Weather Station Gateway User Manual

Contents

1. Introduction

Thank you for your purchase of the Weather Station Gateway. The following user guide provides step by step instructions for installation, operation, and troubleshooting.

2. Warnings and Cautions

⚠️**Warning:** Any metal object may attract a lightning strike, including your weather station mounting pole. Never install the weather station in a storm.

⚠️ **Warning:** Installing your weather station in a high location may result in injury or death. Perform as much of the initial check out and operation on the ground and inside a building or home. Only install the weather station on a clear, dry day.

3. Quick Start Guide

Although the manual is comprehensive, much of the information contained may be intuitive. In addition, the manual does not flow properly because the sections are organized by components.

The following Quick Start Guide provides only the necessary steps to install, operate the weather station, and upload to the internet, along with references to the pertinent sections.

Required		
Step	**Description**	**Section**
1	Power up the GATEWAY and connect to your router.	5.2
2	Calibrate the relative pressure to sea-level conditions (local airport) on the GATEWAY	5.7
3	Register and upload to Weather Servers	5.5

4. Pre-Installation Checkout and Site Survey

4.1   Pre-Installation Checkout

Before installing your weather station in the permanent location, we recommend operating the weather station for one week in a temporary location with easy access. This will allow you to check out all of the functions, ensure proper operation, and familiarize you with the weather station and calibration procedures. This will also allow you to test the wireless range of the weather station.

4.2   Site Survey

Perform a site survey before installing the weather station. Consider the following:
1. You must clean the rain gauge every few months and change the batteries every 2-3 years. Provide easy access to the rain gauge and sensor array.
2. Avoid radiant heat transfer from buildings and structures. In general, install the sensor array at least 5' from any building, structure, ground, or roof top.
3. Avoid wind and rain obstructions. The rule of thumb is to install the sensor array at least four times the distance of the height of the tallest obstruction. For example, if the building is 20' tall and the mounting pole is 6' tall, install the sensor array 4 x (20 – 6)' = 56' away.
4. Mount the sensor array in direct sunlight for accurate temperature readings.
5. Installing the weather station over sprinkler systems or other unnatural vegetation may affect temperature and humidity readings. We suggest mounting the sensor array over natural vegetation.
6. Wireless Range. Radio communication between receiver and transmitter in an open field can reach up to 1,000 feet, providing there are no interfering obstacles such as buildings, trees, vehicles and high voltage lines. Wireless signals will not penetrate metal buildings. Under most conditions, the maximum wireless range is 300'.
7. Radio Interference. Computers, radios, televisions, and other sources can interfere with radio communications between the sensor array and tablet. Please take this into consideration when choosing tablet or mounting locations. Make sure your display tablet is at least five feet away from any electronic

device to avoid interference.

5. Getting Started

5.1 Parts List

QTY	Item
Gateway	
1	GATEWAY Module
1	5V DC Adaptor
1	Ethernet Cable
User manual	

5.2 GATEWAY Network Connection Options

Connect the GATEWAY receiver power jack to AC power with the power adapter (included), as shown in Figure 1, reference 10.

The Gateway can connect to your network via Wi-Fi or directly connected to your router using the included Ethernet cable, as shown in Figure 11, reference 8.

Place the powered sensors (including sensor array, indoor thermo-hygro-barometer) about 5 to 10 feet from the GATEWAY receiver and wait several minutes for the remote sensors to synchronize with the receiver. Once synchronized, the Indoor blue LED (

Figure 1, reference 2) and Outdoor blue LED (

Figure 10, reference 3) will be illuminated. *Adding additional sensors can be found later in Section 2.10*
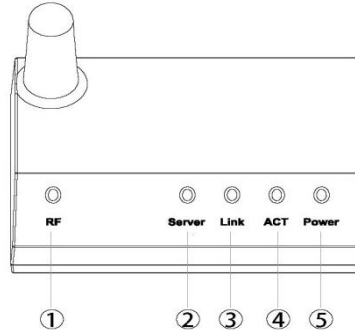
Ref.	LED	Description
1	RF	On when radio frequency receiver is operating properly
2	Server	On when connected to Wunderground.com® internet hosting service
3	Link	Connected to the Internet (or router)
4	ACT	Flashes when there is internet activity
5	Power	AC Power connected

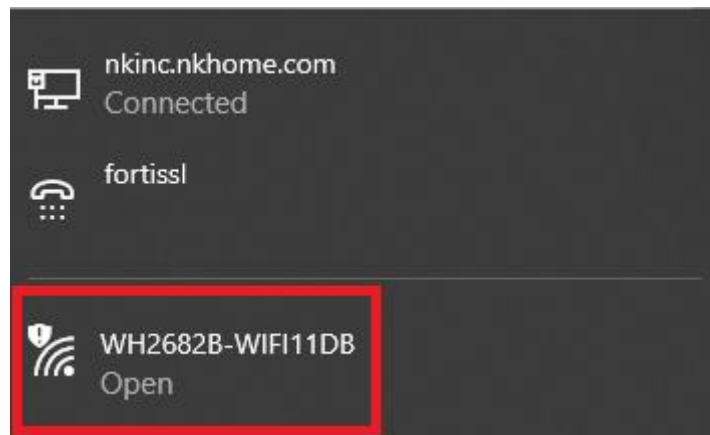**Figure 10**
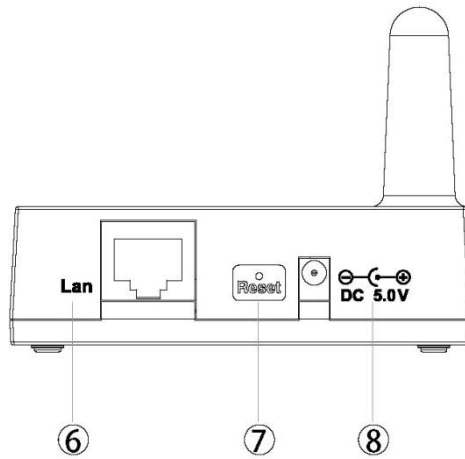
Ref.	Description
6	LAN connection (connect to router)
7	Reset button (use IP Module reset tool or open-ended paper clip)
8	AC Power connection

