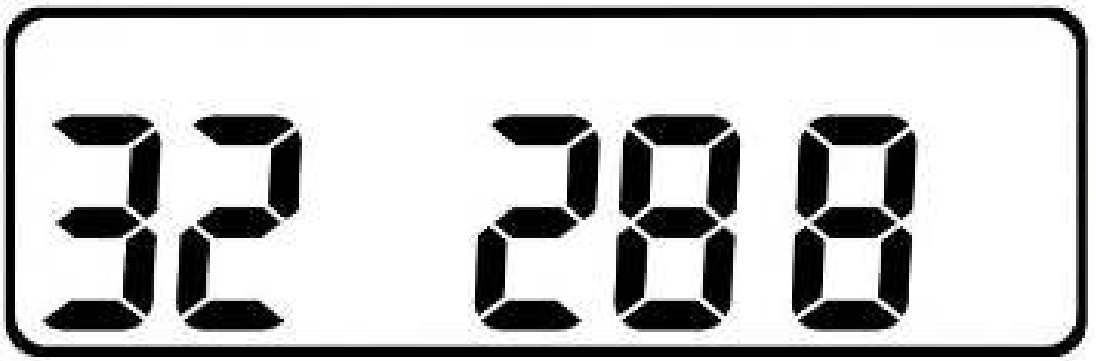


Figure 5

4. 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.

5. 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.

Note: It is highly recommended that the device's body had better be placed at least 20cm higher than the soil surface. If the device's body is very close to the soil, RF would decline, which might affect the transmission of the data.

2.2.2 Wi-Fi Configure with Gateway

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 Ecowitt Wi-Fi Gateway or display consoles, such as GW1100/GW1200/GW2000/ HP2550/HP3500/HP2560 Weather Station

(sold separately).

(1) Pair with Gateway

If Wi-Fi gateway has been in operation, and you have never had any WH51L soil moisture sensor setup before, just power up the sensor and Wi-Fi gateway will pick soil moisture data automatically.

Note: The gateway can support up to 8 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 Ecowitt app and ecowitt.net (will not sync).

If you want to use a new WH51L sensor to replace the old one (already configured on certain channel), please try the following:

1. Open the Ecowitt app, Click 'My Device' and click your gateway, and find your old sensor ID, for example your WH51L's sensor ID is on Soil CH 4, like the Figure 6.



Figure 6

2. Click the upright '...' and choose 'Sensor ID', like the Figure 7.

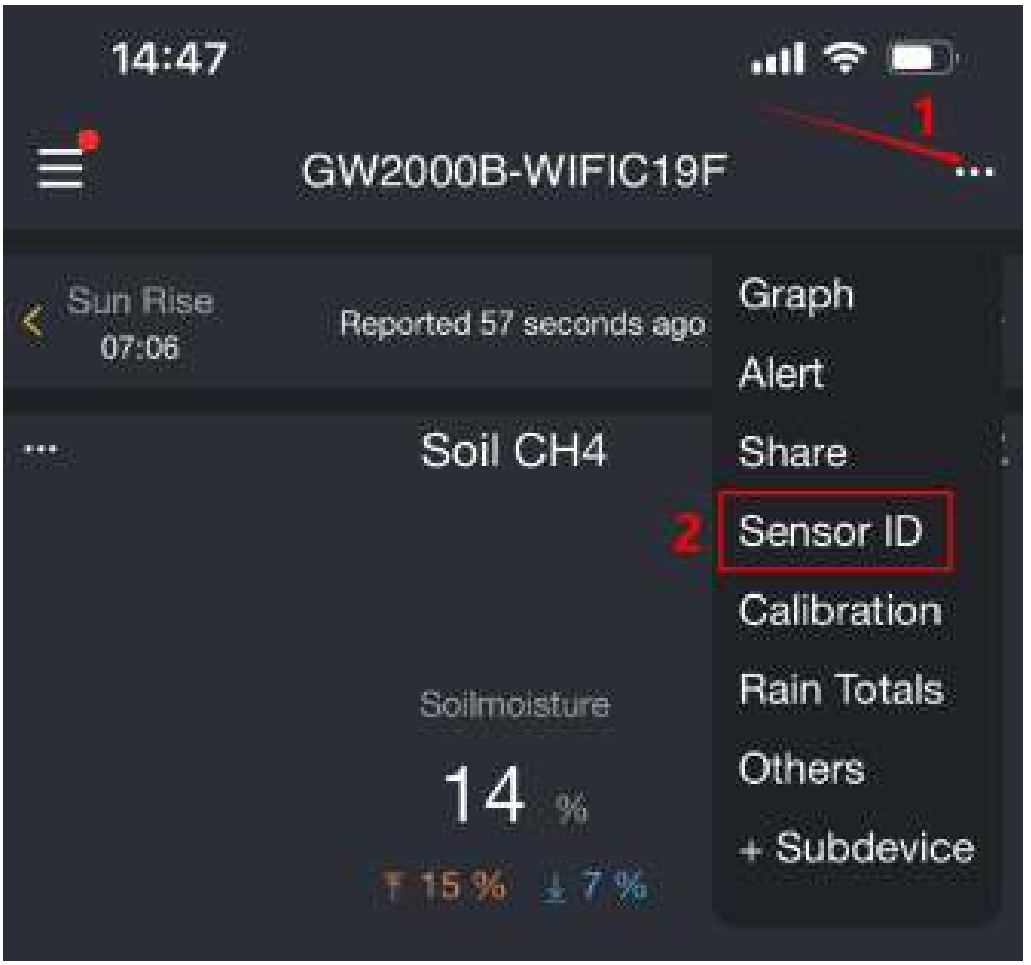


Figure 7

3. Power off the old sensor and power on the new sensor.

4. Click Re-register on the Sensor ID page, like the Figure 8.

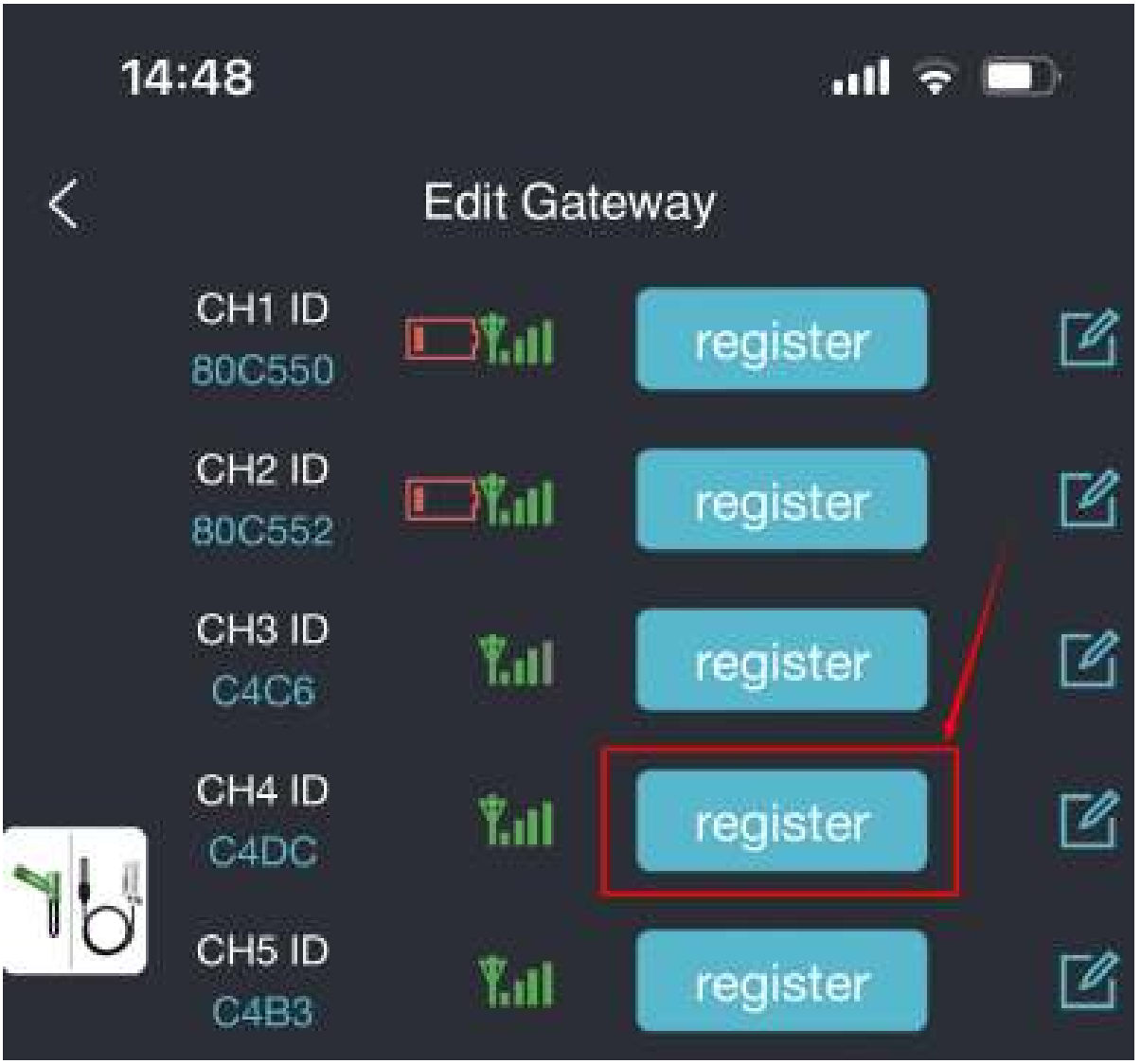


Figure 8

5. Then the new sensor will be learned and the old sensor will be erased, like the Figure 9.



Figure 9

(2). Wi-Fi Connection for the Gateway

For this part, please refer to the manual of the Wi-Fi gateway.

