ecowitt®

NDIR CO_2 and PM2.5 haze sensor

CO_2/PM1.0/PM2.5/PM4.0/PM10/Temperature/Humidity 7-in-1

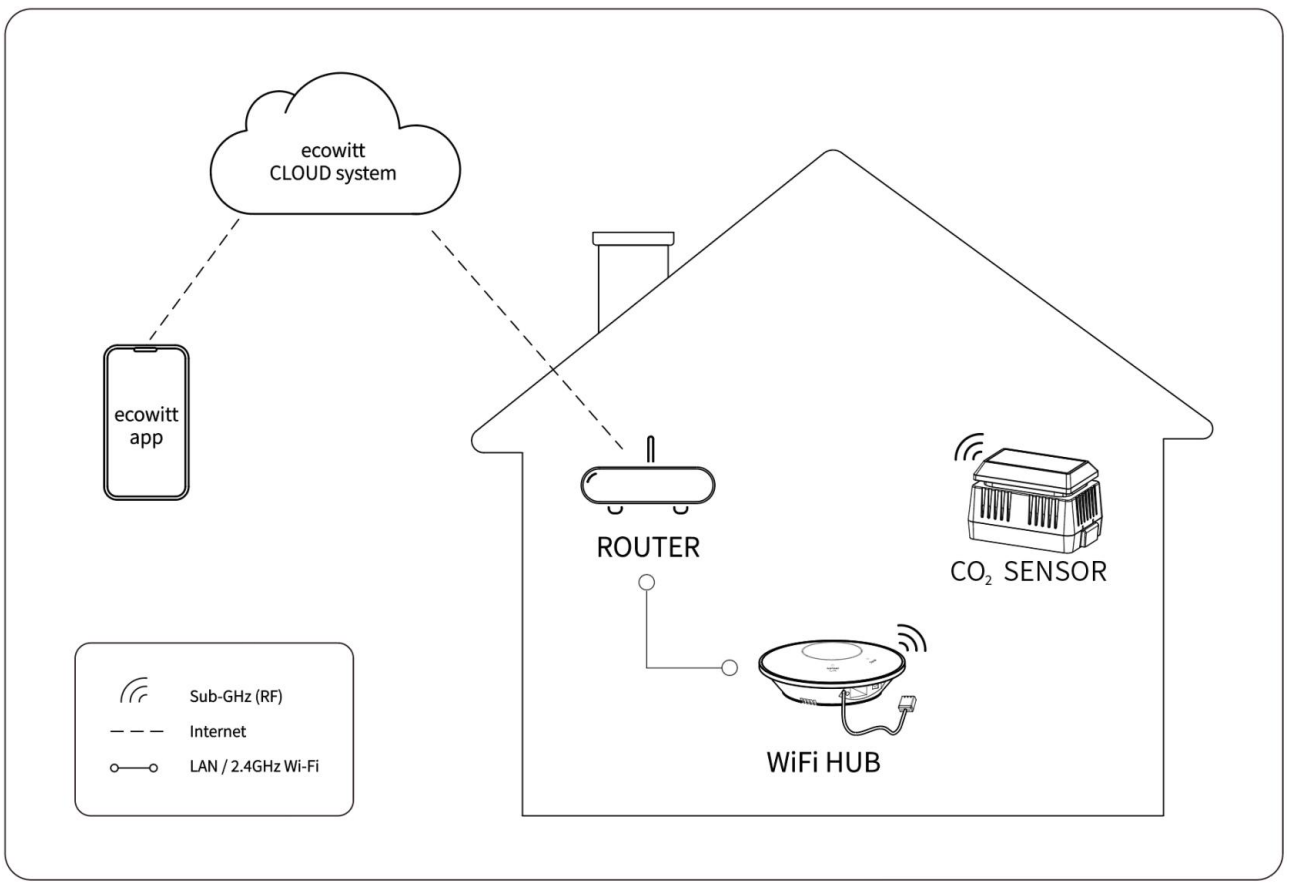
Manual

Model WH46

https://s.ecowitt.com/1RXQHY

Contents

1. Ecowitt Ecosystem



Welcome to our product! To send data to the ecowitt cloud server and enable users to access it via our mobile app, our product requires the setup of a gateway and a router.

2.Similar sensor

Model	WH41	WH43	WH45	WH46
Finish				
CO_2			✔	✔
PM1.0				✔
PM2.5	✔	✔	✔	✔
PM4.0				✔
PM10			✔	✔
Temperature & Humidity			✔	✔
Solar power supply	✔			
Power cord supply	✔	✔	✔	✔
Battery backup	✔	✔	✔	✔
Sensor ID Name	4 CH PM2.5		AQIN	

Note: If you have a WH41/WH43/WH45/WH46 PM2.5 sensor, the reading of PM2.5 may be different due to different sensor type used.