Figure 11

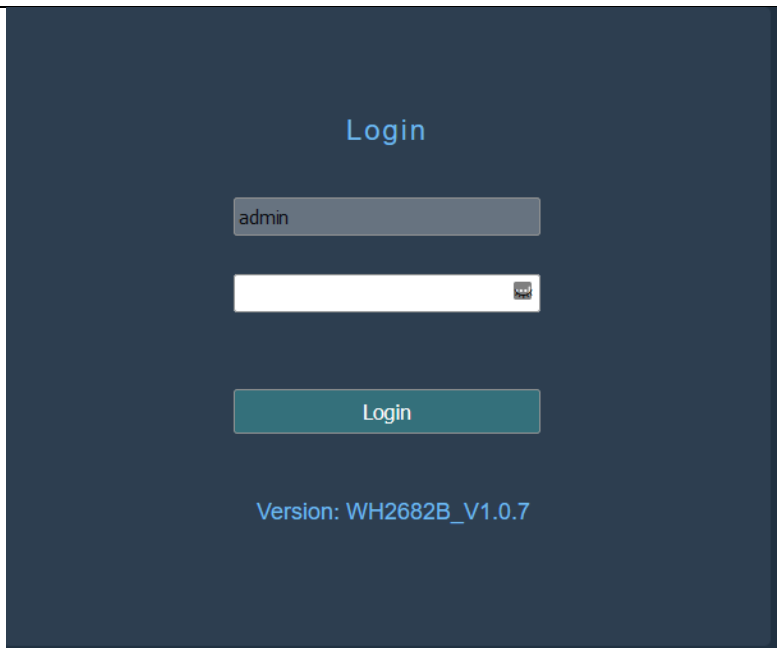## 5.3   Finding the GATEWAY module from your computer

5.3.1 PC Users

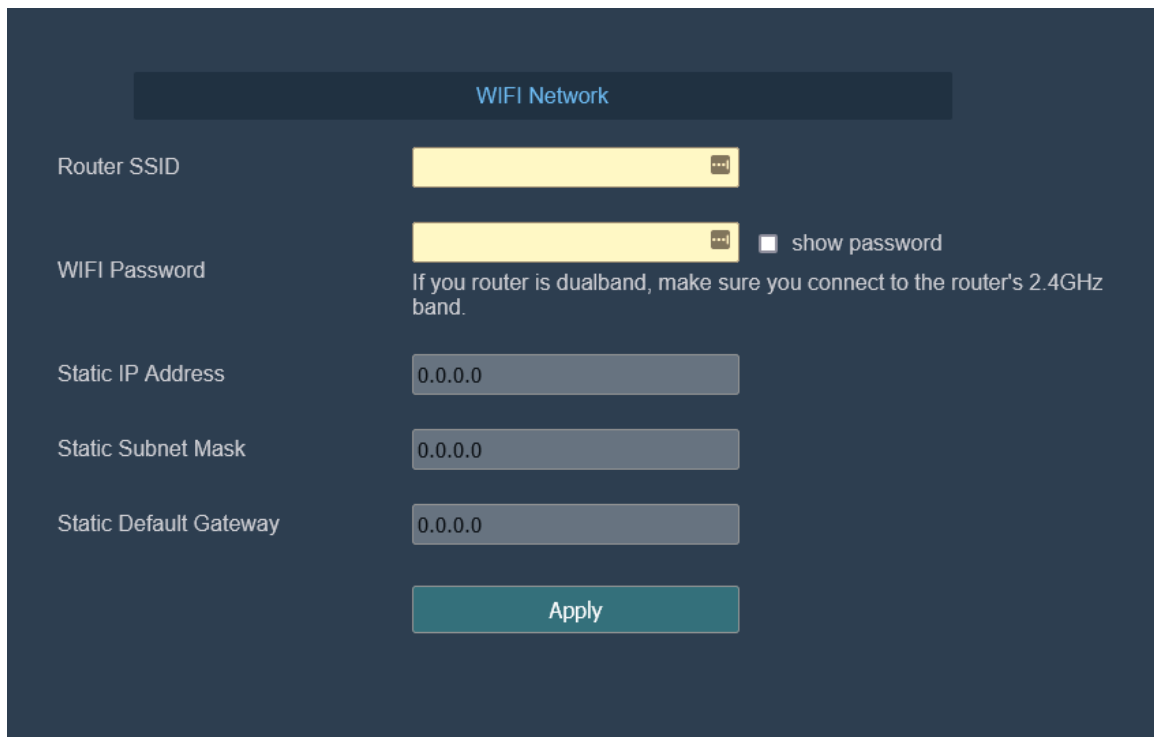To find the GATEWAY, connect to power and look for the following WIFI network.

Connect to the network and then open a browser Note: you may be told network has no internet.

Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)

Login

admin

Login

Version: WH2682B_V1.0.7

Once logged in you will want to navigate to the local network screen to connect to WIFI.

WIFI Network

Router SSID

WIFI Password

If you router is dualband, make sure you connect to the router's 2.4GHz band.

Static IP Address   0.0.0.0

Static Subnet Mask   0.0.0.0

Static Default Gateway   0.0.0.0

Apply

On the Sensors ID screen, you can register or re-register a sensor.

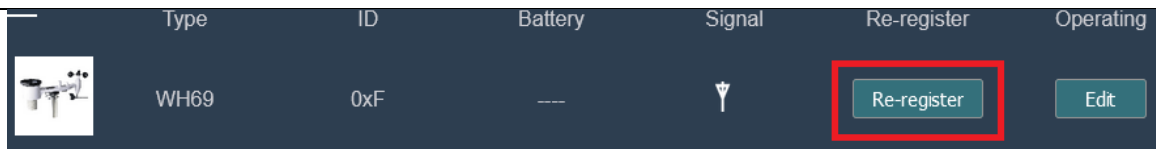|	Type	ID	Battery	Signal	Re-register	Operating
	WH69	0xF	----	Ψ	Re-register	Edit