Any question, please contact the customer service.

2.2.3 Test the Device

After installing the battery and finishing the Wi-Fi configuration with the gateway, please totally insert the WH51L sensor probe into the water for about 1 minute. Then you observe the readout on LCD display of WH51L.

If the readouts of WH51L significantly change, this WH51L could normally work. Otherwise, it might be faulty and please feel free to contact our technical support team.

3. Instructions for Use

3.1 Multiple Views and Size

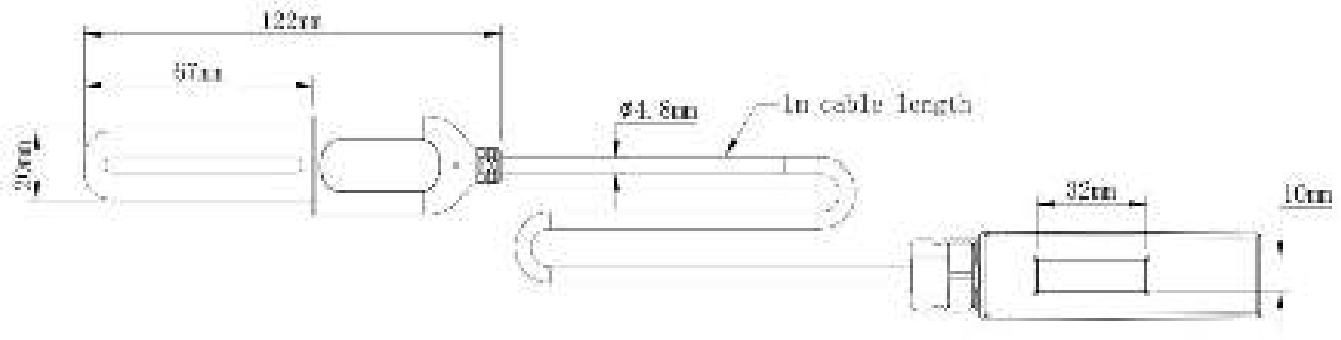


Figure 10: Main View



Figure 11: Right view

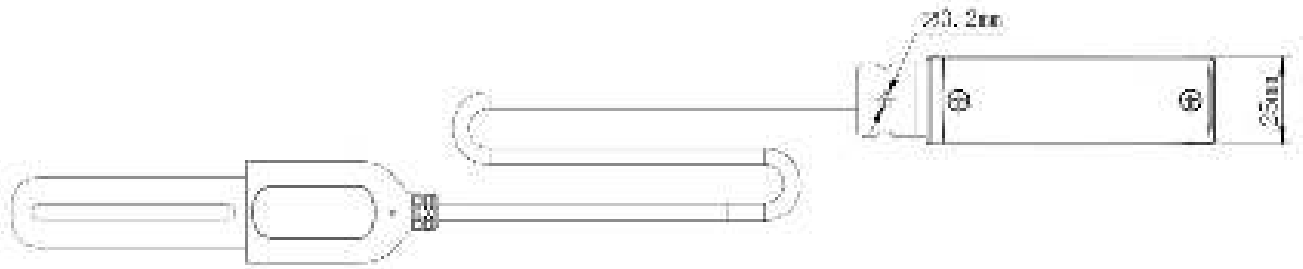
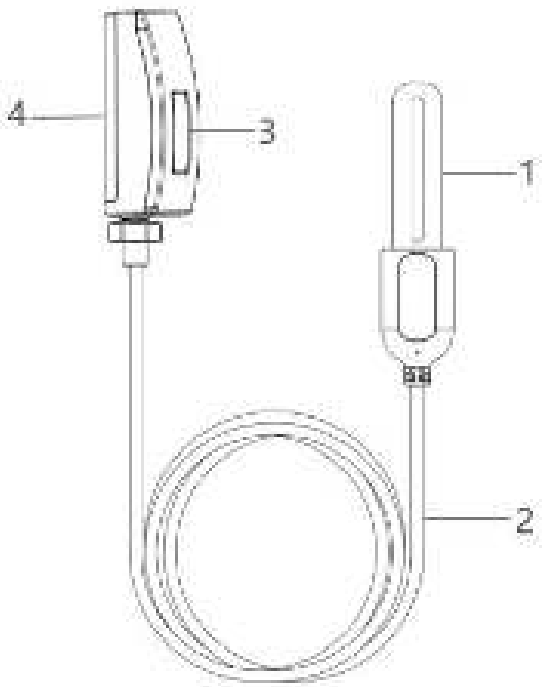


Figure 12: Back View



1	Soil Moisture Sensor Probe
2	1m/3.28ft PVC Wire
3	LCD Display
4	Battery Compartment

Figure 13: Overview

3.2 Features

Soil Moisture Sensor

- Measures soil moisture content every 70 seconds in standard cycle and transmits the data via RF.
- When the current measurement is significant difference from the next time data, RF will enter into quick-transmit state and WH51L will transmit the data every 10 seconds.
- Custom Mode: with 0%AD and 100%AD custom mode to manually calibrate the low/high moisture value so that you can get more accurate results for different soil types.
- Long wireless range, up to 300 feet (100 meters) in open areas.
- The 1m/3.28ft PVC cable sensor enables the measurement of different depths of soil moisture.

3.3 Custom mode

3.3.1 The Principle of Calculating Soil Moisture:

When the WH51L sensor is inside soil with different humidity levels, it will generate electrical signals of different intensities. The sensor will convert the electrical signals into AD values. The higher the humidity, the greater the AD value. We use the following linear function to calculate the soil humidity value:

Soil_Moisture = (Now_AD - 0%AD) * 100% / (100% AD - 0%AD)

Note:

- Now_ AD is the current AD value measured by the sensor.

- 0% AD is the AD value when the soil is dry, and the factory calibration defaults to the AD value in the air.
- 100% AD is the AD value when the soil moisture is saturated, and the factory calibration defaults to the AD value when the sensor is submerged in water.

3.3.2 Custom OFF:

The sensor will use factory-calibrated parameters to calculate soil moisture.

3.3.3 Custom ON:

Due to the different measurement values of AD for different soil types, we have introduced the Custom mode, which can obtain more accurate soil moisture values by setting 0% AD and 100% AD.

When you finish gateway/consoles Wi-Fi configuration

and log in Ecowitt APP, making sure that your phone and the gateway/consoles connect to the same local network, you can calibrate the soil moisture sensor by enable the Custom mode by follow steps, like the Figure 14~ Figure 16.

- Click 'My Devices'.
- Select the gateway with which the sensor is paired.
- Click upper right '...' .
- Choose 'Multi_CH Soil' .
- Click 'Customize' to manually calibrate the data.



Figure 14



Figure 15

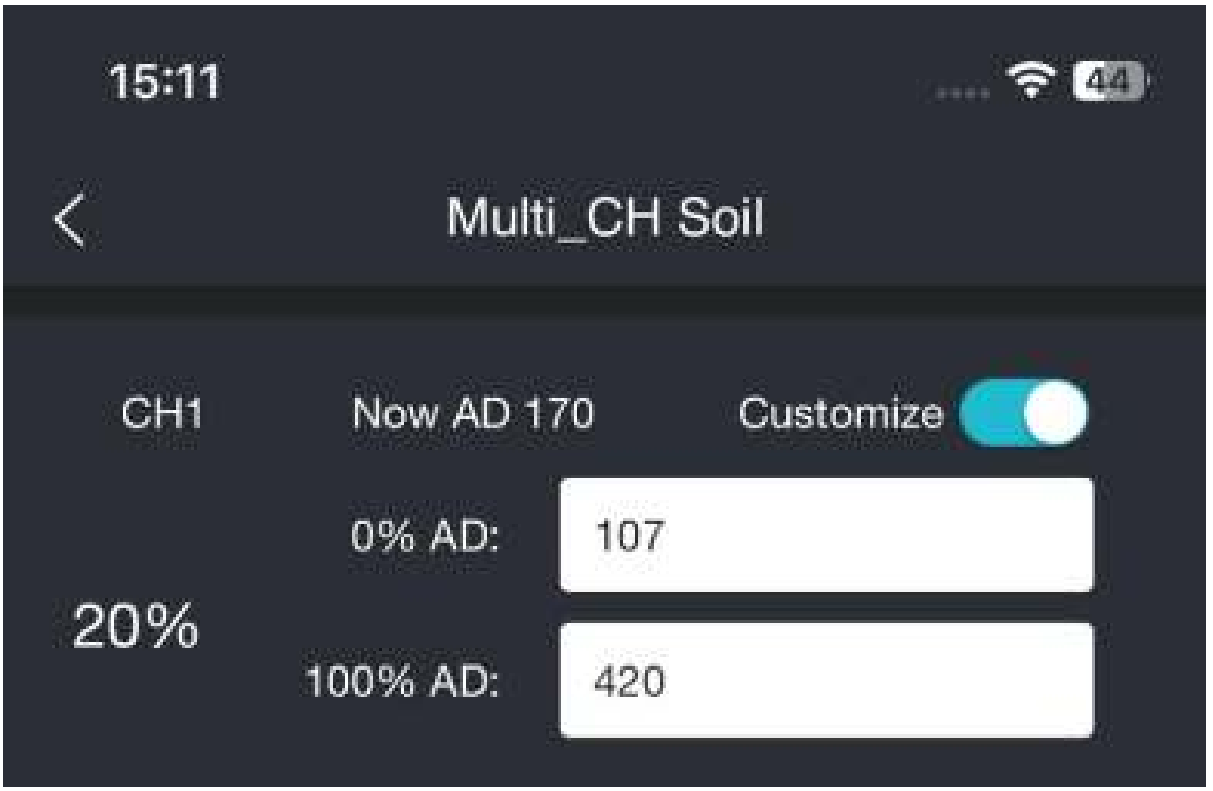


Figure 16

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

In dry soil, when the displayed moisture readings are too high, the setting of 0%AD should be increased, and when the displayed moisture readings are too low, the setting of 0%AD should be reduced.