3. Before Configuration

Prepare an console that has been added to Ecowitt APP, ensuring the frequency matches. The compatible models are listed in the table below.

 GW1XXX	 GW2000	 WS3800	 WS39XX
 WN182X	 WN19XX	 WN1980	 WN1920
 HP25XX	 HP3500		

4. Getting Started

4.1 Parts List

One NDIR CO_2 and PM2.5 haze sensor
One USB Cable
One User Manual

4.2 Sensor Set Up

1.Remove the battery door on the base of the air quality sensor as shown in **Figure 1**.

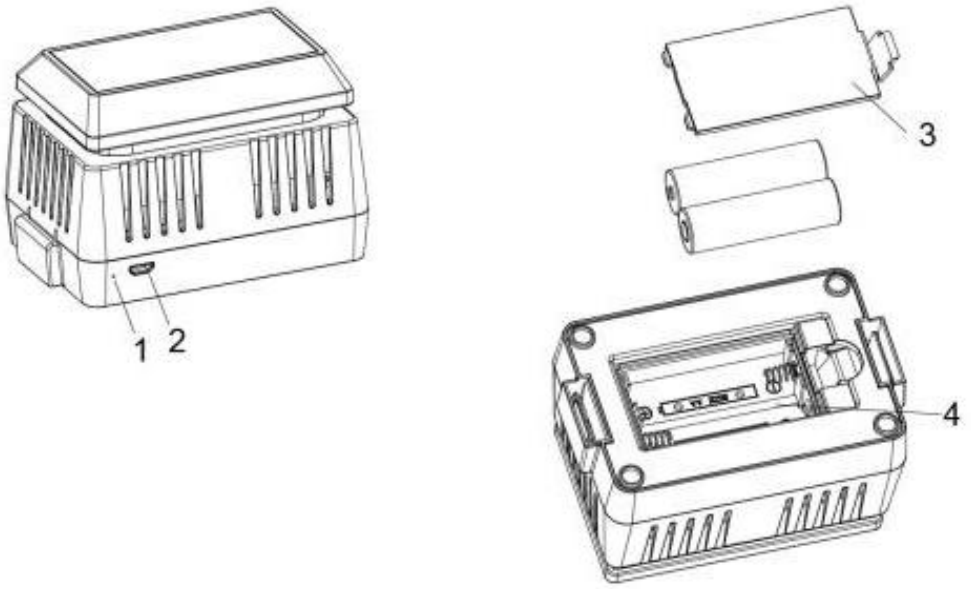


Figure 1

No	Description	No	Description
1	LED Indicator (RF transmission)	3	Battery Compartment Cover
2	AC Adapter USB Power Port	4	Battery Compartment

2.Insert two AA batteries and close the battery door.

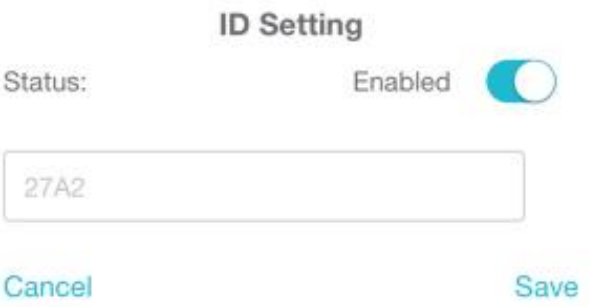
Note: The batteries (not included) are mainly for backup purpose.

2. Connect the USB cable between the sensor and an AC adapter(not included).

Note: After inserting the batteries or connecting AC power, the sensor LED indicator will light for 3 seconds – flash once after 20s, and then flash once per 1 minute thereafter (10 minutes if only powered by batteries). Each time it flashes, the sensor is transmitting data.

4.3 Adding and setting sensor on APP

Open the ecowitt APP → "•••" → "Sensor ID"→ "  "



→Enter sensor ID from WH46 to save

5. View Online Data

When paired with HP2550/HP2560 Console:

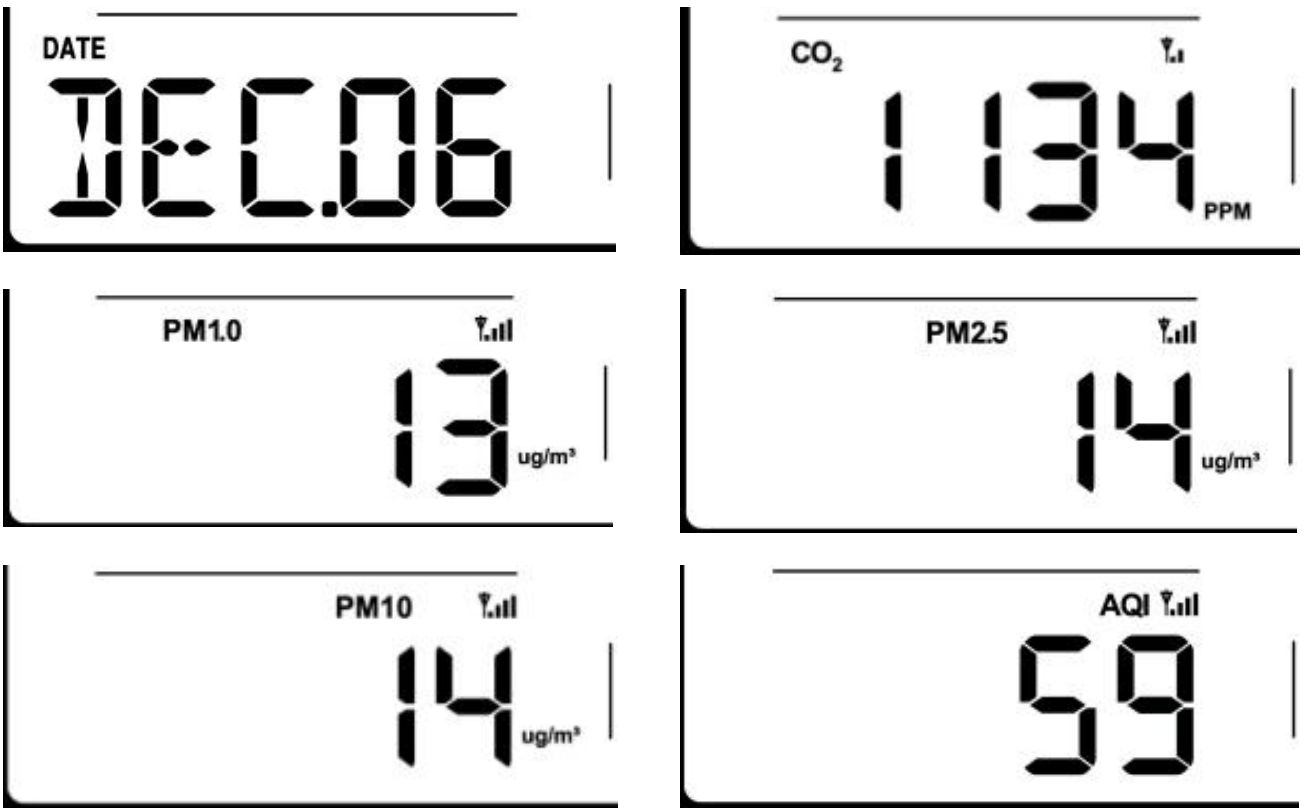
Figure 1 Dashboard

- The CO_2 , PM1.0, PM2.5, PM4.0, PM10 data automatically scrolls displaying on the screen every 5 seconds.

Figure 2 Page Sensor Name&Data

- The T&H, CO_2 , PM1.0, PM2.5, PM4.0, PM10 data on Figure 2 Page Sensor Name&Data

When paired with WS3800/WS3900 Console:



- Press button “+” to switch DATE, CO_2, PM1.0, PM2.5, PM10 and AQI data when default mode.
- **Note:** PM4.0,T&H reading on ecowitt APP or web page, but not display on console

When paired with WN1820:

Press button “+” to switch date, CO_2, $CO_2$24hAVG, $CO_2$1hMAX, $CO_2$24hMAX and CO_2MAX.

Note: PM1.0, PM2.5, PM4.0, PM10 reading on ecowitt APP or web page, but not display on console

When paired with other Console:

Configuration by built-in gateway of console, reading data on ecowitt APP or web page.

When uploaded to Ecowitt APP:

- Edit panel and title by "…" .
- Tap "  " to get graph of history data.

When uploaded to Ecowitt Weather Server:

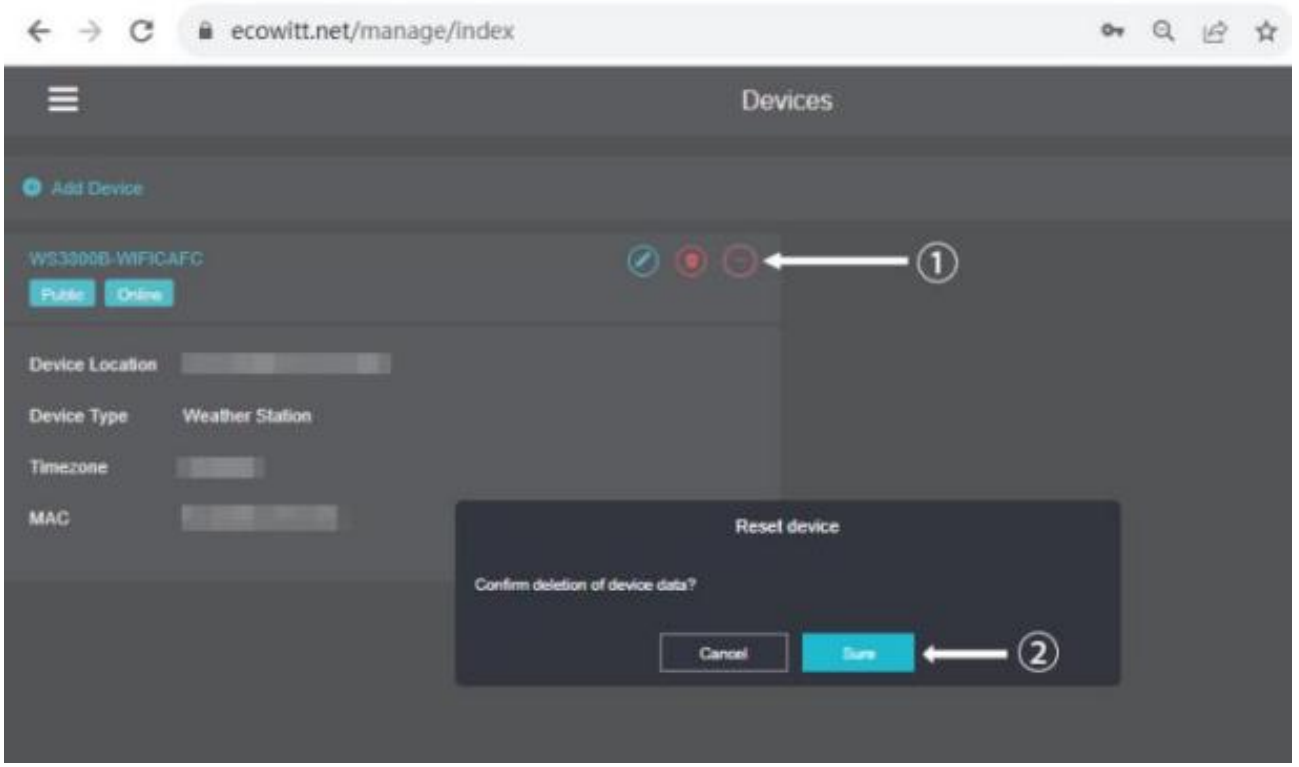
- View current sensor data & history records & graph on the website.
- Set and receive email alerts from the server when alarm condition set under your account.
- Remote monitoring with smart phone, laptop, or computer by visiting the website.

Note: On the 48-hour self-test which takes place with maximum fan rotation and is therefore clearly perceptible. You can set the commissioning start time by removing the batteries and the USB connection to a point in time where the necessary fan noise does not interfere.

6. History data on ecowitt.net

Export history data: ecowitt.net - click "Export" button on the dashboard.

You can set the time period and data frequency for the data here.
The data will be exported in .csv format.



Clear history data: Under "menu" → "devices" → “•••” button to reset history data.

7. Sensor Placement & Mounting

Place the sensor on a horizontally surface. Note that the vents must be clear of any obstructions, and we recommend placement away from other electronic devices to prevent interference. Do not place on a metal table to prevent RF signal loss.

Note: This sensor is designed for indoor use only.

Wireless communication is susceptible to interference, distance, walls and metal barriers. We recommend the following best practices for trouble free wireless communication.

1. Electro-Magnetic Interference (EMI). Keep the console several feet away from computer monitors and TVs.
2. Radio Frequency Interference (RFI). If you have other devices using the same RF frequency and communication is intermittent, try turning off these other devices for troubleshooting purposes. You may need to relocate the transmitters or receivers to avoid intermittent communication.

3. Line of Sight Rating. This device is rated at 300feet line of sight (no interference, barriers or walls) but typically you will get 100 feet maximum under most real-world installations, which include passing through barriers or walls.
4. Metal Barriers. Radio frequency will not pass through metal barriers such as aluminum siding. If you have metal siding, align the remote and console through a window to get a clear line of sight.
5. Finally, please reset your sensor data on ecowitt.net and start using it.

Note:

This device is mainly used to detect the particle concentration in air. The accuracy for temperature and humidity reading may vary due to different environment:

When the sensor is placed at unventilated environment, the temperature reading may be 2 degrees higher in worst case.

When the sensor is placed at ventilated environment, the temperature and humidity reading may be lower than the actual reading.

8. Features

CO_2 and PM2.5 haze sensor

- CO_2 photoacoustic NDIR sensors are usually more mechanically and thermally robust.
- Measures indoor PM1.0, PM2.5, PM4.0, PM10, CO_2 concentration, Temperature and Humidity every 60 seconds when powered with USB or detecting every 10 minutes when powered with batteries only.
- USB power Connection for indoor use only.
- This CO_2 and PM2.5 haze sensor doesn't has a display function and you need to view the data on weather server after pairing this device with our the WiFi Gateway or Console (all sold separately).