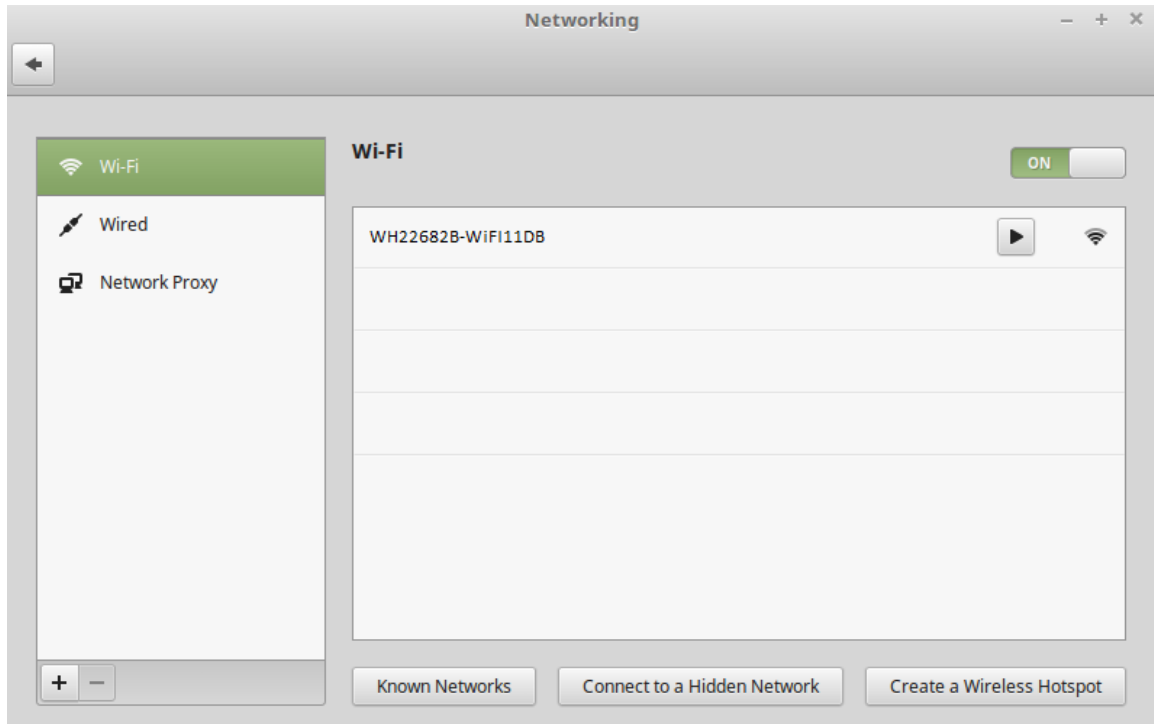**Figure 12**

5.3.2 Mac Users

To find the receiver, connect to power and look for the following WIFI network.

Connect to the network and then open a browser Note: you may be told network has no internet.
Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)
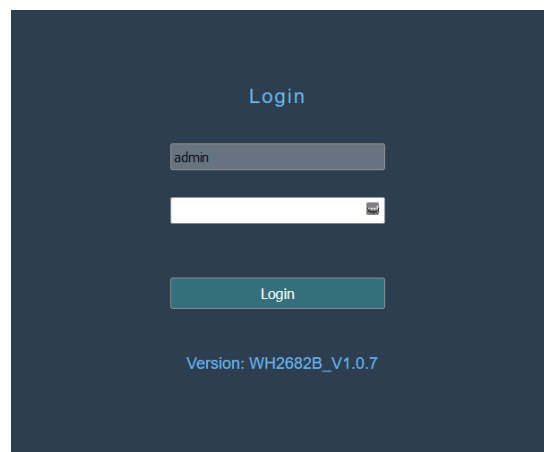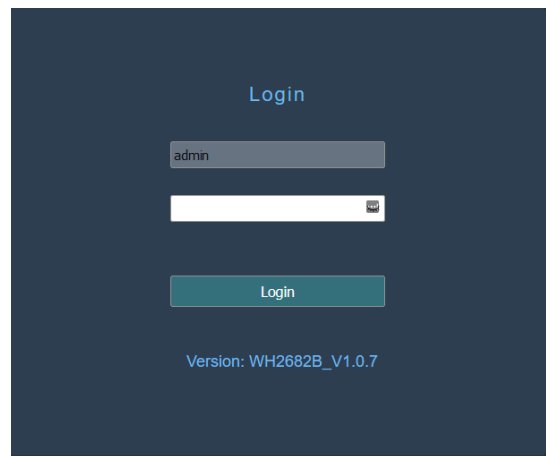
5.3.3 Linux Users

Connect to the network and then open a browser Note: you may be told network has no internet.
Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)

5.4   Local Device Network Settings (optional)

From your web browser, access the Gateway from the IP address in the previous section.

Select the Local Network tab to program the local network settings. Reference Figure 3:
1. IP Address. The default setting is receiving automatically (DCHP), which is recommended. The network will assign an IP address. To statically assign an IP address, select Static from the pull-down menu. This will prevent the IP address from changing each time you power up the receiver.
2. Static IP Address. If Static is selected as the IP address, enter the IP address you wish to access the GATEWAY module.
3. Static Subnet Mask. Default is 255.255.255.0. This should not be changed unless you are familiar with networking and subnet masking.
4. Static Default Gateway. This is typically the IP address of your router.

If you made any Static IP Address changes (not recommended), to confirm these changes, select Apply and Reboot.

Note: If you incorrectly set the static IP settings and can no longer access the GATEWAY 2.0, press the reset button on the back of the module.
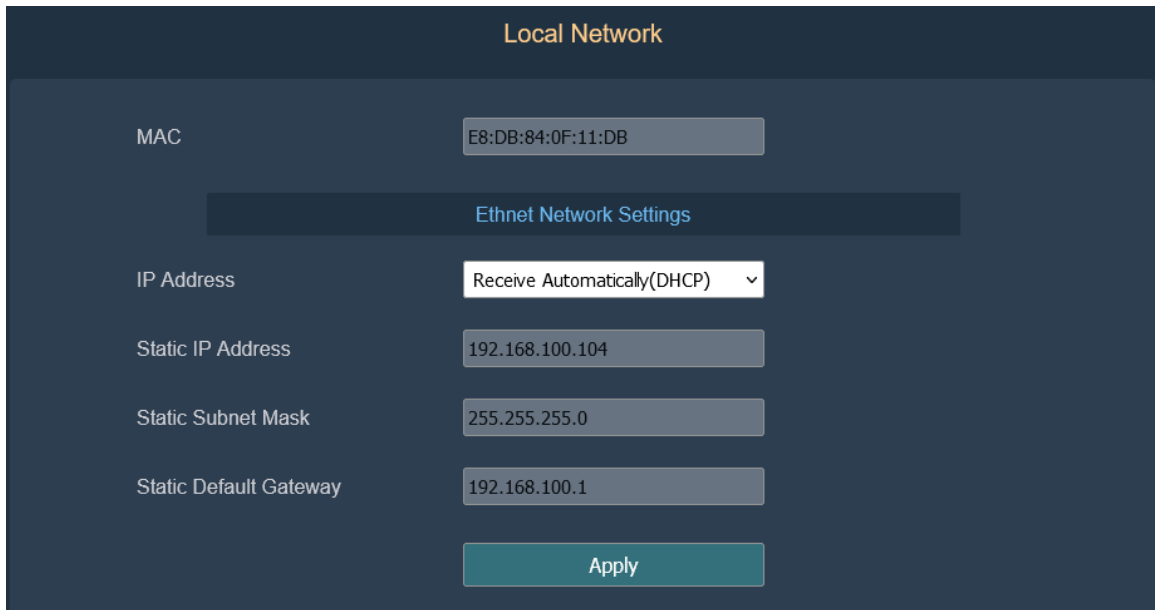