In principle, **0%AD ≤ Now_ AD**.

0%AD can also be calculated using the following formula:

0%AD=(Now-AD - Soil-Moisture * 100%AD)/(1-Soil-Moisture)

For example:
If: Now AD = 170 100%AD = 420
Target Soil Moisture Reading = 20%
Then:
0%AD = (170 - 20% * 420) / (1 - 20%) = 107
Result: 0%AD = 107(take the Integer part)

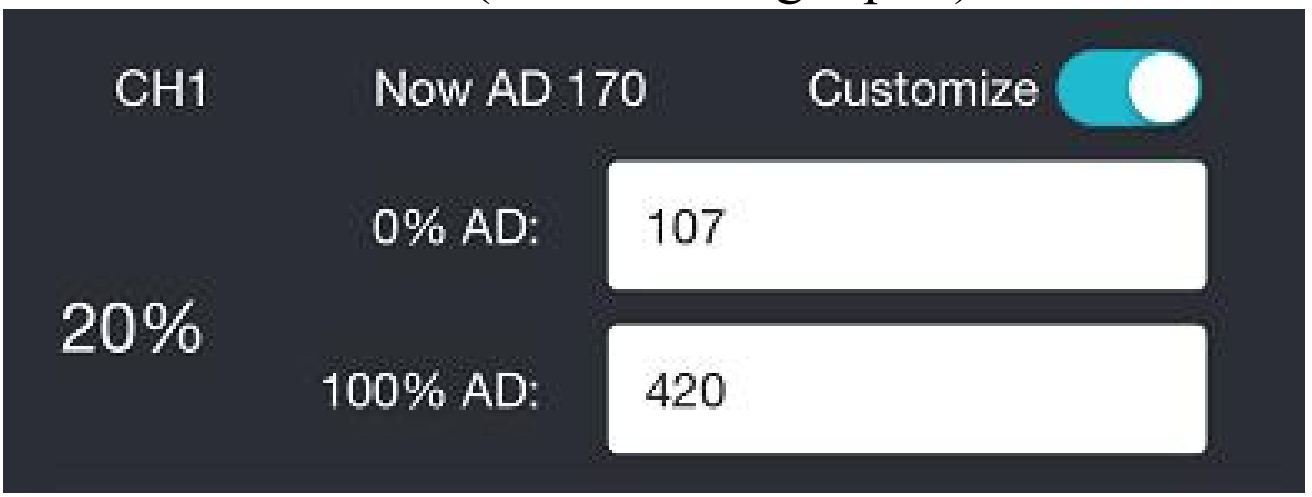


Figure 17

100% AD is used to adjust for wet condition reading inconsistency.
In humid soil, when the displayed moisture readings are too high, the setting of 100%AD should be increased, and when the displayed moisture readings are too low, the setting of 100%AD should be reduced.
In principle, **100%AD ≥ Now_ AD.**
100%AD can also be calculated using the following formula:

100%AD=(Now_ AD - 0%AD)/Soil_ Moisture + 0%AD

For example:

If: Now_AD = 340 0%AD = 107

Target Soil Moisture Reading = 90%

Then:

100%AD = (340– 107) / 90% + 107 = 366

Result: 100%AD = 366(take the Integer part)



Figure 18

After finishing 0%AD and 100%AD value settings, touch the screen 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 into the soil for accurate results.
- Record the 0%AD and 100%AD values for future use (when the WIFI network changes).
- Generally, the sensor must be calibrated to suit your soil type.
- Calibration is only saved on the gateway side, so if you have two different consoles handling this data, you will need to enable custom mode and have the same calibration for 0% and 100% to make consoles showing the same soil moisture.
- After finishing calibration, the Ecowitt APP, ecowitt.net and the display consoles will display the calibrated readouts, while the WH51L's LCD screen still display the readouts before calibration.

3.4 Edit Channel Name on Mobile Application and Website

3.4.1 Edit channel name on Ecowitt APP:

- Log in Ecowitt APP, click 'My Devices', and then choose the gateway/console.
- Slide down the page and find the WH51L sensor channel.
- Click '...' of the top left corner of the sensor channel and choose the 'Change the title' like the Figure 19.

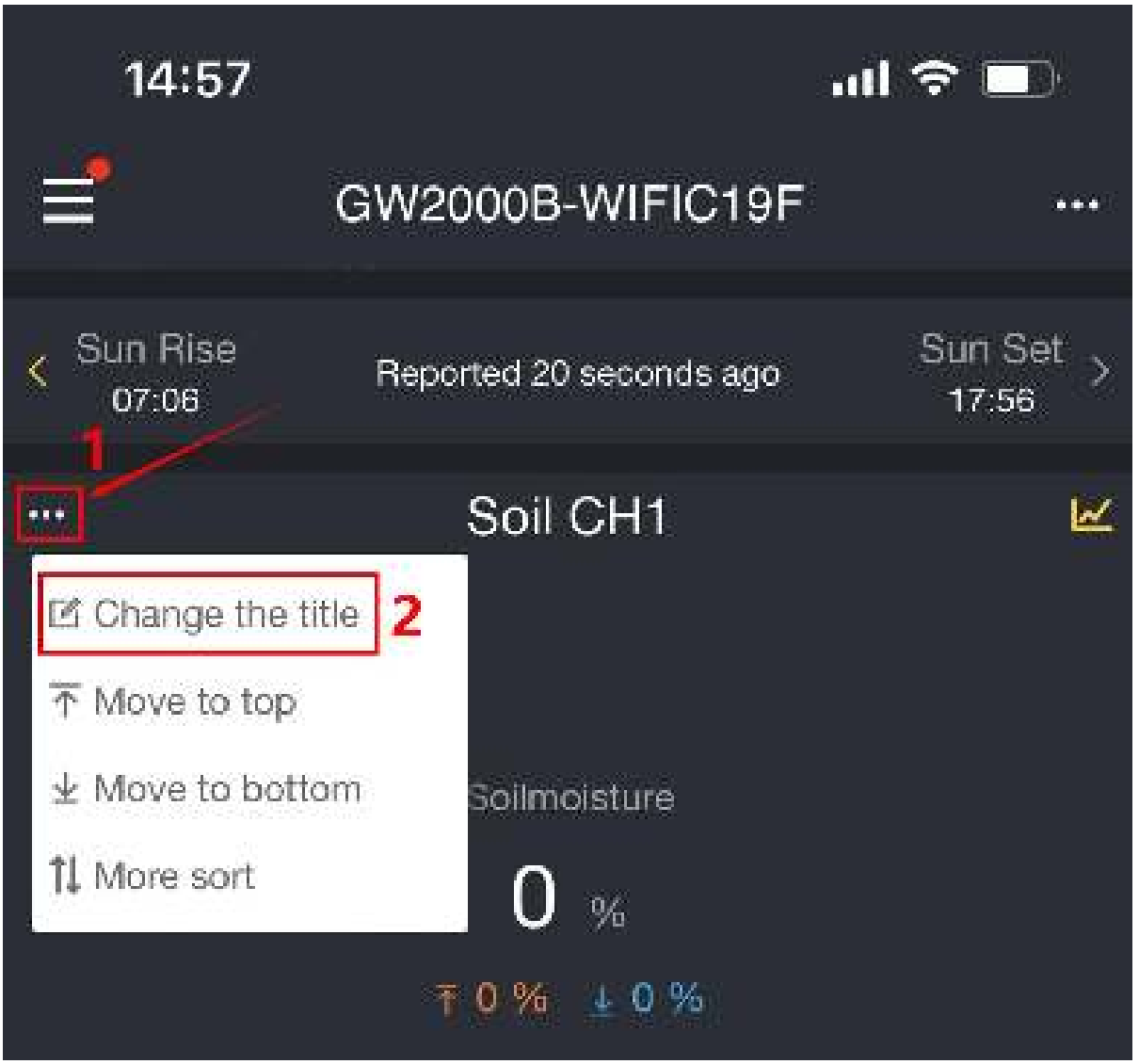


Figure 19

- Edit the channel name on the pop-up and finally click Confirm, like the Figure 20.