9. Specification

Model	WH46
Name	CO_2 and PM2.5 haze sensor
Types of CO_2 sensors	NDIR
Dimensions:	106×68×67(mm)
Material of Plastic Casing	ABS
Mass concentration range	0 ug/m³ to 1000 ug/m³
Mass concentration precision for PM1 & PM2.5	±【5ug/m³+5%】(0 ug/m³ to 100 ug/m³), ±10 % (100 ug/m³ to 1000 ug/m³)
Mass concentration precision for PM4 & PM10	±25 ug/m³ (0 ug/m³ to 100 ug/m³) ±25 % (100 ug/m³ to 1000 ug/m³)
Mass concentration resolution	1 ug/m³
CO_2 measuring range	0 to 40000 ppm
CO_2 measurement accuracy	± (50 ppm + 5% of reading) when 400 to 2000 ppm
CO_2 Accuracy drift per year	± (5ppm + 5% of reading)
CO_2 measurement resolution	1 ppm
Temperature Metering Range	-10°C to 60°C (14°F to 140°F)
Temperature Metering Accuracy	±0.8°C (1.5°F) when 15°C to 35°C (59°F to 95°F) ±1.5°C (2.7°F) when -10°C to 60°C (14°F to 140°F)

Temperature Metering Resolution	0.1°C (0.1°F)
Humidity Metering Range	1%RH to 99%RH
Humidity Metering Accuracy	± 6%RH when 15°C to 35°C (59°F to 95°F) ± 9%RH when -10°C to 60°C (14°F to 140°F)
Humidity Metering Resolution	1%RH
Humidity Accuracy drift per year	< 0.25%RH
Automatic cleanup interval	2 days
Reading Update Interval	About 1 minute
RF Connection Frequency	920/915/868/433MHz (depending on local regulations)
RF Wireless Range	Over 100 meters (in open areas)
Operating Temperature Range	-10°C to 50°C (14°F to 122°F)
Power Supply	2x1.5AA Batteries or USB 5V
Battery Life	2 days

10.Carbon Dioxide Levels and potential health problems are indicated below:

- 250-350 ppm: background (normal) outdoor air level.
- 350-1,000 ppm: typical level found in occupied spaces with good air exchange.
- 1,000-2,000 ppm: level associated with complaints of drowsiness and poor air.
- 2,000-5,000 ppm: level associated with headaches, sleepiness, and stagnant, stale, stuffy air; poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
- >5,000 ppm: This indicates unusual air conditions where high levels of other gases also could be present. Toxicity or oxygen deprivation could occur. This is the permissible exposure limit for daily workplace exposures.
- >40,000 ppm: This level is immediately harmful due to oxygen deprivation.

Air Quality Index (AQI) for the PM2.5 Concentration (24hr)

AQI	Air Pollution Level	PM2.5 Concentration ug/m3
0 - 50	Good	0.0-12.0
51 -100	Moderate	12.1-35.4
101-150	Poor	35.5-55.4
151-200	Unhealthy	55.5-150.4
201-300	Severe	150.5-250.4
300+	Hazardous	250.5+

Air Quality Index (AQI) for the PM10 Concentration (24hr)

AQI	Air Pollution Level	PM2.5 Concentration ug/m3
0 - 50	Good	0-54
51 -100	Moderate	55-154
101-150	Poor	155-254
151-200	Unhealthy	255-354
201-300	Severe	355-424
300+	Hazardous	425+

Note:
The WH46 sensor data can be only viewed on the Live Data interface since it doesn't support uploads to weather underground.
If you choose to upload the data to our weather server: https://www.ecowitt.net, you can view the live data/history graph and download the records on the website. You can add a shortcut of the website on the home screen of your phone for quick access.

11. What types of NDIR sensors exist and how do they work?

An introduction to the principles behind transmissive and photoacoustic NDIR sensing

Characteristics of NDIR Sensors:

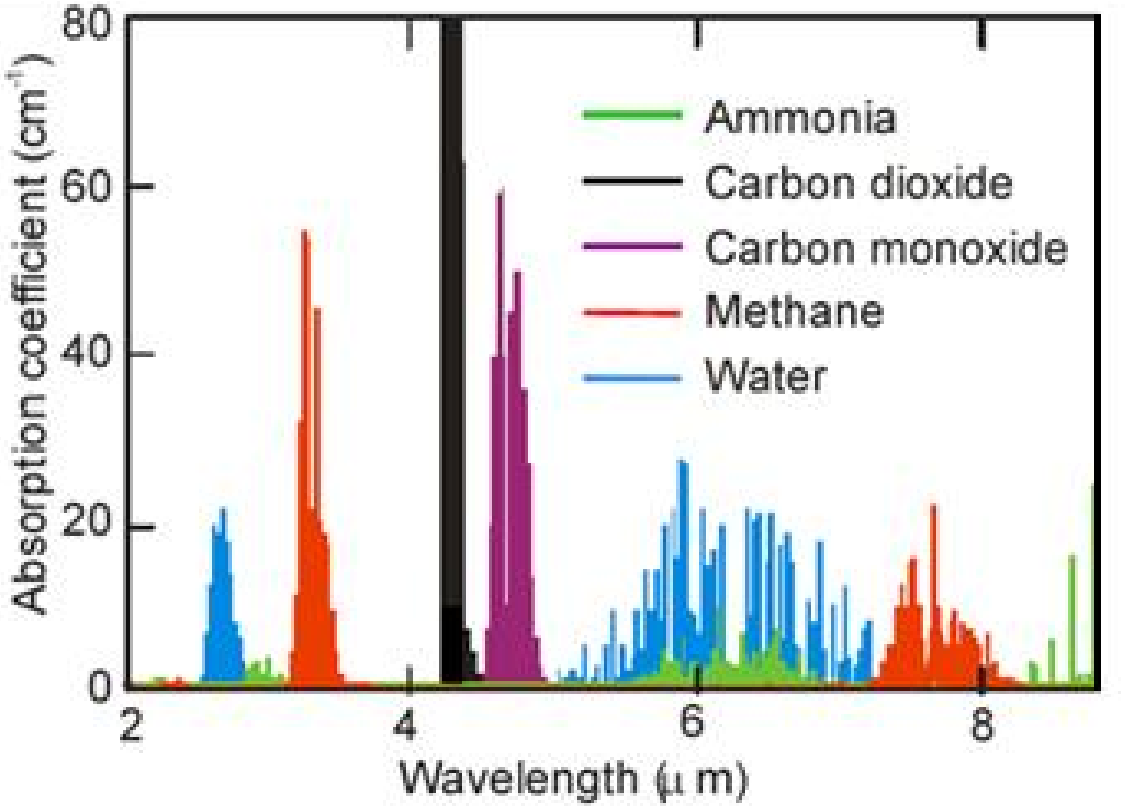
NDIR sensing has become the prevalent technique for measuring CO_2 concentration. The technology exploits the characteristic property of CO_2 molecules to strongly absorb infra-red (IR) light with wavelengths around 4.2 μm. When shining light of this wavelength through a gas sample, the CO_2 concentration can thus be calculated from the proportion of light that is absorbed. It is important to note that NDIR sensors do not require a dispersive element, such as a prism or a diffraction grating, to discriminate for the targeted wavelength. Instead, the light produced by the emitter is shown through a non-dispersive band-pass filter, allowing only

the infrared wavelengths of interest to pass. These characteristics give the sensors their classification: Non-dispersive Infra-red.

Transmissive NDIR:
These NDIR sensors typically feature an IR emitter and an optical detector, such as a photodiode, at opposite ends of a specially designed optical cavity. The optical detector measures the amount of IR light energy that is not absorbed by (i.e., transmitted through) the gas sample.
As the CO_2 concentration in the optical cavity increases, the amount of light detected decreases. Hence, this principle determines the amount of light energy CO_2 molecules have absorbed by calculating the difference between the measurement and a reference intensity at a known CO_2 concentration.

NDIR CO_2 sensors leverage infra-red absorption at 4.2 µm wavelength without the use of dispersive optical elements.

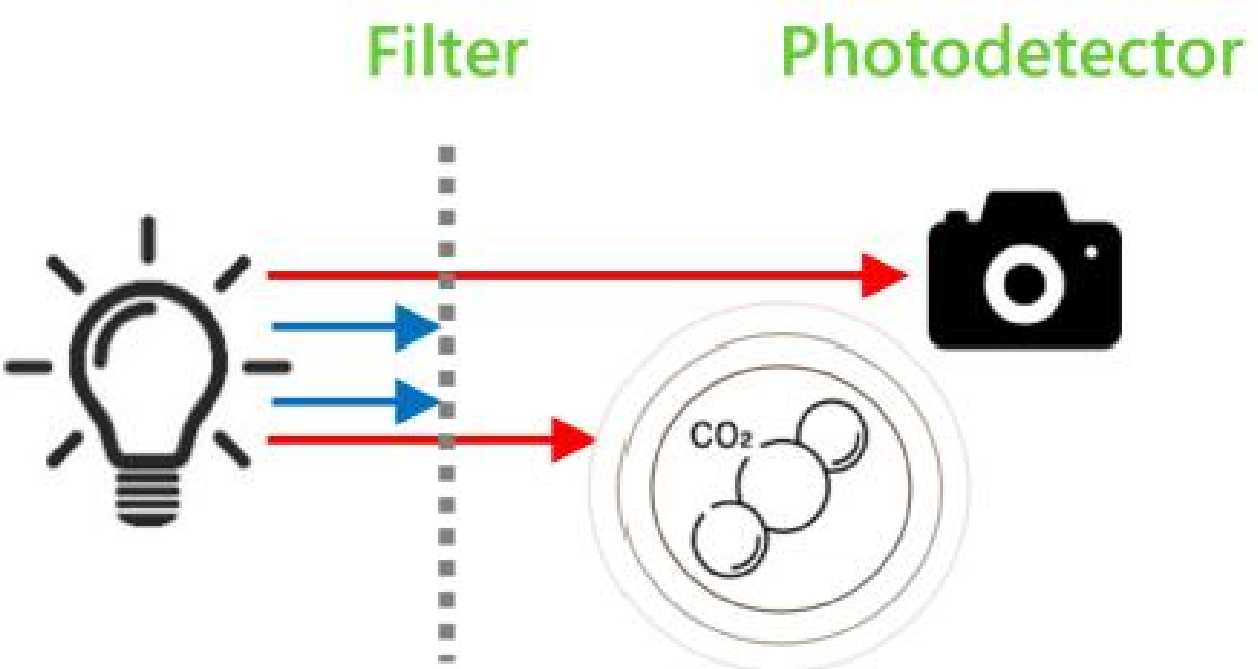
Absorption spectra of common trace gases