Figure 13

5.5 Weather Network Settings

Select the Weather Network tab to program the Weather Underground station settings and Ambient Weather Network settings. Reference Figure 2:
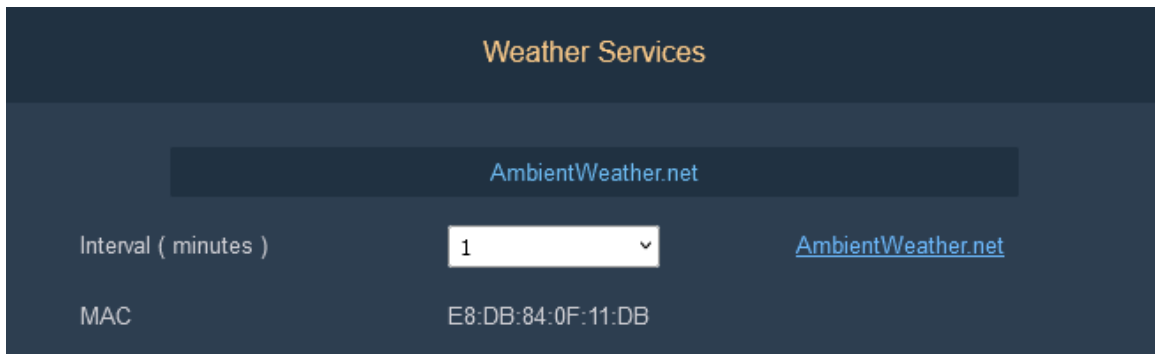

Figure 2

5.6 Live Data

Select the Live Data tab to view your live data from the weather station.

Figure 3

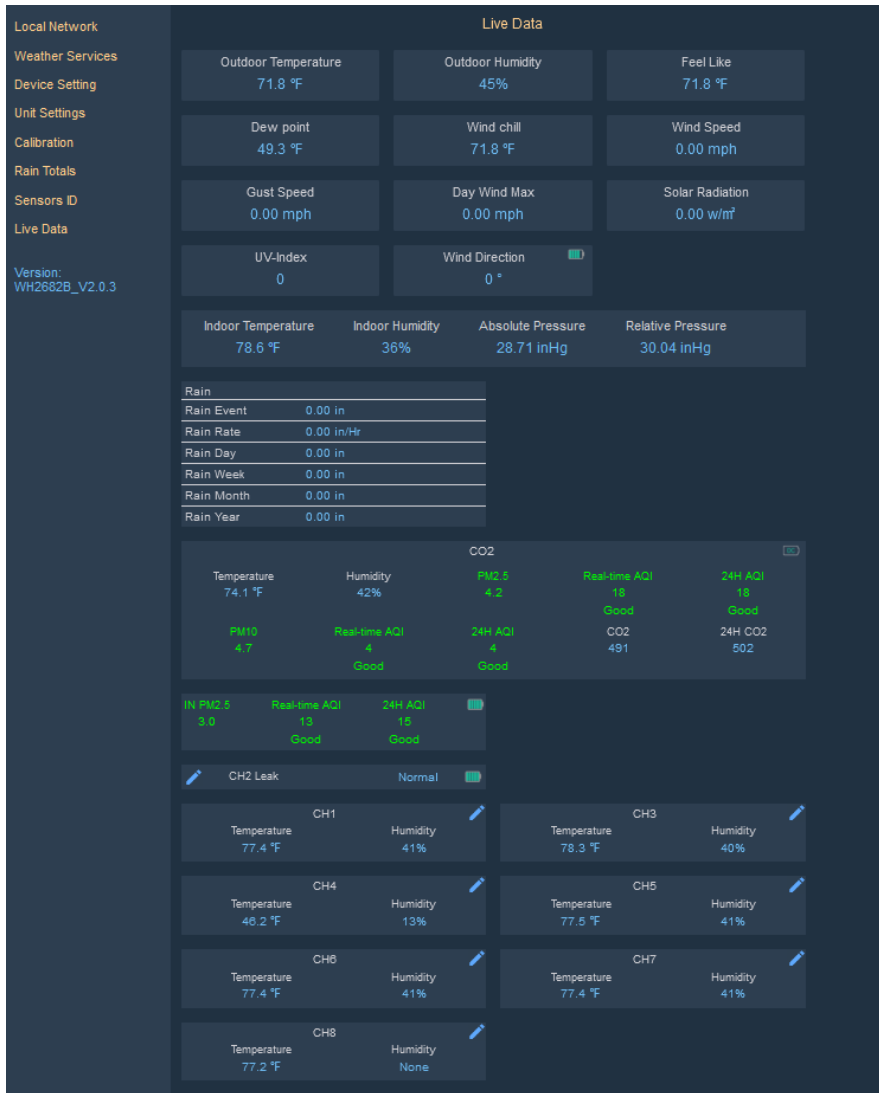### 5.6.1　Reset and Change Rain Totals

During the installation of your weather station, you may report false rain due to vibration of the tipping mechanism. To reset the rain to 0.00, select the Reset button as shown in

Figure 4

Figure 5Figure17,or enter the Daily, Weekly, Yearly, Monthly and Yearly rain totals in the appropriate fields, and select Save.

During rain gauge cleaning, the tipping mechanism may record false rain. Before rain gauge cleaning, record the rain totals before and after the cleaning procedure, then correct the daily, weekly, monthly, and yearly totals.

Figure 5

5.7 Calibration

Select the Calibration tab to view your calibration data from the weather station. Select the Save button to confirm changes.

Calibration of most parameters is not required, except for Relative Pressure, which must be calibrated to sea-level to account for altitude effects. For more information on sea-level pressure calibration, please reference note (3) below.

5.7.1 Relative Barometric Pressure Calibration Example

The following is an example of calibrating the relative pressure. Your results will vary.

1. The local relative pressure from TV, the newspaper, or the internet for the official station in your area is 30.12 inHg.
2. From the Live Data panel, your absolute pressure (measured, and not corrected to sea-level) reads 28.90 inHg.
3. Reference Figure . Enter the following offset in the Calibration panel for Relative Pressure Offset:

Relative Pressure Offset = 30.12 – 28.90 = 1.22

Figure 18

Parameter	Type of Calibration	Default	Typical Calibration Source
Temperature	Offset	Current Value	Red Spirit or Mercury Thermometer (1)
Humidity	Offset	Current Value	Sling Psychrometer (2)
ABS Barometer	Offset	Current Value	Calibrated laboratory grade barometer
REL Barometer	Offset	Current Value	Local airport (3)
Wind Direction	Offset	Current Value	GPS, Compass (4)
Solar Radiation	Gain	1.00	Calibrated laboratory grade solar radiation sensor
UV	Gain	126.7 lux	Solar radiation conversion from lux to w/m^2 for wavelength correction (5)
Wind	Gain	1.00	Calibrated laboratory grade wind meter (6)
Rain	Gain	1.00	Sight glass rain gauge with an aperture of at least 4" (7)

(1) Temperature errors can occur when a sensor is placed too close to a heat source (such as a building structure, the ground, or trees).