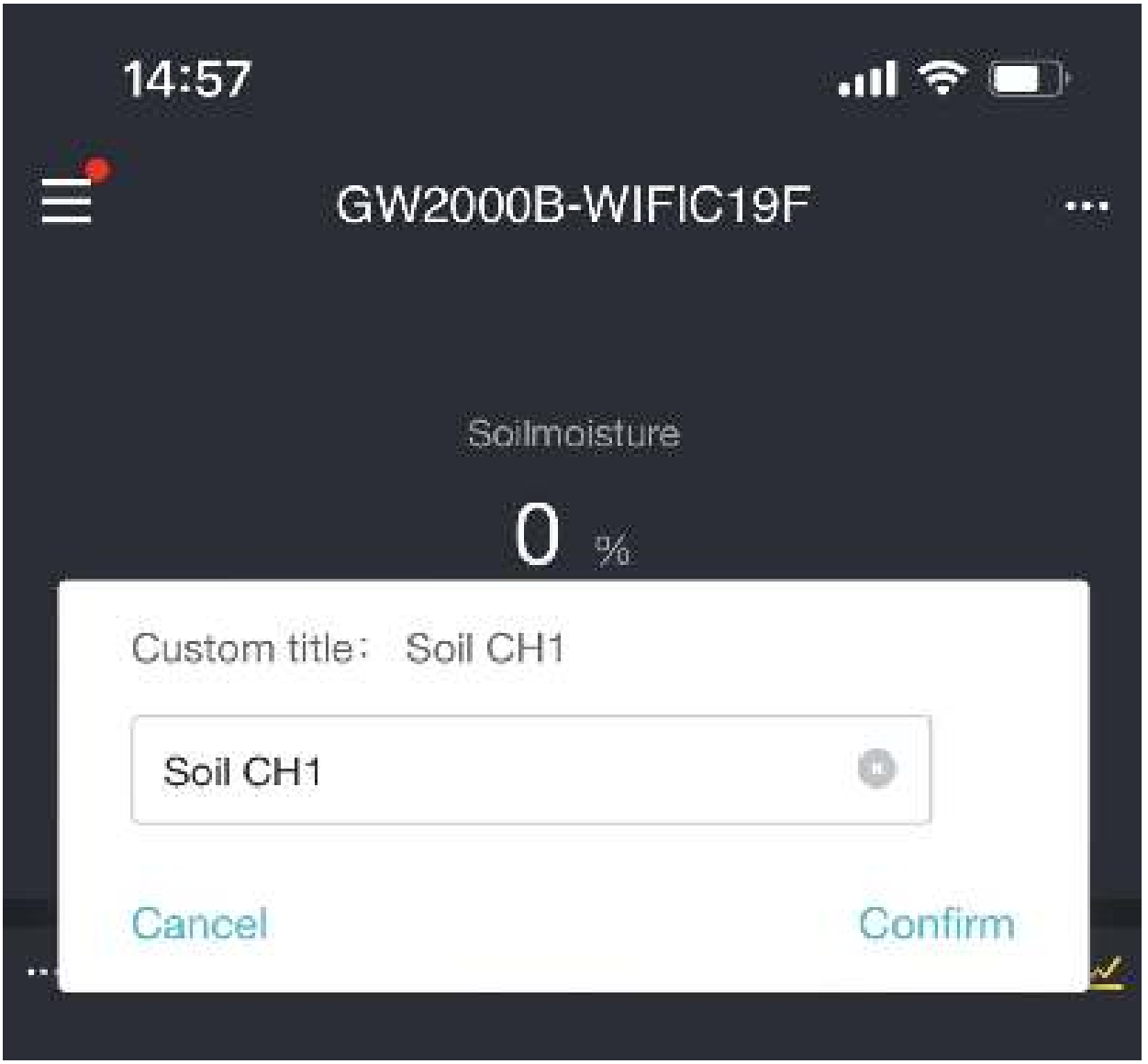

14:57
GW2000B-WIFIC19F
Soilmoisture
0 %
Custom title: Soil CH1
Soil CH1
Cancel
Confirm

Figure 20

3.4.2 Edit Channel Name on Ecowitt.net:

- Log in ecowitt.net.
- Find the gateway/console which pairs with the WH51L sensor.
- Find your sensor's channel and directly click the channel title, for example, click the 'Soil CH4' like the Figure 21.

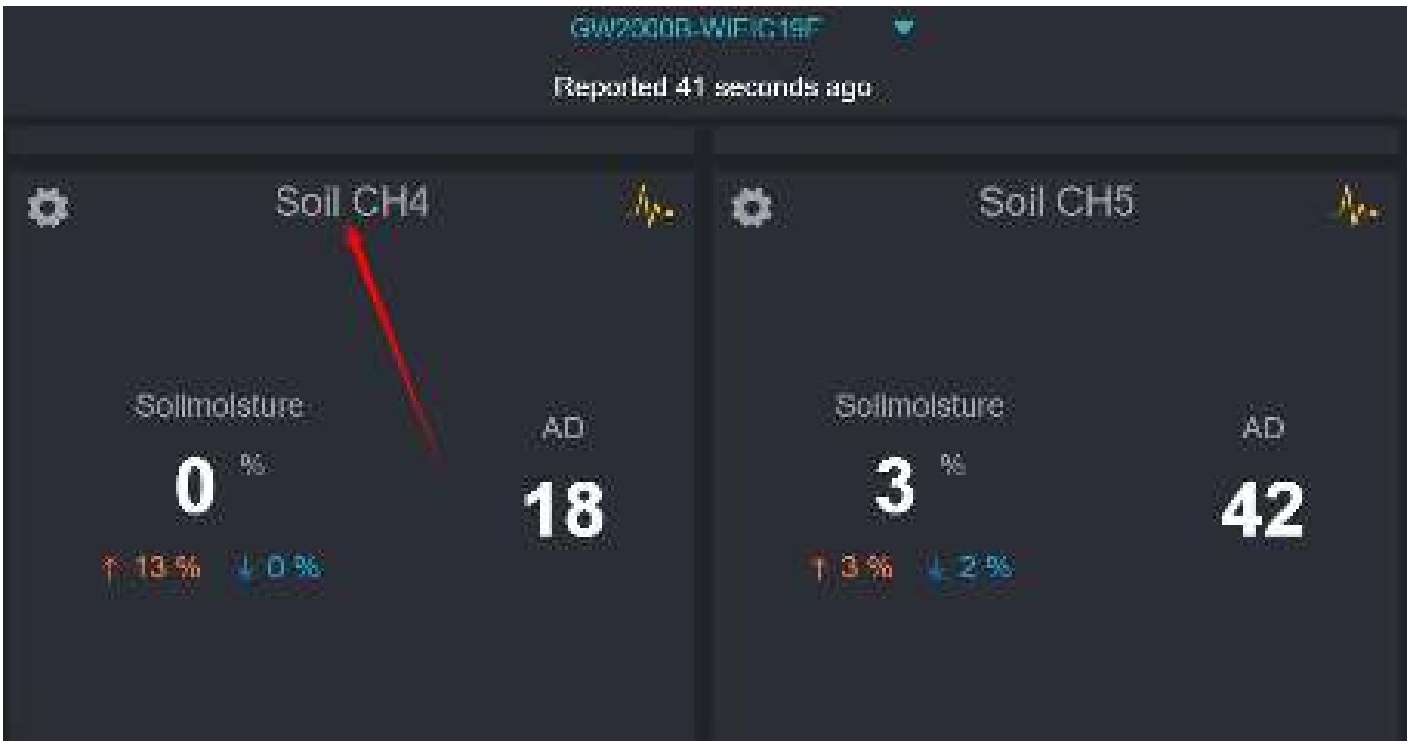


Figure 21

- Edit the channel name on the pop-up and click 'OK' like the Figure 22.