(HITRAN2016 molecular spectroscopic database)

Note that this reference value heavily depends on precise positioning of IR emitter and photodetector, as well as the emission properties of the IR source and the optical cavity. Mechanical and thermal stresses acting on the measurement chamber can thus significantly falsify CO_2 readings.

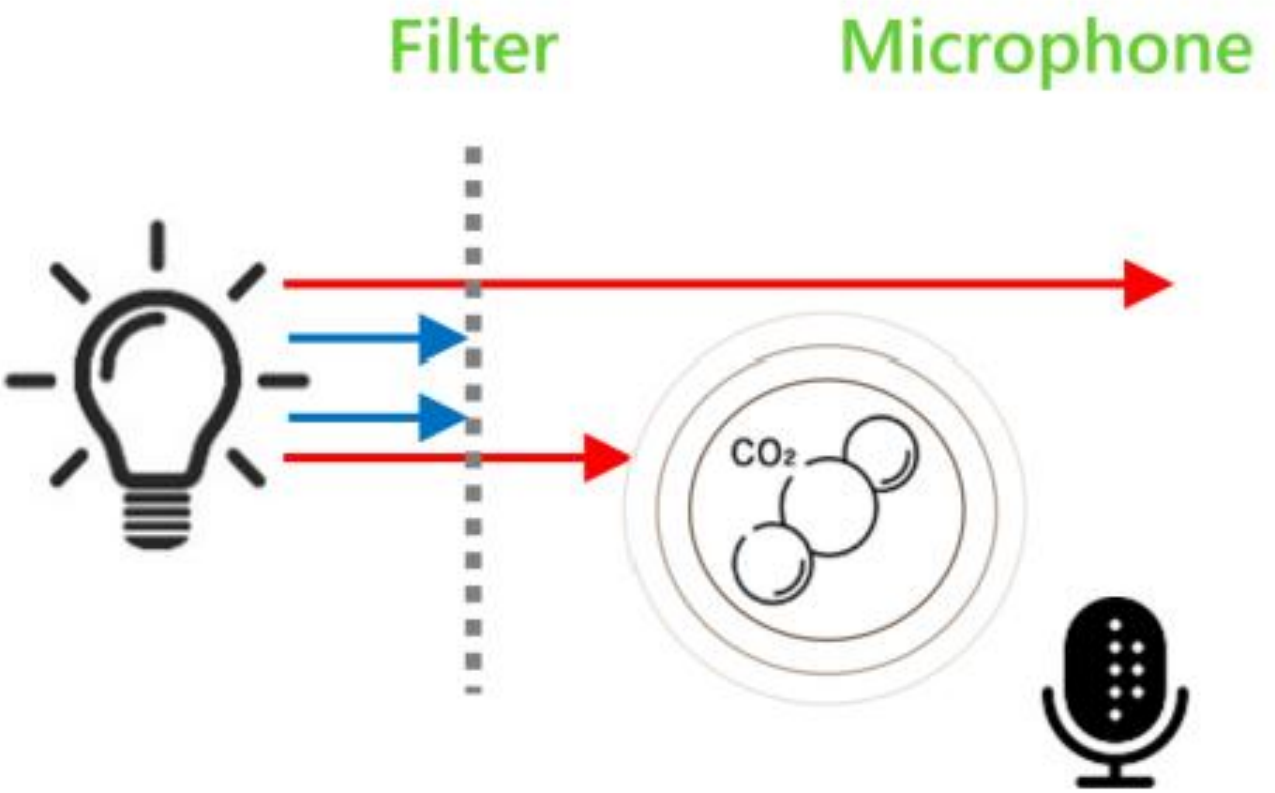
Furthermore, transmissive NDIR sensors generally require a minimal optical path length in the centimeter scale for enough IR absorption to occur to accurately measure lower CO_2 concentrations.