To calibrate temperature, we recommend a mercury or red spirit (fluid) thermometer. Bi-metal (dial) and digital thermometers (from other weather stations) are not a good source and have their own margin of error. Using a local weather station in your area is also a poor source due to changes in location, timing (airport weather stations are only updated once per hour) and possible calibration errors (many official weather stations are not properly installed and calibrated).

Place the sensor in a shaded, controlled environment next to the fluid thermometer, and allow the sensor to stabilize for 48 hours. Compare this temperature to the fluid thermometer and adjust the receiver to match the fluid thermometer.

(2) Humidity is a difficult parameter to measure electronically and drifts over time due to contamination. In addition, location has an adverse effect on humidity readings (installation over dirt vs. lawn for example).

Official stations recalibrate or replace humidity sensors on a yearly basis. Due to manufacturing tolerances, the humidity is accurate to $\pm 5\%$. To improve this accuracy, the indoor and outdoor humidity can be calibrated using an accurate source, such as a sling psychrometer.

(3) The receiver displays two different pressures: absolute (measured) and relative (corrected too sea-level).

To compare pressure conditions from one location to another, meteorologists correct pressure to sea-level conditions. Because the air pressure decreases as you rise in altitude, the sea-level corrected pressure (the pressure your location would be at if located at sea-level) is generally higher than your measured pressure.

Thus, your absolute pressure may read 28.62 inHg (969 mb) at an altitude of 1000 feet (305 m), but the relative pressure is 30.00 inHg (1016 mb).

The standard sea-level pressure is 29.92 in Hg (1013 mb). This is the average sea-level pressure around the world. Relative pressure measurements greater than 29.92 inHg (1013 mb) are considered high pressure and relative pressure measurements less than 29.92 inHg are considered low pressure.

To determine the relative pressure for your location, locate an official reporting station near you (the internet is the best source for real time barometer conditions, such as Weather.com or Wunderground.com), and set your weather station to match the official reporting station.

(4) Only use this if you improperly installed the weather station sensor array and did not point the direction reference to true north.

(5) The default conversion factor based on the wavelength for bright sunlight is 126.7 lux / w/m$^{2.}$ This variable can be adjusted by photovoltaic experts based on the light wavelength of interest, but for most weather station owners, is accurate for typical applications, such as calculating evapotranspiration and solar panel efficiency.

(6) Wind speed is the most sensitive to installation constraints. The rule of thumb for properly installing a wind speed sensor is 4 x the distance of the tallest obstruction. For example, if your house is 20' tall and you mount the sensor on a 5' pole:

Distance = 4 x (20 – 5)' = 60'.

Many installations are not perfect and installing the weather station on a roof can be difficult. Thus, you can calibrate for this error with a wind speed multiplier.

In addition to the installation challenges, wind cup bearings (moving parts) wear over time.

Without a calibrated source, wind speed can be difficult to measure. We recommend using a calibrated wind meter (available from Ambient Weather) and a constant speed, high speed fan.

Make sure you periodically clean the rain gauge funnel.

Note: The purpose of calibration is to fine tune or correct for any sensor error associated with the devices

margin of error. Errors can occur due to electronic variation (example, the temperature sensor is a resistive thermal device or RTD, the humidity sensor is a capacitance device), mechanical variation, or degradation (wearing of moving parts, contamination of sensors).

Calibration is only useful if you have a known calibrated source, you can compare it against, and is optional. This section discusses practices, procedures, and sources for sensor calibration to reduce manufacturing and degradation errors. Do not compare your readings obtained from sources such as the internet, radio, television, or newspapers. The purpose of your weather station is to measure conditions of your surroundings, which vary significantly from location to location.

5.8   Registering Additional Sensors

The GATEWAY module supports up to 8 additional thermos-hygrometer sensors (Model WH31E, WH31P, WH31PF). Place the sensors in and around your home and monitor on AmbientWeather.net.

Figure 19

The data is automatically passed from the Gateway module to AmbientWeather.net based on the channel number.

Registering an additional sensor
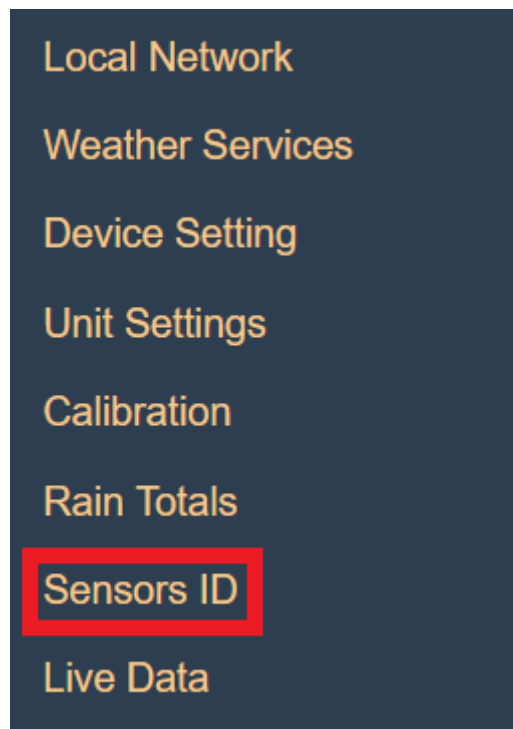Login to the web GUI and access Sensors ID tab.

Figure 20

On the Sensors ID screen, you can register or re-register an additional sensor by clicking the Re-register button.

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Figure 21

5.8.1 Indoor/Outdoor Thermo-Hygrometer, 8 Channel (optional, Model WH31E)

Note: Do not use rechargeable batteries. We recommend fresh alkaline batteries for outdoor temperature ranges between -4 ℉ and 140 ℉ and fresh lithium batteries for outdoor temperature ranges between -40 ℉ and 140 ℉.