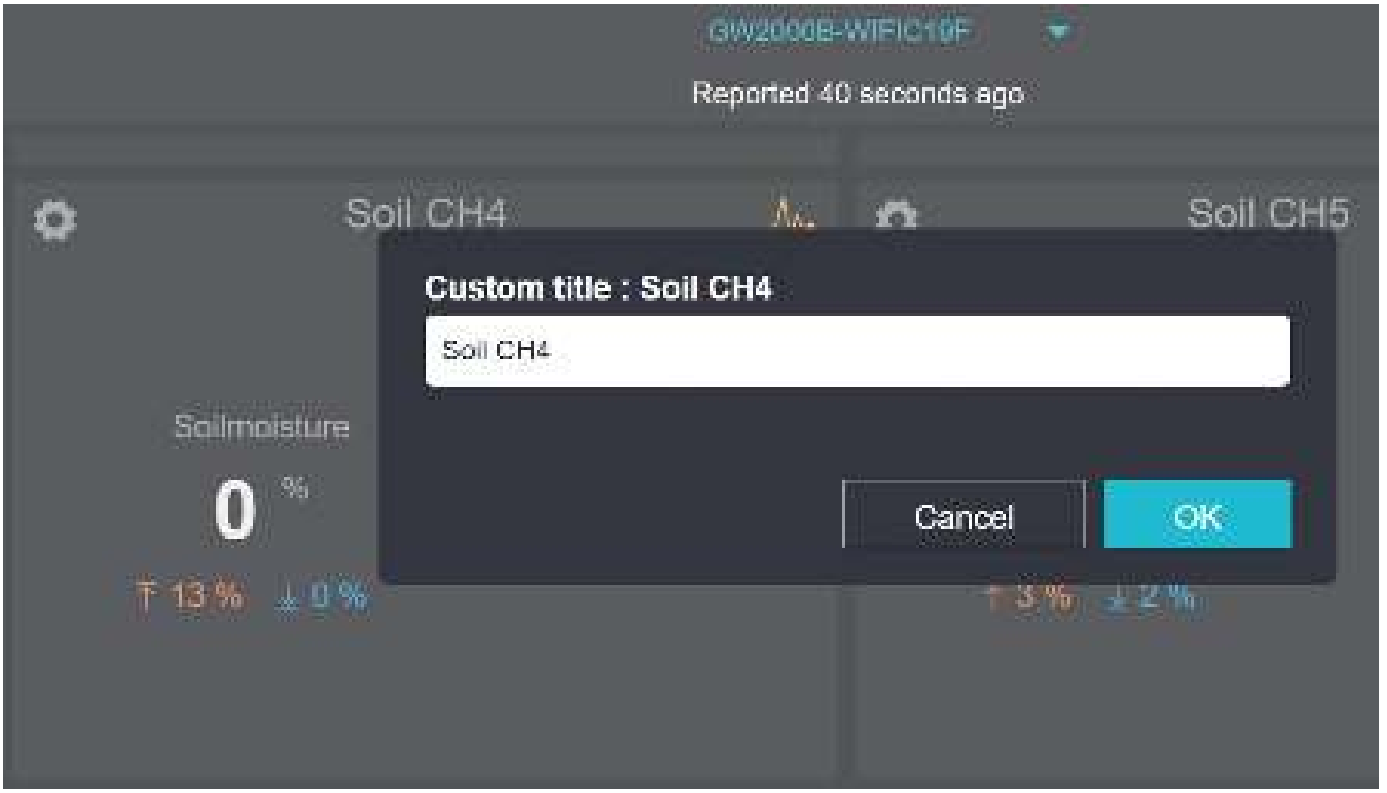


Figure 22

4. Application

4.1 The Installation Process Recommended for the WH51L

1. Excavate the soil until the depth meets your needs.

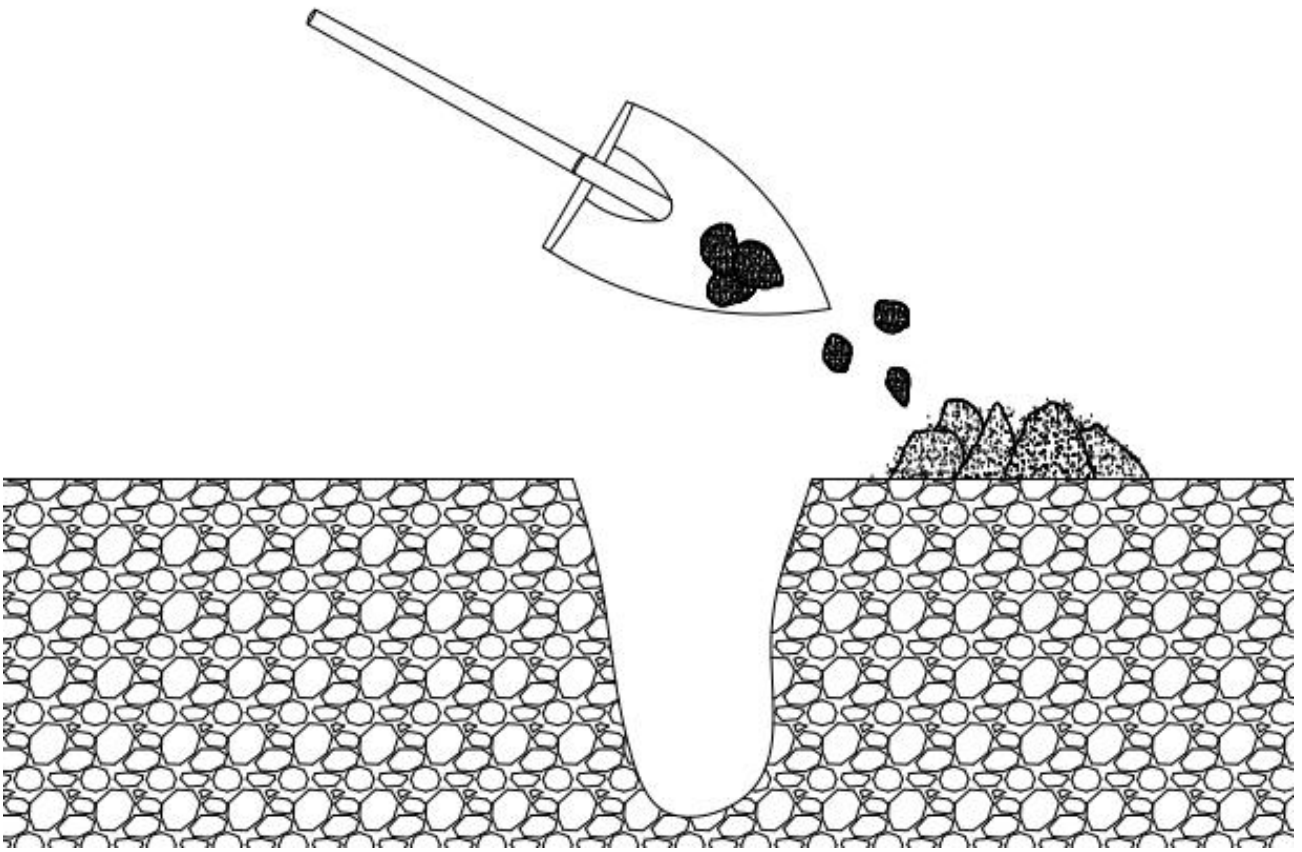


Figure 23

2. Bury the sensor probe of WH51L totally into the hole you dug.

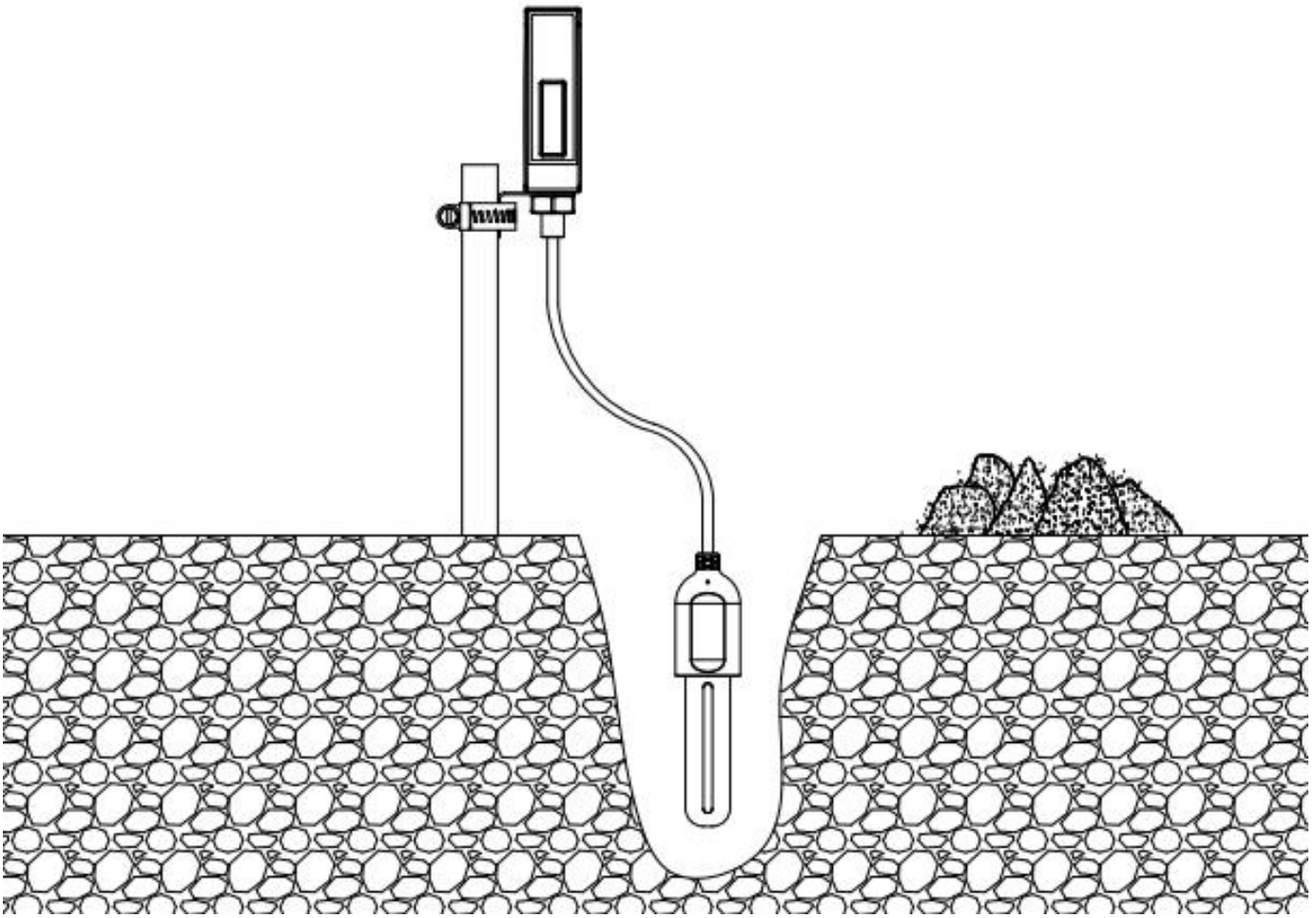


Figure 24

3. Backfill the soil and compact the soil to make sure the sensor probe is inside the soil.

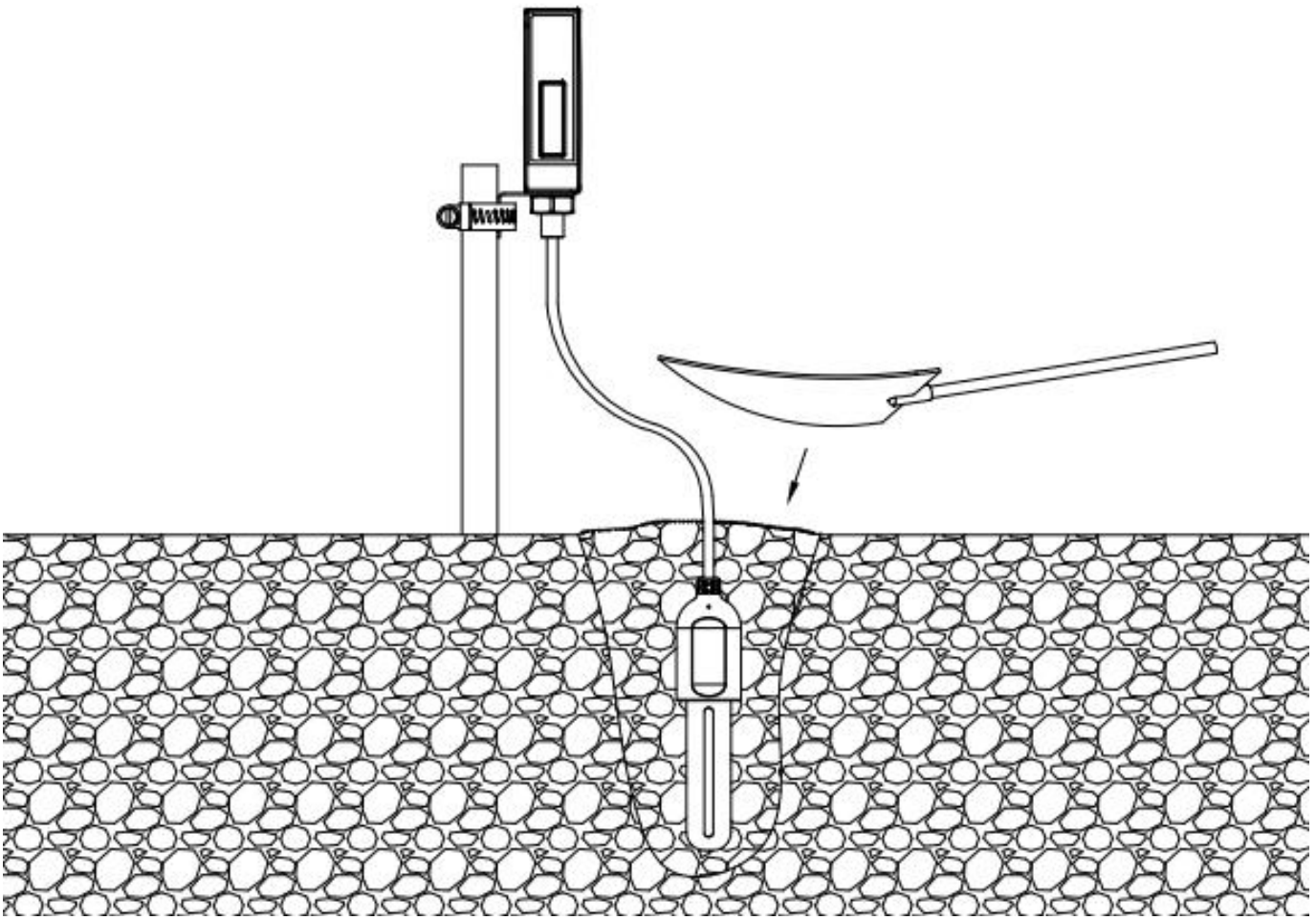


Figure 25

4. Fix the sensor by using the fix bracket and hose clamp, like Figure 26, or using the fix bracket and stainless steel screw, like Figure 27.