Photoacoustic NDIR:

In contrast to transmissive NDIR sensors, photoacoustic NDIR sensors detect the amount of energy that is absorbed by CO_2 molecules. When pulsing the infra-red emitter, CO_2 molecules absorb infra-red light periodically. This causes additional molecular vibration resulting in a pressure wave inside the measurement chamber. The higher the CO_2 concentration, the more light is absorbed, and thus the greater the amplitude of this acoustic wave becomes. A microphone inside the gas chamber measures this, from which the CO_2 concentration can then be calculated.

Photoacoustic NDIR sensing allows for much greater miniaturization of the measurement chamber. Furthermore, as sound waves are omnidirectional, relative positioning of emitter and microphone is unconstrained. Thus, photoacoustic NDIR sensors are usually more mechanically and thermally robust.



12. 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.

Manufacture: ShenZhenShi OuSaiTeDianZi YouXianGongSi
Address: Shajingjiedao, Xihuanlu, Minzhujiujiugongyecheng AQu, C Dong 4 Ceng A, Shenzhen Baoanqu Guangdong 518101 CN

13. 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.

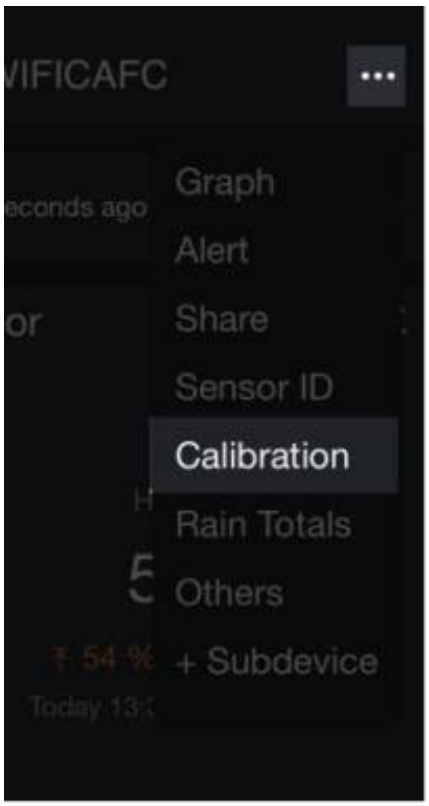
This limited warranty begins on the original date of purchase, is valid only on products purchased, and only to the original purchaser of this product. To receive warranty service, the purchaser must contact us for problem determination and service procedures.

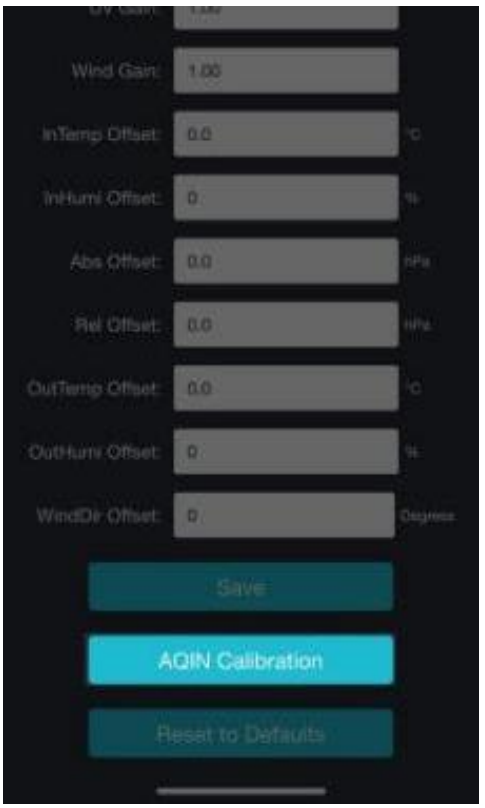
This limited warranty covers only actual defects within the product itself and does not cover the cost of installation or removal from a fixed installation, normal set-up or adjustments, or claims based on misrepresentation by the seller, or performance variations resulting from installation-related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

14. Sensor Calibration

Auto Calibration Operation: If you find that the readings of the carbon dioxide sensor are inaccurate after a period of use, please place the device in a well-ventilated location for at least one day. Make sure there are no other sources of pollution around, and ensure that the sensor surface is not obstructed or affected by external interference. It is important to keep the device connected to the power supply and in normal working condition without shutting down or interrupting the power supply. By continuously detecting the carbon dioxide concentration in the environment, the sensor will automatically calibrate its readings.

If you have a reliable source to calibrate the CO_2 data, you may calibrate the offset on the Ecowitt App, or the console. If the deviation is large, it's recommended to place the sensor in an outdoor ventilated place for 30 minutes before calibrating.





Open ecowitt APP → "…" → "Calibration" → "AQIN Calibration" → setting and save

15. 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 you bought product for assistance.

Usage Inquiries:

For any issues related to product usage, feel free to con tact our customer support team at support@ecowitt.co m. We are committed to providing assistance and resol ving any concerns you may have.

16.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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