1. Remove the battery door on the back of the transmitter(s) by sliding down the battery door, as shown in Figure 6 .
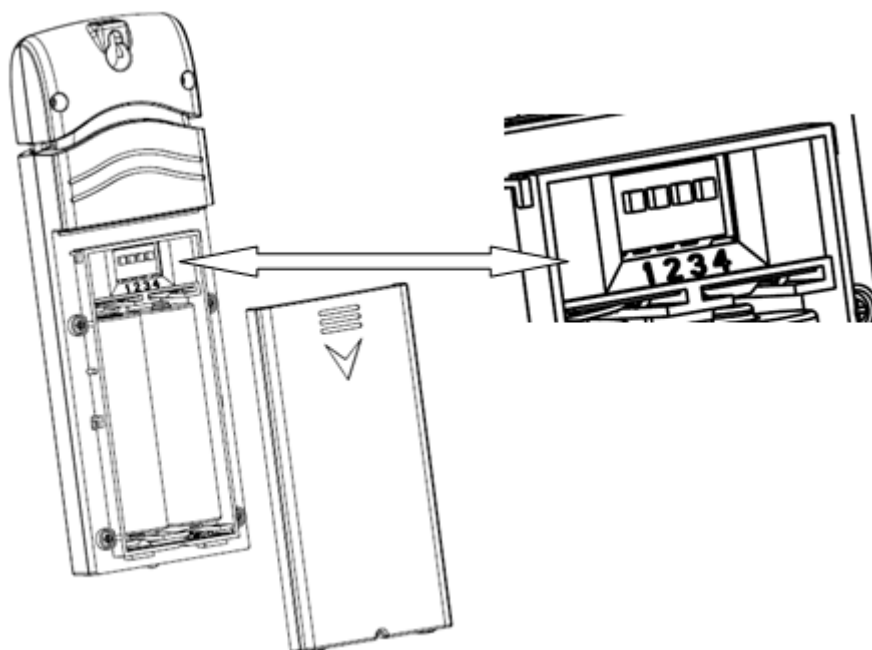

Figure 6

2. BEFORE inserting the batteries, locate the dip switches on the inside cover of the lid of the transmitter.
3. Channel Number: The GATEWAY supports up to eight transmitters. To set each channel number (the default is Channel 1), change Dip Switches 1, 2 and 3, as referenced in Figure 7.
4. Temperature Units of Measure: To change the transmitter display units of measure (℉ vs. ℃), change Dip Switch 4, as referenced in Figure 7.

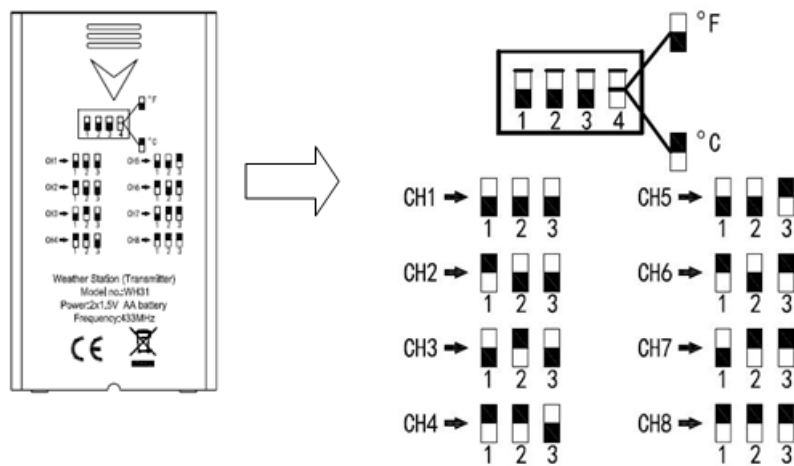■ Switch in down position. □ Switch in up position.

Figure 7

1. Insert two AA batteries.
2. Verify the correct channel number (CH) and temperature units of measure (℉ vs. ℃) are on the display, as shown in Figure 8.
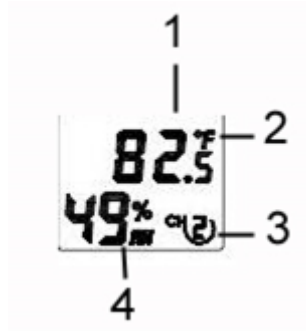

Figure 8

(1) temperature
(2) temperature units (℉ vs. ℃)
(3) channel number
(4) relative humidity

3. Close the battery door.
4. Repeat for the additional remote transmitters, verifying each remote is on a different channel.

5.8.2 Accessories

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Description	Part Number	Image
Ultrasonic Anemometer, Outdoor Thermometer / Hygrometer, Solar Radiation and UV	WS-5000-ARRAY	
Rain Collector	WS-5000-RAIN	
Anemometer, Outdoor Thermometer / Hygrometer, Solar Radiation and UV	WS-2902-ARRAY	

Indoor Air Quality Monitor	WH43	
Outdoor PM25 Particulate Monitor	WH41	
Indoor PM25 Particulate Monitor	WH45	
Wireless Temperature and Humidity Sensor	WH31E	
Leak Detector	WH55	
Waterproof Probe Temperature Sensor	WN30	
Soil moisture sensor	WN51	
Floating Pool Thermometer	WH36	

(*) The WH31E, WH31P and WH31PF share the same 8-channels.
(*) The WH41 and WH43 share the same channel.

5.8.3 Sensor Placement

It is recommended you mount the remote sensor outside on a north facing wall, in a shaded area, at a height at or above the receiver. If a north facing wall is not possible, choose a shaded area, under an eve.

Direct sunlight and radiant heat sources will result in inaccurate temperature readings. Although the sensor is weatherproof, it is best to mount in a well-protected area, such as an eve.

1. Use a screw or nail to affix the remote sensor to the wall, as shown in Figure 25.
2. Hang the remote sensor up on string, as shown in Figure 26.