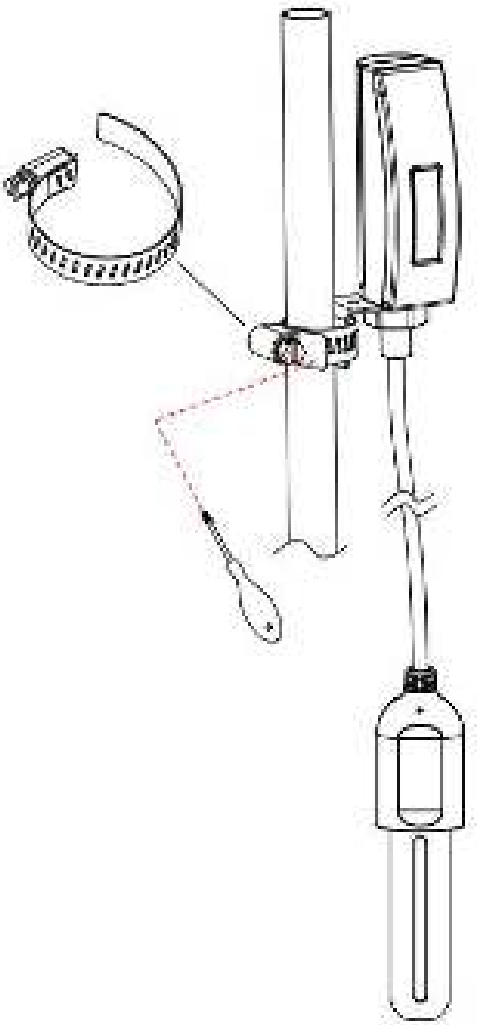


Figure 26

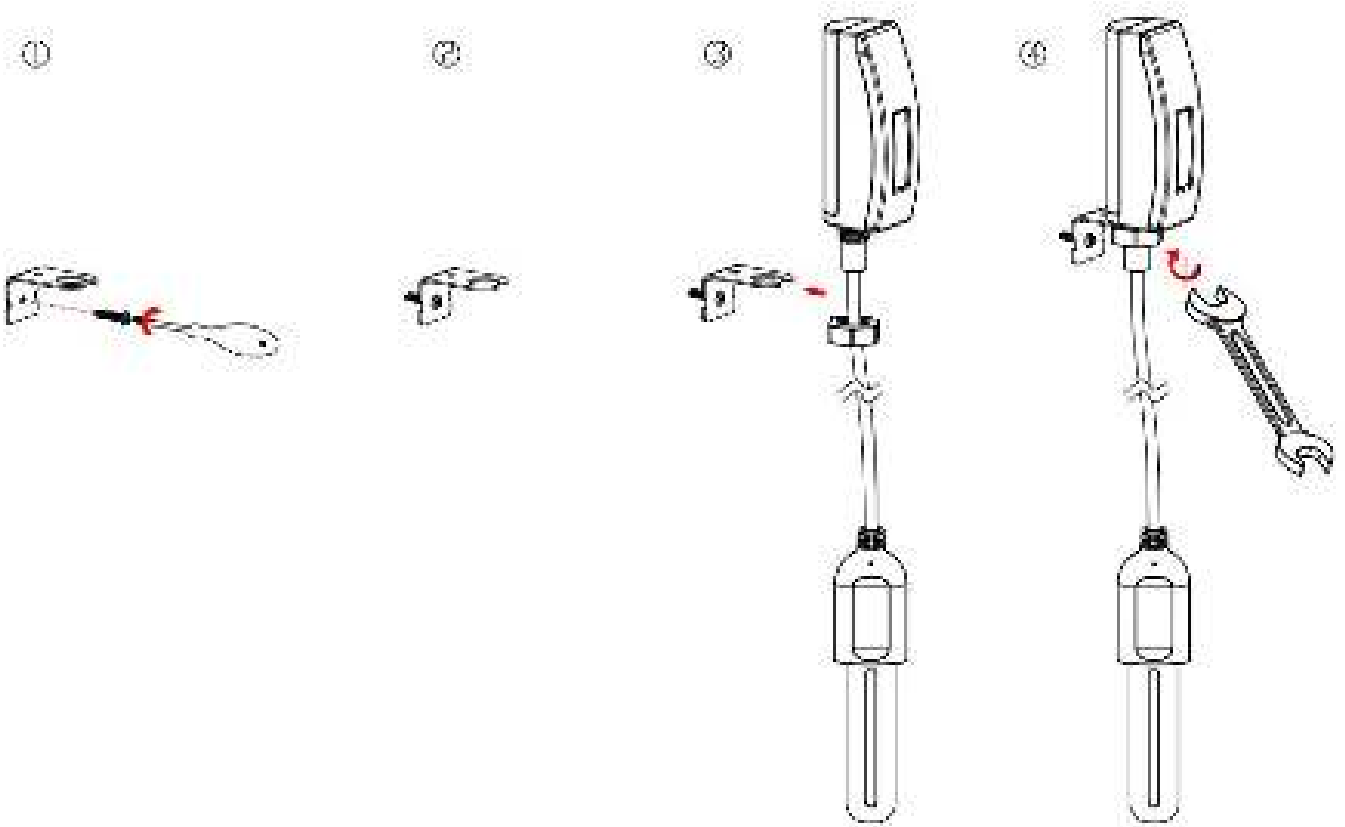


Figure 27

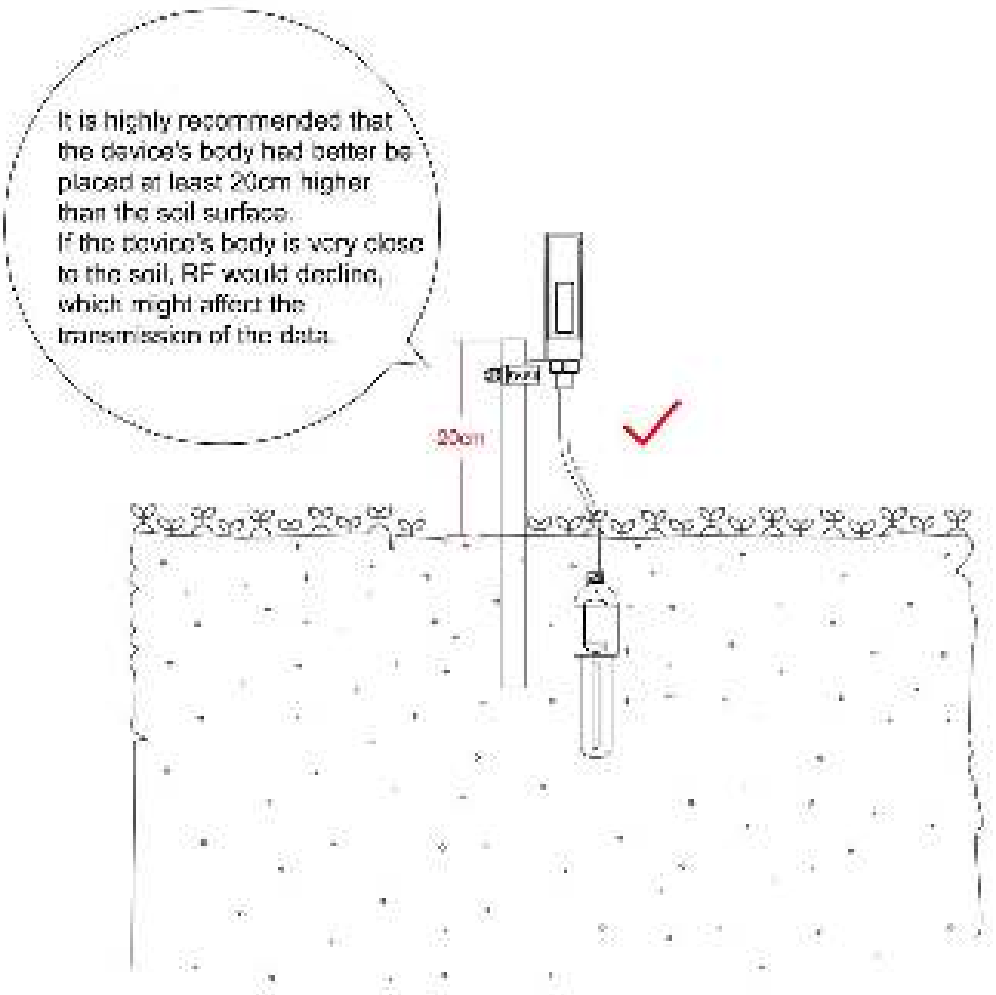


Figure 28: The Correct Installation of the WH51L

4.2 The Wrong Example of Installation of the WH51L

- ✘ The sensor probe does not totally insert inside the soil, like the Figure 29.
- ✘ The device's body is very close to the soil surface and the distance is less than 20cm, like the Figure 30.

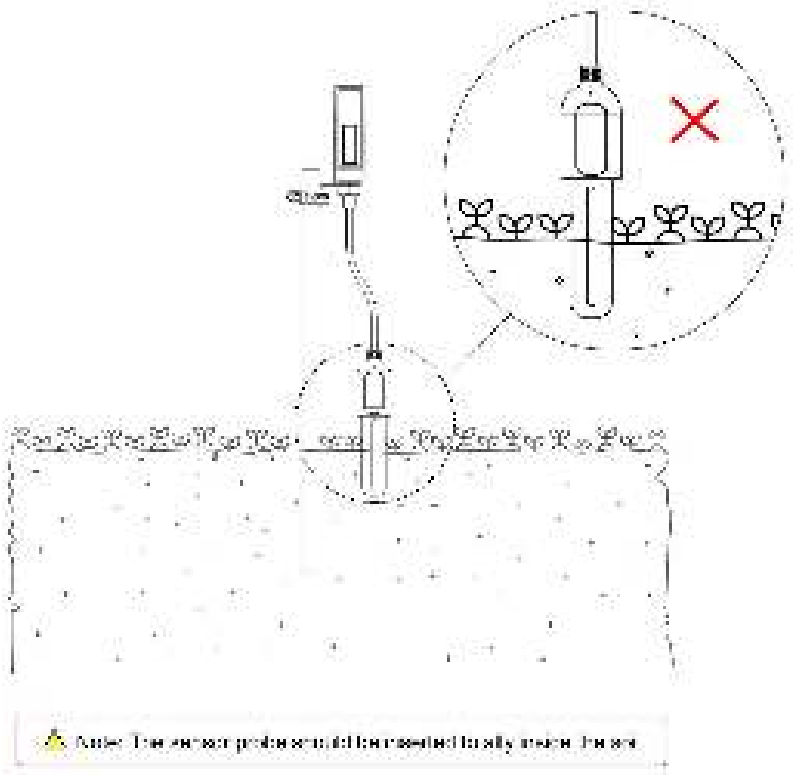


Figure 29: The sensor probe should be inserted totally inside the soil

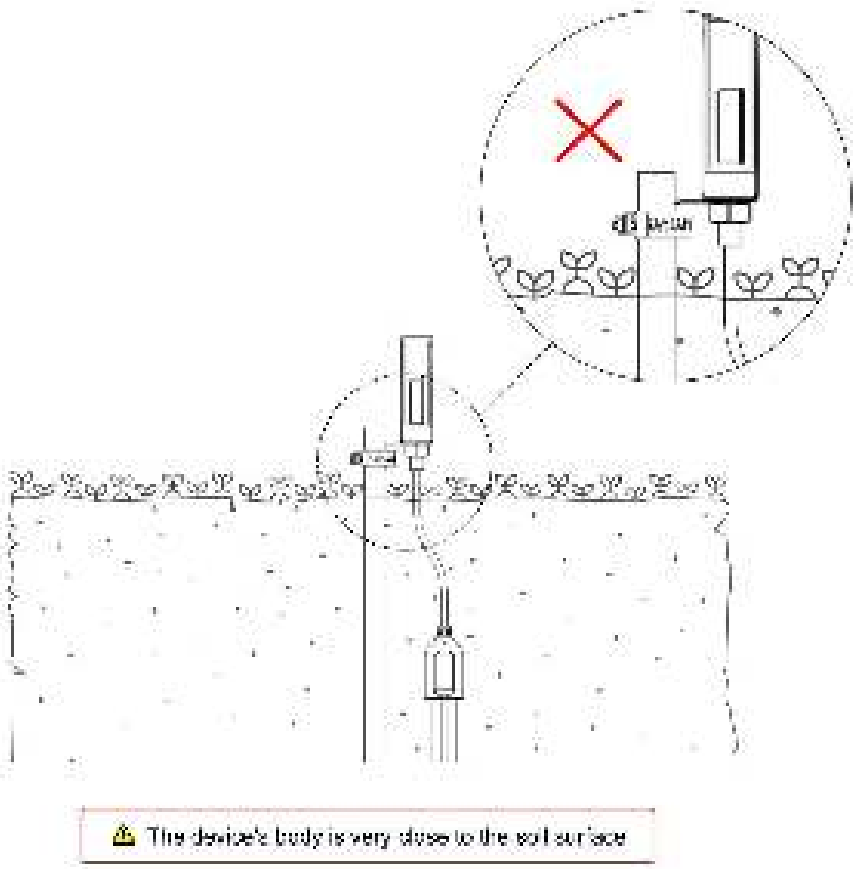


Figure 30 The device's body is very close to the soil surface

5. Optional Gateways/Consoles

5.1 Table of Gateways/Consoles Which could Pair with the WH51L

Gateway /Console Model Name	Quantity of Channels of WH51L	Picture	Whether the data could Upload to Internet	Whether the data Could Display on the Gateway/ Console
WH0291	1		×	√
GW1100	8		√	×

GW2000	**8**		√	×
HP2550	**8**		√	√
HP2560	**8**		√	√
HP3500	**8**		√	√
WN1820 /WN1821	**8**		√	√
WN1900 /WN1910	**8**		√	×

WN1920 /WN1980	**8**		√	×
WS3800	**8**		√	×
WS3900/ WS3910	**8**		√	×
WS6006 (V 1.1.32)	**1**		√	×

Note: Consoles have a maximum of 8 channels left for the soil moisture sensors, which means the WH51 and WH51L share the same 8 channels.

5.2 When paired with a Wi-Fi Gateway

- Monitor live sensor data on the Live Data page of the Ecowitt app (requires the gateway and your phone is using the same Wi-Fi network), like the Figure 31.



Figure 31: Data on Ecowitt APP

- Up to 8 channels supported. Channel names can be edited on the app, like the Figure 32.



Figure 32: Edit Gateway on Ecowitt APP

5.3 When paired with Console WH0291

- View soil moisture data in real-time on the Display, like the Figure 33. But WH0291 display console could not upload WH51L data to Internet.



Figure 33: Data on WH0291 Display Console

- WH51L could also pair with WH0291 display console. But one display console could only pair with one WH51L or WH51.

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

- View soil moisture data in real-time on the Display, like the Figure 34.



Figure 34: Real-time data on HP2560

- Soil moisture data will be looped playback on the main dashboard of HP2550/HP2560, like the Figure 35.



Figure 35: Data on Main Dashboard of HP2560

- Up to 8 channels supported. Channel names can be edited on the Display.
- Register new sensor ID on Figure 36.



Figure 36: Register WH51L on HP2560 Display Console

5.5 When paired with a Weather Station Console (HP3500)

- View soil moisture data in real-time on the Display, like the Figure 37.