Note: Make sure the sensor is mounted vertically and not lying down on a flat surface. This will insure optimum reception. Wireless signals are impacted by distance, interference (other weather stations, wireless phones, wireless routers, TVs, and computer monitors), and transmission barriers, such as walls. In general, wireless signals will not penetrate solid metal and earth (down a hill, for example).
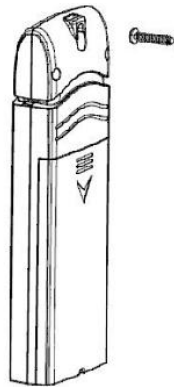
Figure 9
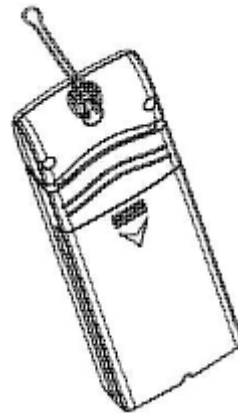
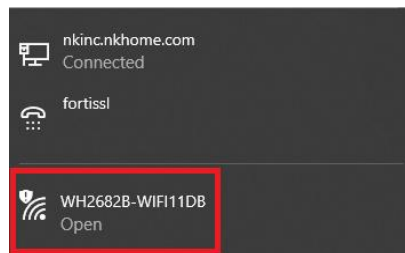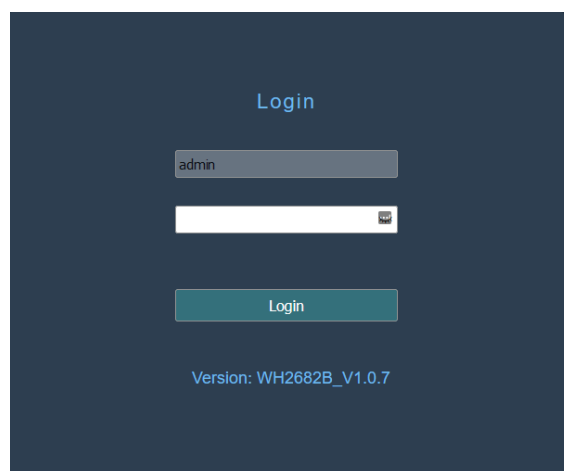**Figure 10**

6. Updating Firmware

6.1   PC Users

Open internet connections on your PC and look for the following WIFI network.
Connect to the network and then open a browser Note: you may be told network has no internet.

Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)

Live Data
Weather Services
Calibration
Rain Totals
Device Setting
Sensors ID
Local Network
Unit Settings

Version:
WH2682B_V1.0.6

Once logged in you will want to navigate to Device Setting page

| Upgrade | ☐ Automatically upgrade firmware | |
| Version | Version: WH2682B_V2.0.3 | Check new version |

You may choose to automatically upgrade firmware by clicking the checkbox and click save.
You may also check for a new version manually.

6.2 Mac Users

To find the receiver, Open internet connections on your Mac and look for the following WIFI network.

Connect to the network and then open a browser Note: you may be told network has no internet.

Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)
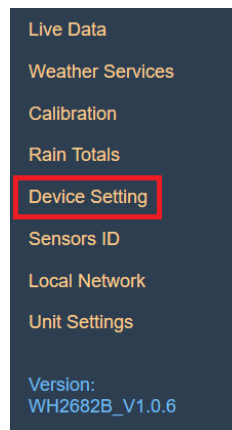
Once logged in you will want to navigate to Device Setting page
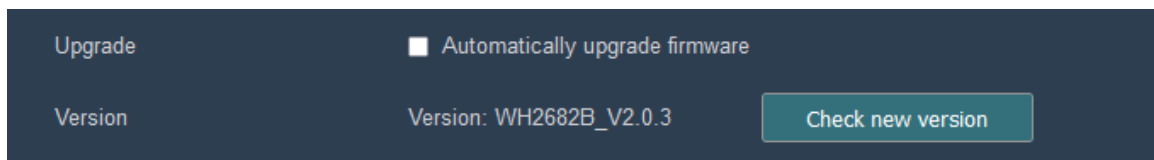
You may choose to automatically upgrade firmware by clicking the checkbox and click save.
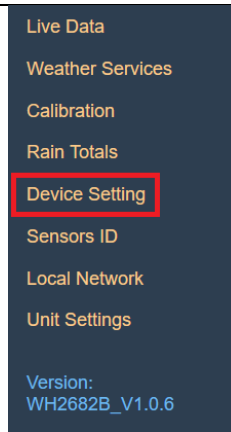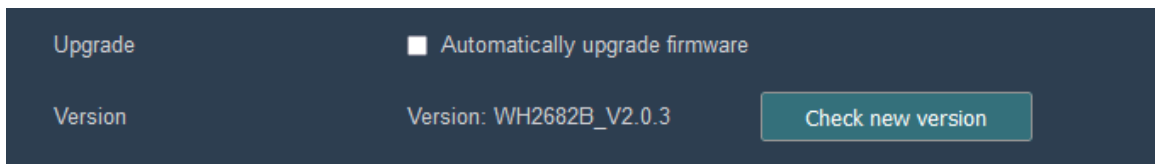You may also check for a new version manually.

6.3   Linux Users
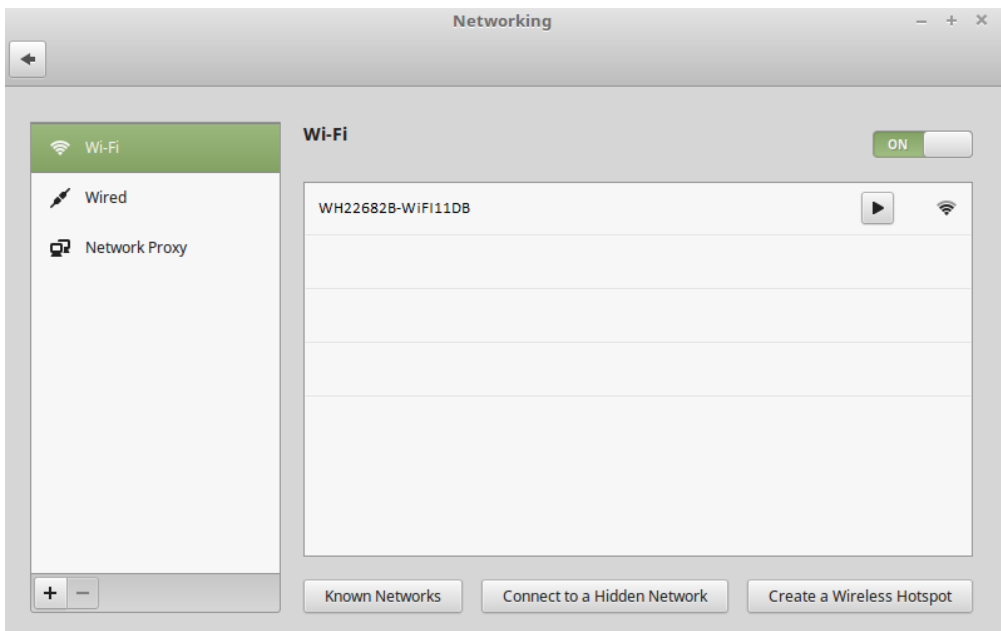
Open internet connections on your PC and look for the above WIFI network.
Connect to the network and then open a browser Note: you may be told network has no internet.

Navigate to the following IP address 192.168.4.1 you will be presented with the following screen.
(Note: default password is blank)

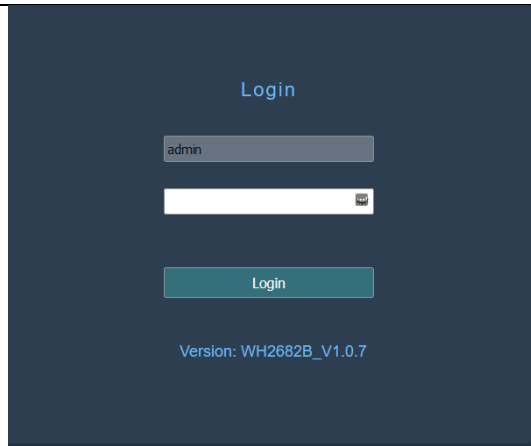Once logged in you will want to navigate to Device Setting page

| Upgrade | ☐ Automatically upgrade firmware | |
| Version | Version: WH2682B_V2.0.3 | Check new version |

You may choose to automatically upgrade firmware by clicking the checkbox and click save.
You may also check for a new version manually.

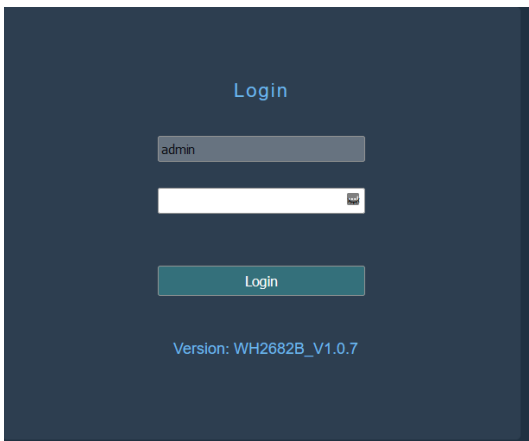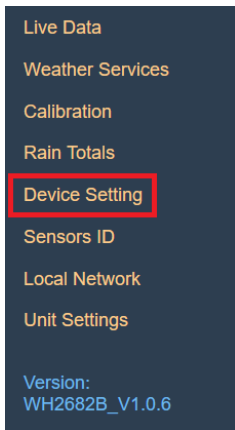# 7. Glossary of Terms

Term	Definition
Absolute Barometric Pressure	Absolute pressure is the measured atmospheric pressure and is a function of altitude, and to a lesser extent, changes in weather conditions. Absolute pressure is not corrected to sea-level conditions. *Refer to Relative Barometric Pressure.*
Accuracy	Accuracy is defined as the ability of a measurement to match the actual value of the quantity being measured.
Barometer	A barometer is an instrument used to measure atmospheric pressure.
Calibration	Calibration is a comparison between measurements – one of known magnitude or correctness of one device (standard) and another measurement made in as similar a way as possible with a second device (instrument).
Dew Point	The dew point is the temperature at which a given parcel of humid air must be cooled, at constant barometric pressure, for water vapor to condense into water. The condensed water is called dew. The dew point is a saturation temperature. The dew point is associated with relative humidity. A high relative humidity indicates that the dew point is closer to the current air temperature. Relative humidity of 100% indicates the dew point is equal to the current temperature and the air is maximally saturated with water. When the dew point remains constant and temperature increases, relative humidity will decrease.
Feels Like	The Feels Like temperature is a combination of Heat Index when it is hot outside, and Wind Chill when it is cold outside. Wind Chill temperature is defined by the National Weather Service for temperatures at or below 40 ℉ and wind speeds above 5.0 mph. Heat Index is not valid or calculated below 80 degF. Thus, when the outdoor temperature is between 40 degF and 80 degF, the feels like temperature is the same as the outdoor temperature. If the temperature is below 40 degF, the feels like temperature is the same as the outdoor temperature when the wind speed is less than 5 mph.
Hectopascals (hPa)	Pressure units in SI (international system) units of measurement. Same as millibars (1 hPa = 1 mbar)
Hygrometer	A hygrometer is a device that measures relative humidity. Relative humidity is a term used to describe the amount or percentage of water vapor that exists in air.
Range	Range is defined as the amount or extent a value can be measured.
Relative Barometric Pressure	Measured barometric pressure relative to your location or ambient conditions.
Resolution	Resolution is defined as the number of significant digits (decimal places) to which a value is being reliably measured.

Term	Definition
Thermometer	A thermometer is a device that measures temperature. Most digital thermometers are resistive thermal devices (RTD). RTDs measure changes in temperature as a function of electrical resistance.

Figure 29

8. Specifications

8.1 Wireless Specifications

- Line of sight wireless sensor array RF transmission (in open air): 1,000 feet, 300 feet under most conditions
- Line of sight Wi-Fi RF transmission (in open air): 80 feet
- Update Rate: 49 seconds
- Wi-Fi Tablet RF Frequency: 2.4 GHz

8.2 Measurement Specifications

The following table provides the specifications for the measured parameters.

Measurement	Range	Accuracy	Resolution
Indoor Temperature	14 to 140 ℉	±2 ℉	0.1 ℉
Indoor Humidity	10 to 99%	±5%	1 %
Barometric Pressure	8.85 to 32.50 inHg	±0.08 inHg (within range of 27.13 to 32.50 inHg)	0.01 inHg

Figure 30

Transmission distance in open field: 300m (1000 ft)
Sensor reporting interval: 4.75 seconds
RF Frequency: 915 MHz

8.3 Power Consumption

- Gateway Module: 5V DC Adaptor (included), Power Consumption: 0.5 Watts (1.25 Watts during Wi-Fi configuration mode)

9.   Troubleshooting Guide

Problem	Solution
Absolute pressure does not agree with official reporting station	You may be viewing the relative pressure, not the absolute pressure. Select the absolute pressure. Make sure you properly calibrate the sensor to an official local weather station. Reference Section 5.7 for details.

Problem	Solution
Data not reporting to Wunderground.com	1. Confirm your password is correct. It is the password you registered on Wunderground.com. Your Wunderground.com password cannot begin with a non-alphanumeric character (a limitation of Wundeground.com, not the station). Example, $oewkrf is not a valid password, but oewkrf$ is valid. 2. Confirm your station ID is correct. The station ID is all caps, and the most common issue is substituting an O for a 0 (or vice versa). Example, KAZPHOEN11, not KAZPH0EN11. 3. Make sure your time zone is set properly. If incorrect, you may be reporting old data, not real time data. 4. Check your router firewall settings. The GATEWAYsends data via Port 80.

10. FCC Statement

Statement according to FCC part 15.19:
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Statement according to FCC part 15.21:
Modifications not expressly approved by this company could void the user's authority to operate the equipment.
Statement according to FCC part 15.105:
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 into an outlet on a circuit different from that to which the receiver is connected.

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