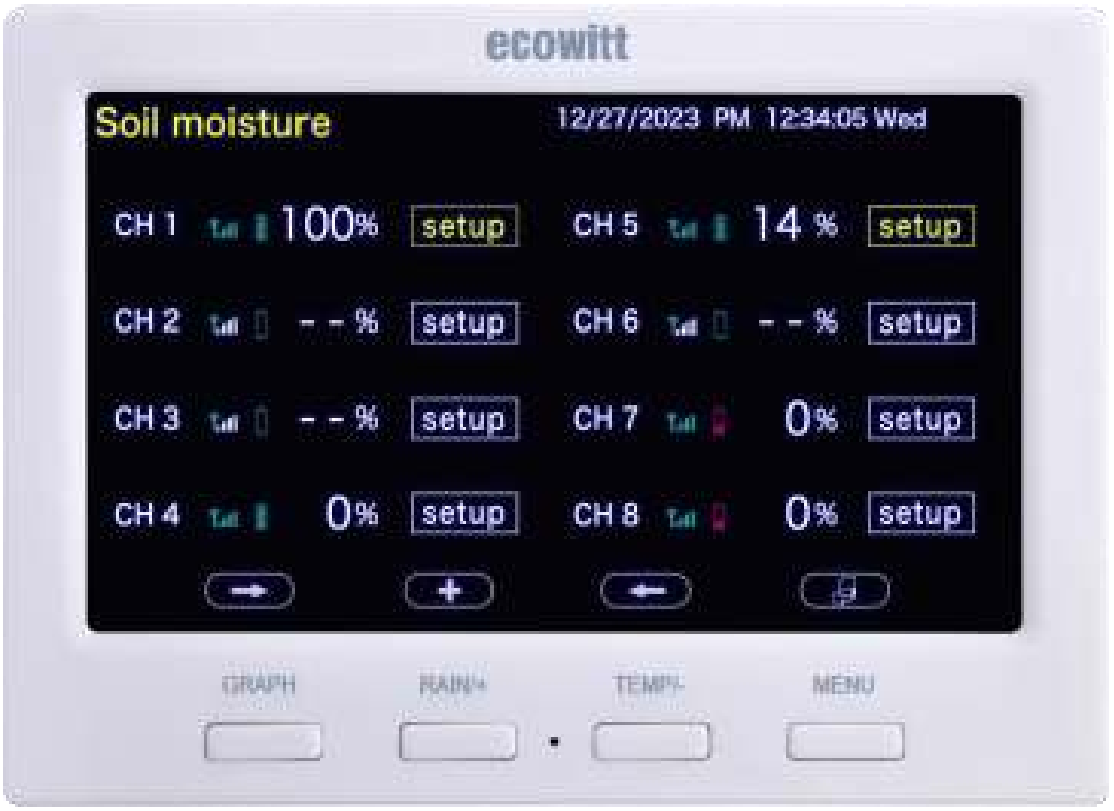


Figure 37: Real-time data on HP3500

- Soil moisture data will be looped playback on the main dashboard of HP3500, like the Figure 38.

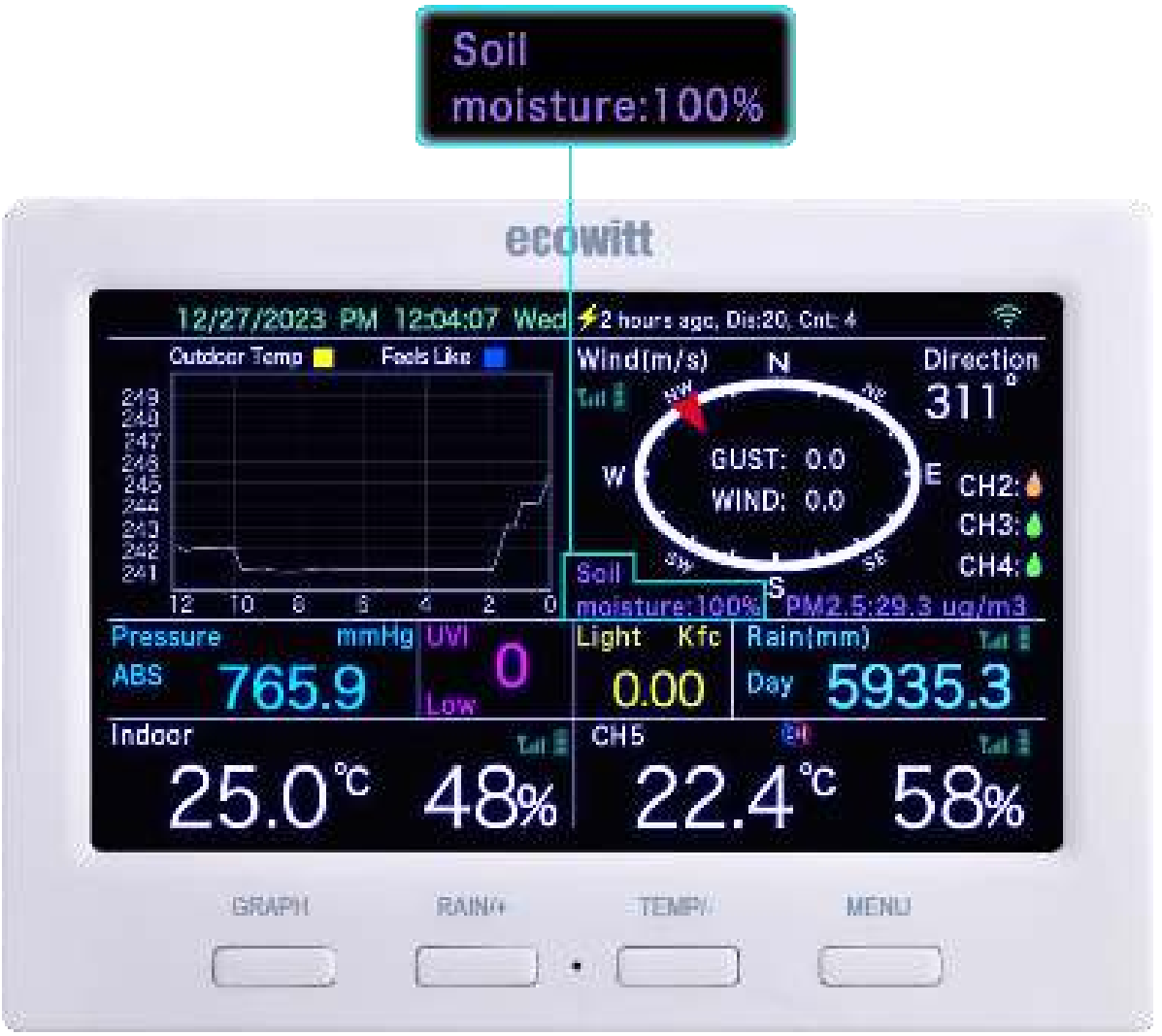


Figure 38: Data on Main Dashboard of HP3500

- Up to 8 channels supported. Channel names can Not be edited on the Display.
- Register new sensor ID on Figure 39.



Figure 39: Register WH51L on HP3500 Display Console

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

- View soil moisture data in real-time on the Display, like the Figure 40.



Figure 40

- Up to 8 channels supported.
- The channel's names could only be edited on the Ecowitt APP or website (ecowitt.net). For example, when you edit the channels' names on Ecowitt app, please refer the Figure 18~ Figure 19; when you edit the channels' names on ecowitt.net, please refer the Figure 21~ Figure 22.

5.7 When paired with a weather station console(WN1900/WN1910/WN1920/WN1980/WS3800/WS3900)

- Could NOT view the real-time data on the display.
- Only Support pair with WH51L and upload the data to the Internet.
- The channel's names could only be edited on the Ecowitt APP or website (ecowitt.net). For example, when

you edit the channels' names on Ecowitt app, please refer the Figure 19~ Figure 20; when you edit the channels' names on ecowitt.net, please refer the Figure 21~ Figure 22.

5.8 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 WH51L 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.

6. Specification

Dimensions of Housing	102.5×49×24(mm)
Dimensions of Sensor Probe	122×29×14(mm)
Length of Sensor Wire	100(mm)
Weight	122(g)
Material of Housing	ABS+PC
Material of Sensor Wire	PVC
Material of Probe Casing	PVC
Material of Probe	FR-4(Glass Fiber Reinforced Epoxy)
Measurement Principle	Frequency Domain Reflectometry
Moisture Range	0~100%(Ecowitt APP/display consoles/website); 0~99%(WH51L's LCD screen)
Accuracy	±5%
Resolution	1%
Working Temperature Range	-10°C to 50°C(14°F to 122°F)
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)
Device Housing Waterproof Level	IP66
Sensor Probe Waterproof Level	IP68

Power consumption

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

7. Warranty Information

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

All trademarks and patents are recognized.

We provide a 1-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 only to the original purchaser of this product. To receive warranty service, the purchaser must contact us for problem determination and service procedures.

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

Manufacture: Shenzhen Fine Offset Electronics Co., Ltd.

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

8. Care and 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

9. Contact Us

9.1 After-sales Service

Order Issues:

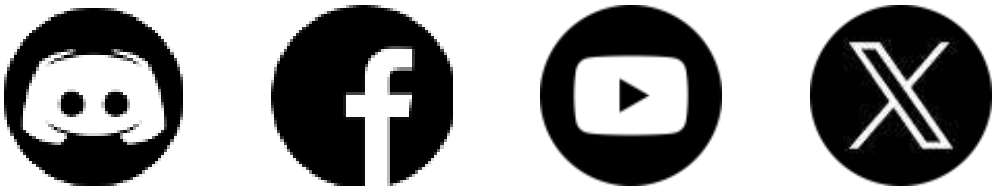
If you encounter any missing or incorrect shipments of Ecowitt products purchased, please reach out to the respective platform's customer service from the store where you bought the product for assistance.

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.

9.2 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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